Appendix 11.3

Flood Risk Assessment
Part 2

Appendix 11.3

Flood Risk Assessment

Annex C: Assessment Supporting Information

Contents

C.1 Initial Sifting Exercise – Identifying Storage Encroachments

Sifting exercise carried out on Initial Design

Table C1-1: Sifting exercise – encroachments from clashes

Chainage	Associated feature	*Indicative vol. lost (200yr, m^3)	Characteristics of floodplain encroachment	Sifting decision** *{Proposed Scheme Design comment}*
Ch.42,080	MW9.2	136	Water backing up u/s of ID138 crossing.	Ruled out – Proposed channel and structure will span floodplain
Ch.43,800	MW9.3	8	Overland flow: Access track footprint within tributary flood extent	Ruled out – Access track to be kept at existing ground levels crossing under access track to remain as per existing
Ch.45,675	MW9.4	269	Mainline embankment footprint over tributary in channel (upstream) and overland (downstream)	Ruled out – Proposed embankment will accommodate the incoming channel. Proposed tributary crossing will have similar capacity and conveyance. Downstream channel designed to carry 200yr flows.
Ch.45,700 – ch.45,760	MW9.4	10	Overland flow. Access track footprint within tributary flood extent	Ruled out – Access track to be kept at existing ground levels crossing under access track to remain as per existing
Ch.45,850 – ch.45,960	W9.11	194	Overland flow. Access road and SuDS access track footprint within tributary flood extent	Ruled out – Access track to be kept at existing ground levels crossing under access track to remain as per existing
Ch.46,060	W9.11	4170	Proposed mainline and access road footprint within flood extent	[Upstream] Encroachment – Floodplain lost upstream {Realigned access track and encroachment REDUCED to 4030m^3.} [Downstream] Ruled out – Proposed crossing will have similar capacity and conveyance.
Ch.46,650 – ch.47,500	MW9.6	14270	Mainline southern embankment footprint within flood extent Access road footprint within flood extent	Encroachment – Floodplain lost. {Proposed access road running alongside the A9 mainline, out with the floodplain – junction with existing access track still in the floodplain – Encroachment REDUCED to 14090m^3.}
Ch.47,940 – ch.48,070	W9.15	1200	Water backing up for ID 148. Mainline embankment footprint with the flood extent	Encroachment – Floodplain lost {Steepened embankment – encroachment REDUCED to 1150m^3.}
Ch.49,250 – ch.49,400	MW9.1	6940	SuDS 492 footprint within Spey Flood extent	Encroachment – Floodplain lost {SuDS design amended – basin footprint increased – Encroachment INCREASED to 7200m^3.}

