Appendix 11.4

Hydromorphology Assessment Part 4

Annex 11.4.3 - Hydromorphological Catchment Assessment - 94

Catchment No.	94
Catchment Name	-

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

Quantitative Spatial Elements	Catchment Area (km^2)	No Data
	Average slope in catchment (°)	No Data
	% Catchment over 750m (for snow melt risk)	No Data

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 94)	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 94)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 94	
	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	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 94)	Yes	Aqueduct, ETL construction track and tower sites
	Comment on sediment source potential in catchment	Limited. ETL construction works possible source of sediment supply.	
	Comment on sediment supply potential to crossing	Limited. No well developed channels to carry sediment d/s to crossing.	

Morphology and Process-Reach upstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Gravel	
	Unvegetated bars	No	
	Vertical incision	Medium	Cross-slope drain enters from left bank (south) near culvert entrance. There appears to be some nick point migration up this channel, causing vertical incision and production of mobile fine and coarse sediment.
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (Map 1d)	Yes	Aqueduct
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 94)	No	Might restrict d/s sediment supply and flows
	Channel realignment	No	

Morphology and Process-At crossing	Channel morphology	Engineered	
	Predominant sediment size	Gravel	
	Estimated discharge at 1:200 event (m^3/s)	3.5	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Low	Some gravel deposition at culvert outlet, likely generated from erosion immediately u/s of culvert
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	Yes	Some damage to drain armouring

Morphology and Process-Reach downstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Fine	
	Unvegetated bars	No	
	Vertical incision	Low	
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (Map 1d)	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 94)	No	
	Channel realignment	No	

Summary behaviour	Channel is continuation of drain to allow drainage from upslope to downslope of aqueduct. Cross-slope drain joins the main downslope drain just u/s of road culvert. Some incision evident u/s of culvert, generating sediment. Coarsest sediment has not moved very far, some gravel deposited in and d/s of culvert. Sluggish flow d/s of culvert, little activity.

Annex 11.4.3 - Hydromorphological Catchment Assessment - 95

Catchment No.	95
Catchment Name	-

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

Quantitative Spatial Elements	Catchment Area (km^2)	No Data
	Average slope in catchment (°)	No Data
	% Catchment over 750m (for snow melt risk)	No Data

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 95)	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 95)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 95	
	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	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 95)	Yes	Aqueduct
	Comment on sediment source potential in catchment	Limited. Short catchment. Possible supply from ETL construction but this is u/s of aqueduct crossing	
	Comment on sediment supply potential to crossing	Limited. Short catchment and much likely to be retained at aqueduct crossing	

Morphology and Process-Reach upstream of crossing	Channel morphology	Engineered	
	Predominant sediment size	-	
	Unvegetated bars	-	
	Vertical incision	None	
	Deposition	None	
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (Map 1d)	Yes	Aqueduct
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 95)	Yes	Likely to restrict flow and sediment delivery
	Channel realignment	No	

Morphology and Process-At crossing	Channel morphology	Engineered	
	Predominant sediment size	-	
	Estimated discharge at 1:200 event (m^3/s)	3.5	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	None	
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	Yes	Limited damage to paving slabs u/s of road

Morphology and Process-Reach downstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Fine	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Medium	Fines only, vegetation growing in channel due to sluggish water
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (Map 1d)	None	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 95)	No	
	Channel realignment	No	

Summary behaviour	Engineered drain to take flow from d/s of aqueduct to d/s of road. ETL construction is a potential source of sediment, but flow is restricted under aqueduct so sediment delivery to crossing likely to be limited and no evidence for adverse delivery of sediment here.

Annex 11.4.3 - Hydromorphological Catchment Assessment - 98

Catchment No.	98
Catchment Name	

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

Quantitative Spatial Elements	Catchment Area (km^2)	No Data
	Average slope in catchment (°)	No Data
	% Catchment over 750m (for snow melt risk)	No Data

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 98)	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 98)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

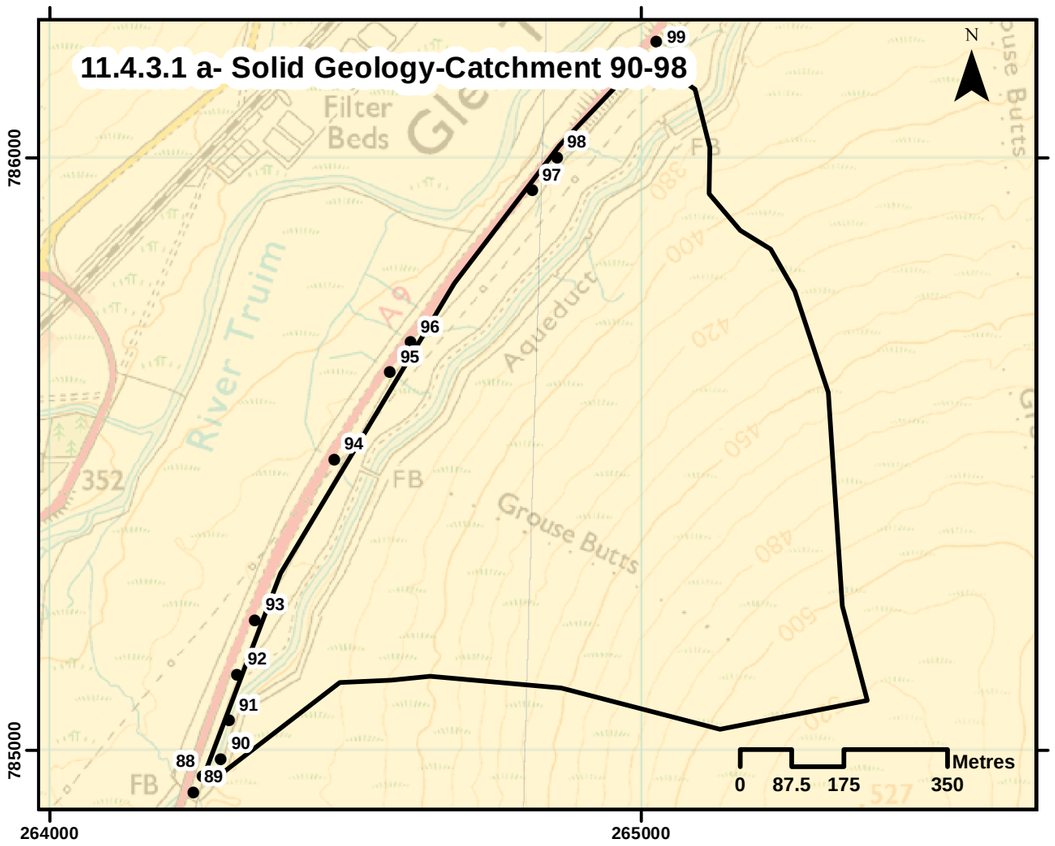
Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 98	
	Is peat present in the catchment	Yes	According to BGS mapping but likely thin
	Is there a bog burst risk	No	
	Current valley side or terrace erosion	No	
	Potential valley side or 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	Yes	
	Bank erosion/lateral migration	No	
	Unvegetated bars	No	
	Wooded/forested areas in catchment	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 98)	Yes	Aqueduct
	Comment on sediment source potential in catchment	Limited but channel is very steep and potential for lots of energy and bed erosion	
	Comment on sediment supply potential to crossing	Where generated from channel bed erosion likelihood of supply to crossing is high due to	

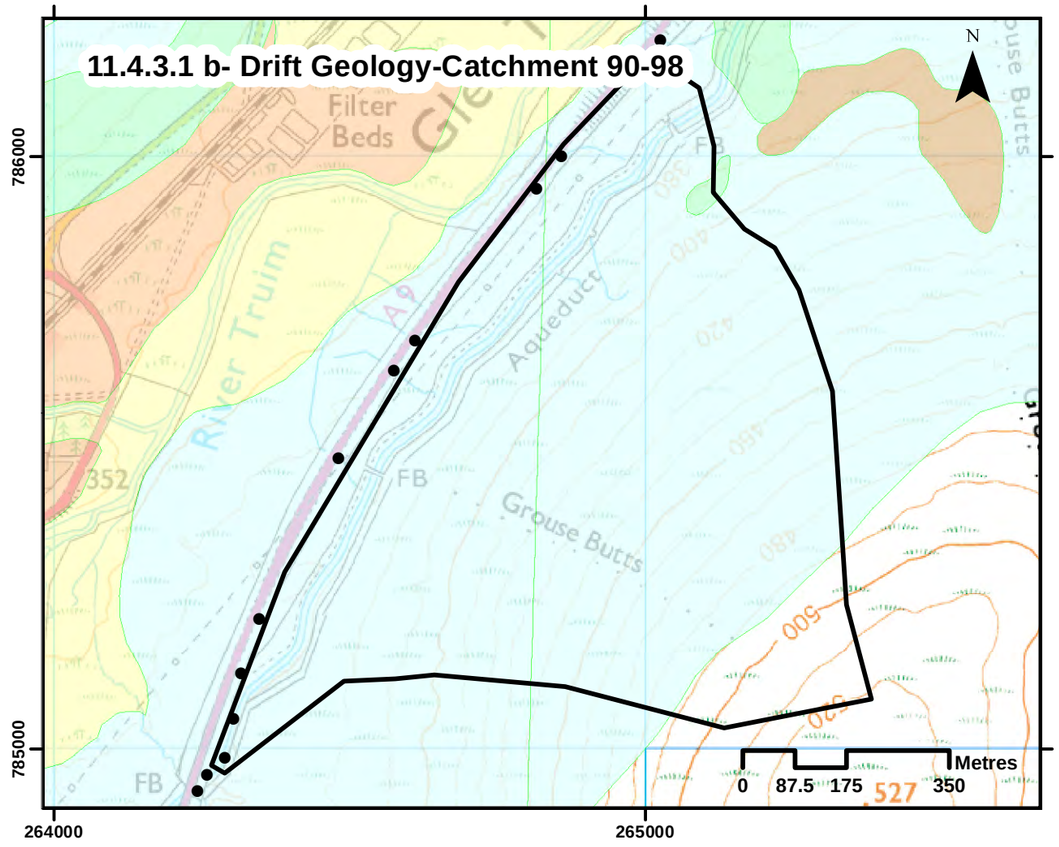
Morphology and Process-Reach upstream of crossing	Channel morphology	Engineered	
	Predominant sediment size	-	
	Unvegetated bars	No	
	Vertical incision	Medium	Possible incision u/s of armoured section of drain towards aqueduct. Road-parallel drain (unarmoured also eroding on descent to culvert
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (Map 1d)	Yes	Aqueduct and armoured drain
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 98)	Yes	Aqueduct likely to limit sediment supply, fixing channel alignment
	Channel realignment	No	

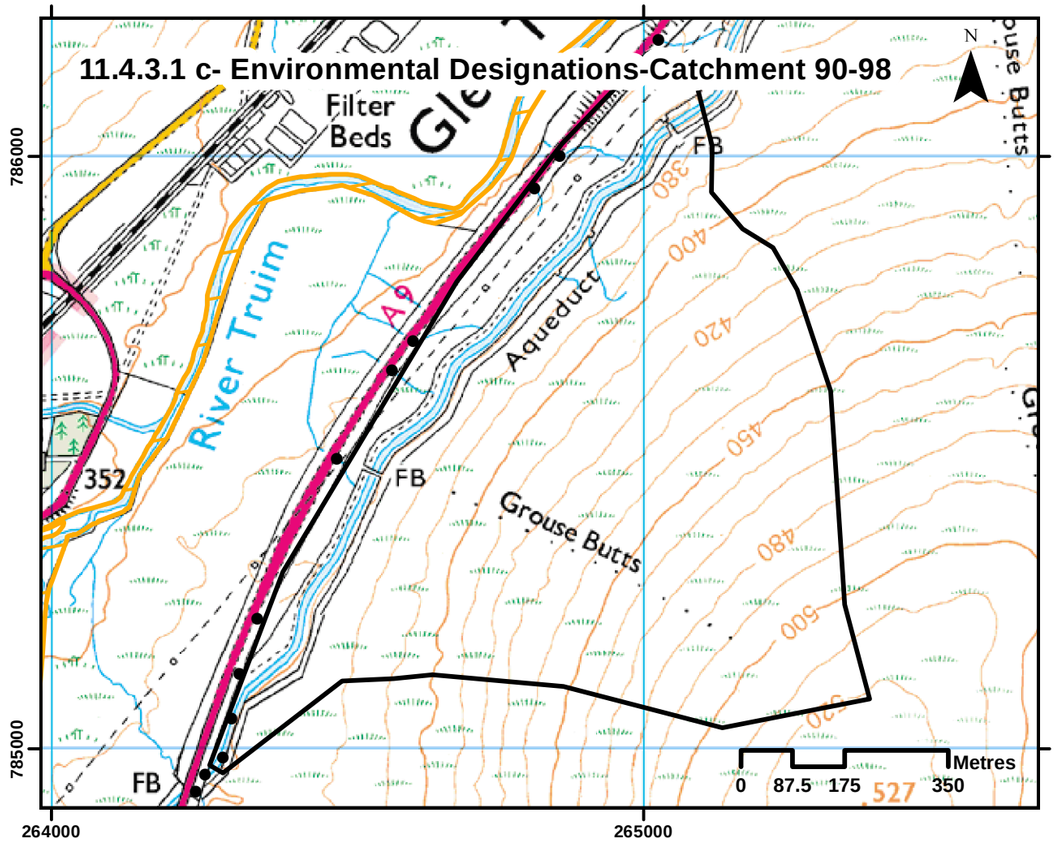
Morphology and Process-At crossing	Channel morphology	Engineered	
	Predominant sediment size	-	
	Estimated discharge at 1:200 event (m^3/s)	3.5	
	Unvegetated bars	No	
	Vertical incision	Low	
	Deposition	Medium	Some deposition of gravel-cobbles at u/s end of culvert where gradient reduces
	Lateral migration/bank erosion	Low	Low
	Damaged/unstable drains or armouring	No	Armouring seems to be in good condition

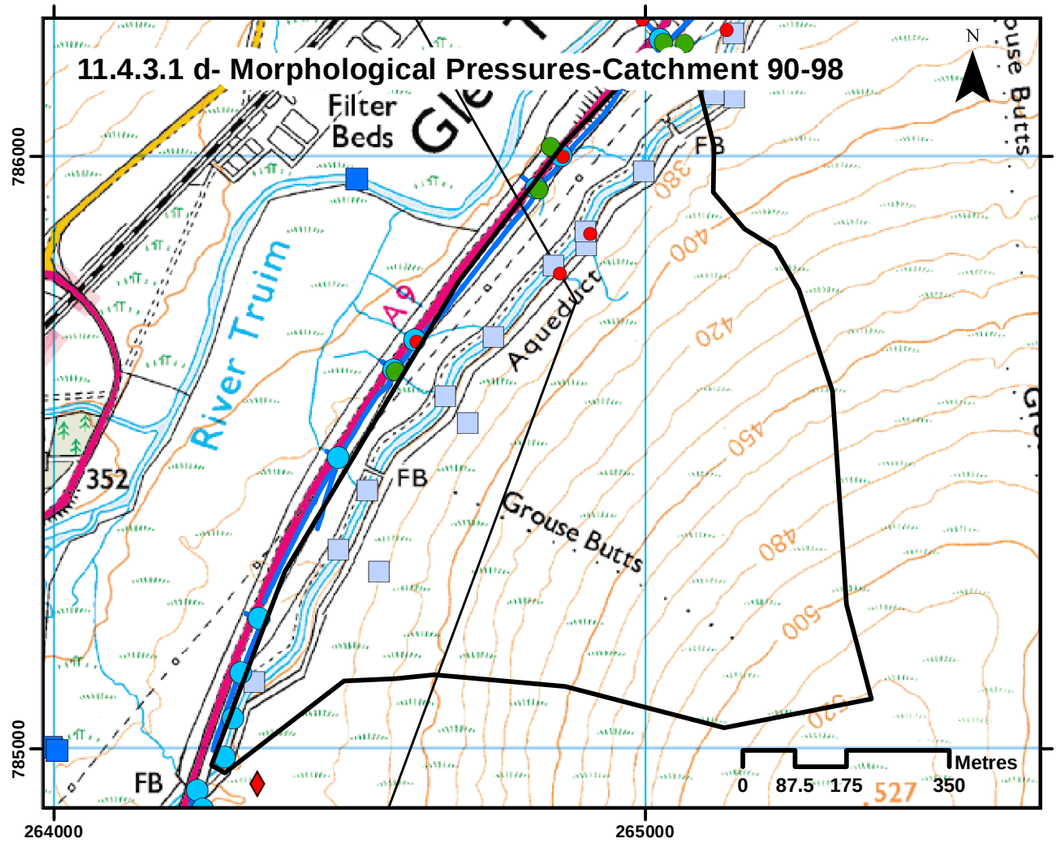
Morphology and Process-Reach downstream of crossing	Channel morphology	Engineered	
	Predominant sediment size	-	
	Unvegetated bars	No	
	Vertical incision	Medium	Appears scour has occurred where engineered drain finishes
	Deposition	Medium	Deposition of coarse sediment, although this is possibly generated by scour effect at end of engineered section.
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (Map 1d)	None	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 98)	No	
	Channel realignment	No	

Summary behaviour	Possibly was once a natural channel but has now been incorporated almost completely into an armoured drain. Flow and sediment transfer from upper catchment limited by presence of aqueduct. Where drain unarmoured it has possibly incised (appears deeply set on aerial photos) u/s of crossing and in road-parallel drain erosion has occurred in steepest section causing deposition at culvert entrance. D/s of culvert, the armoured drain drops steeply with no flow interruptions for 20m. At end of this armoured section there is a sudden drop in bed elevation and exposure of coarse sediment indicating issues with scour at the end of the this armoured section. OPPORTUNITY TO IMPROVE DRAIN DESIGN AND REDUCE SCOUR/UNDERMINING OF D/S extent of armouring.









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 Area of Conservation

Morphological Pressures
- Culvert
- Cascade
- Step in Bed
- Dam or Weir
- Discharge Location
- Abstraction Location
- Drainage Ditch
- Power Lines

REV	SUIT	DATE	DESCRIPTION	BY	APP

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TRANSPORT SCOTLAND

A9 DUALLING PERTH TO INVERNESS

PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

Drawing 11.4.3.1 Catchment 90-98 Catchment Overview

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

DATE: 12/07/2017

PROJ: 495298

DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0001

SHEET:	REVISION:	SUITABILITY:
1 of 1	C01	A3

Coarse material deposition where gradient reduces

Scour at end of steeply inclined armoued drain

Limited deposition at culvert entrance where gradient reduces.

Possible incision u/s of armoured drain

Armoured drain

Aqueduct

Erosion in unarmoured road-parellel drain where drops steeply to culvert entrance

Aqueduct

Some incision in cross slope drain

ETL Construction

Many small channels moving sediment and water towards the crossing

99
98
97
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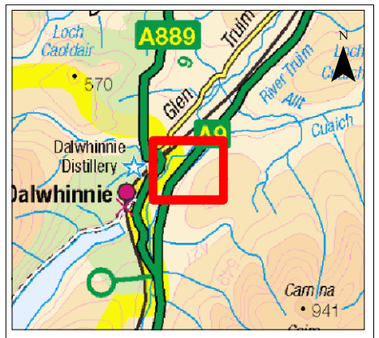
N

0 65 130 260 Metres



Legend

- Major crossing
- Minor crossing
- Other crossing
- Contemporary channel
- Incision
- Crossing catchment

REV	SUIT	DATE	DESCRIPTION	BY	APP

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PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

DRAWING 11.4.3.2.
Catchment 90-98 Baseline Assessment

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

DATE: 11/07/2017

PROJ: 495298

DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0002

SHEET:	REVISION:	SUITABILITY:
1 of 1	C01	A3

Annex 11.4.3 - Hydromorphological Catchment Assessment - 99

Catchment No.	**99**
Catchment Name	**-**

Channel Nature	Nature of water course	Drain
	Size of water course	Minor

Quantitative Spatial Elements	Catchment Area (km^2)	0.04
	Average slope in catchment (°)	8
	% Catchment over 750m (for snow melt risk)	0

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 99)	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 99)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

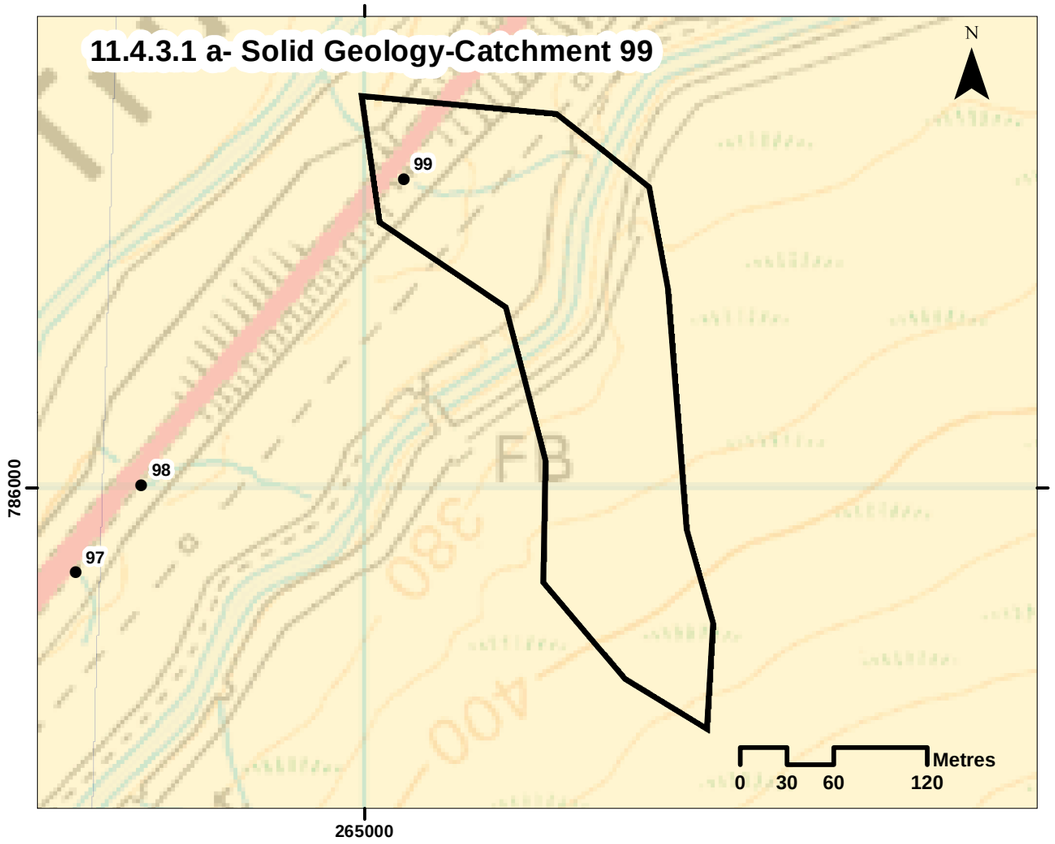
Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 99	
	Is peat present in the catchment	Yes	50k BGS mapping suggests very limited peat cover
	Is there a bog burst risk	No	
	Current valley side or terrace erosion	No	
	Potential valley 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	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 99)	Yes	Aqueduct- reducing downstream sediment transfer and flow
	Comment on sediment source potential in catchment	Limited	
	Comment on sediment supply potential to crossing	Limited as aqueduct cuts upper catchment off from crossing	

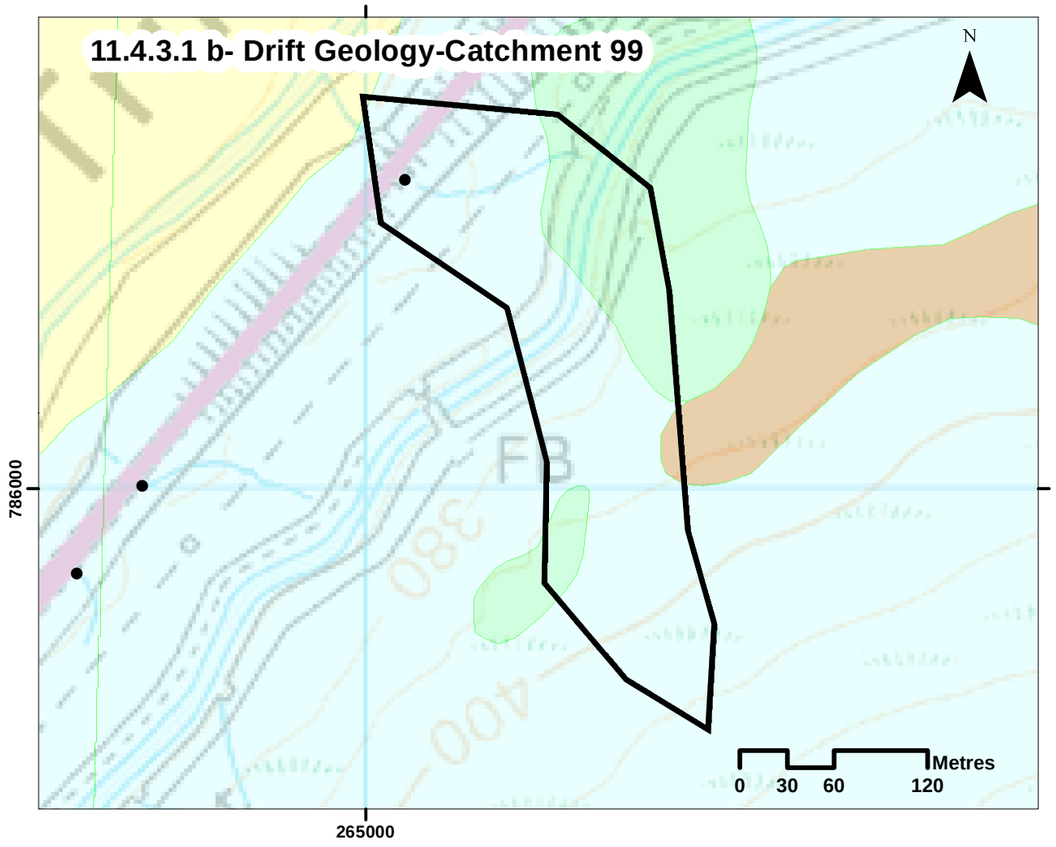
Morphology and Process-Reach upstream of crossing	Channel morphology	Engineered	Is engineered but also heavily incised.
	Predominant sediment size	Coarse (gravel-cobble)	
	Unvegetated bars	No	
	Vertical incision	High	Appears to be very high incision beyond d/s end of engineered cascade d/s of aqueduct. Gabion basket check dams put in place to slow flow and limit this incision
	Deposition	Low	
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (Map 1d)	Yes	Aqueduct, cascade, check dams
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 99)	Yes	This channel appears to be an overspill for the aqueduct. This flow has caused incision which has needed to be controlled with check dams
	Channel realignment	No	

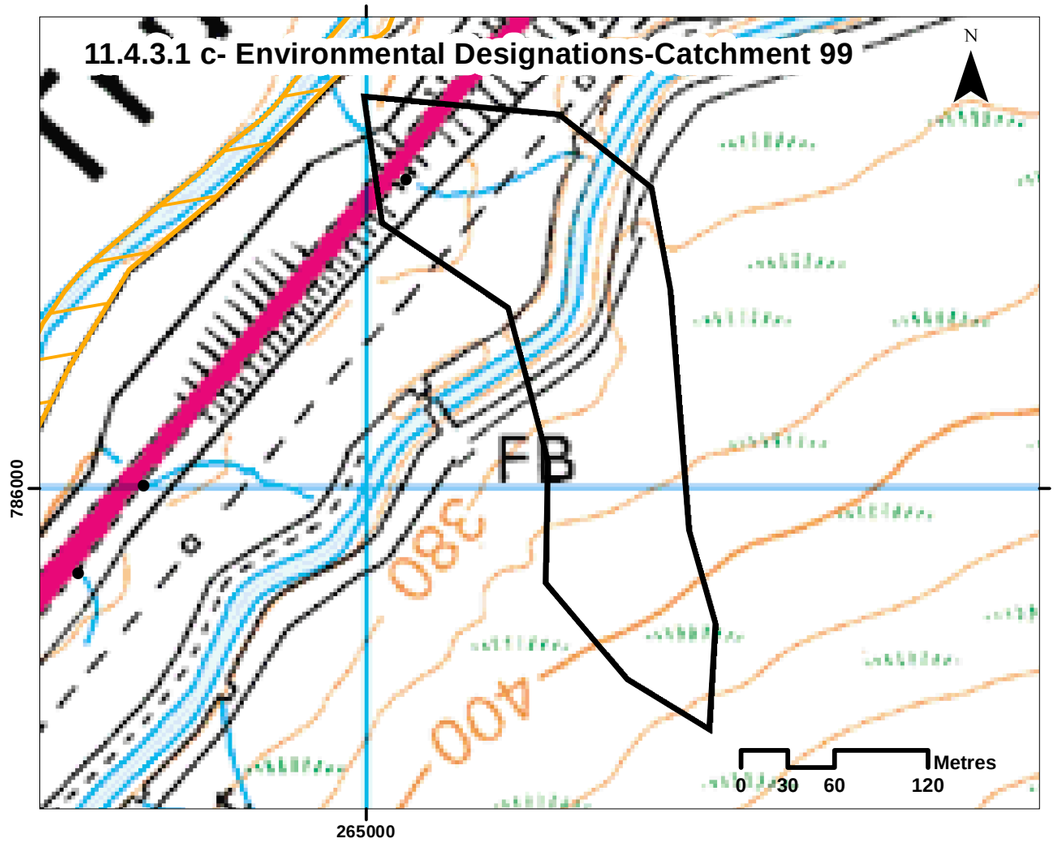
Morphology and Process-At crossing	Channel morphology	Engineered	
	Predominant sediment size	-	
	Estimated discharge at 1:200 event (m^3/s)	0.15	
	Unvegetated bars	No	
	Vertical incision	Medium	Would be high but revegetation has occurred, either as incision occurred during one major event, or check dams have worked.
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Damaged/unstable drains or armouring	Yes	Gabion basket cascade is moderately deformed, particularly in its lower steps. D/s side of culvert right bank armouring is being 'outflanked' by bank erosion. There is a drop of c.0.5-1m at end of armouring indicating there is scour here and the armouring is becoming a nick point, although u/s migration of this is so far limited.