Chainage	Associated feature	*Indicative vol. lost (200yr, m^3)	Characteristics of floodplain encroachment	Sifting decision** *{Proposed Scheme Design comment}*
Ch.49,300 – ch.50,200	MW9.1	7000(1)	Mainline and SuDS pond access track embankment footprint at Spey crossing within flood extent	Encroachment – Floodplain lost {A new layby and SuDS access track has been added on the Spey Bridge Embankment – Encroachment marginally INCREASED to 11880m^3.}
Ch.50,680 – ch.50,780	MW9.1	1620	Mainline embankment footprint onto flood extent	Encroachment – Floodplain lost {A86 crossing structure headwall extended – Encroachment REDUCED to 1070m^3.}
Ch.50,700 – ch.50,750	MW9.1	200	SuDS 507 and associated access track footprint onto flood extent	Encroachment – Floodplain lost {SuDS 507 moved out of the floodplain - encroachment REMOVED}
Ch.51,200	MW9.11	706	Overland/sheet flow: Mainline and access road	Ruled out – Proposed crossing will have similar capacity and conveyance.
Ch.51,300	MW9.11 / W9.26	177	Overland flow: SuDS 513 and associated access track footprint	Ruled out – Proposed crossing will have similar capacity and conveyance.
Ch.51,450	W9.26	79	Mainline and access road	Ruled out – Proposed crossing will have similar capacity and conveyance.
Ch.51,700 – ch.51,950	MW9.12 / W9.62	9630	[Upstream] flood water ponding alongside the existing road embankment [Downstream] spread flows due to undefined channel	[Upstream] Encroachment – Floodplain lost {Proposed mainline embankment has been steepened – Encroachment REDUCED to 9040m^3.} [Downstream] Ruled out – Proposed crossing will have similar capacity and conveyance
Ch. 52,550 – ch.52,800	W9.27	283	Mainline and track across flows spilling overland across A9 and through existing underpass	Ruled out – Proposed crossing will have similar capacity and conveyance
Ch.52,900 – ch.52,950	W9.30	23	Access road over existing tributary channel	Ruled out – realigned channel will have similar capacity and conveyance
Ch.52,930 – ch.53,080	MW9.1 / MW9.14	1040	SuDS 530 and associated access track in River Spey floodplain	Encroachment – Floodplain lost {Access track layout changed and SuDS 530 shape amended – encroachment INCREASED to 1380m^3.}
Ch.53,320 – Ch. 53,800	MW9.14	4000	SuDS 534 and SuDS 537 in Raitts Burn floodplain	Encroachment – Floodplain lost {SuDS 534 and SuDS 537 layout refined– Encroachment REDUCED to 2060m^3.}
Ch.53,260 – ch.53,820	MW9.14	6500	Raitts Burn flood water ponding alongside the existing A9 embankment. Proposed mainline and access road within the flood extent	Encroachment – Floodplain lost {Access road no longer running alongside the A9 mainline, NMU instead. SuDS access track brought as much as possible to existing ground levels. – Encroachment REDUCED to 4980m^3.}

Chainage	Associated feature	*Indicative vol. lost (200yr, m^3)	Characteristics of floodplain encroachment	Sifting decision** *{Proposed Scheme Design comment}*
Ch.55,250 – ch.55,320	W9.35	153	[Upstream] water backing up from ID166 (110 m^3). [Downstream] mainline embankment over flows downstream of ID166	[Upstream] Encroachment – Floodplain lost [Downstream] Ruled out – channel will have similar capacity and conveyance
Ch.55,420 – ch.56,180	W9.39	1867	Proposed Mainline across flows spilling along and across the existing A9	Ruled out – realigned channel will have similar capacity and conveyance
Ch.56,180	MW.9.17	1210	Water backing up u/s ID170 crossing and downstream floodplain.	Encroachment – Floodplain lost {HWP access crossing structure headwall extended – Encroachment REDUCED to 650m^3.}

(1) Volume estimate accounts for removal of existing embankment

* Conservative estimates, indicative only and do not account for 3D shape or channel flow volume (therefore may significantly over-estimate volume).

** 'Ruled out' = clash on plan view (between pre-development 200yr flood extents and Proposed Scheme) rejected as a tangible encroachment.
'Encroachment' = area of floodplain volume loss identified, see FRA **sub-section 8** and **sub-section 9**.

C.2 Impacts on 200yr Floodplain

Impacts estimated using H&HM model based on Initial Design, without mitigation.

Table C2-1: Comparison of Stage 3 model results (post-development versus existing case)