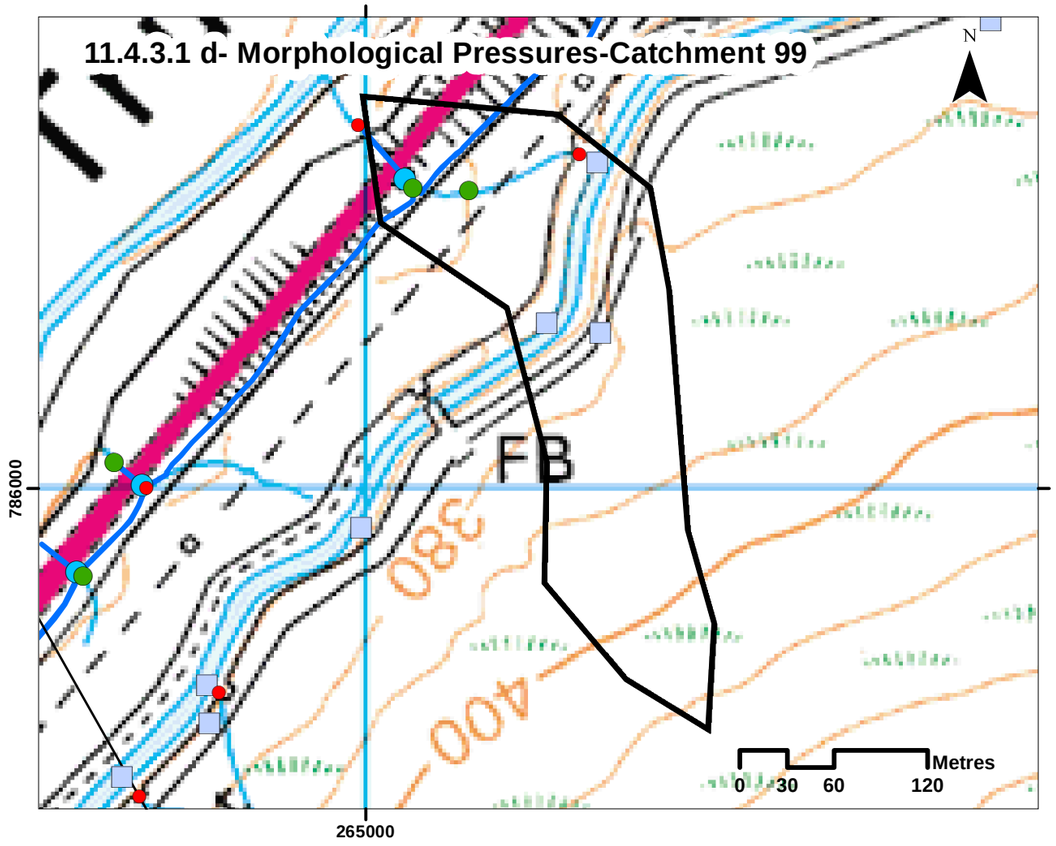
Morphology and Process-Reach downstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Cobble with fine drape	Has revegetated.
	Unvegetated bars	No	
	Vertical incision	High	D/s of engineered outfall, severe incision may have occurred, which has now stabilised although from photos it isn't possible to say explicitly if the channel was actually cut to near this depth originally.
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (Map 1d)	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 99)	No	
	Channel realignment	No	

Summary behaviour	Channel is an overspill from the aqueduct. Immediately d/s of the aqueduct a cascade has been created which appears to be formed from a series of concrete steps. At the end of the cascade the gradient reduces and the would-be flow becomes diffuse and unconstrained by the channel. However, after a further 30m the channel reappears and is heavily incised. Gabion basket check dams have been put in the channel to either slow flow or retain sediment (or both) and reduce incision. Immediately u/s of the crossing, a gabion basket cascade is present to bring the channel to the culvert level. There is no evidence of substantial deposition at the entrance to the culvert. D/s of the culvert, there is a short section of armouring before the flow discharges over a c.0.5m-1m step (assumed to be formed by scour). Scour here has destabilised the right bank leading to outflanking of the armouring. From here the flow is in a channel which is either cut or deeply incised or partially both. CAREFUL REDESIGN NEEDED WITH THIS CHANNEL. WHILST FLOW IS LIKELY TO BE VERY SPORADIC, IT WILL OCCUR IN EXTREME CONDITIONS WHEN THE AQUEDUCT IS UNABLE TO COPE AND THESE INTERMITTENT FLOWS ARE LIKELY TO BE HIGH ENERGY DUE TO VOLUME OF WATER AND STEEPNESS OF DROP.









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 Area of Conservation

Morphological Pressures
- Culvert
- Cascade
- Step in Bed
- Abstraction Location
- Drainage Ditch
- Power Lines

REV	SUIT	DATE	DESCRIPTION	BY	APP

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PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

Drawing 11.4.3.1 Catchment 99 Catchment Overview

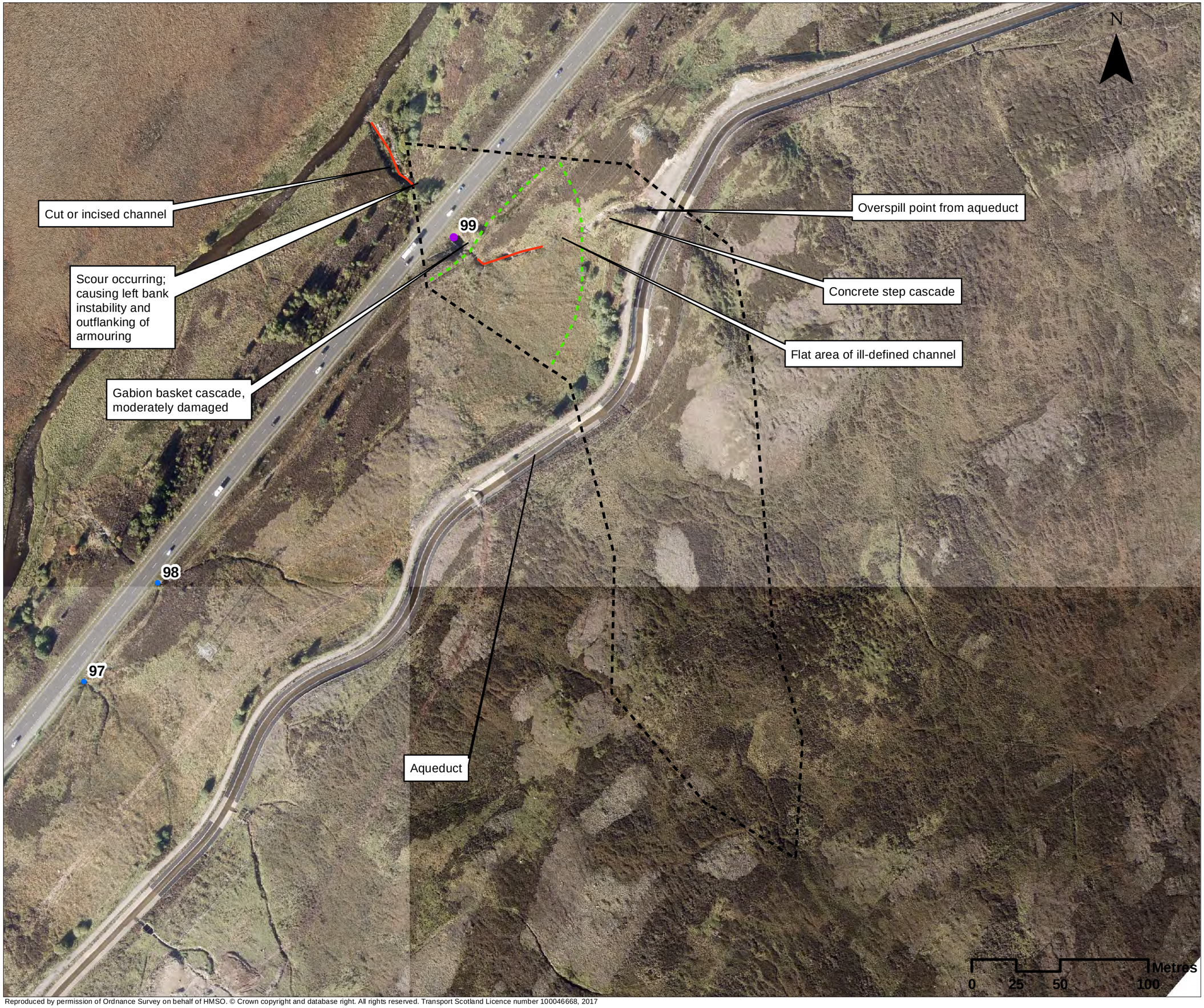
DESIGN:	DRAWN:	CHK:	APP:
EL	EV	EL	EL

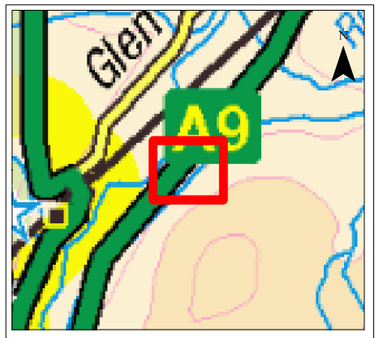
DATE: 20/07/2017

PROJ: 495298

DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0001

SHEET:	REVISION:	SUITABILITY:
1 of 1	C01	A3





Legend

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

REV	SUIT	DATE	DESCRIPTION	BY	APP

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PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

DRAWING 11.4.3.2.
Catchment 99 Baseline Assessment

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

DATE: 14/07/2017

PROJ: 495298

DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0002

SHEET:	REVISION:	SUITABILITY:
1 of 1	C01	A3

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Annex 11.4.3 - Hydromorphological Catchment Assessment - 100

Catchment No.	100
Catchment Name	-

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

Quantitative Spatial Elements	Catchment Area (km^2)	0.8
	Average slope in catchment (°)	6.4
	% Catchment over 750m (for snow melt risk)	0

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 100)	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 100)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 100	
	Is peat present in the catchment	Yes	1:50k BGS mapping indicates limited small area in mid catchment
	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)	Yes	In the upper catchment
	Hill slope failures coupled to channel	No	
	Vertical incision present in catchment	Yes	Some incision and geotechnical bank failure indicated u/s of reservoir, but also possibly soil pipe collapse.
	Bank erosion/lateral migration	No	
	Unvegetated bars	No	
	Wooded/forested areas in catchment	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 100)	Yes	Aqueduct- changing downstream flow and sediment supply
	Comment on sediment source potential in catchment	Possible collapsed pipe and associated nick points may supply some sediment.	
	Comment on sediment supply potential to crossing	Unlikely to have large volumes reaching crossing from upper catchment due to flatter areas with lack of defined channel leading to flow diffusion and aqueduct creating a barrier (although there is a culvert taking flow under the aqueduct)	

Morphology and Process-Reach upstream of crossing	Channel morphology	Plane bed	NB cut drain though
	Predominant sediment size	Large gravel -small cobble	
	Unvegetated bars	No	
	Vertical incision	Medium	Likely combination of incision in addition to original drain cutting
	Deposition	Low	
	Lateral migration/bank erosion	Low	Limited collapse of drain banks
	Presence and nature of infrastructure (Map 1d)	Yes	Aqueduct
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 100)	Yes	Splits catchment, probably limits flow and sediment transfer from u/s
	Channel realignment	Yes	Channel must parallel aqueduct on its u/s side before entering aqueduct culvert

Morphology and Process-At crossing	Channel morphology	Engineered	In culvert, but plane bed on approach
	Predominant sediment size	Large gravel	
	Estimated discharge at 1:200 event (m^3/s)		
	Unvegetated bars	No	
	Vertical incision	Low	Some incision and potential for nick point migration but limited
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Damaged/unstable drains or armouring	Yes	Limited undermining of armouring at confluence of two drains c.10m u/s of culvert entrance. Possible potential for nick point migration. Damaged gabion opposite outflow of culvert where channel must make 90° to parallel road

Morphology and Process-Reach downstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Gravel-Cobble	
	Unvegetated bars	Yes	Deposit of coarse sediment at channel outflow
	Vertical incision	Medium	Scour pool at culvert exit. Channel has possibly spilled out of cut channel which parallels road and eroded floodplain, re-joining at where track crosses channel.
	Deposition	Low	Deposit of coarse sediment at channel outflow where channel bends right to parallel road, at outflow from scour pool.
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (Map 1d)	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 100)	No	
	Channel realignment	Yes	Channel realigned to parallel road before heading across floodplain.

Summary behaviour	Majority of catchment u/s of aqueduct. Whilst there is a culvert under the aqueduct, the run-off from the upper catchment to the lower catchment is restricted and sediment transfer from u/s to d/s of aqueduct is likely to be limited. Sources of sediment exist in the upper catchment, notably a possible natural pipe collapse. D/s of the aqueduct channelisation is limited and intermittent (reducing where gradient reduces), but drains have been cut on the approach to the crossing. There appears to be limited incision of these and potential for knickpoint migration where hard points have been put in place where the bed elevation of the channel needs to change. D/s of the crossing, there is a scour pool and a gabion basket which has been damaged through the scour processes. The gabion is there to protect the bank opposite the outflow as the channel must make a 90° turn to parallel the road. This road-parallel channel has potentially been under-capacity as flow has spilled across the floodplain eroded a secondary channel, which re-joins the main channel where the forest track crosses.

Photograph 11.4.3.65- Downstream to crossing

Photograph 11.4.3.66- Upstream to channel realignment creating a step in bed

Photograph 11.4.3.67-Upstream to channel in peat

Photograph 11.4.3.68 - Looking upstream to poorly defined channel

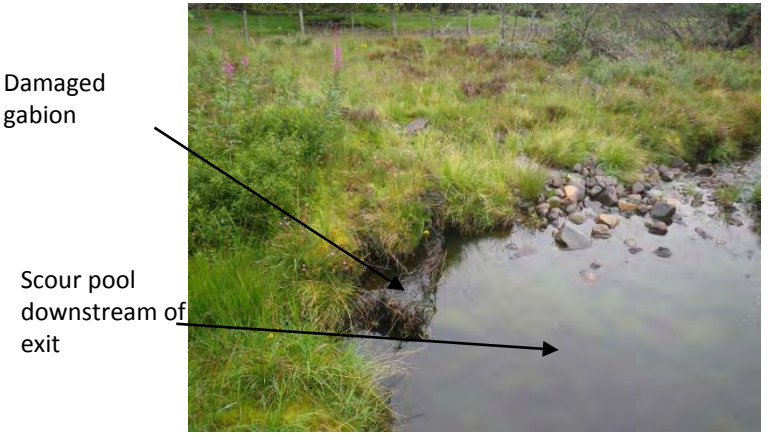
Photograph 11.4.3.69- Downstream

Photograph 11.4.3.70 – Low lying catchment

Photograph 11.4.3.71 - Low lying catchment

Photograph 11.4.3.72 - Crossing exit- Over wide, shallow channel

Photograph 11.4.3.73- Downstream of diverted channel



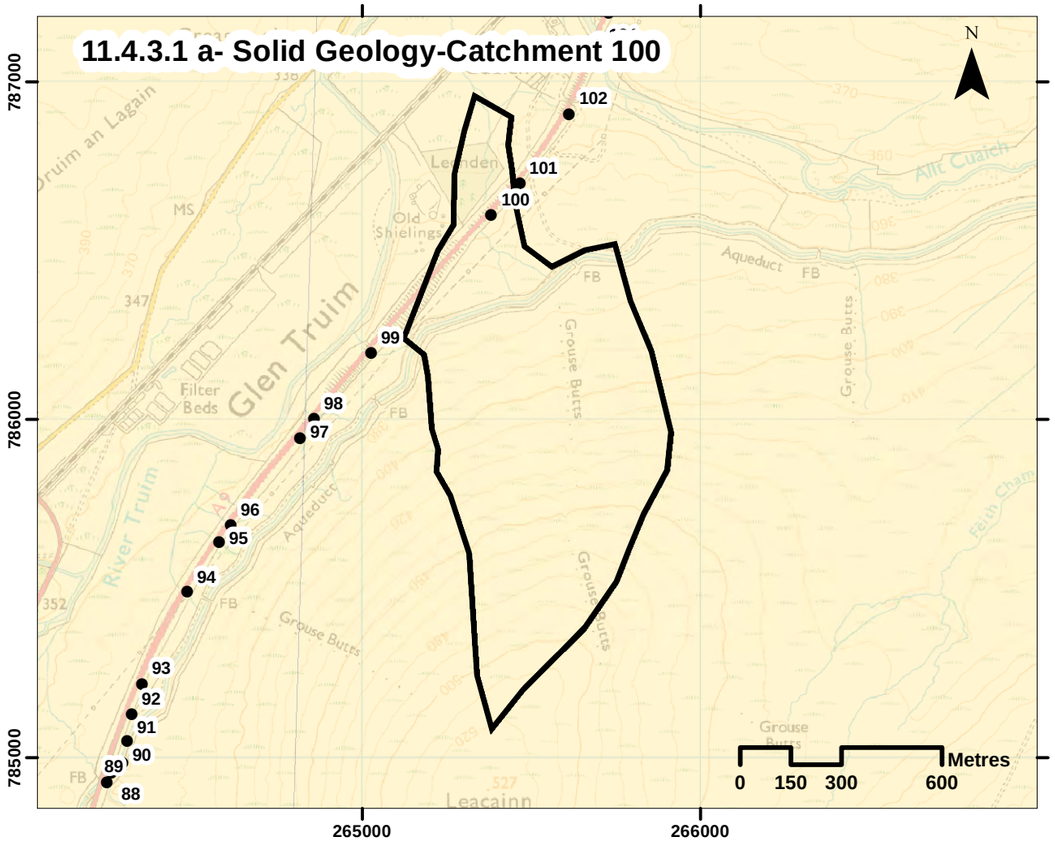
Photograph 11.4.3.74-Pool downstream of culvert

Photograph 11.4.3.75- Floodplain erosion

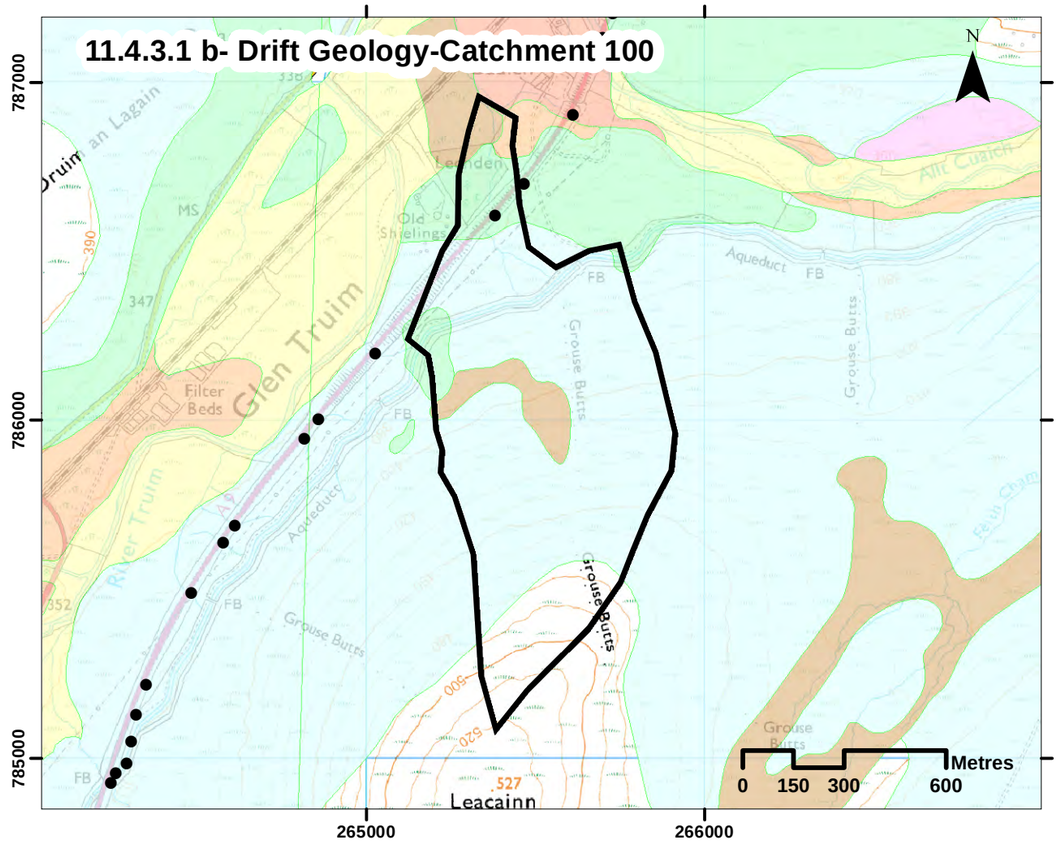
Photograph 11.4.3.76- Downstream channel with cobble and gravel bed

Photograph 11.4.3.77- Downstream to wooded section- Gravel bed and influence of woody debris

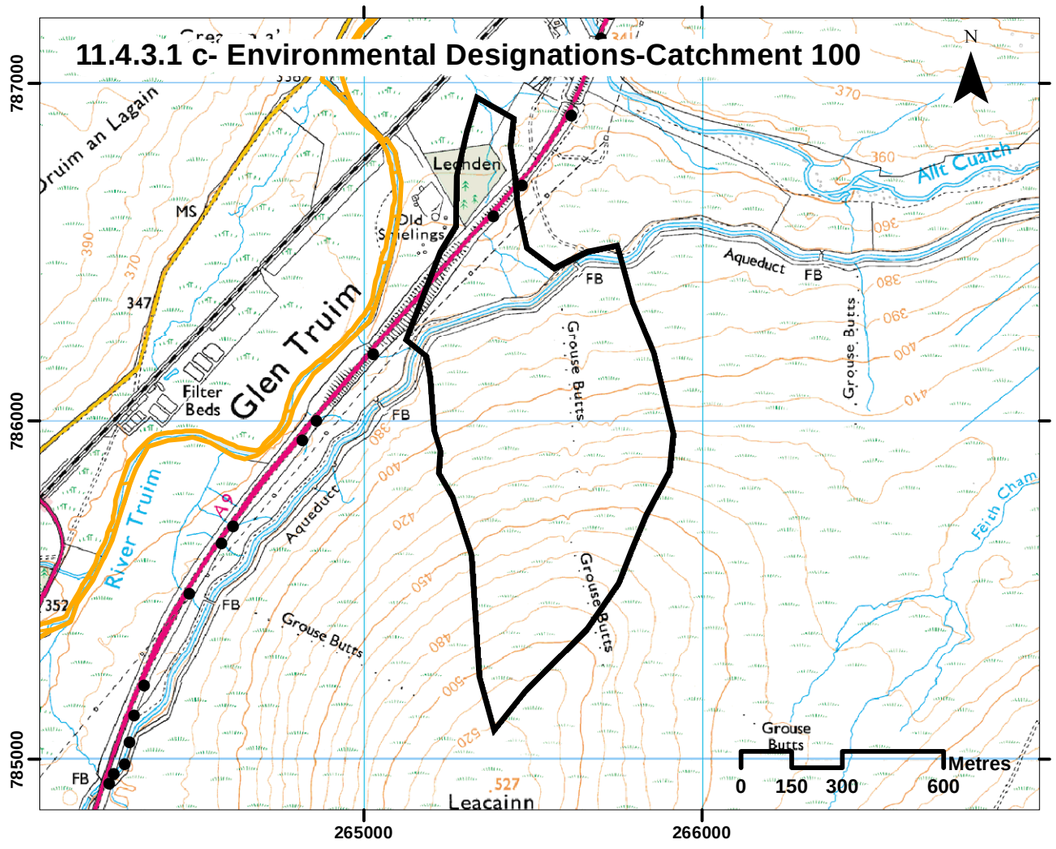
11.4.3.1 a- Solid Geology-Catchment 100



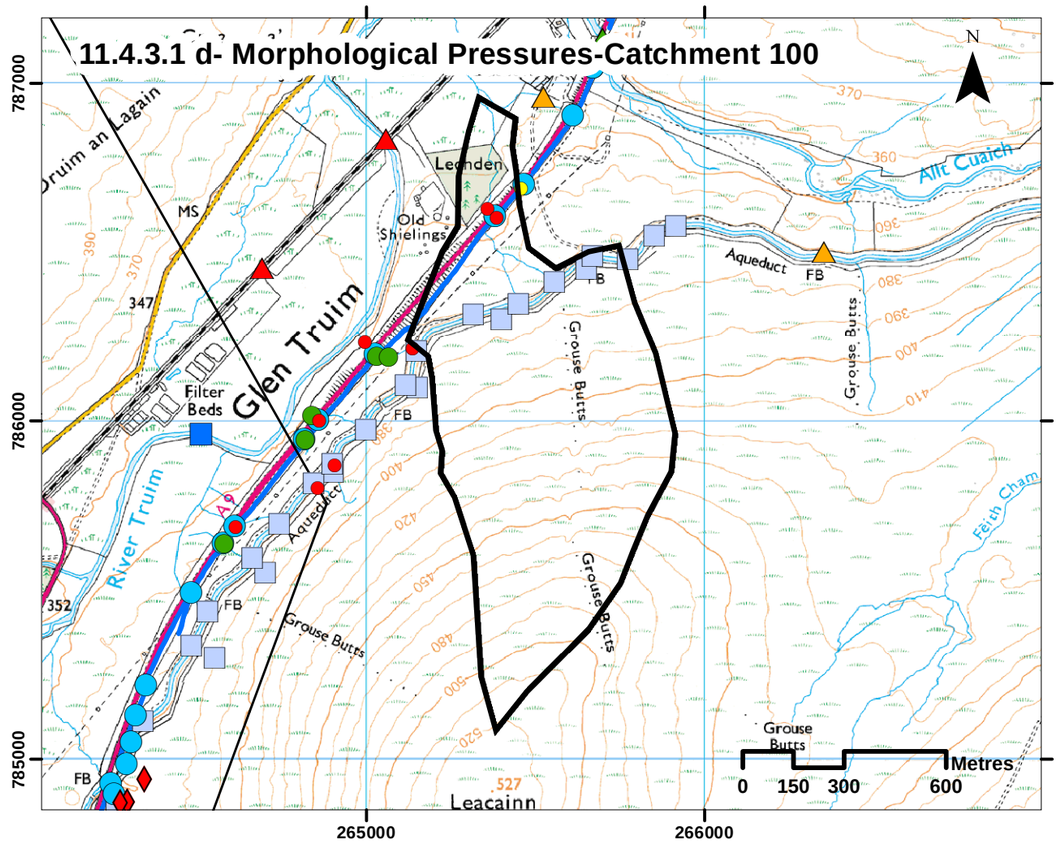
11.4.3.1 b- Drift Geology-Catchment 100



11.4.3.1 c- Environmental Designations-Catchment 100



11.4.3.1 d- Morphological Pressures-Catchment 100



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 Area of Conservation

Morphological Pressures
- Railway Bridge
- Road Bridge
- Track/Footbridge
- Culvert
- Cascade
- Step in Bed
- Catchpit
- Dam or Weir
- Discharge Location
- Abstraction Location
- Drainage Ditch
- Power Lines

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TRANSPORT SCOTLAND

A9 DUALLING PERTH TO INVERNESS

PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

Drawing 11.4.3.1 Catchment 100 Catchment Overview

DESIGN:	DRAWN:	CHK:	APP:
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DATE: 20/07/2017