Chainage	Feature	Changes affecting the floodplain*	Comparison of indicative 200yr floodplains**	Overall impact and effect on flood risk including adverse impact at receptors {Proposed Scheme Design Comments}
Spey Tributaries				
ch.42,075	MW 9.2	Crossing ID138 – Culvert and Diversion	**Locally:** Upstream changes local to the watercourse diversions and culvert inlet. Downstream negligible change in water levels. **Downstream:** Peak water levels show minor decreases at confluence with Spey.	**No local impact on flood risk** **Negligible beneficial contribution to cumulative impacts downstream**
ch.43,810	MW9.3	Crossing ID142 – Culvert and Diversions	**Locally:** Upstream changes local to the watercourse diversions and culvert inlet. Downstream negligible to major increases and decreases downstream relating to the diversion channel. **Downstream:** Negligible increases extending downstream to the confluence with the River Spey.	**Negligible local increase in flood risk** **Negligible adverse contribution to cumulative impacts downstream** Local road downstream sees minor increases and decreases depending on the location. (up to **9mm** increase) {Realignment of the crossing outfall at ID142 returns outfall to existing location therefor impacts are mitigated as it returns to the existing downstream flow patterns.}
ch.45,675	MW9.4	Crossing ID 145 – Culvert and Diversions	**Locally:** Upstream changes local to the watercourse diversions and culvert inlet. Downstream negligible to major increases and decreases downstream relating to the diversion channel. **Downstream:** Negligible and minor decreases where it crosses the local road.	**Minor local decrease in flood risk** **Negligible beneficial contribution to cumulative impacts downstream** Local road sees minor decreases in the 200 year water level. (up to **37mm** decrease)
ch.46,050	W9.11	Crossing ID146 – Culvert and Diversions Removal of underpass from floodplain	**Locally:** Upstream of A9 major decrease in 200 year water level associated with upsized crossing. Downstream of A9 minor to moderate increases throughout floodplain associated with lost upstream storage. **Downstream:** minor to moderate increases in water level extending downstream to confluence with River Spey.	**Moderate local increase in flood risk** **Moderate adverse contribution to cumulative impacts downstream** Underpass is no longer flooded. Local road downstream sees increase of **54mm** in water levels. Residential and non-residential properties downstream experience **51mm** and **47mm** increases in water levels. Access tracks downstream experience **49mm** increase in water level. {Introduction of compensatory storage local to the A9 mainline crossing within the Scheme Design mitigates the adverse impacts downstream of the A9.}

Chainage	Feature	Changes affecting the floodplain*	Comparison of indicative 200yr floodplains**	Overall impact and effect on flood risk including adverse impact at receptors {Proposed Scheme Design Comments}
ch.46,800	MW9.6	Mainline earthworks	**Locally:** Negligible to moderate increases and decreases in 200 year water level resulting from changes to the overland flow route. **Downstream:** No changes in level propagating downstream.	**Negligible local increases in flood risk** **No contribution to cumulative impacts downstream**
ch.47,350	MW9.6	Crossing ID147 – Structure Sizes and underpass rising Mainline earthworks	**Locally:** Upstream negligible to major increase in 200 year water level. Downstream negligible to minor increases in water level immediately downstream of the crossing becoming a negligible decrease downstream of the track bridge. **Downstream:** Negligible decrease in water level extending to confluence with River Spey.	**Overall reduction in flood risk** **Negligible beneficial contribution to cumulative impacts downstream** Moderate decreases in water level at sole access to residential property. (47mm decrease) {Modelling includes the Scheme Design geometry therefore results are as per Scheme Design. Compensatory storage through upstream displacement is included hence there is major increases in level upstream and no adverse impact downstream}
ch.48,050	W9.15	Crossing ID148 – Culvert and diversions Mainline earthworks	**Locally:** Ponding upstream of crossing removed. Lochan an Tairbh experiences moderate increases in water level. **Downstream:** Loch an Tairbh does not have a formal surface outflow. Model does not extend downstream.	**Negligible local increase on flood risk** **No contribution to cumulative impacts downstream**
ch.51,250	MW9.11	Crossing ID155 – Culvert and diversions Mainline and access track earthworks	**Locally:** Upstream negligible to major decreases in 200 year water level. A9 mainline no longer inundated by overland flow. Downstream generally negligible to major decreases in water level where overland flow routes have been cut off. Significant areas no longer inundated attributed to improved channel capacities. Downstream watercourse diversion directs more flow towards localised areas resulting in moderate increases in water levels. **Downstream:** Negligible increases passed downstream to confluence with River Spey floodplain.	**Major local decrease in flood risk** **Negligible adverse contribution to cumulative impacts downstream** A9 Mainline no longer at risk of inundation. Flow from watercourse diversion results in increases in water level at one non-residential property (**12mm**) downstream. Four other receptors see decreases in levels including two that are no-longer inundated. {Modelling includes the Scheme Design geometry therefore results are as per Scheme Design. Small changes to the watercourse diversion would fully mitigate all impacts at receptors in this area}
ch.51,450	W9.26	Crossing ID156 – Culvert and diversions Access track earthworks	**Locally:** Upstream major decrease in 200 year water level. A9 mainline no longer inundated by overland flow. Downstream access track results in localised major increases in water level. **Downstream:** Negligible increases in water level passed downstream to confluence with MW9.11.	**Major local decrease in flood risk** **Negligible adverse contribution to cumulative impacts downstream** A9 Mainline no longer at risk of inundation.
ch.51,800	MW9.12 W9.62	Crossings ID157 and ID158 -Culverts and diversions Mainline earthworks	**Locally:** Large upstream ponding area and overland flow route between the two watercourses removed. Downstream of ID157 major and moderate increases in 200 year water level. Downstream of ID158 major and moderate decreases in water level. **Downstream:** The complex hydraulics of the two crossings and the	**No local impact on flood risk** **Negligible adverse contribution to cumulative impacts downstream** Peak flows passed downstream to the River Spey increase slightly. This increase will be absorbed within the floodplain around the Insh Marshes.