PROJ: 495298

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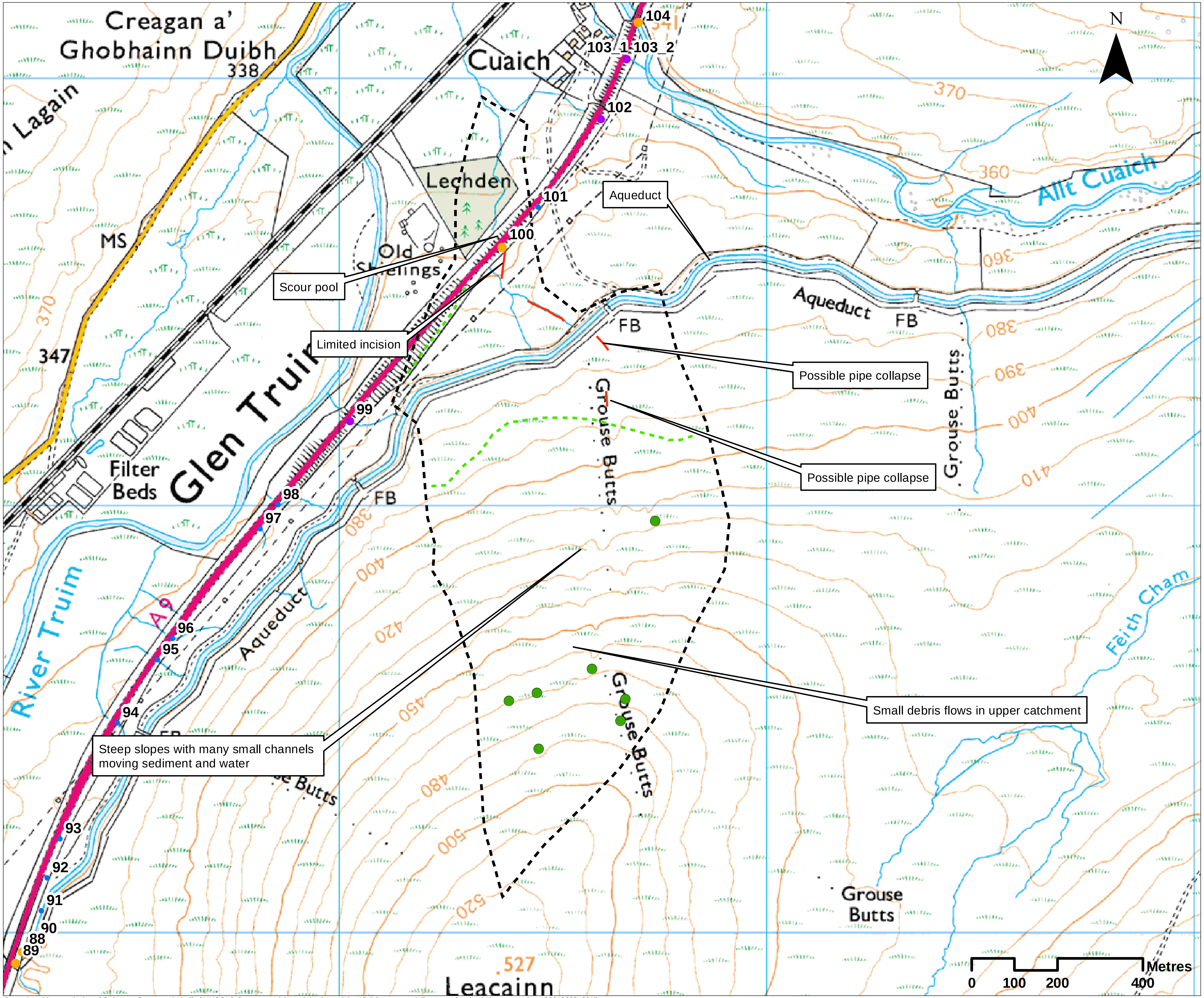

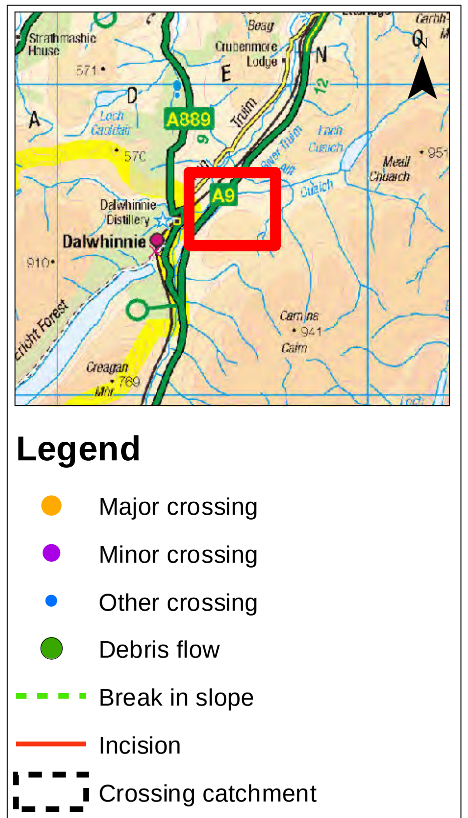

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PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

DRAWING 11.4.3.2.
Catchment 100 Baseline Assessment

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

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Annex 11.4.3 - Hydromorphological Catchment Assessment - 102

Catchment No.	102
Catchment Name	-

Channel Nature	Nature of water course	Drain
	Size of water course	Minor

Quantitative Spatial Elements	Catchment Area (km^2)	0.09
	Average slope in catchment (°)	3.5
	% Catchment over 750m (for snow melt risk)	0

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 102)	Gaick Psammite formation-Psammite	resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	Yes	Risk of avulsion into 104

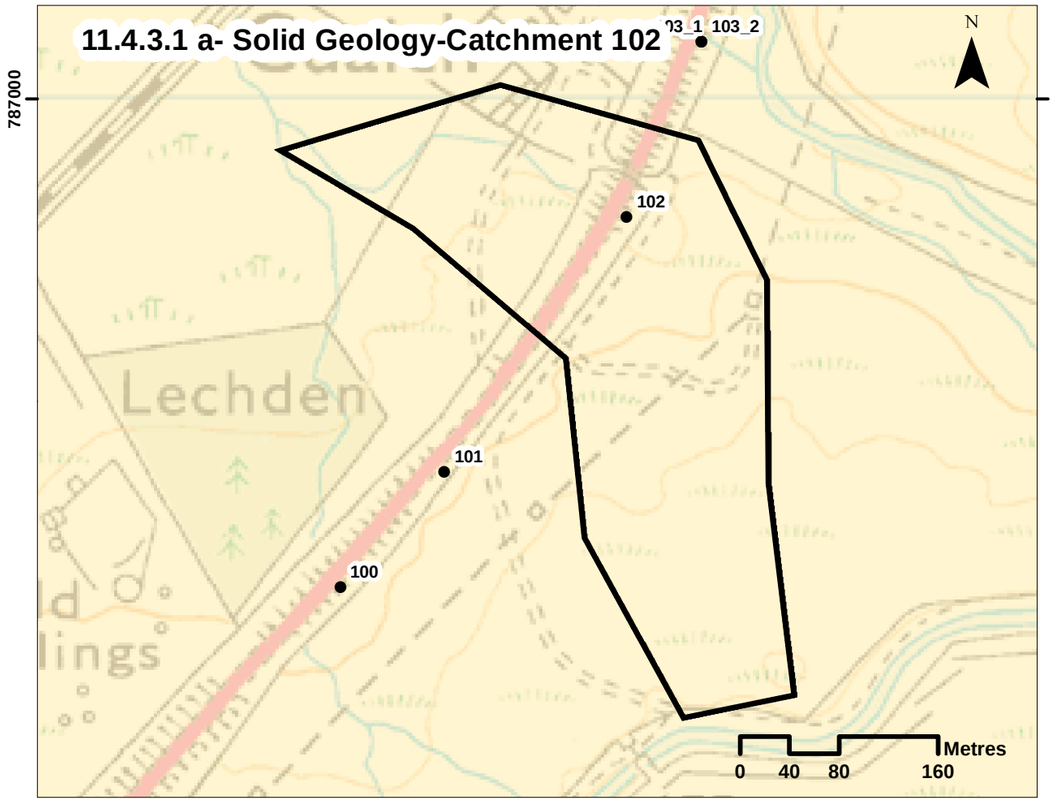
Environmental designations (see Drawing 11.4.3.1 c, Catchment 102)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

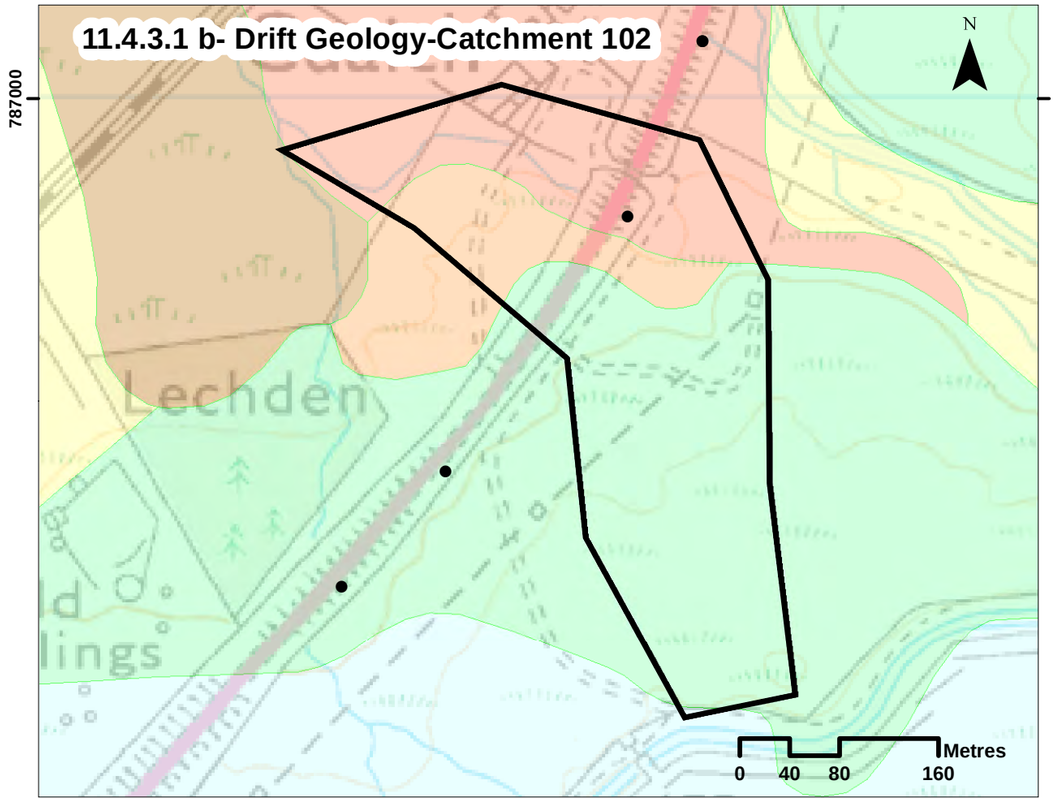
Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 102	
	Is peat present in the catchment	No	
	Is there a bog burst risk	No	
	Current valley side or terrace erosion	No	
	Potential valley side or terrace erosion	No	
	Hill slope failures (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	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 102)	Yes	Upper end of catchment truncated by Aqueduct
	Comment on sediment source potential in catchment	Limited to fines and organics. Low slope angles preclude mass movements and sediment arising from erosion of failure of short steep terrace slope (likely formed in hummocky glacial deposits from review of BGS map) unlikely to be transported far	
	Comment on sediment supply potential to crossing	Very limited. Fine organic sediment only.	

Morphology and Process-Reach upstream of crossing	Channel morphology	Engineered	
	Predominant sediment size	Fine	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Medium	Fines, organics
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (Map 1d)	Yes	Access track immediately u/s
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 102)	Yes	Likely limits flow reaching crossing
	Channel realignment	Yes	Under access track

Morphology and Process-At crossing	Channel morphology	Engineered	
	Predominant sediment size	Fine	
	Estimated discharge at 1:200 event (m^3/s)	0.3	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Medium	
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	None	

Morphology and Process-Reach downstream of crossing	Channel morphology	Engineered	Looks like cut drain
	Predominant sediment size	Fine	
	Unvegetated bars	None	
	Vertical incision	None	
	Deposition	Medium	Fines deposited in channel
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (Map 1d)	None	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 102)	None	
	Channel realignment	Yes	Cut drain, likely for farmland drainage d/s
Summary behaviour	Very limited activity. Some fine deposition u/s of crossing, but catchment area also very limited. Risk of avulsion into 104.		





Legend

General

- Crossing location

Solid Geology

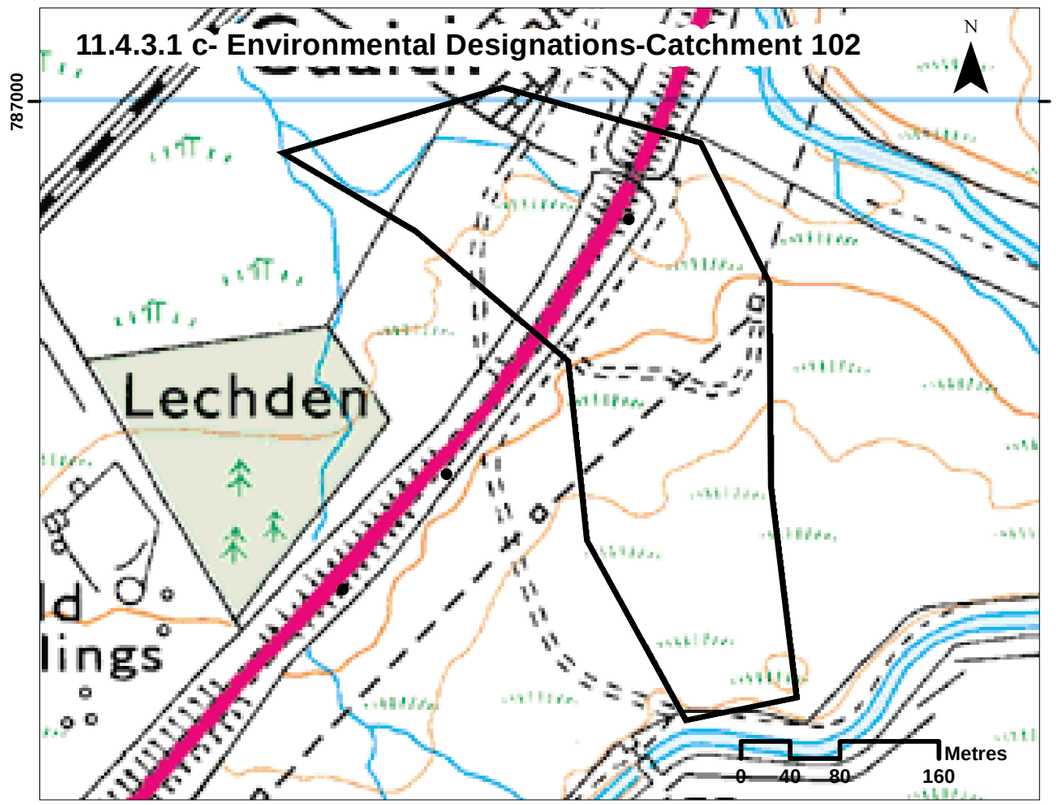
- Gaick Psammite Formation - Psammite

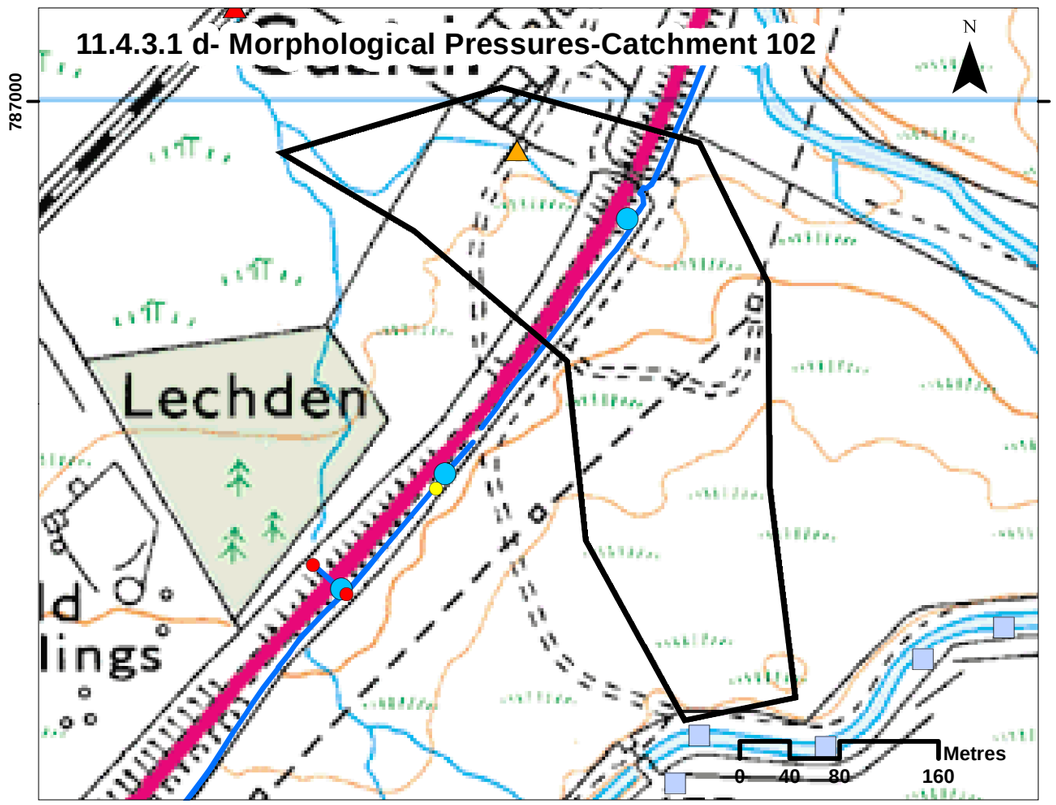
Drift Geology

- 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

Morphological Pressures

- Railway Bridge
- Track/Footbridge
- Culvert
- Step in Bed
- Catchpit
- Abstraction Location
- Drainage Ditch





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PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

Drawing 11.4.3.1 Catchment 102 Catchment Overview

DESIGN:	DRAWN:	CHK:	APP:
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DATE: 20/07/2017

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Legend

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

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PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

DRAWING 11.4.3.2.
Catchment 102 Baseline Assessment

DESIGN:	DRAWN:	CHK:	APP:
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Annex 11.4.3 - Hydromorphological Catchment Assessment - 103_1 and 2

Catchment No.	103_1 and 2
Catchment Name	-

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

Quantitative Spatial Elements	Catchment Area (km^2)	No Data
	Average slope in catchment (°)	No Data
	% Catchment over 750m (for snow melt risk)	0

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

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 103_1 and	Gaick Psammite formation-Psammite	resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	Yes	Risk of avulsion into 104

Environmental designations (see Drawing 11.4.3.1 c, Catchment 103_1 and 2)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 103_1 and 2	
	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	Yes	D/s of road
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 103_1 and 2)	No	
	Comment on sediment source potential in catchment	This is a channel that will only operate when main channel of the Allt Cuaich (Crossing 104) is over bankfull. There is a plentiful supply of coarse sediment in the Allt Cuaich, but this is unlikely to reach the crossing for the reasons indicated below.	
	Comment on sediment supply potential to crossing	Sediment supply is likely to be limited to that fines which drop out of suspension when channel is in operation. Channel crosses the flood plain of the Allt Cuaich and the gradient is relatively low and coarse bed load is unlikely to leave the main channel.	

Morphology and Process- Reach upstream of crossing	Channel morphology	Engineered	Straight, cut drain
	Predominant sediment size	Fine	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	None	
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (Map 1d)	Yes	Fences
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 103_1 and 2)	No	
	Channel realignment	Yes	On 1902 map, there is a secondary, slightly sinuous channel shown diverging from the main channel c.30m u/s of the current divergence. This channel crosses the current road alignment roughly where the current channel does. Mapping indicates that this channel was probably much larger and less ephemeral than present cut drain.

Morphology and Process- At crossing	Channel morphology	Engineered	Pipe culvert, possible two entrances and one exit?
	Predominant sediment size	Fine	
	Estimated discharge at 1:200 event (m^3/s)		
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	None	
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	None	

Morphology and Process- Reach downstream of crossing	Channel morphology	Engineered	Straight, cut drain
	Predominant sediment size	Fine	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	None	
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (Map 1d)	No	(Flow re-joins main 104 channel u/s of railway)
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 103_1 and 2)	No	
	Channel realignment	Yes	D/s of the road, the 1902 map shows the slightly sinuous secondary channel continuing, with the Cuaich/Quoich farm sitting on top of a low terrace on it's left bank.

Summary behaviour	This channel is now a very minor artificial drain and flows only occur when the Allt Cuaich is out of bank. U/s of the road, the former large secondary channel shown in the 1902 map is no longer active. This drain may have been cut, and the channel shown in the 1902 map abandoned, well before road construction, as later map (1920s- 1940s, 1:63k) indicates a much straighter, smaller channel in this location and it may be this rather than the original sinuous secondary channel that was incorporated into the original road design. D/s of the road crossing the channel is straight c. 50m away from the secondary channel shown on the 1902 map. Characteristics of the present channel d/s of the road are similar to those of the present channel u/s of the road. Former channel banks and bars from before road/rail construction are clearly visible in the floodplain morphology. This crossing has been highlighted as one for potential improvement. Major changes would probably be required to return the channel to it's form shown on the 1902 map, including removal of the embankment, or at least incorporating a second major crossing in the embankment for a secondary channel of the Allt Cuaich to flow. Implications of this would need to consider the flood risk implications for the hamlet of Cuaich/Quoich. There is a risk of avulsion of flows into 104 and visa versa.

Annex 11.4.3 - Hydromorphological Catchment Assessment - 104

Catchment No.	104
Catchment Name	Allt Coire Cuaich

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

Quantitative Spatial Elements	Catchment Area (km^2)	36.4
	Average slope in catchment (°)	12.3
	% Catchment over 750m (for snow melt risk)	21.5

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

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 104)	Gaick Psammite formation-Psammite	resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	Yes	Risk of avulsion at crossing to the east

Environmental designations (see Drawing 11.4.3.1 c, Catchment 104)	Ramsar	No	
	SAC	Downstream of crossing is part of Spey	
	SPA	No	
	SSSI	No	

Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 104	
	Is peat present in the catchment	Yes	
	Is there a bog burst risk	No	
	Current valley side or terrace erosion	Several locations	Med sediment input
	Potential valley side or terrace erosion	Yes	Med sediment input
	Hill slope failures (including peat slides and debris flows and slides)	Extensive in steep upper catchment	Very high availability of sediment
	Hill slope failures coupled to channel	Extensive in steep upper catchment	Very high availability of sediment
	Vertical incision present in catchment	Yes, in tributaries rather than in main channel	Main channel stream appears relatively stable vertically
	Bank erosion/lateral migration	Extensive evidence of lateral channel	High availability of sediment
	Unvegetated bars	Extensive and numerous undeleted bars	Very high availability of sediment
	Wooded/forested areas in catchment	None	Low availability of floating debris
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 104)	Aqueduct Dams	Do not seem to be stopping downstream sediment transfer, will be altering downstream discharge and sediment transport
	Comment on sediment source potential in catchment	Very high sediment source potential from debris flows, shallow slides and valley side erosion Extensive areas of exposed gravel bars and lengths of bank erosion	
	Comment on sediment supply potential to crossing	Lots of channels to transport sediment short distance from hill side to main channel Short area of reduced slope upstream of crossing will increase deposition here, reducing speed of transport from hillside to crossing, but sediment will remain here for future transport Channel becomes steep and confined towards crossing, funnelling sediment downstream Crossing is then on a flatter location (area of deposition)	

Morphology and Process-Reach upstream of crossing	Channel morphology	Wandering	Actively laterally mobile channel
	Predominant sediment size	Cobbles	
	Unvegetated bars	Extensive	Lots of available sediment
	Vertical incision	Medium	
	Deposition	High	Due to volume of available sediment
	Lateral migration/bank erosion	High	
	Presence and nature of infrastructure (Map 1d)	None	N/A
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 104)	N/A	N/A
	Channel realignment	Yes	Moved towards right bank, and secondary channel cut off

Morphology and Process-At crossing	Channel morphology	Engineered	
	Predominant sediment size	Cobbles	
	Estimated discharge at 1:200 event (m^3/s)	103.1	
	Unvegetated bars	Yes	
	Vertical incision	Medium	
	Deposition	High	
	Lateral migration/bank erosion	High	Damage to gabions installed to prevent erosion of the right bank/terrace
	Damaged/unstable drains or armouring	No	

Morphology and Process-Reach downstream of crossing	Channel morphology	Wandering	
	Predominant sediment size	Cobbles	
	Unvegetated bars	Some	
	Vertical incision	Medium	
	Deposition	High	
	Lateral migration/bank erosion	High	Channel laterally mobile between crossings
	Presence and nature of infrastructure (Map 1d)	Railway bridge	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 104)	Impounding high flows and fixing channel position	Increased deposition upstream Fixing channel position- Possible scour to base as channel adjusts
	Channel realignment	Yes	

Summary behaviour	Extensive sediment supply from the upper catchment transported to and along the main channel, forming a wandering channel with extensive mobile bars. Flow and downstream sediment transport are reduced by the Hydropower dam on Loch Cuaich, and there is no requirement to release any compensation flow to the Allt Cuaich from this structure (Enviro Centre, 2008). Channels are laterally mobile within the boundaries of the terraces, but will erode banks and terraces at times. There is potential for avulsion of the channel across floodplain during a flood event. High deposition and lateral migration risk. Med Incision risk. Risk of avulsion at crossing.

Photograph 11.4.3.78-Downstream

Photograph 11.4.3.79- Upstream

Photograph 11.4.3.80

Photograph 11.4.3.80 - Sheep crossing

Photograph 11.4.3.81- Upstream

Photograph 11.4.3.82- Upstream

Photograph 11.4.3.83-Upstream

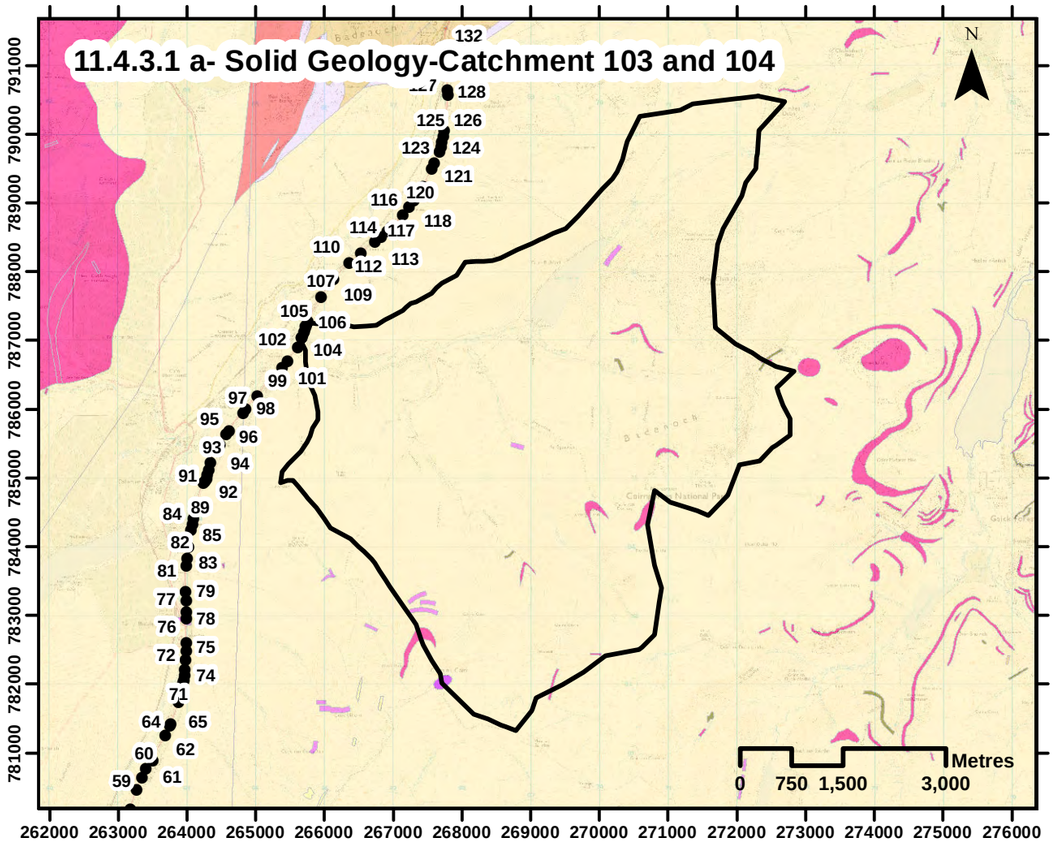
Photograph 11.4.3.84- Upstream

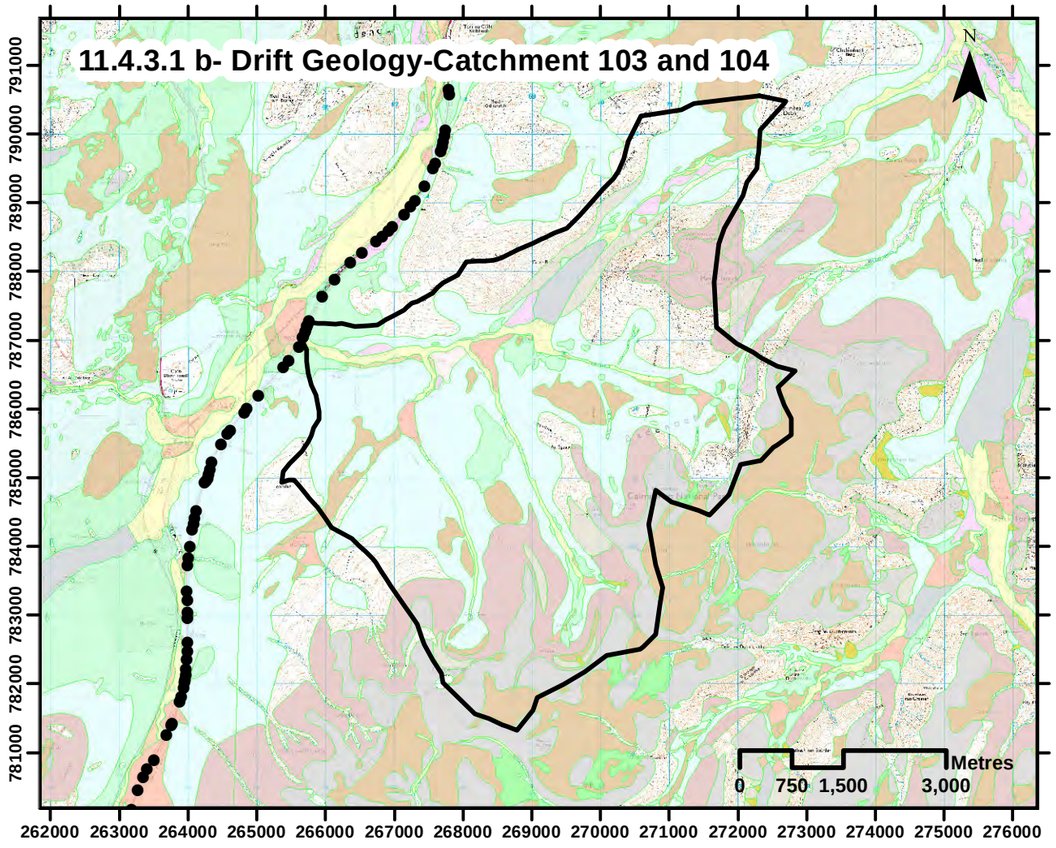
Photograph 11.4.3.85

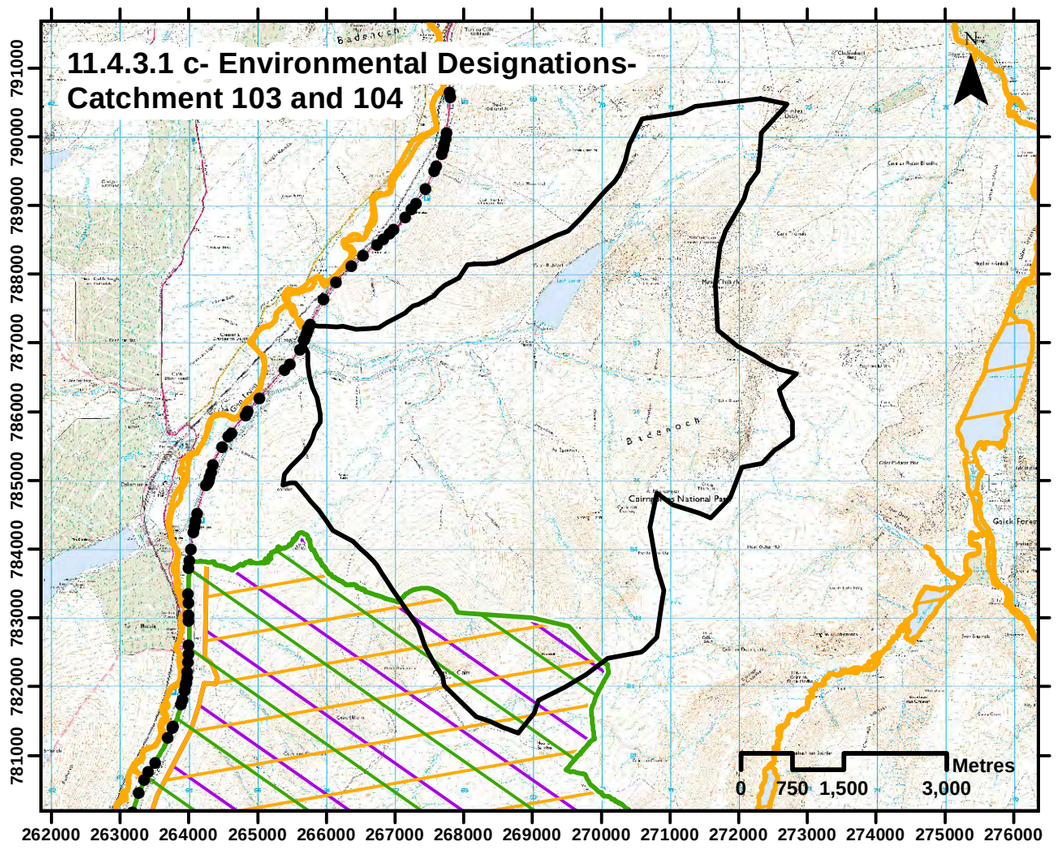
Photograph 11.4.3.86

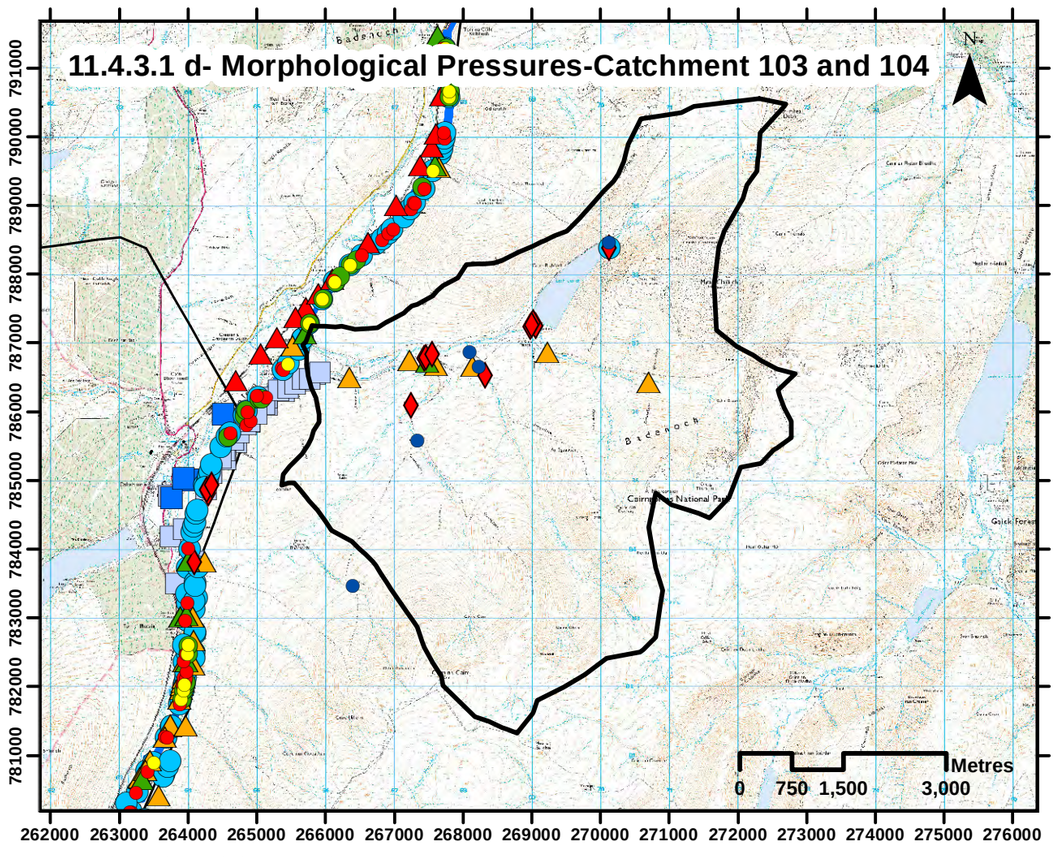
Photograph 11.4.3.87 - Paelochannel visible on the floodplain

Photograph 11.4.3.88 - Downstream









Legend

General
- Crossing Location
- Catchment Area

Solid Geology
- Gaick Psammite Formation - Psammite
- Scottish Highland Ordovician Minor Intrusion Suite - Pegmatite
- Scottish Highland Siluro-Devonian Calc-Alkaline Minor Intrusion Suite-Lamprophyres
- Scottish Highland Siluro-Devonian Calc-Alkaline Minor Intrusion Suite-Microgranite, Porphyritic

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
- Road Bridge
- Track/Footbridge
- Culvert
- Cascade
- Step in Bed
- Catchpit
- Ford
- Dam or Weir
- Discharge Location
- Abstraction Location
- Drainage Ditch
- Power Lines

REV	SUIT	DATE	DESCRIPTION	BY	APP

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TRANSPORT SCOTLAND
A9 DUALLING PERTH TO INVERNESS

PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

Drawing 11.4.3.1
Catchment 103 and 104 Catchment Overview

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

DATE: 20/07/2017

PROJ: 495298

DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0001

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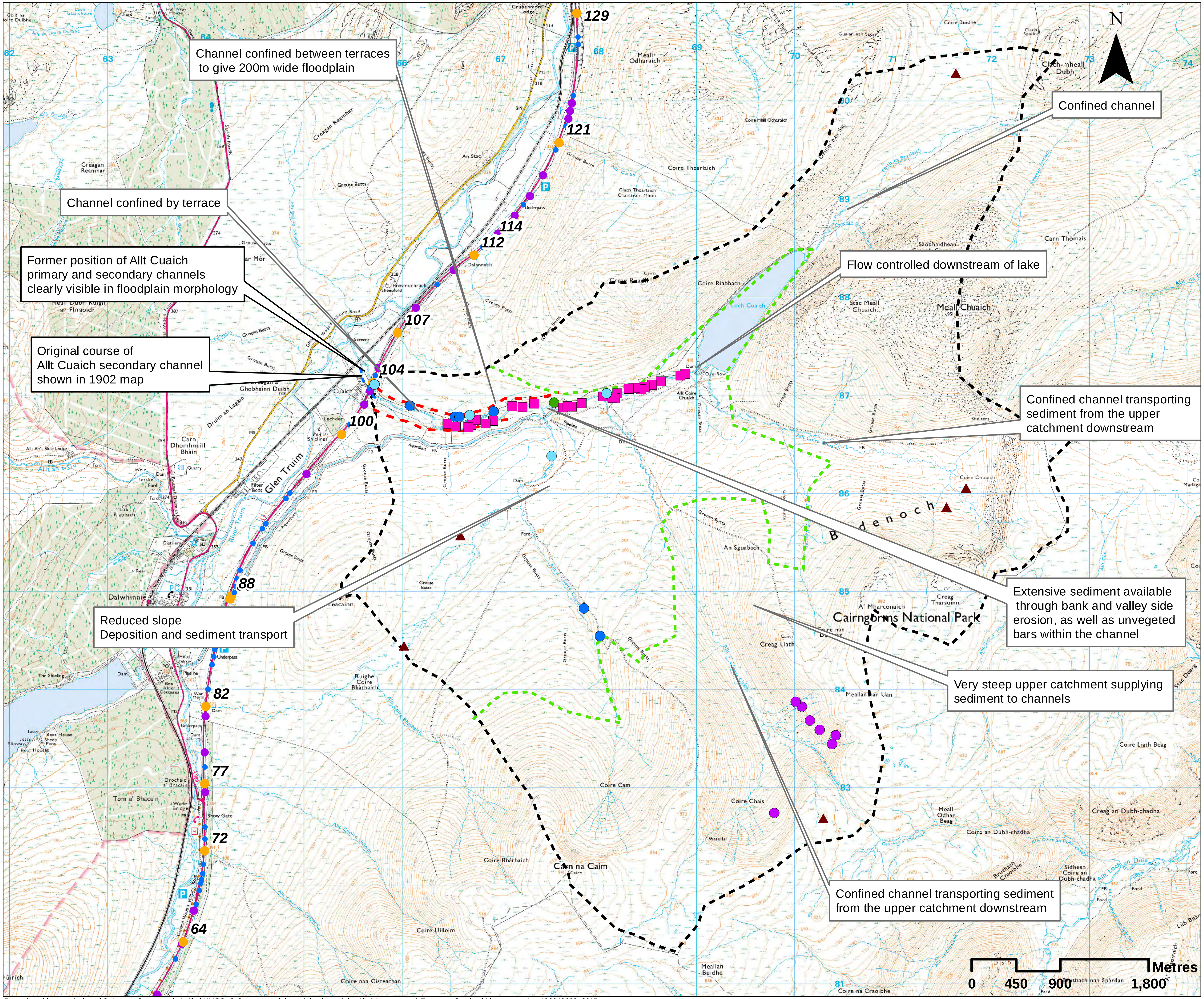

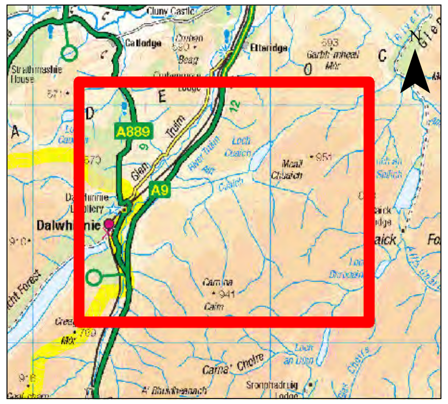

Legend

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

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TRANSPORT SCOTLAND
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PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

DRAWING 11.4.3.2.
Catchment 103 and 104 Baseline Assessment

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

DATE: 11/07/2017

PROJ: 495298

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SHEET:	REVISION:	SUITABILITY:
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Annex 11.4.3 - Hydromorphological Catchment Assessment - 106

Catchment No.	106
Catchment Name	-

Channel Nature	Nature of water course	Drain
	Size of water course	Minor

Quantitative Spatial Elements	Catchment Area (km^2)	0.1
	Average slope in catchment (°)	4.3
	% Catchment over 750m (for snow melt risk)	0

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

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 106)	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 106)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 106	
	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	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 106)	No	
	Comment on sediment source potential in catchment	Limited - no exposed sediment sources	
	Comment on sediment supply potential to crossing	Likely to be supply limited, and therefore little.	

Morphology and Process-Reach upstream of crossing	Channel morphology	Engineered	
	Predominant sediment size	Fines	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (Map 1d)	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 106)	No	
	Channel realignment	Yes	Drain to capture hillslope drainage

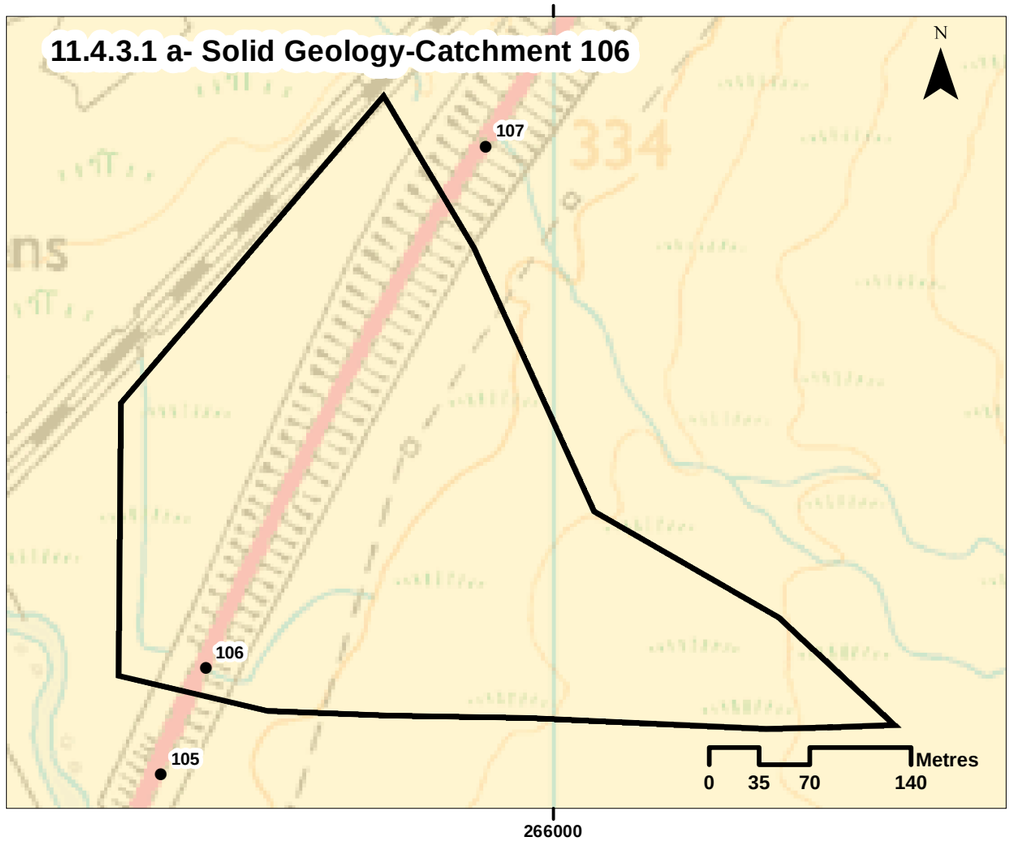
Morphology and Process-At crossing	Channel morphology	Engineered	
	Predominant sediment size	Fine	
	Estimated discharge at 1:200 event (m^3/s)	0.4	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Low	
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	Yes	Very limited damage (displaced armouring stones) in otherwise intact cascade

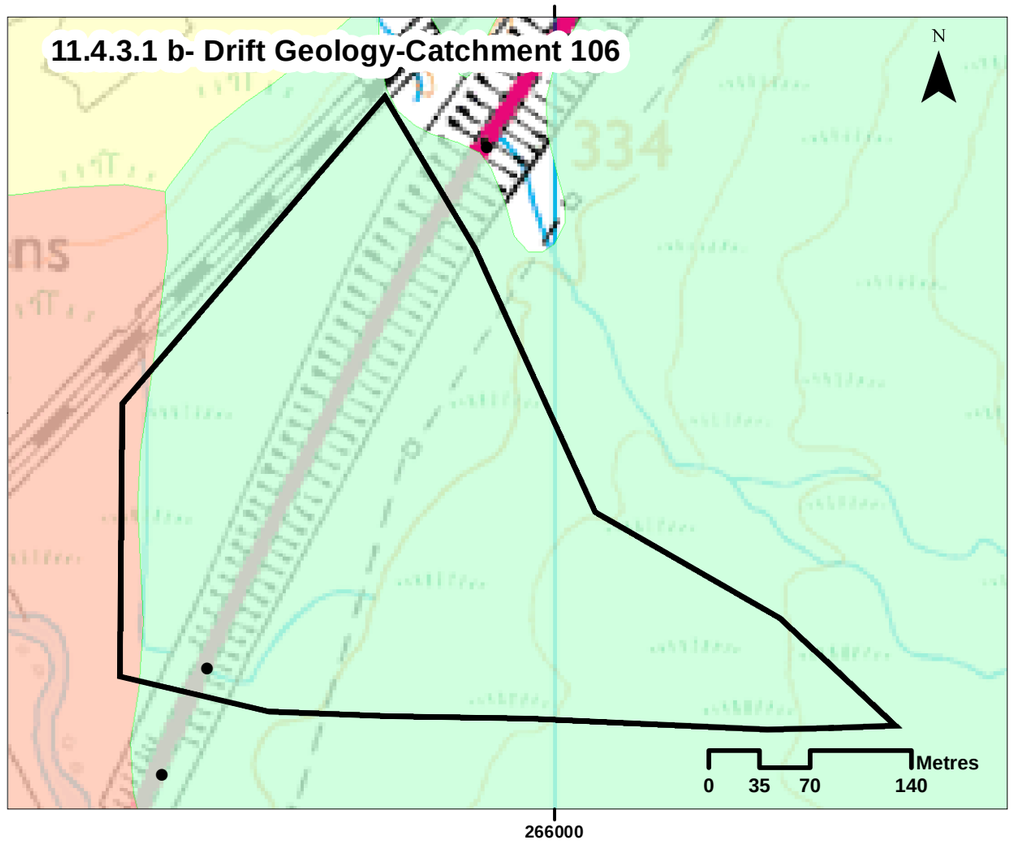
Morphology and Process-Reach downstream of crossing	Channel morphology	Engineered	
	Predominant sediment size	Fine	
	Unvegetated bars	No	
	Vertical incision	Medium	Some scour at outflow from road culvert
	Deposition	Low	Fines
	Lateral migration/bank erosion	Low	Immediately d/s of outflow, due to scour - see above
	Presence and nature of infrastructure (Map 1d)	Yes	Railway (on embankment)
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 106)	Yes	Impoundment of 104 at high flows
	Channel realignment	Yes	Cut drain, straight

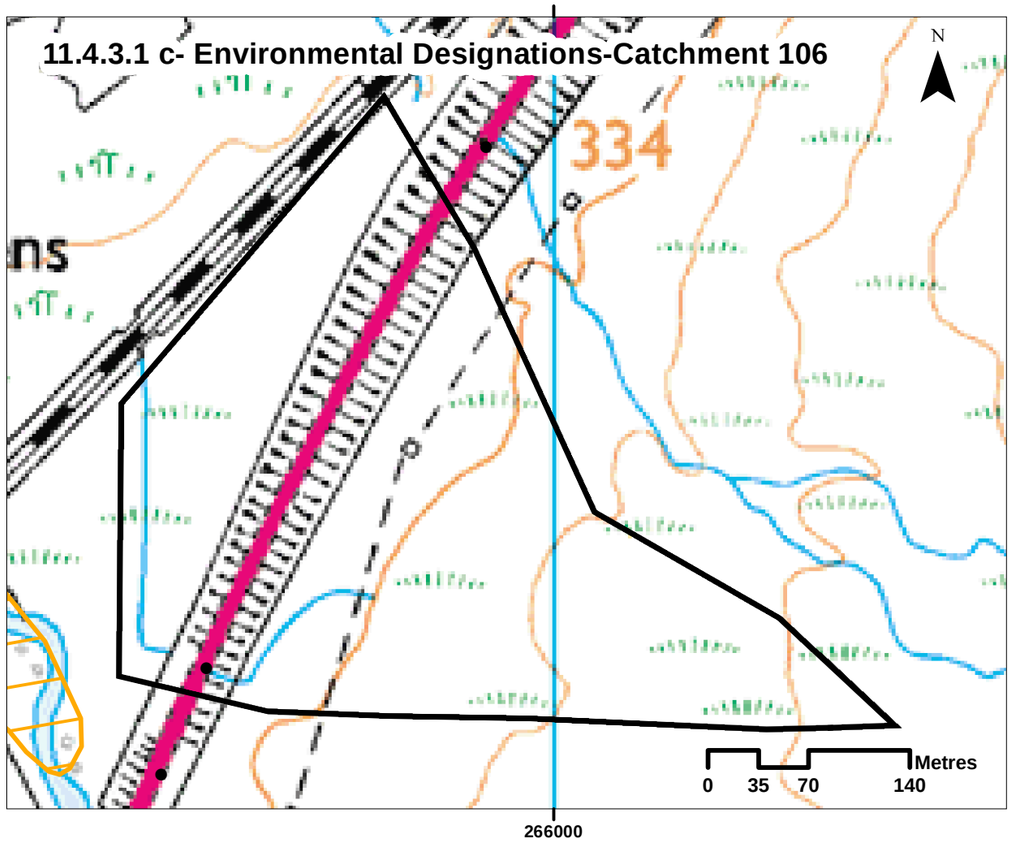
Summary behaviour	U/s of the road, a cut drain collects natural hillslope drainage from small channels. This descends to the road culvert on a principally intact cascade. D/s of the road culvert, there is a small amount of scour, before the drain crosses the flood plain/alluvial fan, close to its edge. At the railway embankment, flow goes through a railway crossing which appears oversized for channel 106. A large scour pool is also present on the d/s side of the railway crossing, which also appears very large for the limited flow that is likely to occur through crossing 106. Closer inspection of the LiDAR and aerial photographs indicate that this scour pool has likely been created when impounded high flows from channel 104 have drained through this railway crossing. These are more likely to have the energy to create the scour pool than the flow from channel 106 alone.

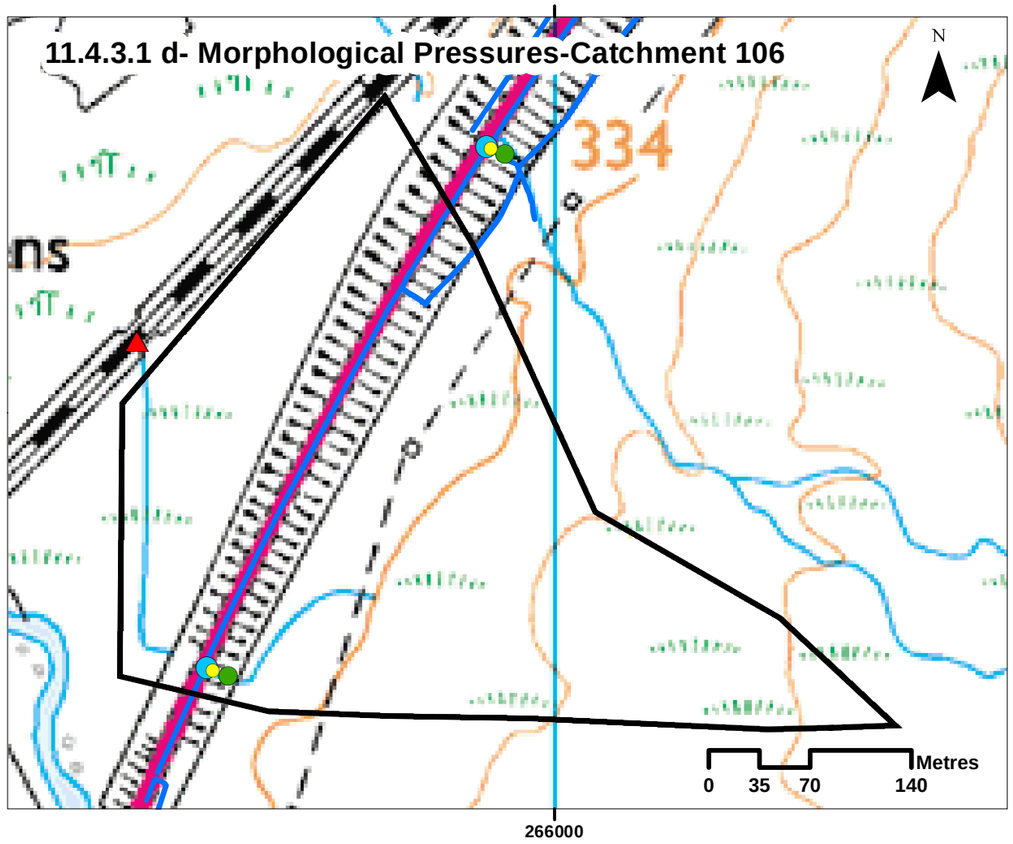
Photograph 11.4.3.89

Photograph 11.4.3.90 -Downstream crossing exit









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 Area of Conservation

Morphological Pressures
- Railway Bridge
- Culvert
- Cascade
- Catchpit
- Drainage Ditch

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TRANSPORT SCOTLAND
A9 DUALLING PERTH TO INVERNESS

PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

Drawing 11.4.3.1 Catchment 106 Catchment Overview

DESIGN:	DRAWN:	CHK:	APP:
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DATE: 20/07/2017

PROJ: 495298

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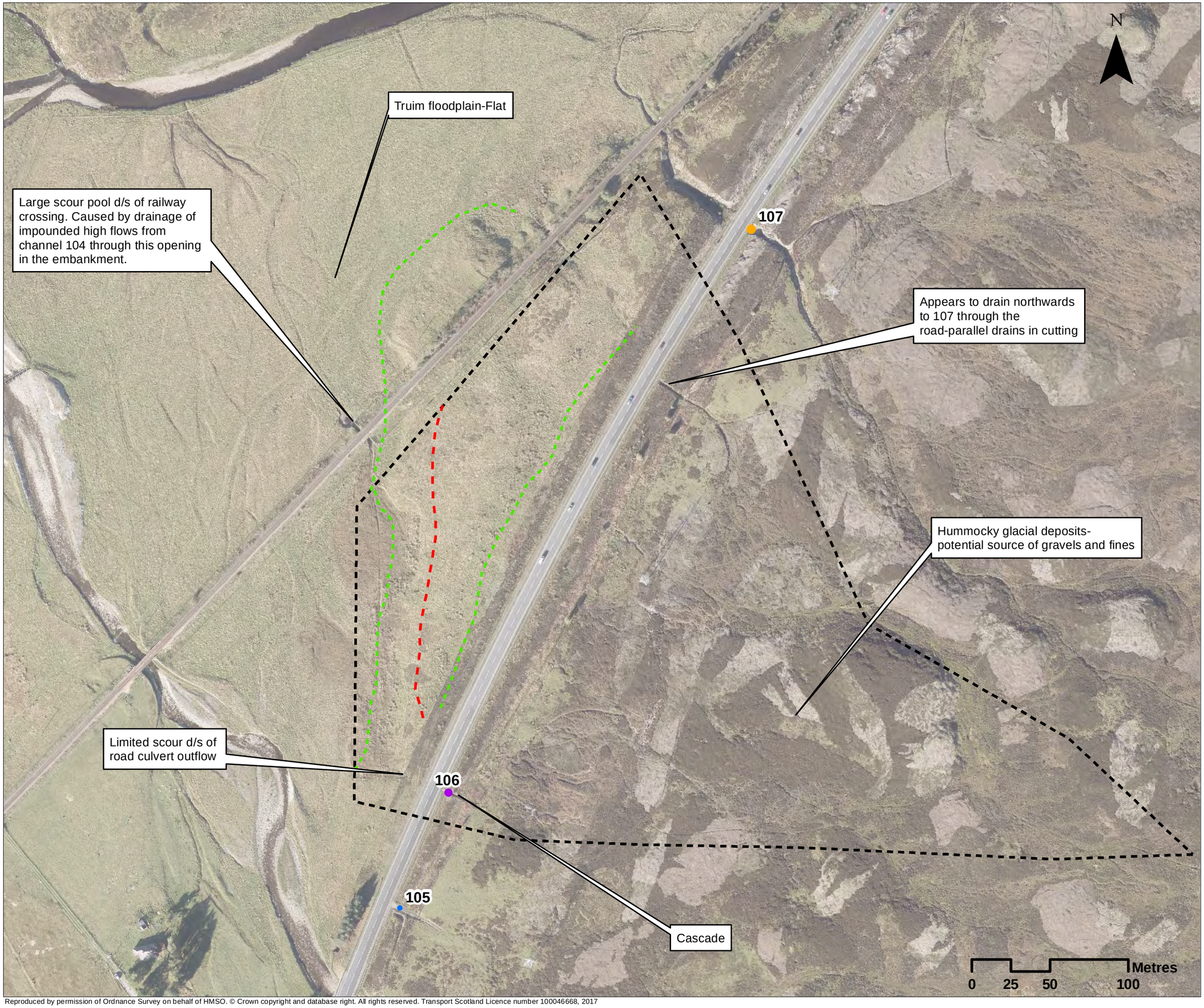