Chainage	Feature	Changes affecting the floodplain*	Comparison of indicative 200yr floodplains**	Overall impact and effect on flood risk including adverse impact at receptors {Proposed Scheme Design Comments}
			downstream ponding area result in minor decreases in water level being passed downstream to the confluence with the River Spey.	
ch.52,700	W9.27	Crossing ID159 – Culvert and diversion Mainline and access track earthworks	**Locally:** Upstream major increases and decreases in water level relating to the new channel diversions and access track earthworks. A9 Mainline no longer inundated by overland flow from undersized crossing. Downstream localised negligible to major decreases in water level. **Downstream:** Negligible decreases being passes downstream to the confluence with flooding from relating to the River Spey.	**Major local decrease in flood risk** **Negligible beneficial contribution to cumulative impacts downstream** A9 Mainline no longer at risk of flooding from overland flow. Downstream negligible decreases in water level on the access to at residential property. Major decreases in water level at the barn west of Chapel Park. {Modelling includes the Scheme Design geometry therefore results are as per Scheme Design. Change in channel arrangement relating to ID161 is in part the reason for the decreased downstream water levels. No adverse impacts relating to this realignment of crossing ID161}
ch.53,450	MW9.14	Crossing ID162 – SUDS ponds Mainline and access track earthworks	**Locally:** Upstream major decreases in 200 year water level over a large area. Downstream negligible to minor increases in water level over a large area. Access track to SuDS 534 alters flow patterns around the B9152 crossing. **Downstream:** Negligible increases being passed downstream to the River Spey.	**Negligible local increase on flood risk** **Negligible adverse contribution to cumulative impacts downstream** Major decrease in water levels at Mains of Balavil. Increases in water level downstream of the crossing and to the west over a local road and the HML (4mm – 10mm). 4mm increase at the railway cottage and 9mm increase at west lodge. {Modelling includes the Proposed Scheme Design geometry therefore results are as per Proposed Scheme Design. Compensatory storage is introduced to mitigate the majority of these impacts however the impacts from the access track to SuDS 534 remains.}
ch.55,400	W9.35 MW9.16	Crossing ID166 and ID168 – Culverts and diversions Access track and mainline earthworks	**Locally:** Upstream of ID166 water ponds behind access track resulting in in a major increase in water levels. Upstream of crossing ID168 major decrease in water levels and as a result the overland flow to between ID168 and ID166 is reduced. A9 no longer at risk of inundation as a result of overland flow from ID168 traveling east to ID170. Downstream of ID166 better channel results in moderate decreases in water levels. **Downstream:** Increased flows passed downstream from ID168 as a result of the overland flow to ID170 being removed result in major increases in water level in the downstream ponding area.	**Major local decrease in flood risk** **Moderate adverse contribution to cumulative impacts downstream** A9 Mainline no longer at risk from overland flow resulting from the undersized crossing at ID168. Moderate decrease in water levels at the local road downstream of ID166 as a result of improved channel capacity. Major decrease in water level at local road downstream of old outlet from crossing ID168. Major increase in water level downstream adjacent to local road and HML although no additional inundation of these receptors. {Culvert implemented under access track upstream of ID166 reduces increased ponding. Compensatory storage area introduced to mitigate floodplain encroachment upstream of ID166.}
ch.56,200	MW9.17	Crossing ID170 Culvert and diversions Mainline earthworks	**Locally:** Upstream of crossing earthworks push water upstream resulting in major increases in water level. Overland flow route through underpass has been removed. Localised minor and negligible increases in water level downstream of the downstream channel diversion. Overland flow route coming from ID168 no	**Moderate local decrease in flood risk** **Moderate beneficial contribution to cumulative impacts downstream** Access through underpass is no longer at risk of inundation. Minor increases