Legend

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

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PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

DRAWING 11.4.3.2.
Catchment 106 Baseline Assessment

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

DATE: 11/07/2017

PROJ: 495298

DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0002

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1 of 1	C01	A3

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Annex 11.4.3 - Hydromorphological Catchment Assessment - 107

Catchment No.	107
Catchment Name	-

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

Quantitative Spatial Elements	Catchment Area (km^2)	0.38
	Average slope in catchment (°)	4.5
	% Catchment over 750m (for snow melt risk)	0

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

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 107)	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 107)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 107	
	Is peat present in the catchment	No	
	Is there a bog burst risk	No	
	Current valley side or terrace erosion	None	Low sediment supply potential
	Potential valley side or terrace erosion	None	Low sediment supply potential
	Hill slope failures (including peat slides and debris flows and slides)	None	Low sediment supply potential
	Hill slope failures coupled to channel	None	Low sediment supply potential
	Vertical incision present in catchment	Yes- Upstream of crossing	
	Bank erosion/lateral migration	None	Low sediment supply potential
	Unvegetated bars	None	Low sediment supply potential
	Wooded/forested areas in catchment	None	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 107)	None	
	Comment on sediment source potential in catchment	Small relatively flat catchment, with little sediment supply to the channel from hillslopes Incision noted upstream of crossing will be adding sediment to the channel and has potential to continue cutting back upstream releasing a large volume of sediment	
	Comment on sediment supply potential to crossing	Low slopes reduce sediment transport potential	

Morphology and Process-Reach upstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Gravel	
	Unvegetated bars	No	
	Vertical incision	High	Sediment input to channel
	Deposition	Medium	
	Lateral migration/bank erosion	Medium	Sediment input to channel
	Presence and nature of infrastructure (Map 1d)	None	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 107)	N/A	
	Channel realignment	Yes	

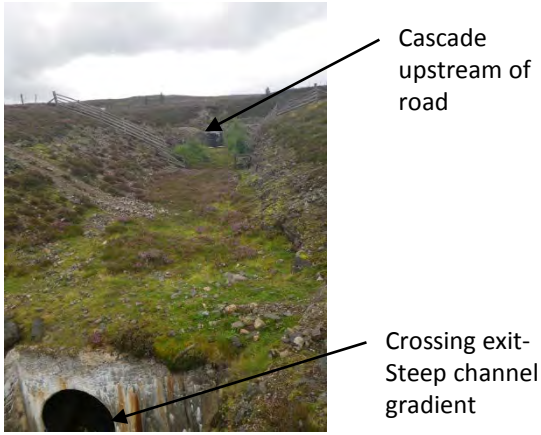
Morphology and Process-At crossing	Channel morphology	Cascade	
	Predominant sediment size	Gravel	
	Estimated discharge at 1:200 event (m^3/s)		
	Unvegetated bars	None	
	Vertical incision	High	
	Deposition	Medium	
	Lateral migration/bank erosion	High	
	Damaged/unstable drains or armouring	Yes	Drains undercut as channel incises

Morphology and Process-Reach downstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Gravel	
	Unvegetated bars	None	
	Vertical incision	Medium	
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (Map 1d)	None	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 107)	N/A	
	Channel realignment	Yes	

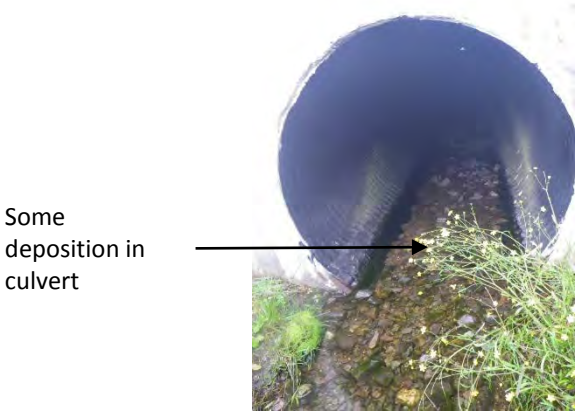
Summary behaviour	Low sediment supply from hillslope failure, but channel incision at and upstream of the crossing caused by a change in bed level and slope at the crossing (due to road being in cutting and channel being culverted under roadbed) is supplying some sediment to the crossing and has the potential to provide further sediment by under cutting banks and causing instability.

Photograph 11.4.3.91 -Downstream

Photograph 11.4.3.92-Dowstream



Photograph 11.4.3.93- Crossing

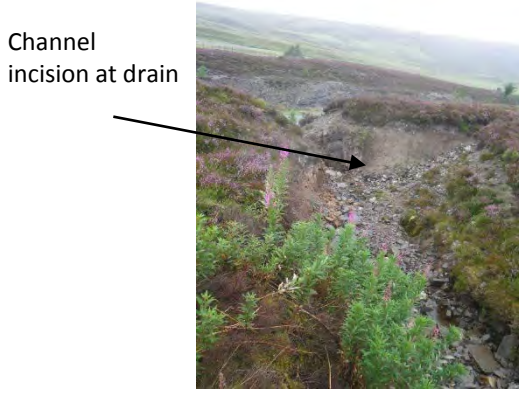


Photograph 11.4.3.94- Crossing exit

Photograph 11.4.3.95-Crossing exit

Photograph 11.4.3.96 -Upstream

Photograph 11.4.3.97 –Upstream of crossing, looking upstream



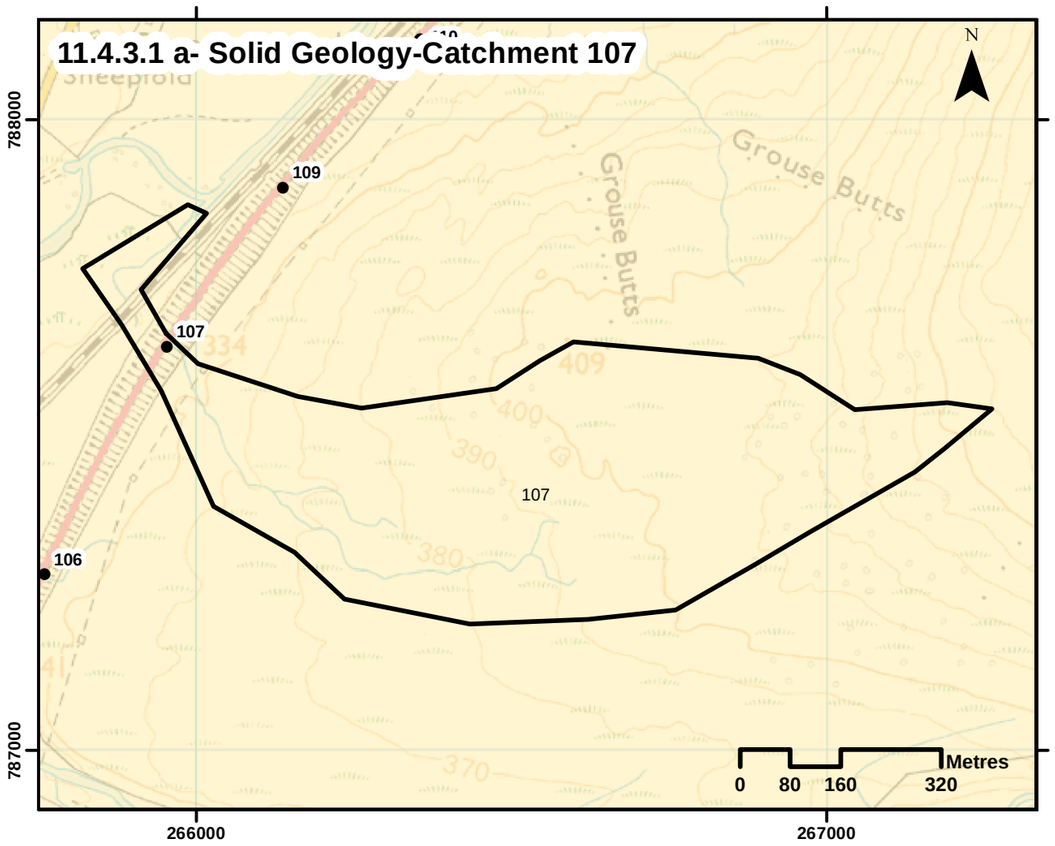
Photograph 11.4.3.98- Downstream to cascade

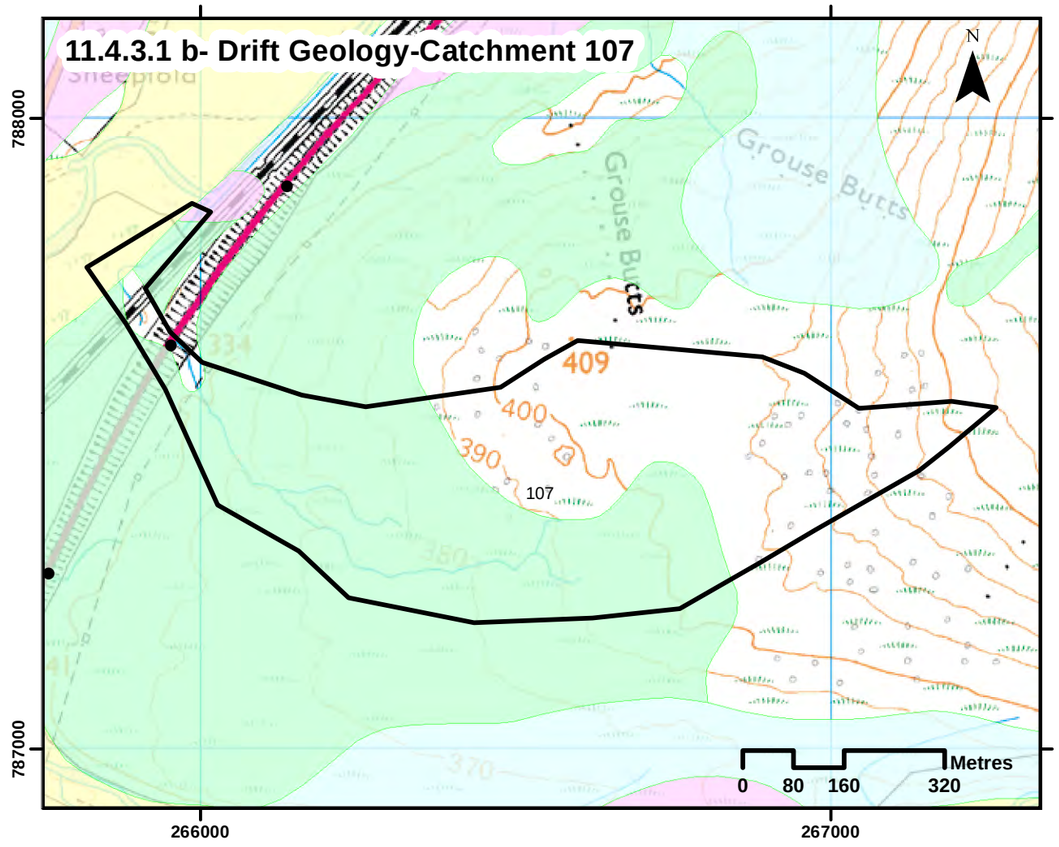
Incision of drain entering crossing

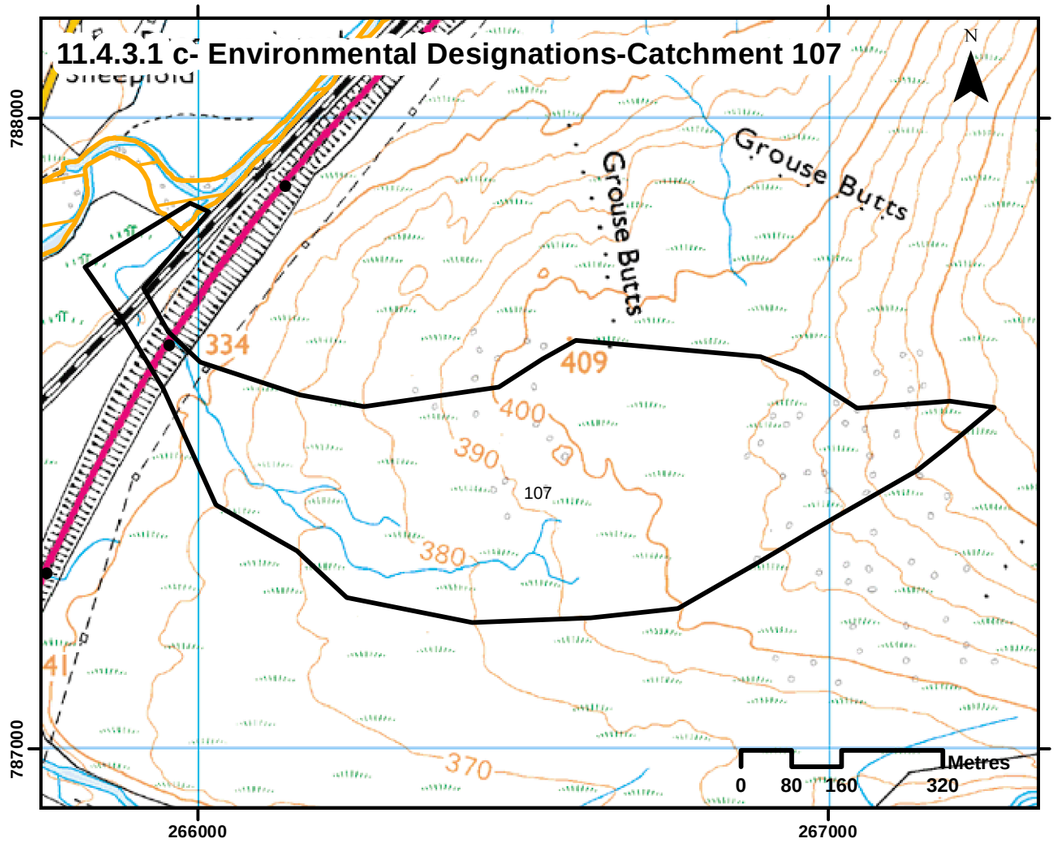
Photograph 11.4.3.99- Upstream of cascade

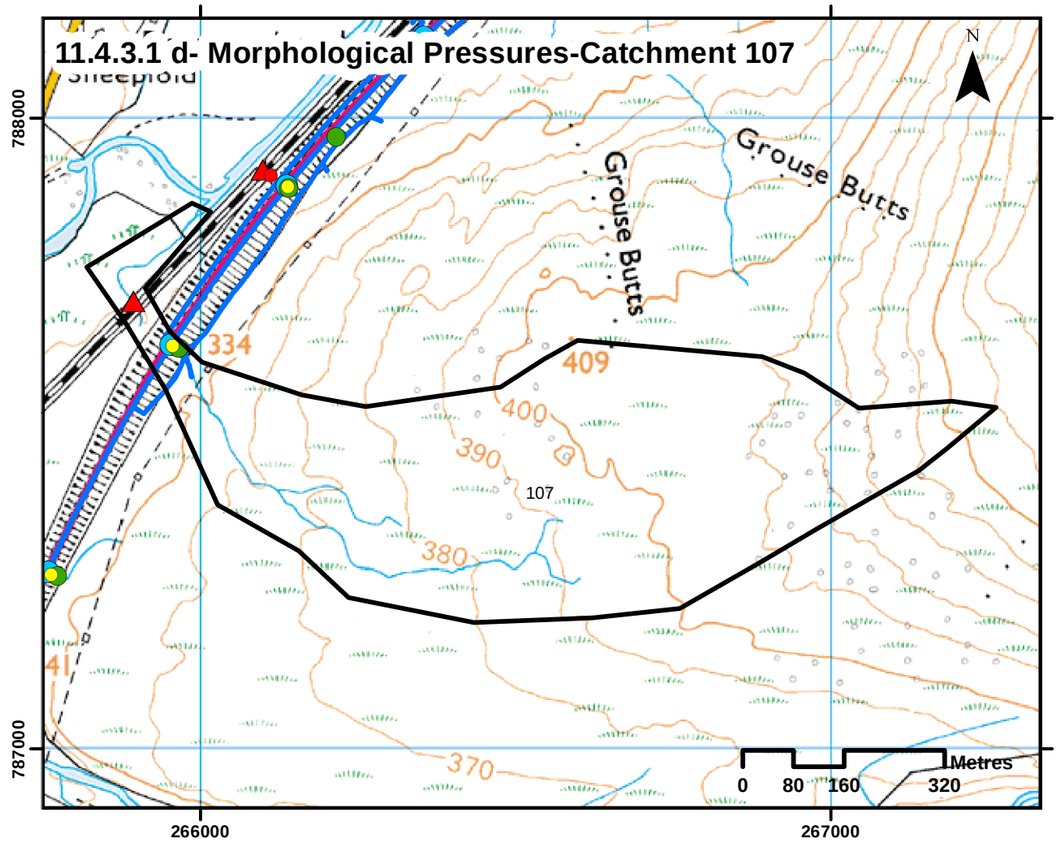
Bank instability and erosion caused by channel incision

Photograph 11.4.3.100- Upstream of cascade









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 Area of Conservation

Morphological Pressures
- Railway Bridge
- Culvert
- Cascade
- Step in Bed
- Catchpit
- Drainage Ditch

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TRANSPORT SCOTLAND — A9 DUALLING PERTH TO INVERNESS

PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

Drawing 11.4.3.1 Catchment 107 Catchment Overview

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

DATE: 12/07/2017

PROJ: 495298

DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0001

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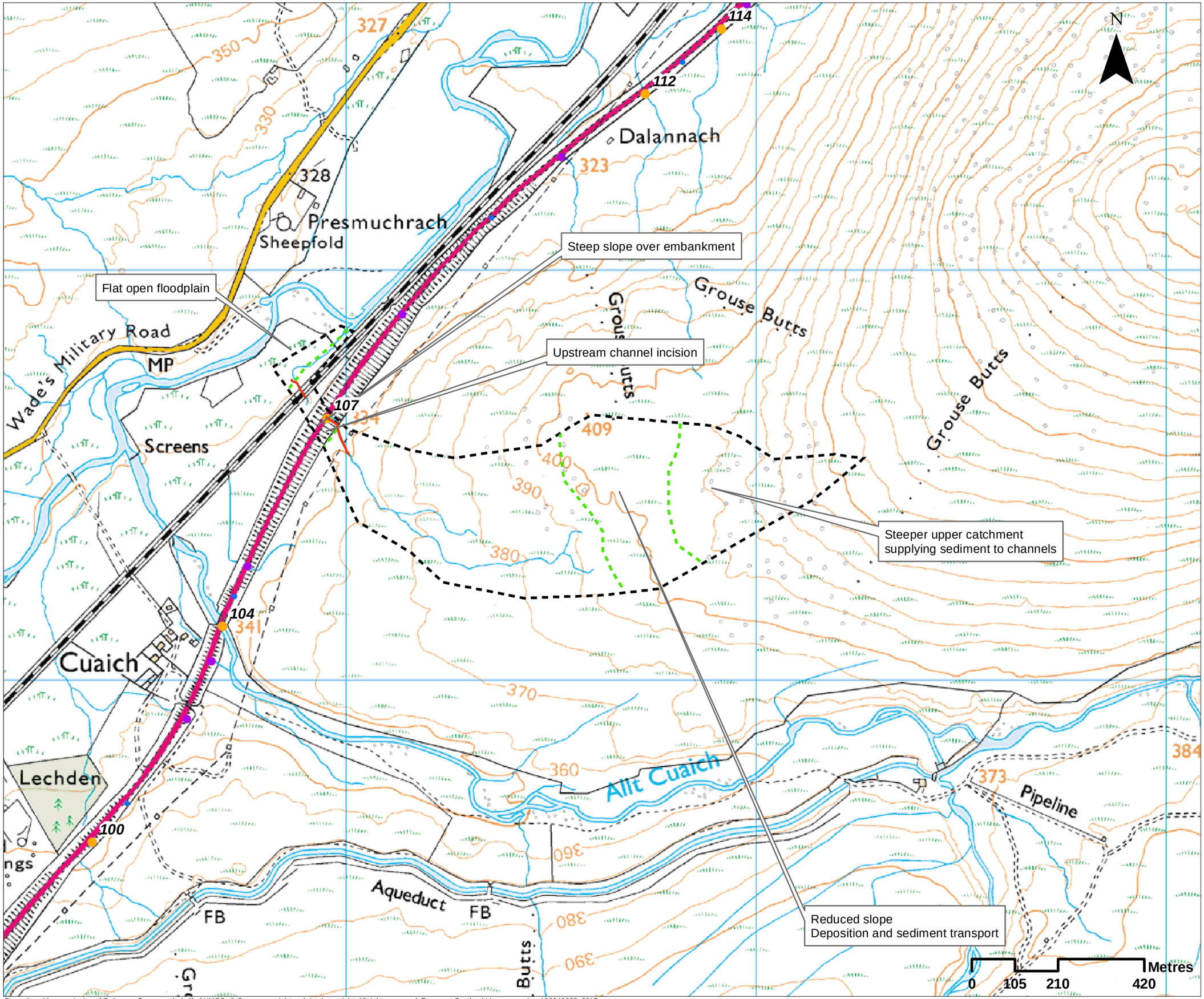

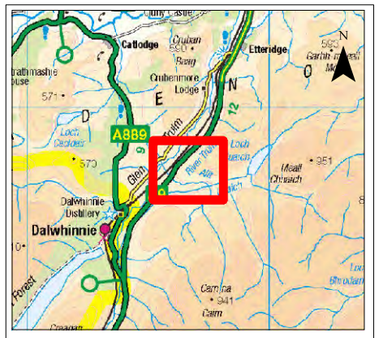

Legend

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

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TRANSPORT SCOTLAND

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PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

DRAWING 11.4.3.2.
Catchment 107 Baseline Assessment

DESIGN:	DRAWN:	CHK:	APP:
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DATE: 11/07/2017

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1 of 1	C01	A3

Annex 11.4.3 - Hydromorphological Catchment Assessment - 109

Catchment No.	109
Catchment Name	-

Channel Nature	Nature of water course	Drain
	Size of water course	Minor

Quantitative Spatial Elements	Catchment Area (km^2)	No Data
	Average slope in catchment (°)	8.3
	% Catchment over 750m (for snow melt risk)	0

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

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 109)	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 109)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

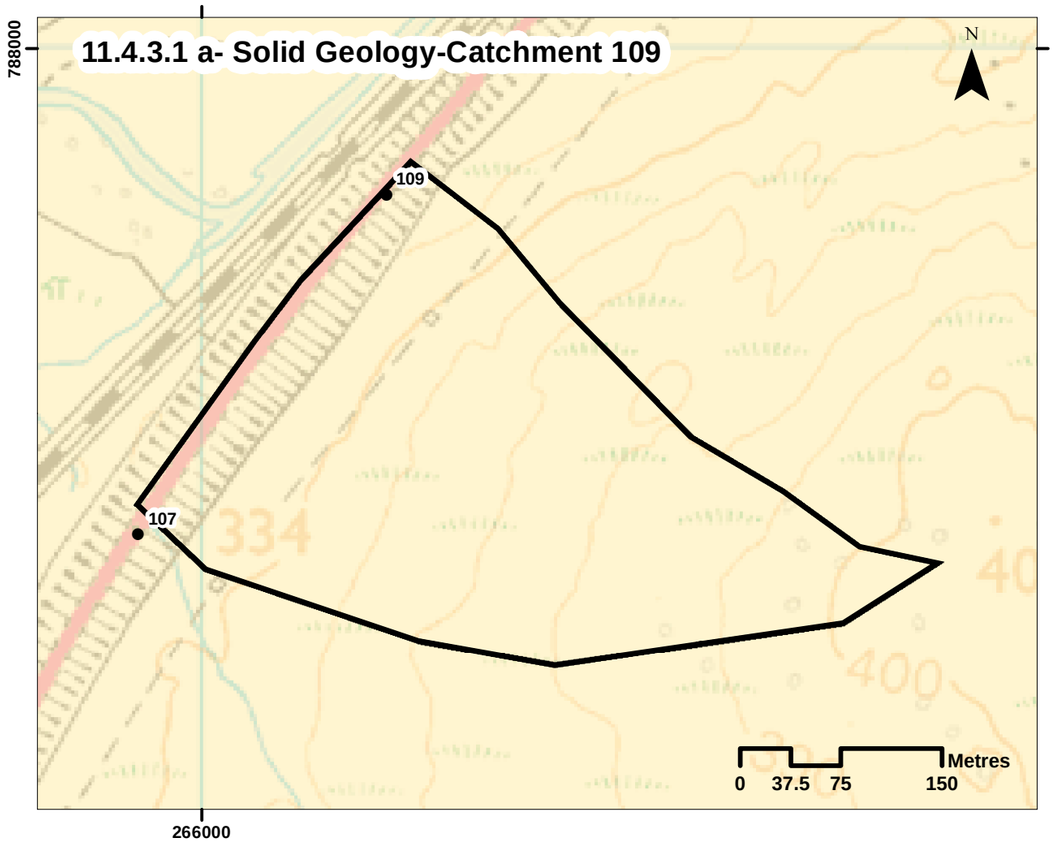
Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 109	
	Is peat present in the catchment	No	Possible peat upslope in delineated area, but actually drains to catchment 111. Peaty lower slopes, but likely shallow.
	Is there a bog burst 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	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 109)	No	
	Comment on sediment source potential in catchment	Mostly fines and organic sediments	
	Comment on sediment supply potential to crossing	Likely to reach catchment through drain network via cascade.	