Chainage	Feature	Changes affecting the floodplain*	Comparison of indicative 200yr floodplains**	Overall impact and effect on flood risk including adverse impact at receptors {Proposed Scheme Design Comments}
			longer exists. Negligible to major decreases in water level downstream of crossing. **Downstream:** Negligible decreases in water level passed downstream to River Spey.	in water level at local road crossing downstream of downstream watercourse diversion. Otherwise minor decreases on local road and adjacent to the HML.
River Spey				
ch.50,100	MW9.1	Spey crossing widening Mainline, access track and SUDS earthworks	**Locally:** Major decreases in 200 year water level upstream of crossing around Kingussie. These decreases become moderate, minor and then negligible as you move upstream towards and beyond the B970. Minor increases in water level immediately downstream of the crossing quickly becoming negligible as you move downstream of the crossing. **Downstream:** There is one point (277145E, 801140N) downstream where there is a major increase in water level on the north side of the HML as a result of the negligible increase in water level pushing slightly more water through a culvert under the HML. Past Loch Insh the increases in water level decay to <1mm. **Upstream:** Upstream of Kingussie there are localised negligible increases in water level of between 1mm and 3mm which are as a result of slight instabilities in the model and are therefore not considered to be realistic.	**Location specific increases and decreases in flood risk** Negligible to major decreases in water level at numerous receptors upstream of the Spey crossing at Kingussie including residential and non-residential, utilities and local roads. Major increase in water level at one location adjacent to a local road and the HML. Minor increase adjacent to one local road downstream of the crossing. Negligible increases in water level at a large number of receptors downstream of the crossing with the magnitude of this generally decreasing the further downstream of the crossing the receptor is located.
ch.50,700	MW9.1	Mainline and SUDS earthworks	No measurable impact on water levels attributable to these encroachments. Loss of flood plain storage will affect cumulative impacts.	No measurable direct impacts on flood risk. Loss of flood plain storage will add to cumulative downstream increases in water levels.

*Elements of the Proposed Scheme categorized as: 'Mainline', 'SuDS' or 'Track' (encroachments), 'Crossing' (watercourse crossing structure/culvert changed) and 'Diversion' (watercourse channel moved and or significantly enlarged).

**Changes described as the post-development results relative to the baseline model results.

C.3 Potential Flood Risk Receptors

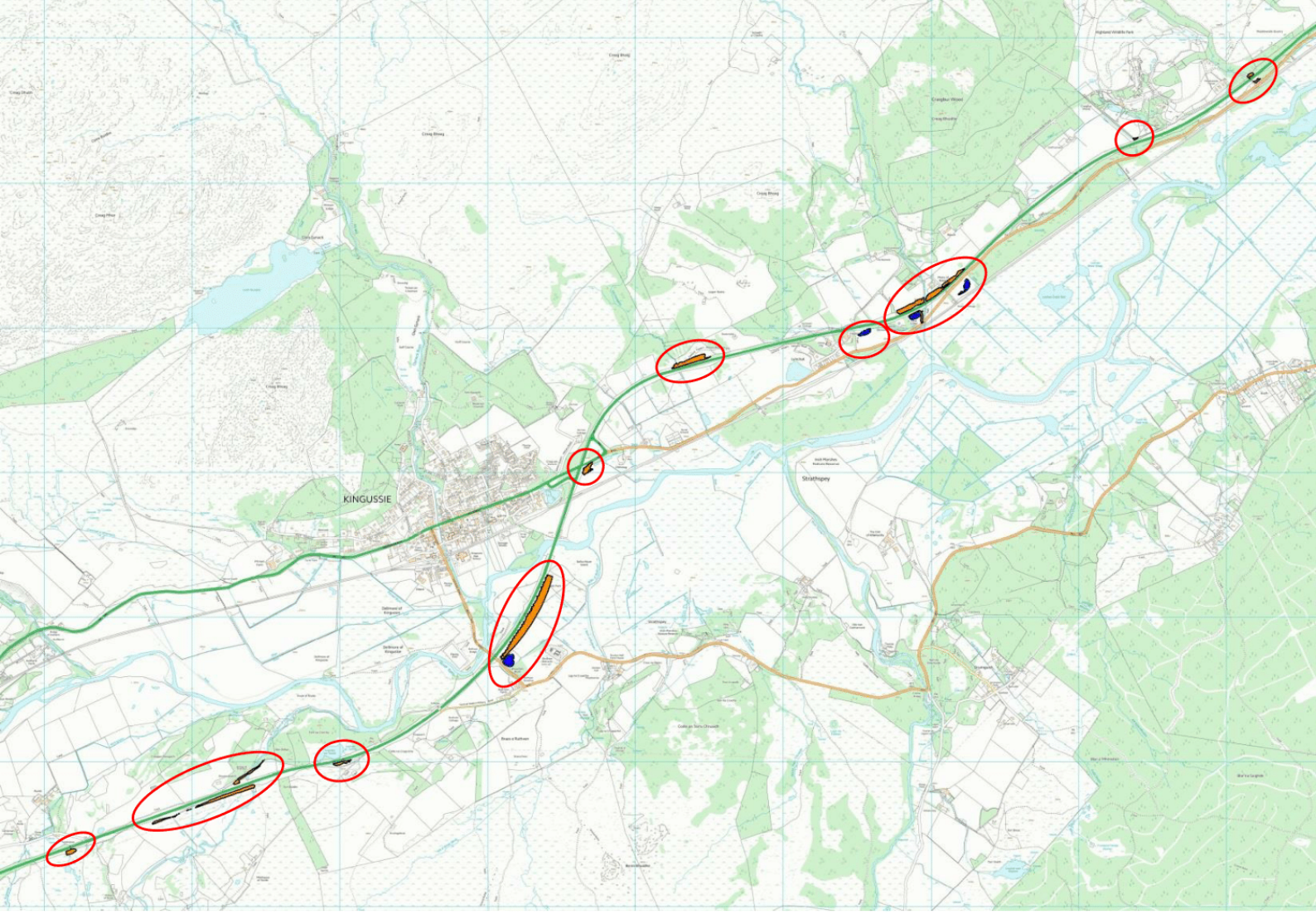
*Table C3-1: Location of potential flood risk receptors identified on **Figures PFR-1 to PFR-8 in Annex D.5***