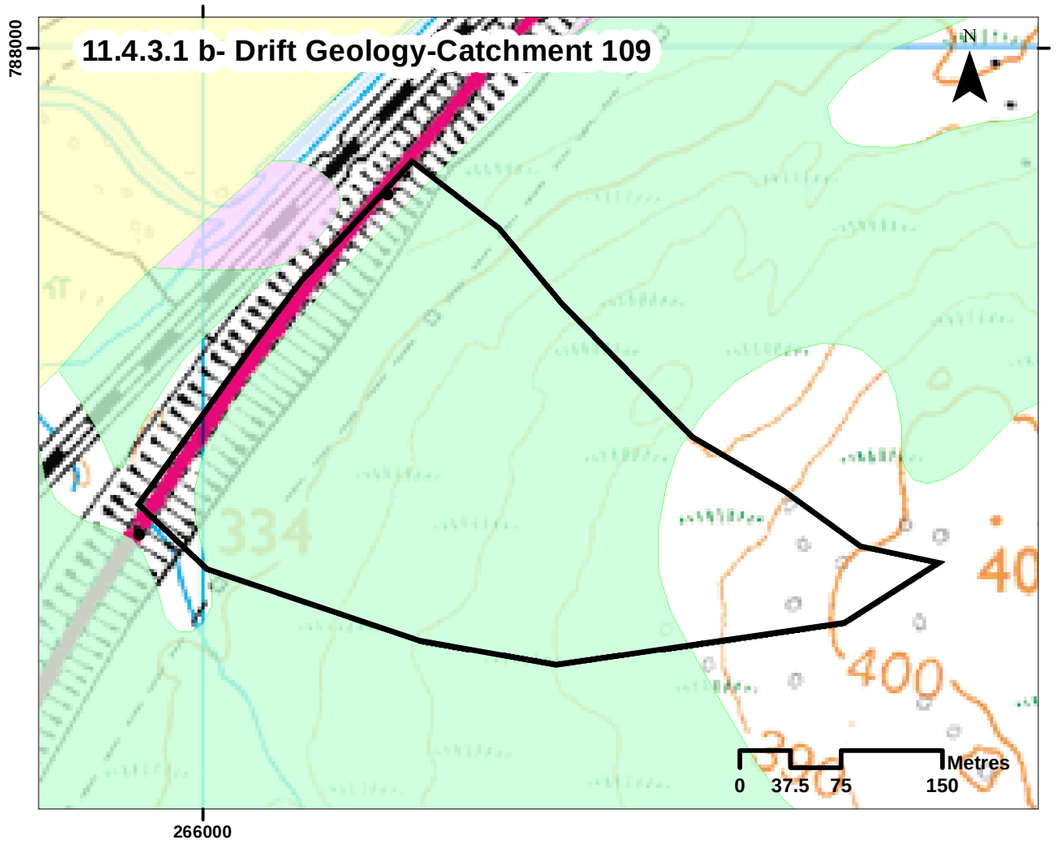
Morphology and Process-Reach upstream of crossing	Channel morphology	Engineered	
	Predominant sediment size	Fine	
	Unvegetated bars	No	
	Vertical incision	Medium	Some incision into peaty soils on lower slopes and erosion of cascades
	Deposition	Medium	Ponding of water and fines dropping out u/s of cascade
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (Map 1d)	Yes	Cascade cut into bedrock in cutting
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 109)	Yes	Steepens channel on approach to crossing
	Channel realignment	Yes	All realigned as is a cut drain

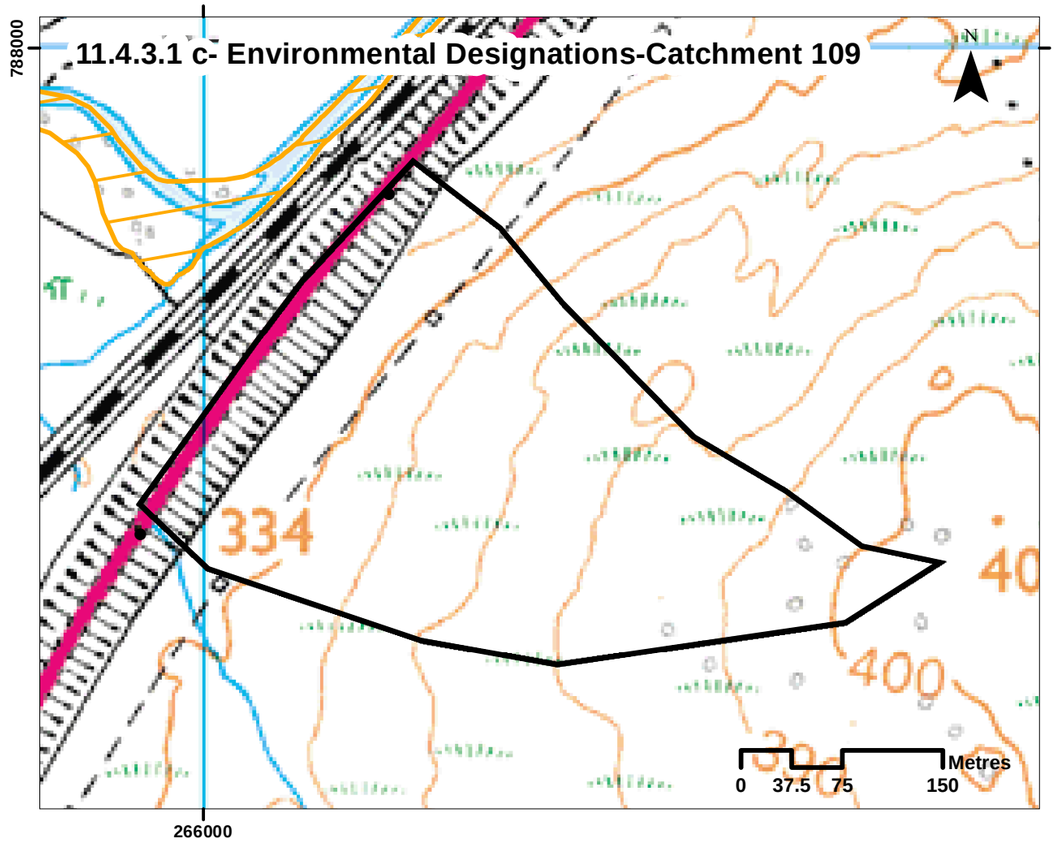
Morphology and Process-At crossing	Channel morphology	Engineered	
	Predominant sediment size	Fine	
	Estimated discharge at 1:200 event (m^3/s)	0.4	
	Unvegetated bars	No	
	Vertical incision	Medium	
	Deposition	Medium	
	Lateral migration/bank erosion	Low	
	Damaged/unstable drains or armouring	Yes	Cobble-size angular blocks being eroded from cascade

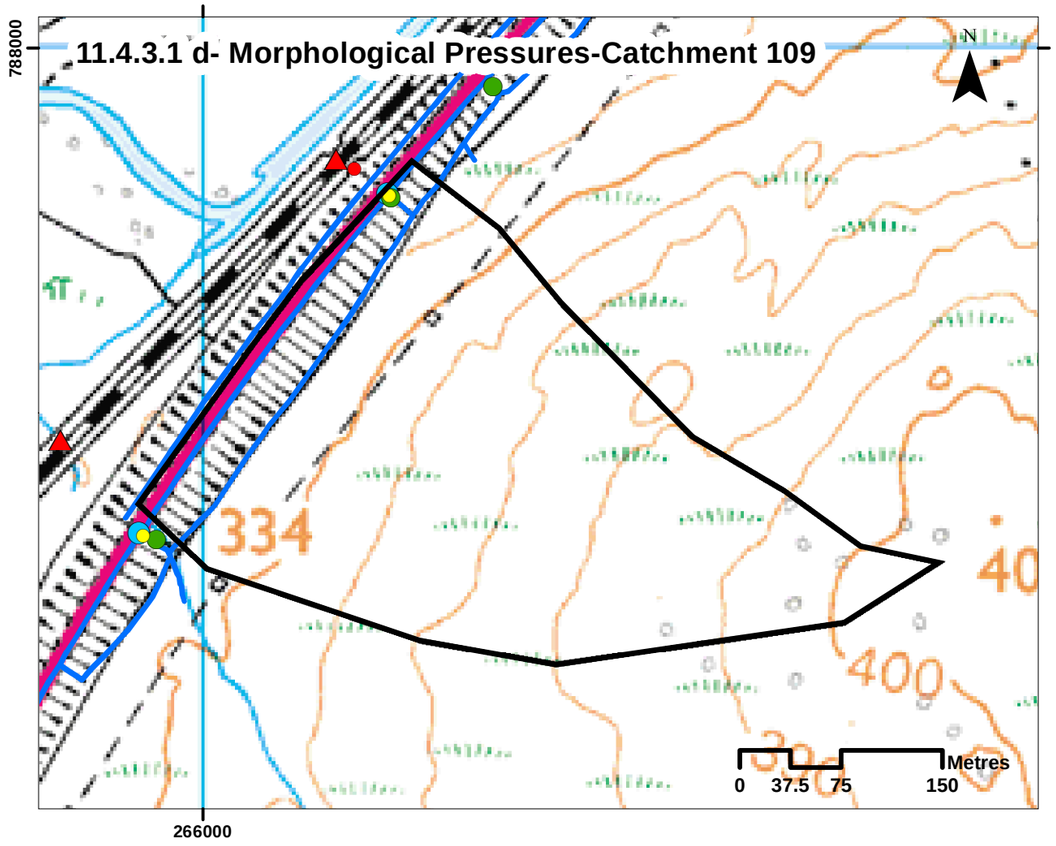
Morphology and Process-Reach downstream of crossing	Channel morphology	Engineered	
	Predominant sediment size	Fine	
	Unvegetated bars	No	
	Vertical incision	Low	
	Deposition	Medium	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (Map 1d)	Yes	Railway
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 109)	None	Channel realigned to join up with other drainage channels to pass through railway embankment at just one point.
	Channel realignment	Yes	To take water through railway underpass.

Summary behaviour	This appears to be a drain cut to take hillslope overland flow and very small channel flow under the road. The low gradient and low flow appears to have led to ponding and deposition of fines (particularly peaty, organic material). The road is in a bedrock cutting at this point and a cascade has been cut into the bedrock to achieve the required drop in elevation. Some angular blocks have become detached and deposited at the culvert entrance but have not been transported further as flows are not great enough. Downstream of the culvert, the channel passes through a railway crossing, and appears to have been realigned, possibly at the time of railway construction, to allow drainage to pass through this channel.









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 Area of Conservation

Morphological Pressures
- Railway Bridge
- Culvert
- Cascade
- Step in Bed
- Catchpit
- Drainage Ditch

REV	SUIT	DATE	DESCRIPTION	BY	APP

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TRANSPORT SCOTLAND
A9 DUALLING PERTH TO INVERNESS

PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

Drawing 11.4.3.1 Catchment 109 Catchment Overview

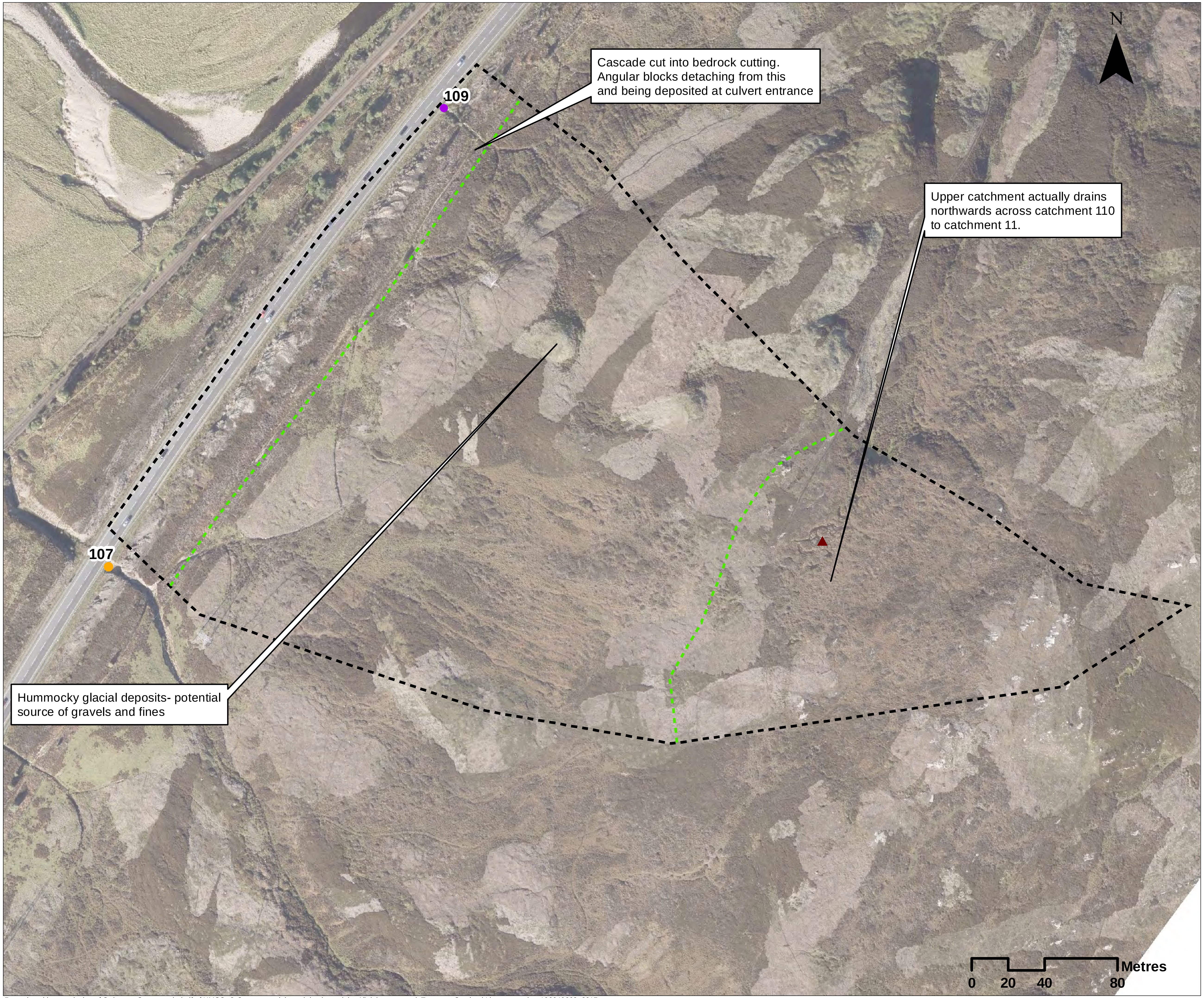
DESIGN:	DRAWN:	CHK:	APP:
EL	EV	EL	EL

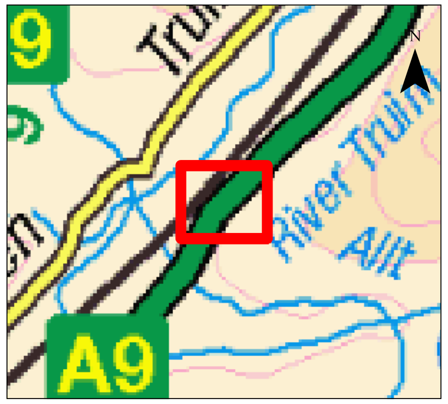
DATE: 20/07/2017

PROJ: 495298

DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0001

SHEET:	REVISION:	SUITABILITY:
1 of 1	C01	A3





Legend

- Major crossing
- Minor crossing
- Peat
- Break in slope
- Crossing catchment

REV	SUIT	DATE	DESCRIPTION	BY	APP

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TRANSPORT SCOTLAND — A9 DUALLING PERTH TO INVERNESS

PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

DRAWING 11.4.3.2.
Catchment 109 Baseline Assessment

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

DATE: 11/07/2017

PROJ: 495298

DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0002

SHEET:	REVISION:	SUITABILITY:
1 of 1	C01	A3

Annex 11.4.3 - Hydromorphological Catchment Assessment - 111

Catchment No.	111
Catchment Name	-

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

Quantitative Spatial Elements	Catchment Area (km^2)	0.2
	Average slope in catchment (°)	6.4
	% Catchment over 750m (for snow melt risk)	0

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

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 111)	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 111)	Ramsar	No	
	SAC	Yes	River Spey - Atlantic salmon, freshwater pearl mussel, otter, sea lamprey
	SPA	No	
	SSSI	No	

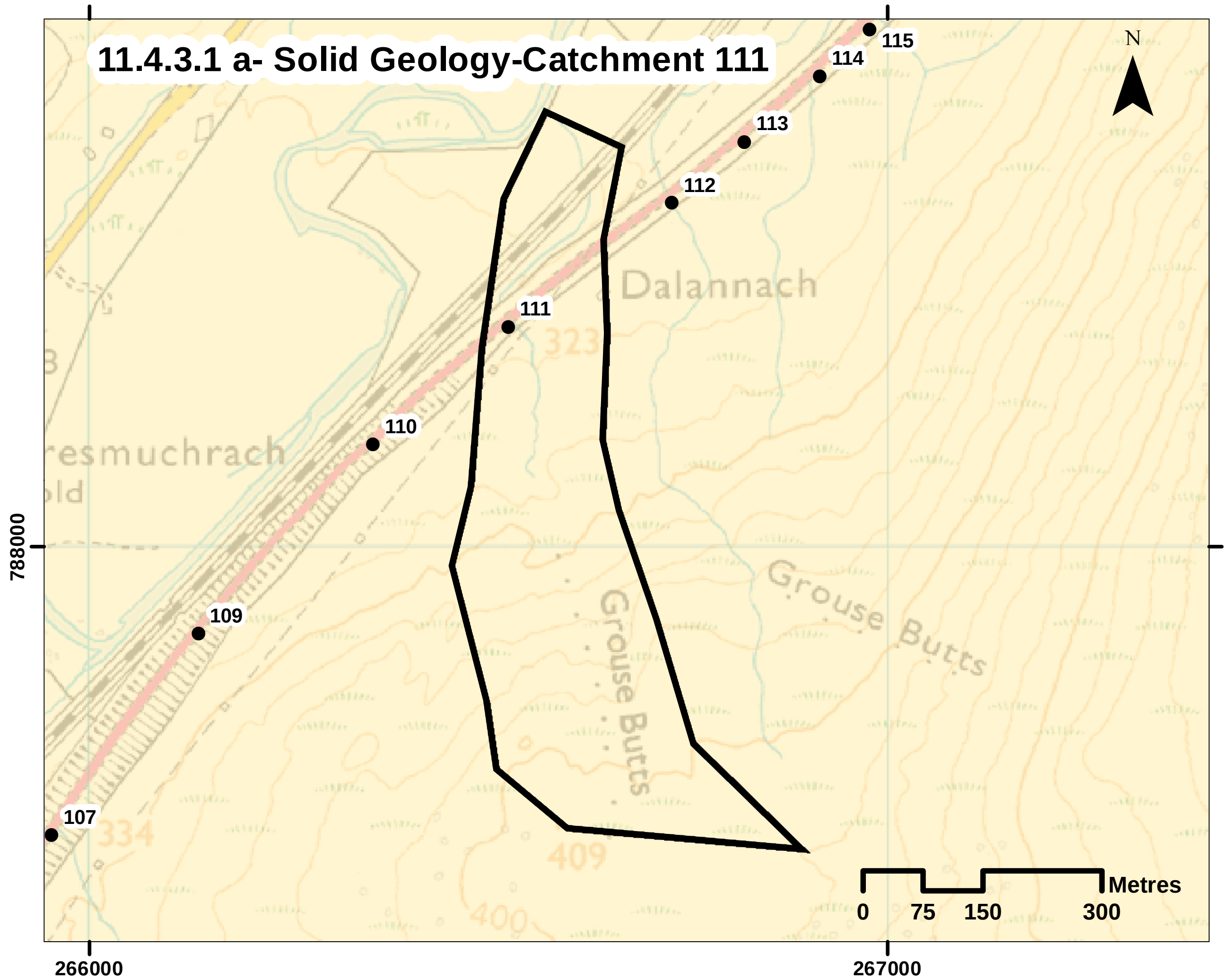
Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 111	
	Is peat present in the catchment	Yes	Possible limited peaty deposits on flatter slopes in mid catchment.
	Is there a bog burst risk	No	
	Current valley side or terrace erosion	No	
	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	Yes	Evidence of historic incision to form terrace, but no current
	Bank erosion/lateral migration	No	
	Unvegetated bars	No	
	Wooded/forested areas in catchment	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 111)	No	
	Comment on sediment source potential in catchment	Limited - no major sources of sediment evident. Channel appears stable	
	Comment on sediment supply potential to crossing	Supply-limited and just fines.	

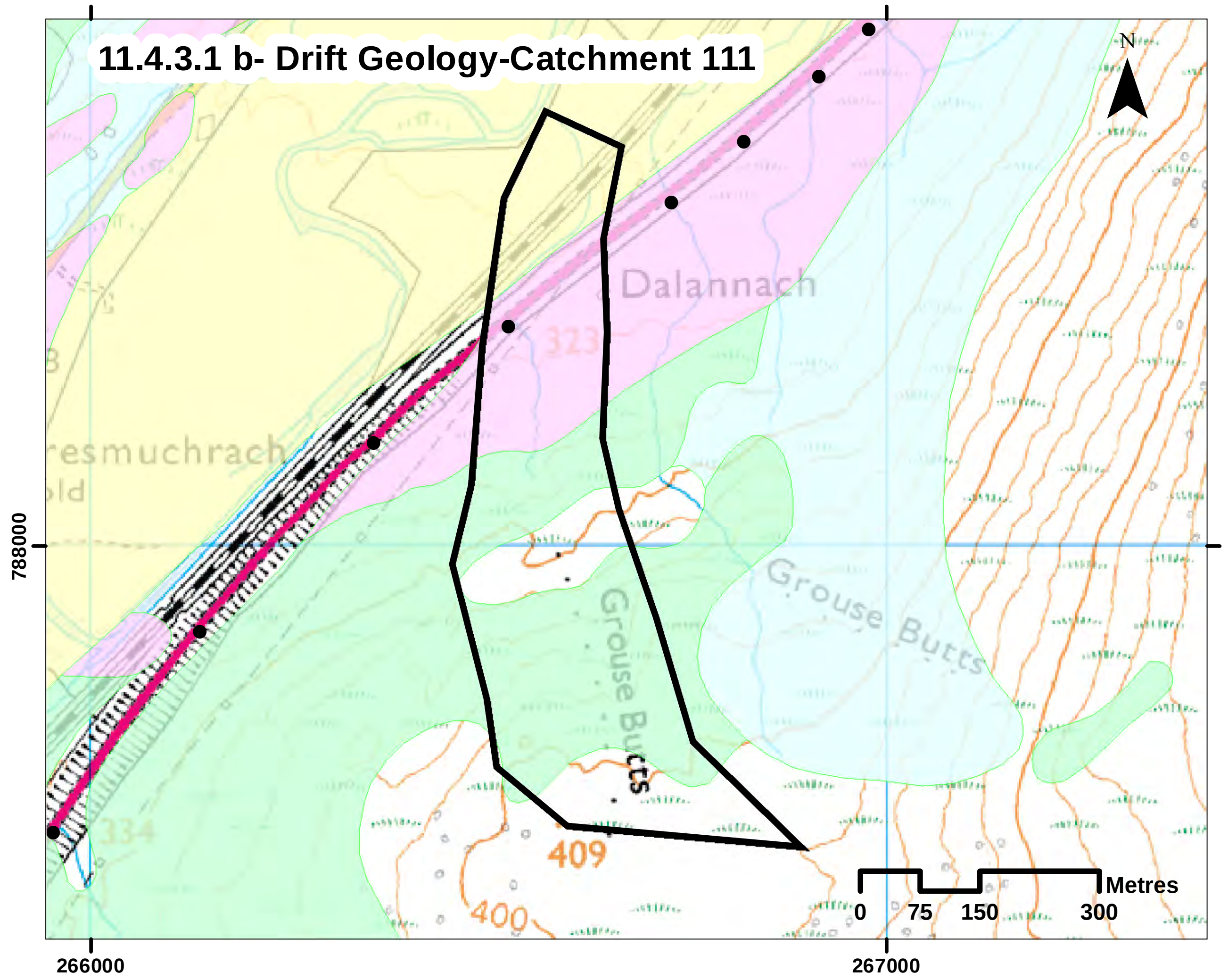
Morphology and Process-Reach upstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Gravel	
	Unvegetated bars	No	
	Vertical incision	Low	
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (Map 1d)	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 111)	No	
	Channel realignment	No	

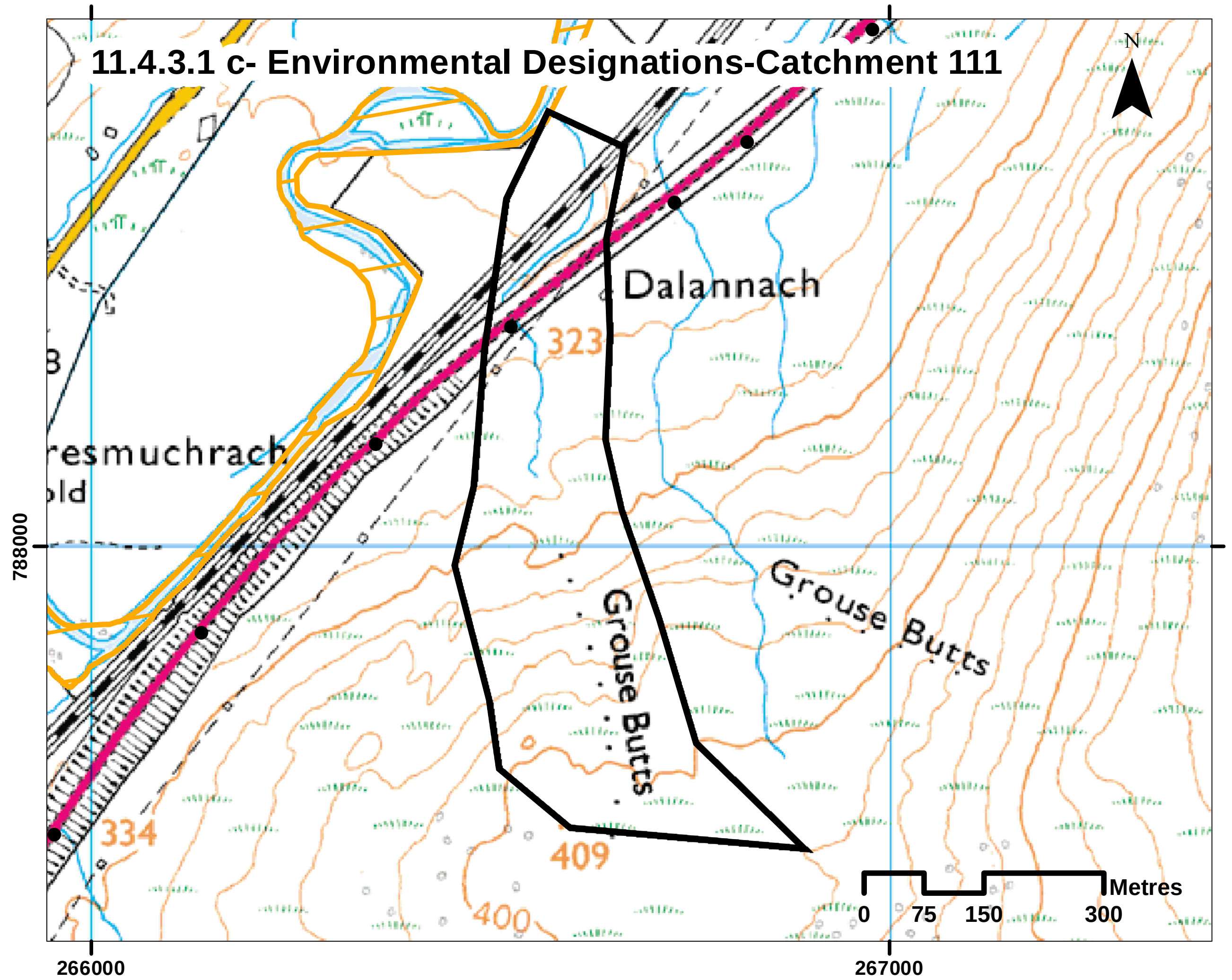
Morphology and Process-At crossing	Channel morphology	Engineered	Small catch pit and culvert u/s.
	Predominant sediment size	Fines - gravel	
	Estimated discharge at 1:200 event (m^3/s)	0.5	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Medium	
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	No	Armouring in good condition

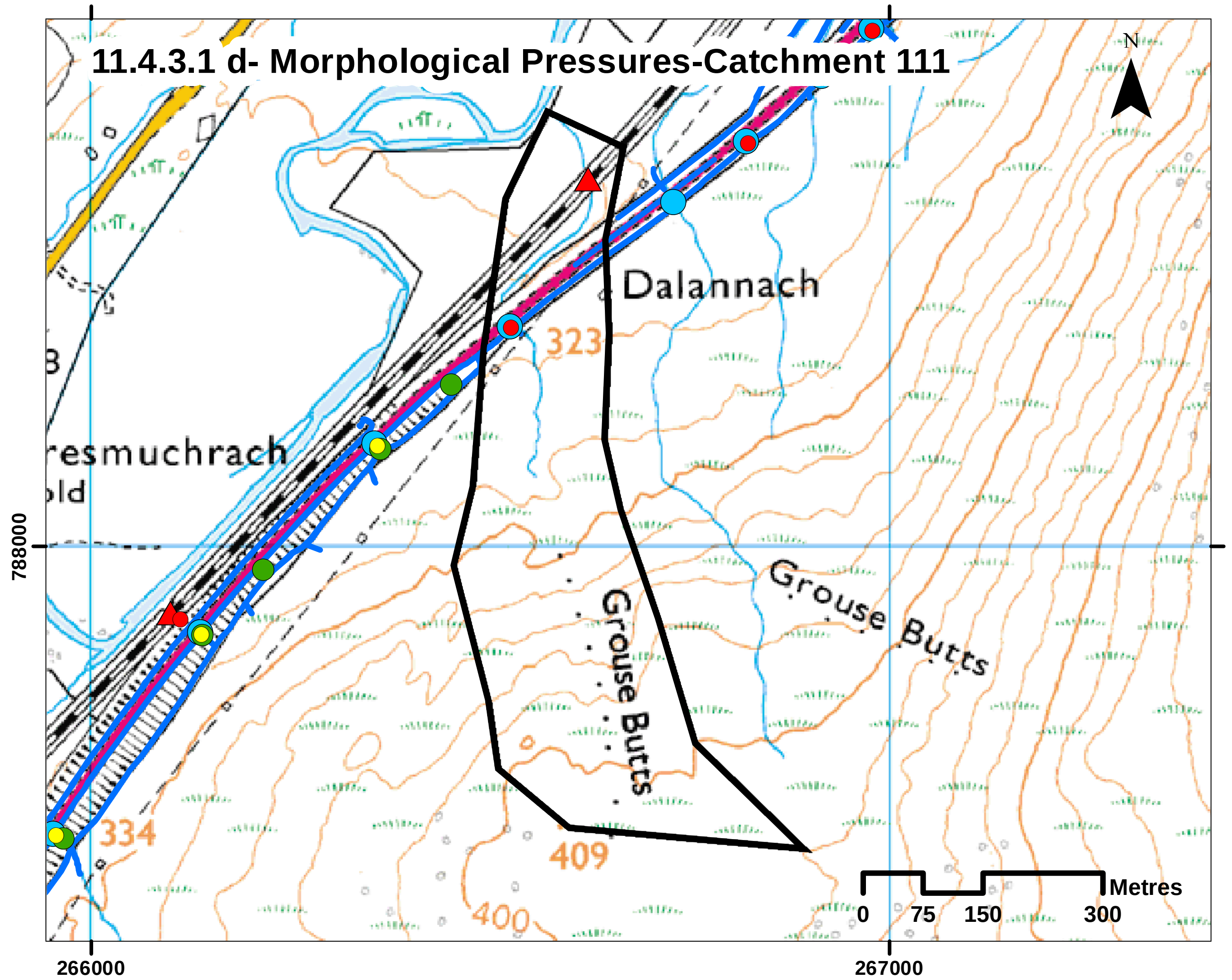
Morphology and Process-Reach downstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Fines and organics	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Medium	
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (Map 1d)	Yes	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 111)	Railway	
	Channel realignment	Yes	Possibly realigned to pass under railway.

Summary behaviour	Small catchment with historic incision which has created a terrace. Stabilisation now occurred and u/s of crossing the channel appears to wander with a small flood plain. Some gravel is deposited at the culvert entrance where gradient reduces. D/s of the culvert, the outflow appears to be partially blocked with fines and vegetation is growing in this deposited sediment. Flow onwards across the Truim floodplain is sluggish, eventually passing through the railway embankment (railway crosses channel on a bridge) .









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 Area of Conservation

Morphological Pressures
- Railway Bridge
- Culvert
- Cascade
- Step in Bed
- Catchpit
- Drainage Ditch

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PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

Drawing 11.4.3.1 Catchment 111 Catchment Overview

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

DATE: 20/07/2017

PROJ: 495298

DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0001

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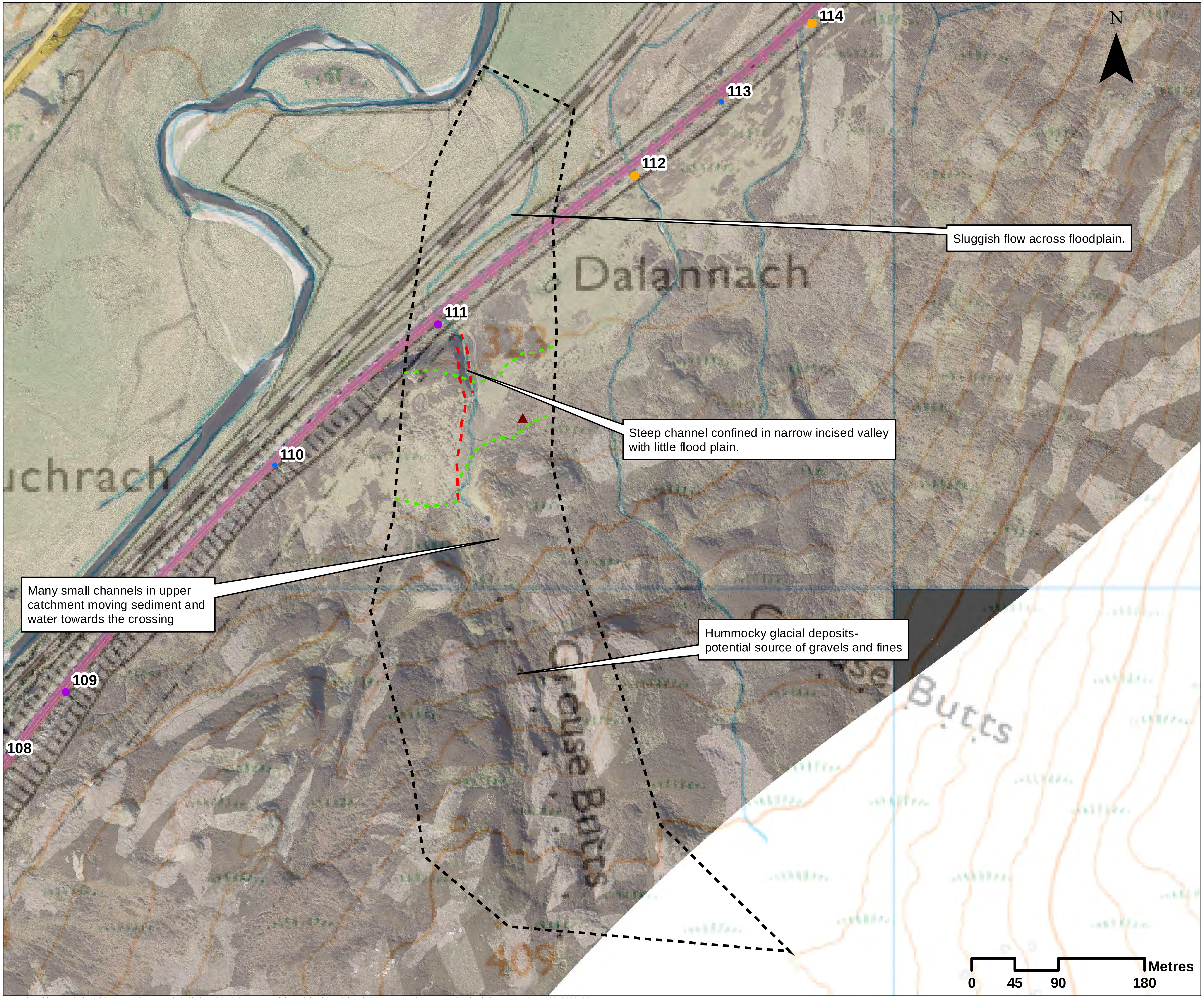

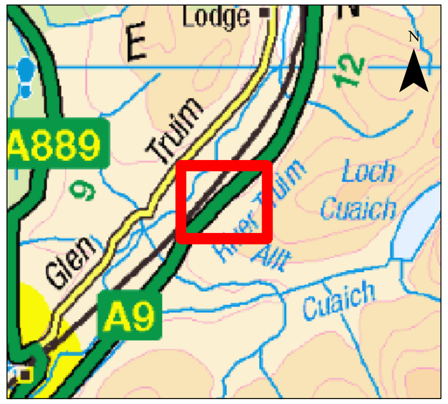

Legend

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

REV	SUIT	DATE	DESCRIPTION	BY	APP

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PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

DRAWING 11.4.3.2.
Catchment 111 Baseline Assessment

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

DATE: 11/07/2017

PROJ: 495298

DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0002

SHEET:	REVISION:	SUITABILITY:
1 of 1	C01	A3

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Annex 11.4.3 - Hydromorphological Catchment Assessment - 112

Catchment No.	112
Catchment Name	-

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

Quantitative Spatial Elements	Catchment Area (km^2)	0.2
	Average slope in catchment (°)	6.6
	% Catchment over 750m (for snow melt risk)	0

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

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 112)	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 112)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 112	
	Is peat present in the catchment	Yes	Small amounts possible on lower slopes visible in Google
	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	Yes	for c.90m u/s of crossing
	Bank erosion/lateral migration	No	
	Unvegetated bars	No	
	Wooded/forested areas in catchment	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 112)	No	
	Comment on sediment source potential in catchment	Channel development is limited until c.90m u/s of crossing, where vertical incision has occurred, seemingly generating large amounts of gravel.	
	Comment on sediment supply potential to crossing	High - area of vertical incision proximal to crossing with limited opportunity for deposition before reaching crossing.	

Morphology and Process-Reach upstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Gravel-Cobble	
	Unvegetated bars	No	
	Vertical incision	Medium	
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (Map 1d)	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 112)	No	
	Channel realignment	No	

Morphology and Process-At crossing	Channel morphology	Engineered	
	Predominant sediment size	Gravel	
	Estimated discharge at 1:200 event (m^3/s)	0.6	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Medium	Culvert with gravel bed
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	No	

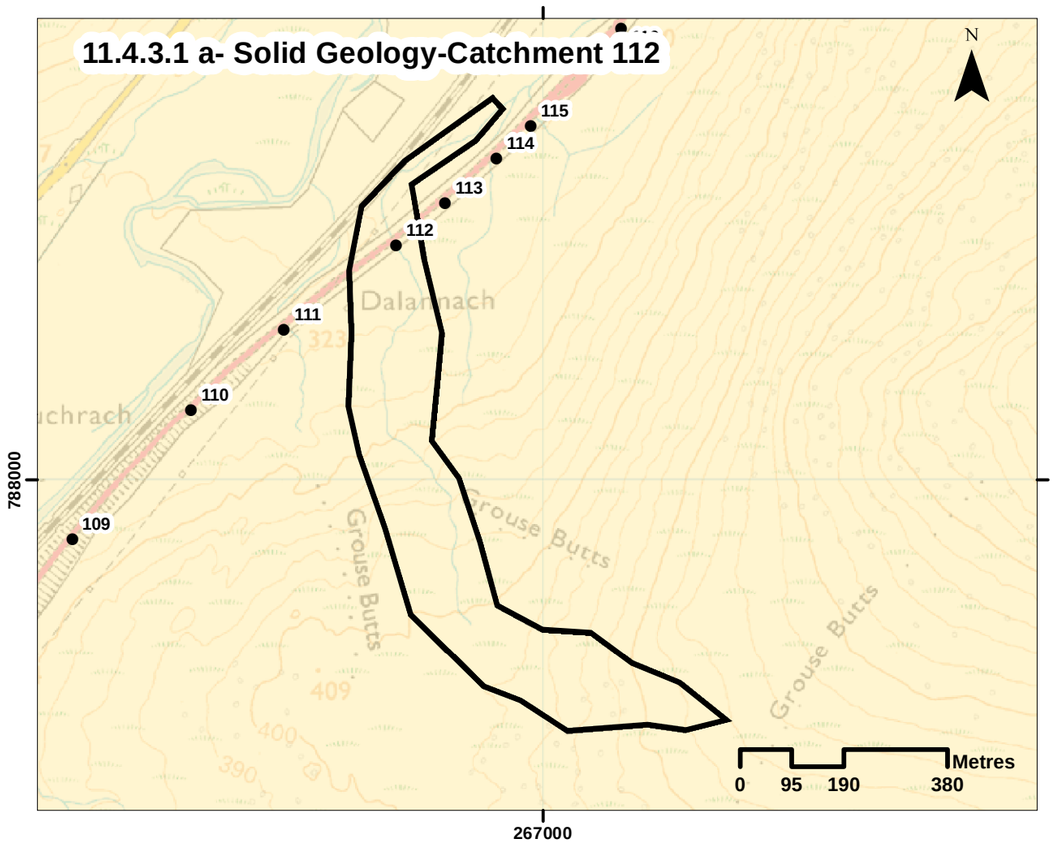
Morphology and Process-Reach downstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Fine	
	Unvegetated bars	No	
	Vertical incision	Low	
	Deposition	Medium	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (Map 1d)	Yes	Railway
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 112)	Channel Realignment	
	Channel realignment	Yes - Possibly	Channel possibly realigned to join it to other more northerly channels to minimise numbers of railway crossings. Doesn't appear to have been realigned specifically for the road .

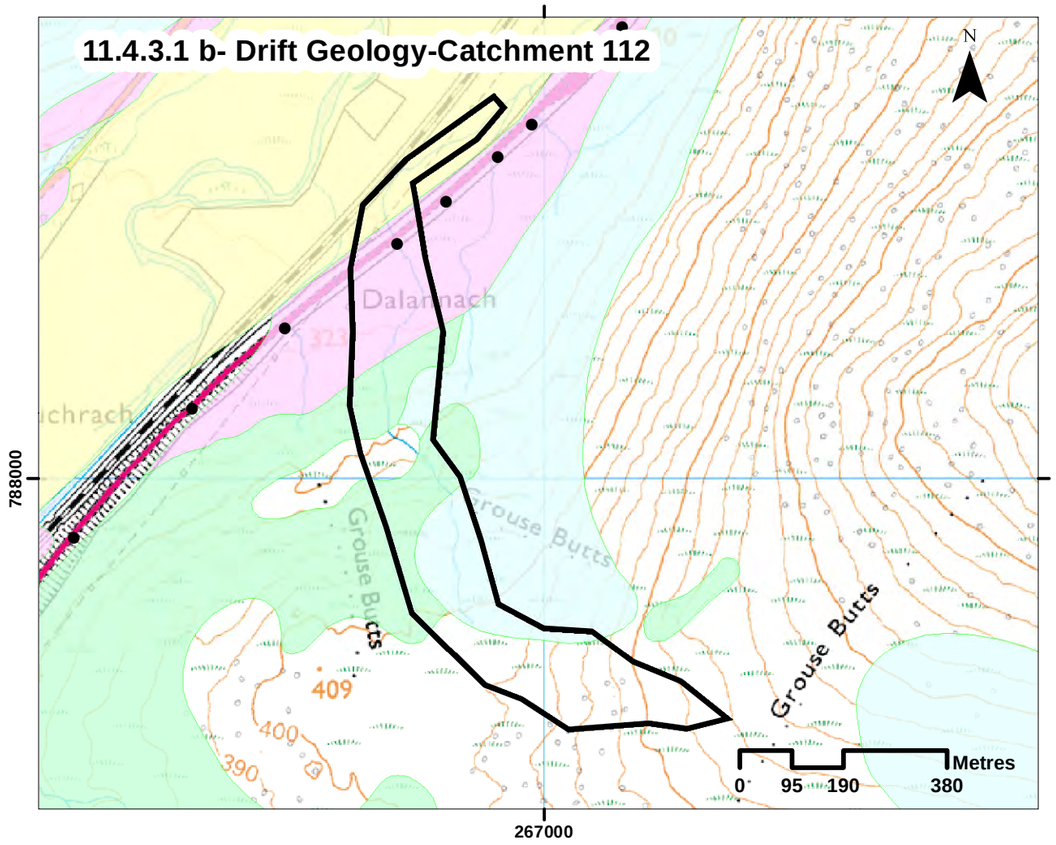
Summary behaviour	Few signs of erosion or sediment supply in the upper catchment. A knickpoint is present c.90m u/s of the crossing d/s of which vertical incision has occurred. Stream gradient abruptly reduces at crossing and gravel eroded from vertical incision reach has been deposited in the culvert itself, reducing capacity by c.1/3. Very sluggish d/s of crossing as channel takes very long route across floodplain, possibly due to diversion for railway embankment construction.

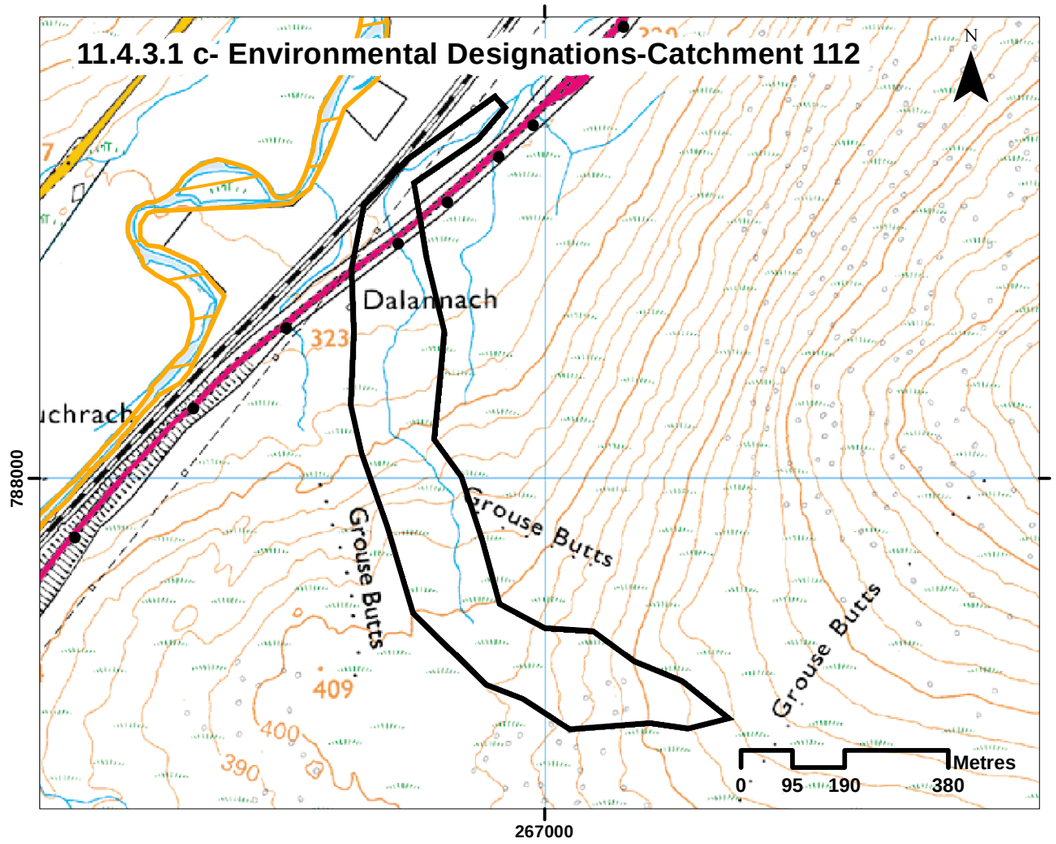
Photograph 11.4.3.101 – Upstream of crossing

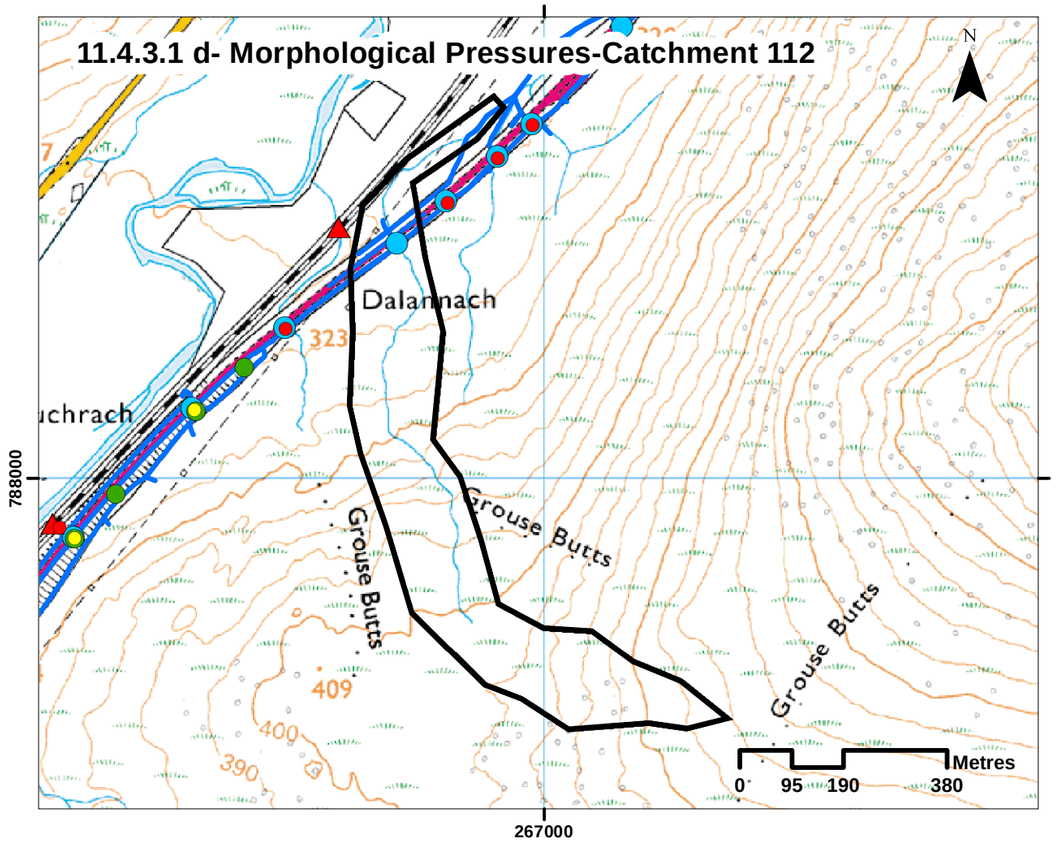
Photograph 11.4.3.102 – Upstream of crossing

Photograph 11.4.3.103- Entrance to 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 Area of Conservation

Morphological Pressures
- Railway Bridge
- Culvert
- Cascade
- Step in Bed
- Catchpit
- Drainage Ditch

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TRANSPORT SCOTLAND
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PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

Drawing 11.4.3.1 Catchment 112 Catchment Overview

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

DATE: 20/07/2017

PROJ: 495298

DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0001

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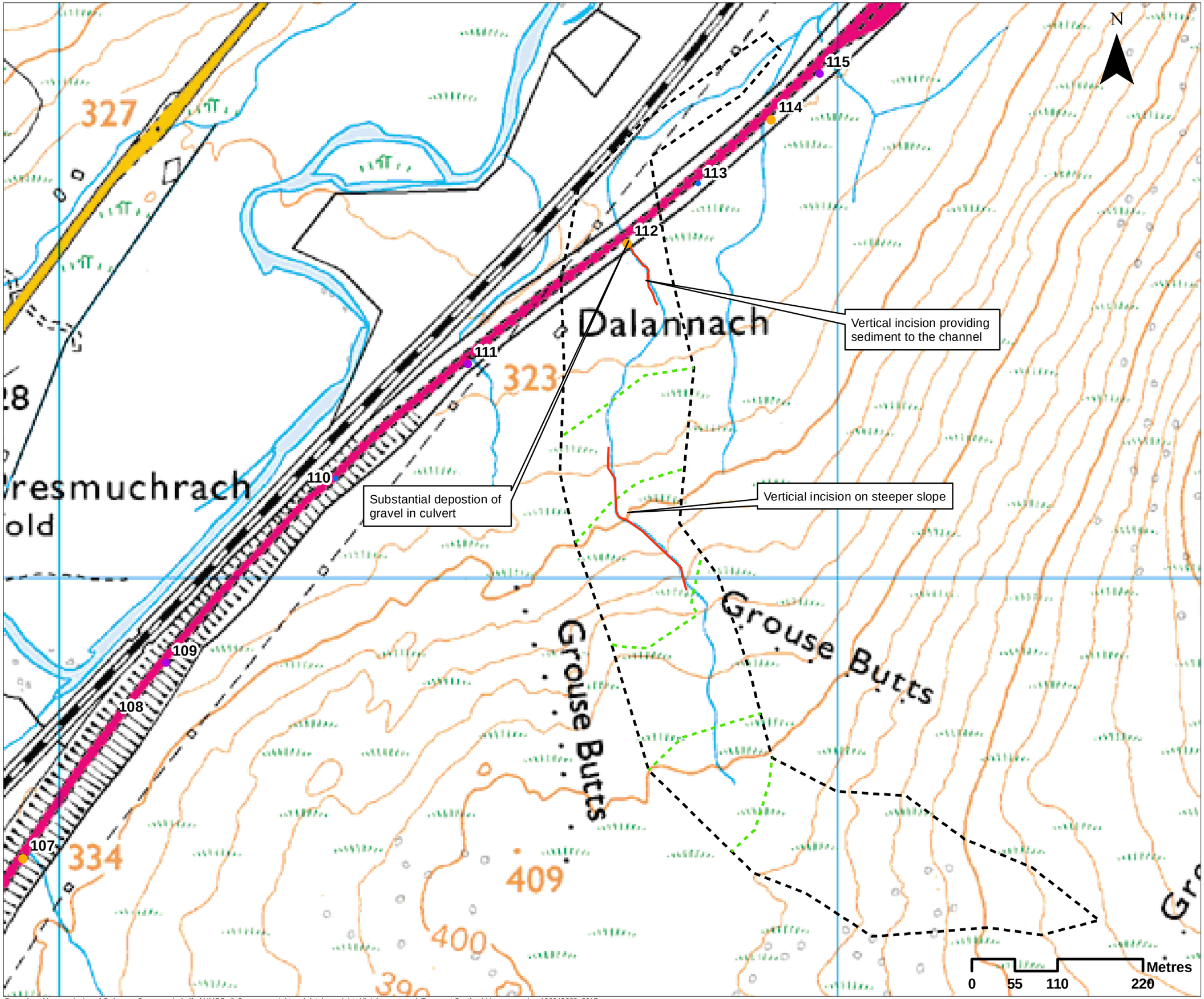

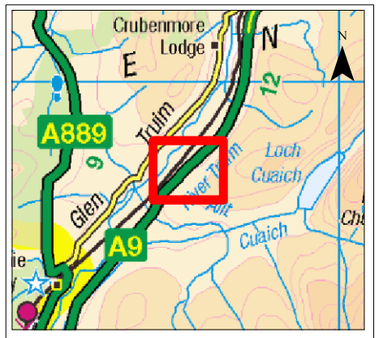

Legend

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

REV	SUIT	DATE	DESCRIPTION	BY	APP

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TRANSPORT SCOTLAND

A9 DUALLING PERTH TO INVERNESS

PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

DRAWING 11.4.3.2.
Catchment 112 Baseline Assessment

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

DATE: 11/07/2017

PROJ: 495298

DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0002

SHEET:	REVISION:	SUITABILITY:
1 of 1	C01	A3

Annex 11.4.3 - Hydromorphological Catchment Assessment - 114

Catchment No.	114
Catchment Name	-

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

Quantitative Spatial Elements	Catchment Area (km^2)	0.5
	Average slope in catchment (°)	10
	% Catchment over 750m (for snow melt risk)	0

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

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 114)	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 114)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 114	
	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	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 114)	No	
	Comment on sediment source potential in catchment	Limited evidence for major sediment sources in catchment	
	Comment on sediment supply potential to crossing	Low, but there is some evidence for bed mobility resulting in gravel sediment being delivered to channel.	

Morphology and Process-Reach upstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Gravel	
	Unvegetated bars	Yes	Bar deposit on inside of right-angle bend c.20m
	Vertical incision	Low	
	Deposition	Medium	
	Lateral migration/bank erosion	Medium	
	Presence and nature of infrastructure (Map 1d)	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 114)	No	
	Channel realignment	Yes	Channel realigned to run parallel to road

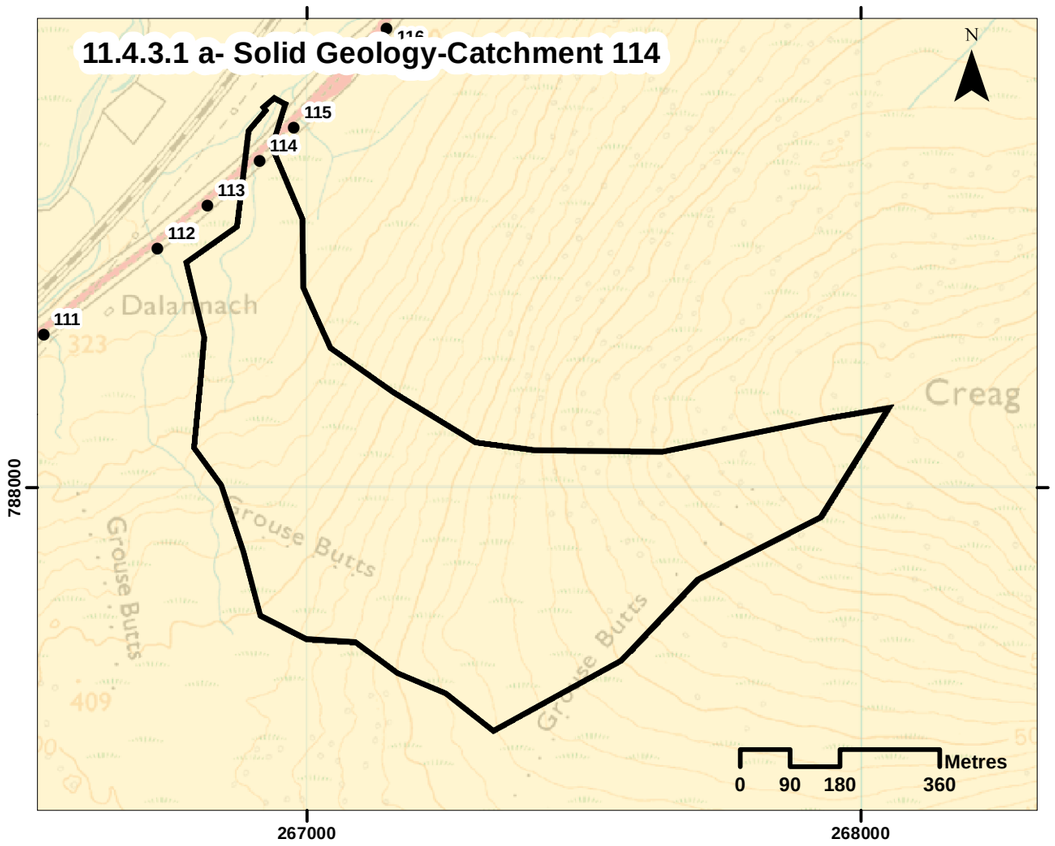
Morphology and Process-At crossing	Channel morphology	Engineered	Concrete box culvert sections
	Predominant sediment size	Gravel	
	Estimated discharge at 1:200 event (m^3/s)	1.4	
	Unvegetated bars	No	
	Vertical incision	Low	
	Deposition	Medium	
	Lateral migration/bank erosion	Low	
	Damaged/unstable drains or armouring	Yes	Paving slab armour ripped up d/s of crossing

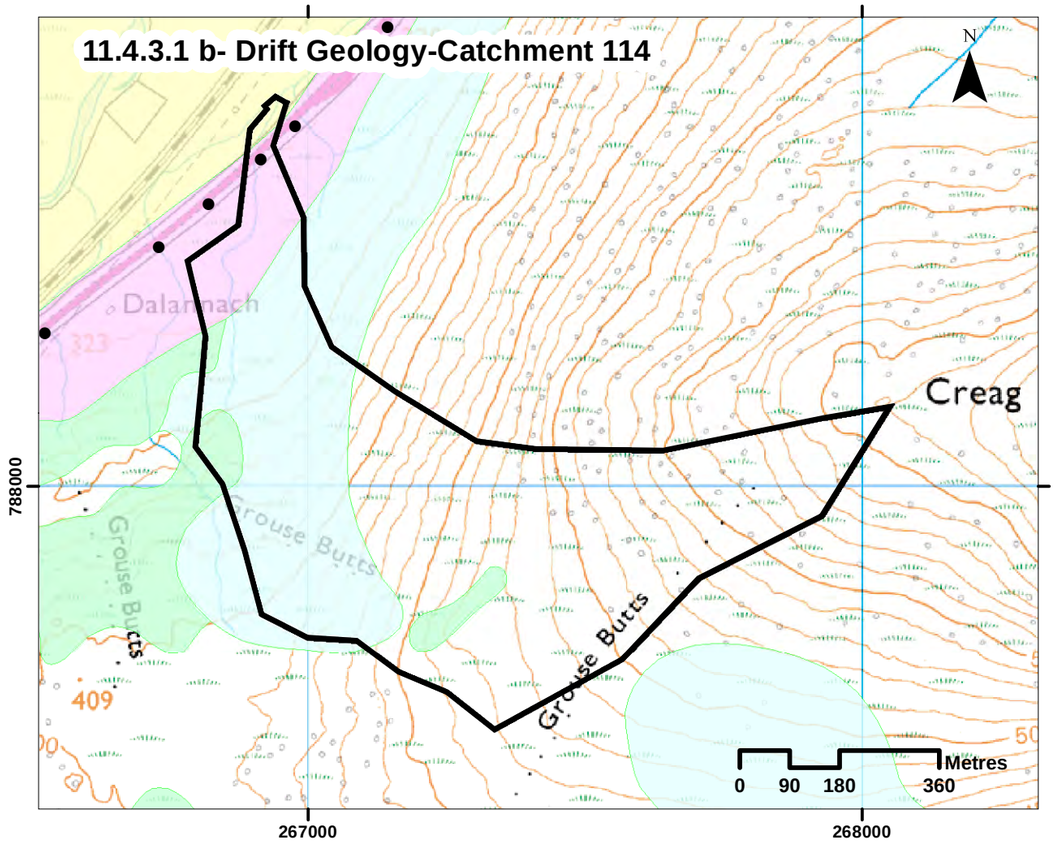
Morphology and Process-Reach downstream of crossing	Channel morphology	Engineered	
	Predominant sediment size	Gravel	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Low	
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (Map 1d)	Yes	Railway
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 114)	Yes	Channel Realignment
	Channel realignment	Yes	Channel realigned so several pass under railway at one point.

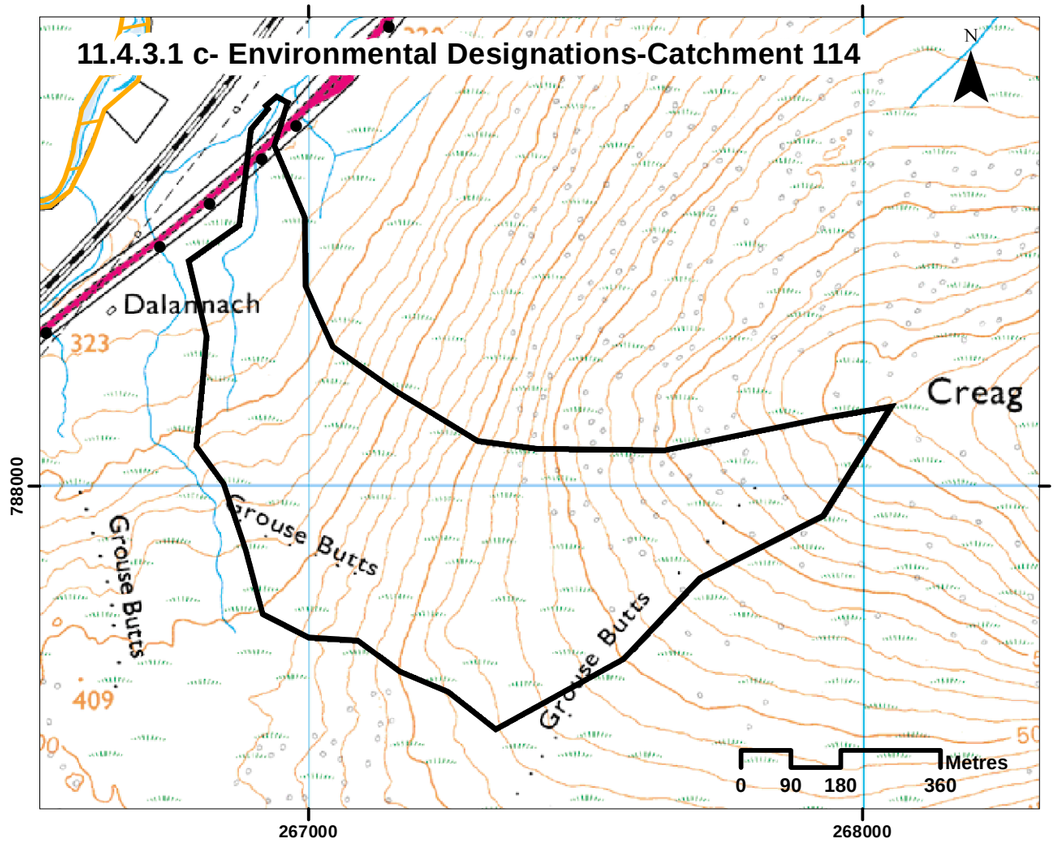
Summary behaviour	Appears to be a natural channel which has been realigned to a drain. Around 20-40m u/s of the crossing the channel appears to be near to it's natural alignment, but is incising. At 20m u/s of the crossing, the channel reaches the road and turns sharply to enter a road parallel drain. At this turn, the channel is eroding the outer edge of the verge on the outside of the bend and depositing coarse sediment on the inside, reinforcing the pattern of channel migration. Gravel is present in the road-parallel drain and is mobile. This gravel is not deposited u/s of the culvert where there is a catch pit, as the concrete bed is exposed, and is transported through the culvert and deposited at the d/s end of the culvert. C.5m d/s of the culvert the paving slab armouring has been damaged, but flow is sluggish beyond this. OPPORTUNITY PRESENTED TO IMPROVE CHANNEL AND REDUCE LATERAL MIGRATION AT SHARP BEND C.20m U/S OF CROSSING, and REDUCE DEPOSTION d/s of culvert.

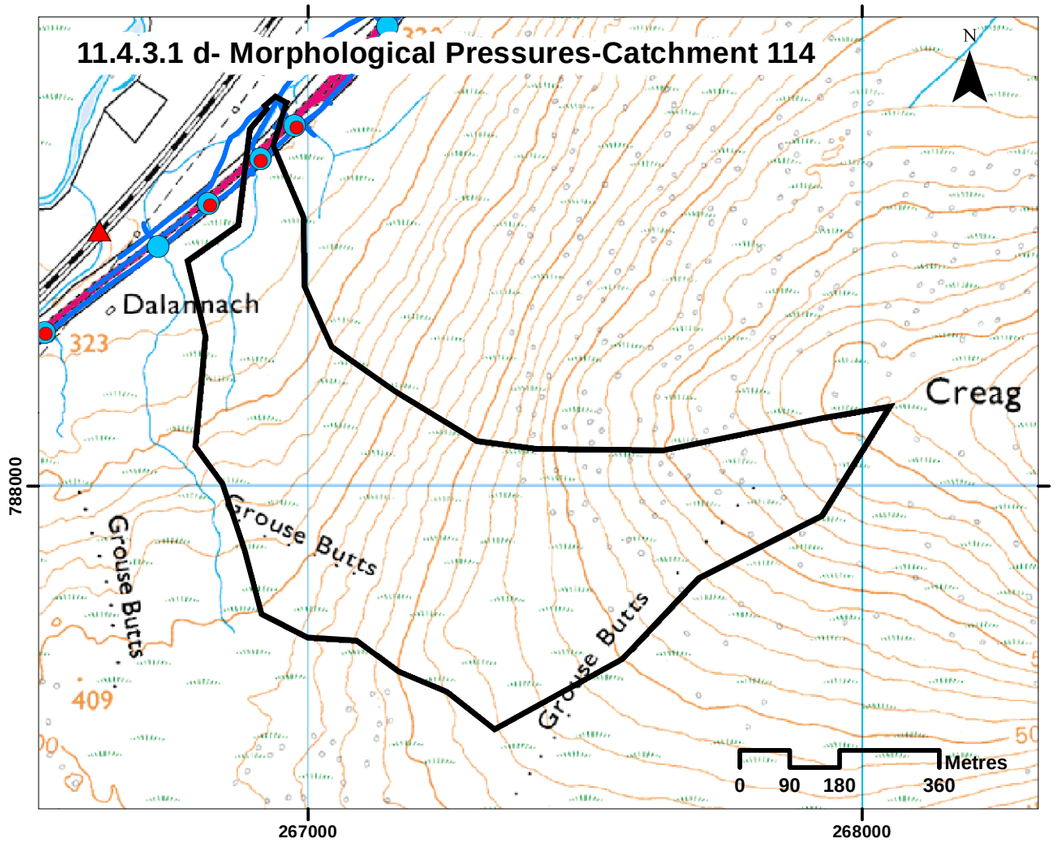
Photograph 11.4.3.104-Entrance to crossing

Photograph 11.4.3.105-Channel









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 Area of Conservation

Morphological Pressures
- Railway Bridge
- Culvert
- Step in Bed
- Drainage Ditch

REV	SUIT	DATE	DESCRIPTION	BY	APP

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PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

Drawing 11.4.3.1 Catchment 114 Catchment Overview

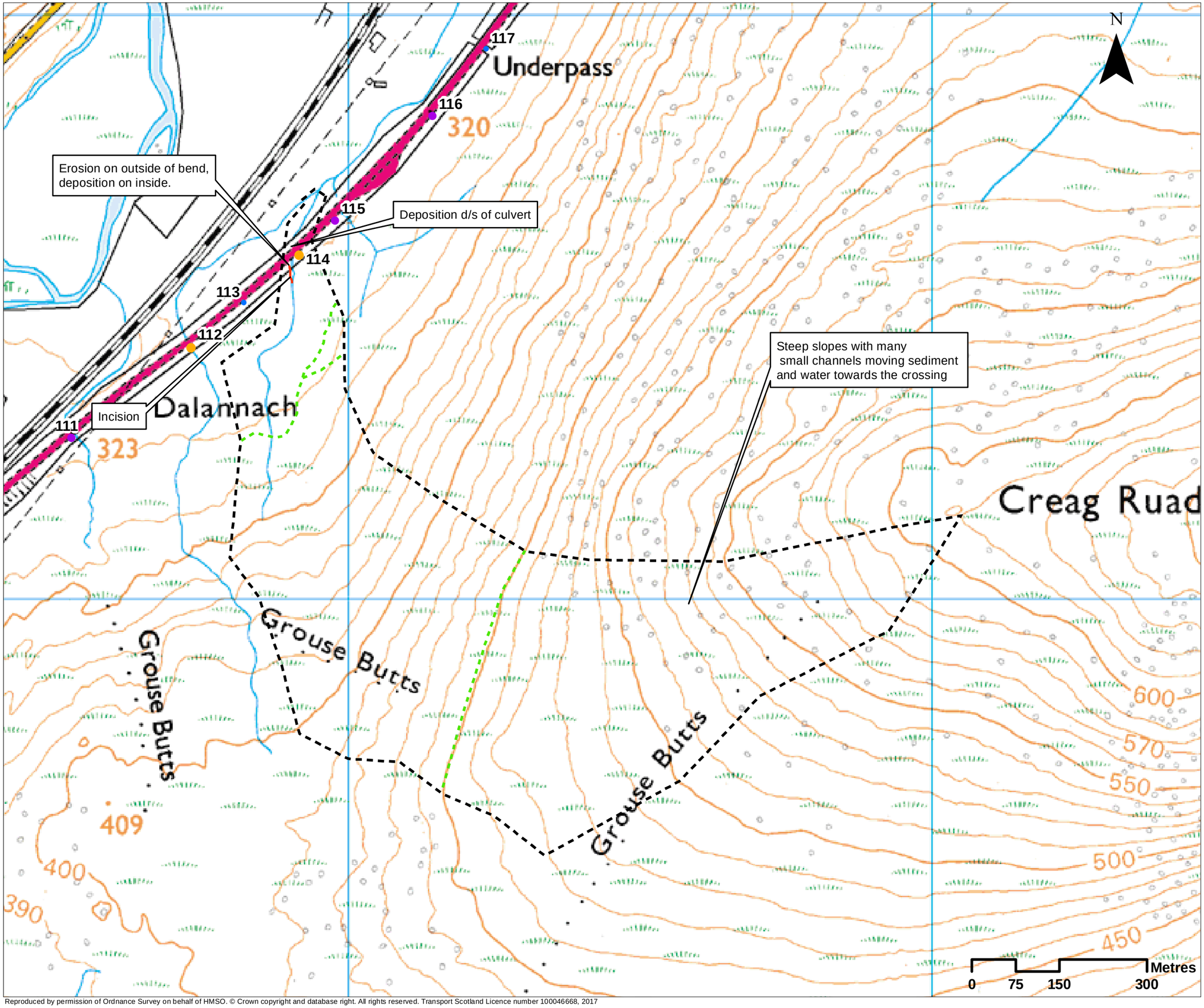
DESIGN:	DRAWN:	CHK:	APP:
EL	EV	EL	EL

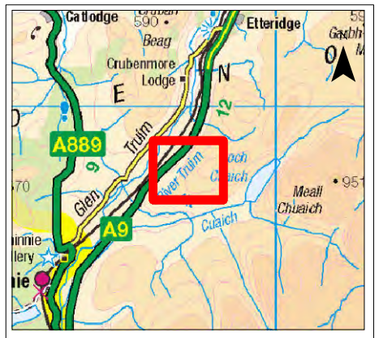
DATE: 20/07/2017

PROJ: 495298

DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0001

SHEET:	REVISION:	SUITABILITY:
1 of 1	C01	A3





Legend

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

REV	SUIT	DATE	DESCRIPTION	BY	APP

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TRANSPORT SCOTLAND

A9 DUALLING PERTH TO INVERNESS

PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

DRAWING 11.4.3.2.
Catchment 114 Baseline Assessment

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

DATE: 11/07/2017

PROJ: 495298

DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0002

SHEET:	REVISION:	SUITABILITY:
1 of 1	C01	A3

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Annex 11.4.3 - Hydromorphological Catchment Assessment - 115

Catchment No.	115
Catchment Name	-

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

Quantitative Spatial Elements	Catchment Area (km^2)	0.5
	Average slope in catchment (°)	15
	% Catchment over 750m (for snow melt risk)	0

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

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 115)	Gaick Psammite formation-Psammite	resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	No	

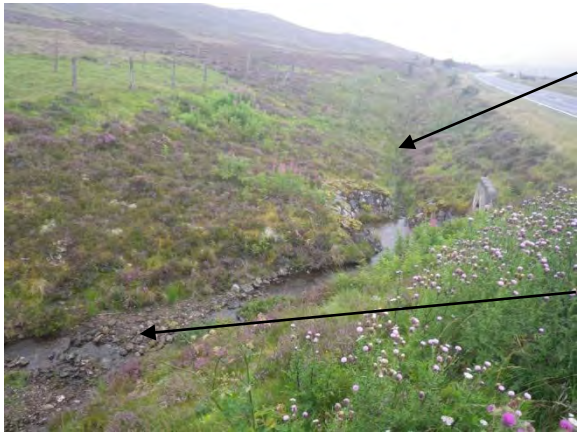
Environmental designations (see Drawing 11.4.3.1 c, Catchment 115)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 115	
	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	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 115)	No	
	Comment on sediment source potential in catchment	Limited source areas, mostly vegetated so likely just fines from slope wash	
	Comment on sediment supply potential to crossing	Gravel-Cobble bed in channel could potentially supply coarse sediment to channel	

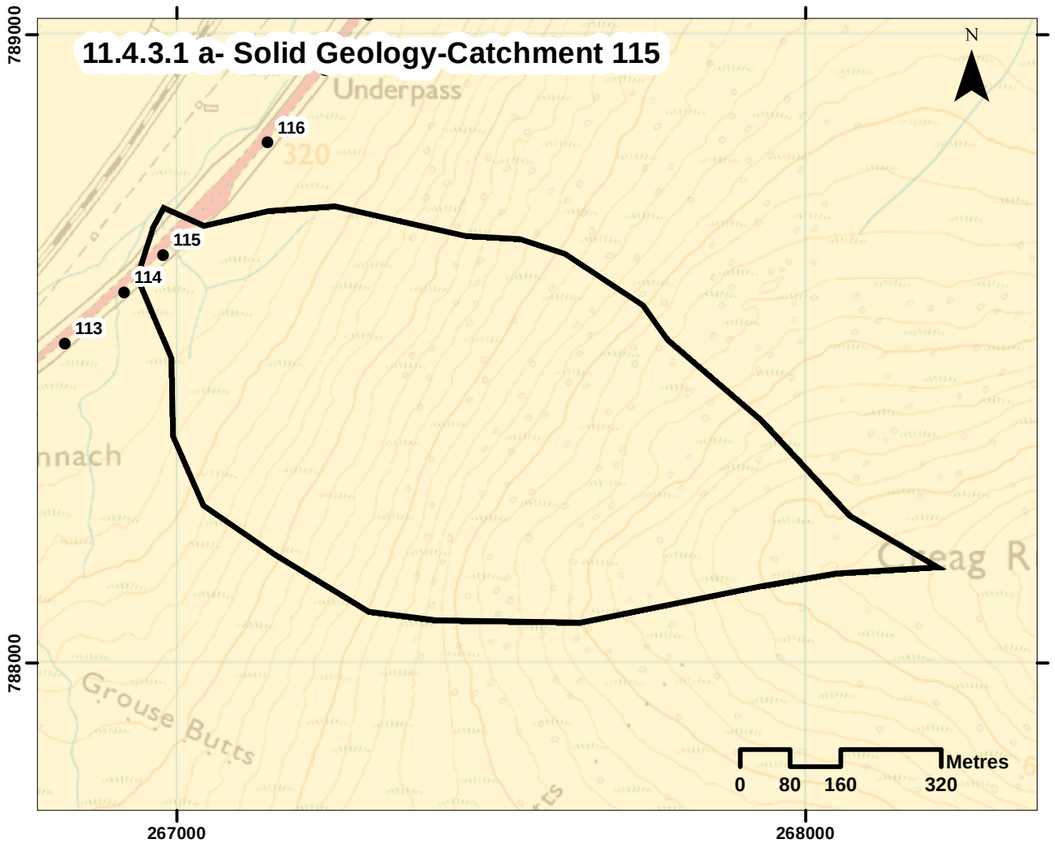
Morphology and Process-Reach upstream of crossing	Channel morphology	Cascade	
	Predominant sediment size	Coarse (Gravel-Cobble)	
	Unvegetated bars	No	
	Vertical incision	Medium	
	Deposition	Low	
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (Map 1d)	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 115)	No	
	Channel realignment	Yes	Appears to be a "new" drain from aerials and maps

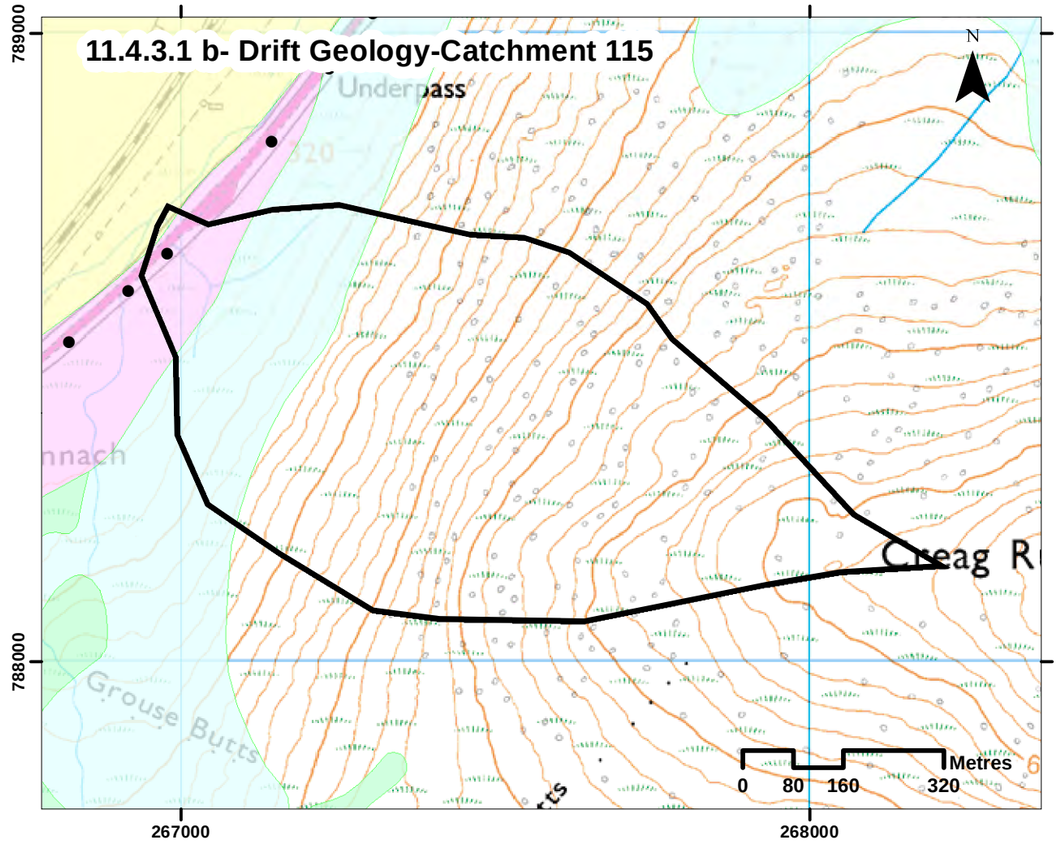
Morphology and Process-At crossing	Channel morphology	Plane bed	
	Predominant sediment size	Gravel-Cobble	
	Estimated discharge at 1:200 event (m^3/s)	2.5	
	Unvegetated bars	No	
	Vertical incision	Medium	
	Deposition	Medium	
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	No	

Morphology and Process-Reach downstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Gravel-cobble	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (Map 1d)	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 115)	No	
	Channel realignment	Yes	To take flow from several hillslope drains through single railway crossing further d/s
Summary behaviour	Channel has possibly been cut to drain hillside u/s of road and railway, or at least modified to do so. There is some vertical incision evident u/s of the road, possibly as a result of straightening. This is generating a supply of coarse sediment which is becoming deposited in the culvert itself where the gradient is substantially less.		



Photograph 208





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
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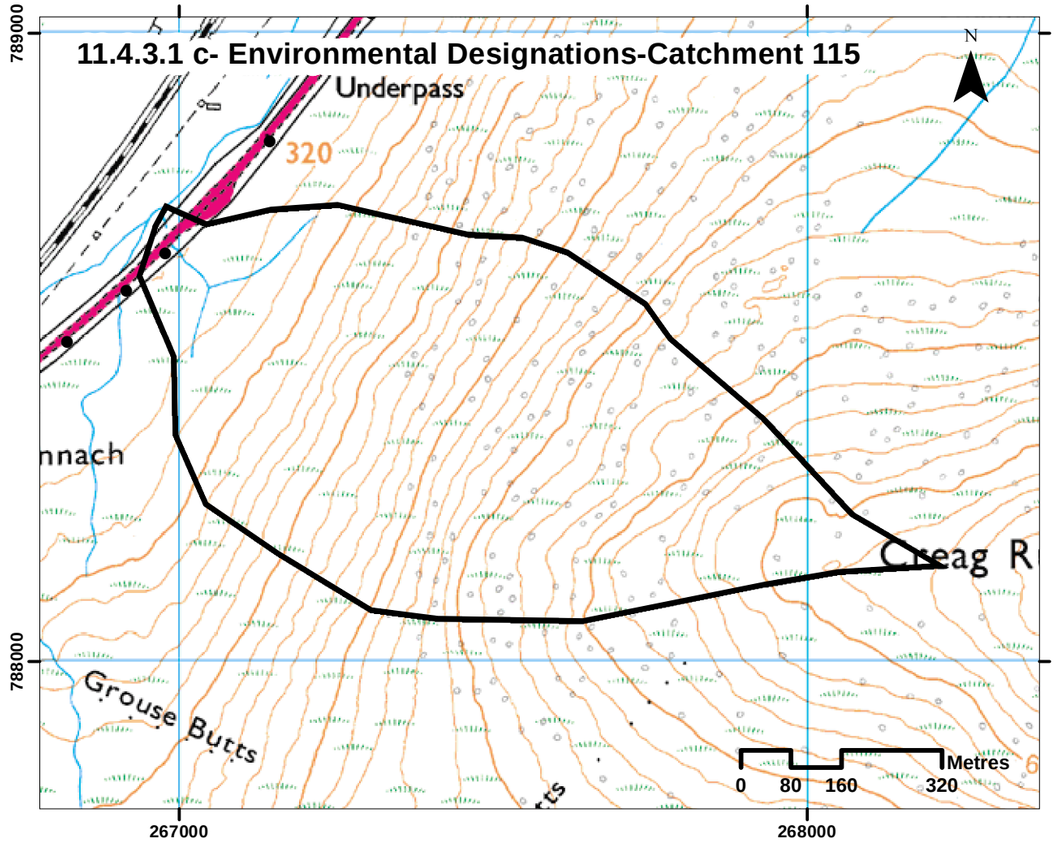
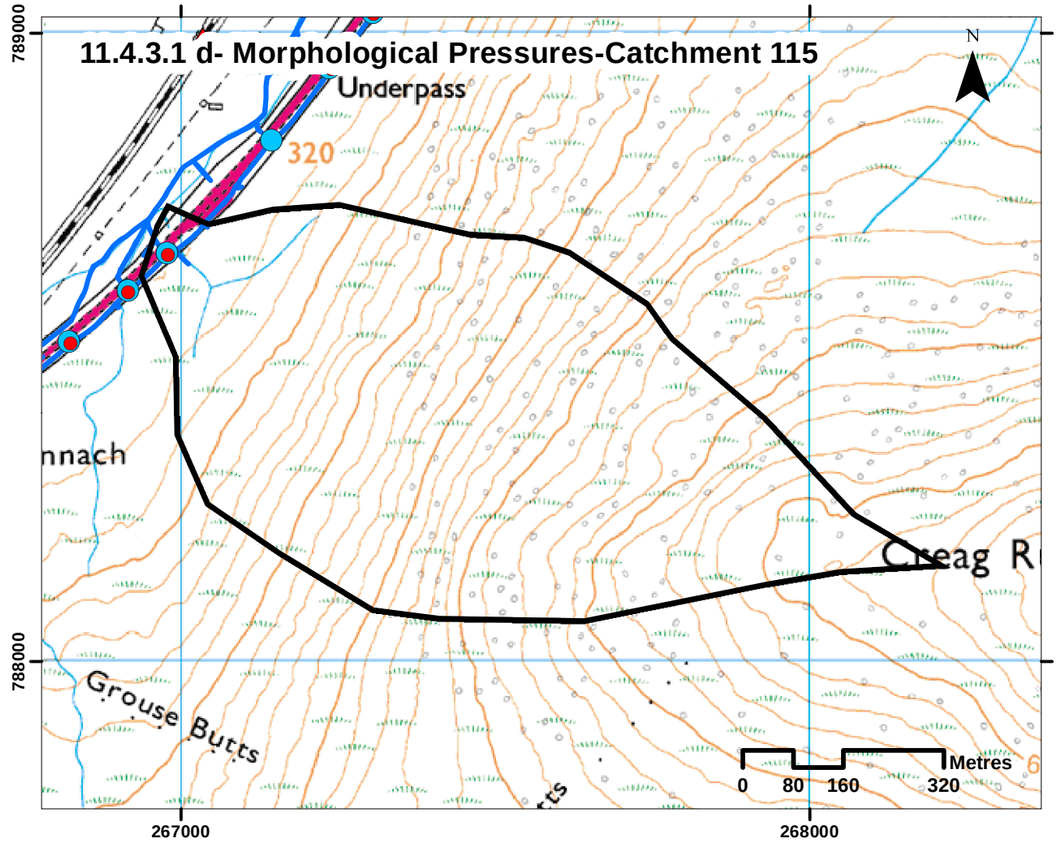
- Talus - Rock Fragments
- Talus Cone

Morphological Pressures

- Railway Bridge
- Culvert
- Step in Bed
- Drainage Ditch





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PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

Drawing 11.4.3.1 Catchment 115 Catchment Overview

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

DATE: 20/07/2017

PROJ: 495298

DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0001

SHEET:	REVISION:	SUITABILITY:
1 of 1	C01	A3

Underpass

117

116

115

114

320

Cut drains

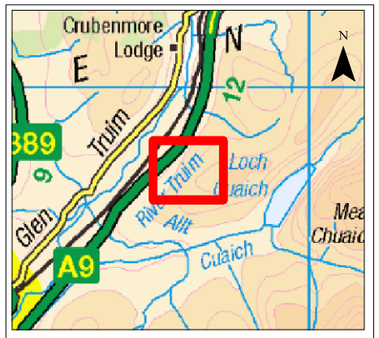
Steeper slopes with small channels moving sediment and water towards the crossing

N

Grouse Butts

Creag

Metres
0 50 100 200



Legend

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

REV	SUIT	DATE	DESCRIPTION	BY	APP

ch2m FAIRHURST
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TRANSPORT SCOTLAND

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PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

DRAWING 11.4.3.2.
Catchment 115 Baseline Assessment

DESIGN:	DRAWN:	CHK:	APP:
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DATE: 11/07/2017

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DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0002

SHEET:	REVISION:	SUITABILITY:
1 of 1	C01	A3

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Annex 11.4.3 - Hydromorphological Catchment Assessment - 116

Catchment No.	116
Catchment Name	-

Channel Nature	Nature of water course	Drain
	Size of water course	Minor

Quantitative Spatial Elements	Catchment Area (km^2)	No Data
	Average slope in catchment (°)	No Data
	% Catchment over 750m (for snow melt risk)	0

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

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 116)	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 116)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 116	
	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	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 116)	No	
	Comment on sediment source potential in catchment	Limited, but drain incising.	
	Comment on sediment supply potential to crossing	Likely supply limited.	

Morphology and Process-Reach upstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Cobble	
	Unvegetated bars	No	
	Vertical incision	Low	
	Deposition	None	
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (Map 1d)	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 116)	No	
	Channel realignment	Yes	Drain has captured hillslope drainage

Morphology and Process-At crossing	Channel morphology	Engineered	
	Predominant sediment size	Gravel	
	Estimated discharge at 1:200 event (m^3/s)	1.4	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	None	
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	None	

Morphology and Process-Reach downstream of crossing	Channel morphology	Engineered	
	Predominant sediment size	Fine	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	None	
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (Map 1d)	Railway	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 116)	Yes	Channel realigned to join others to pass under railway at one single point.
	Channel realignment	Yes	See above
Summary behaviour	Very little happening with this one except some incision u/s of road. POSSIBLY DOWNGRADE!		