Label	Type	Location
D-001	Residential Property	Newtonmore
D-002	Residential Property	Newtonmore
D-003	Residential Property	Newtonmore
D-004	Residential Property	Newtonmore
D-005	Residential Property	Newtonmore
D-006	Residential Property	Newtonmore
D-007	Residential Property	Newtonmore
D-008	Residential Property	Nuide Farm
D-009	Residential Property	Kingussie
D-010	Residential Property	Kingussie
D-011	Residential Property	Kingussie
D-012	Residential Property	Kingussie
D-013	Residential Property	Kingussie
D-014	Residential Property	Kingussie
D-015	Residential Property	Kingussie Cemetery
D-016	Residential Property	Kingussie Cemetery
D-017	Residential Property	Kingussie Cemetery
D-018	Residential Property	Lynchat
D-019	Residential Property	Lynchat
D-020	Residential Property	Balavil
D-021	Residential Property	Balavil
D-022	Residential Property	Highland Wildlife Park
D-023	Residential Property	Kincraig
D-024	Residential Property	Kincraig
D-025	Residential Property	Dalnavert
D-026	Residential Property	Kinrara
NRes-001	Non-Residential Property	Newtonmore
NRes-002	Non-Residential Property	Newtonmore
NRes-003	Non-Residential Property	Newtonmore
NRes-004	Non-Residential Property	Newtonmore
NRes-005	Non-Residential Property	Newtonmore
NRes-006	Non-Residential Property	Newtonmore
NRes-007	Non-Residential Property	Newtonmore
NRes-008	Non-Residential Property	Newtonmore
NRes-009	Non-Residential Property	Newtonmore
NRes-010	Non-Residential Property	Newtonmore

Label	Type	Location
NRes-011	Non-Residential Property	Newtonmore
NRes-012	Non-Residential Property	Newtonmore
NRes-013	Non-Residential Property	Newtonmore
Nres-014	Non-Residential Property	Newtonmore
NRes-015	Non-Residential Property	Newtonmore
NRes-016	Non-Residential Property	Newtonmore
NRes-017	Non-Residential Property	Newtonmore
NRes-018	Non-Residential Property	Newtonmore
NRes-019	Non-Residential Property	Newtonmore
NRes-020	Non-Residential Property	Newtonmore
NRes-021	Non-Residential Property	Newtonmore
NRes-022	Non-Residential Property	Newtonmore
NRes-029	Non-Residential Property	Newtonmore
NRes-030	Non-Residential Property	Newtonmore
NRes-031	Non-Residential Property	Nuide Farm
NRes-032	Non-Residential Property	Kingussie
NRes-033	Non-Residential Property	Kingussie
NRes-034	Non-Residential Property	Kingussie
NRes-035	Non-Residential Property	Kingussie
NRes-036	Non-Residential Property	Kingussie
NRes-037	Non-Residential Property	Kingussie
NRes-038	Non-Residential Property	Kingussie
NRes-039	Non-Residential Property	Kingussie
NRes-040	Non-Residential Property	Kingussie Cemetery
NRes-041	Non-Residential Property	Kingussie Cemetery
NRes-042	Non-Residential Property	Balavil
NRes-043	Non-Residential Property	Highland Wildlife Park
NRes-044	Non-Residential Property	Highland Wildlife Park
NRes-045	Non-Residential Property	Kincraig
NRes-046	Non-Residential Property	Kinrara
Util-001	Utilities	Newtonmore
Util-002	Utilities	Kingussie
Util-003	Utilities	Lynchat
Util-004	Utilities	Kincraig
Util-005	Utilities	Kincraig
Access-001	Property Access	Nuide Farm
Access-002	Property Access	Inverton
Access-003	Property Access	Kingussie
Access-004	Property Access	Kingussie

Label	Type	Location
Access-005	Property Access	Lynchat
Access-006	Property Access	Insh Marshes
Access-007	Property Access	Kincraig
Access-008	Property Access	Kincraig
Access-009	Property Access	Kincraig
Access-010	Property Access	Kincraig
Road-01	Public Road	Ralia
Road-02	Public Road	Nuide Farm
Road-03	Public Road	Kingussie
Road-04	Public Road	Gordon Hall Farm
Road-05	Public Road	Kingussie Cemetery
Road-06	Public Road	Lynchat
Road-07	Public Road	Balavil
Road-09	Public Road	Highland Wildlife Park
Road-10	Public Road	Dunachton
Road-11	Public Road	Kincraig
HML-01	Highland Mainline	Newtonmore
HML-02	Highland Mainline	Insh Marshes
HML-03	Highland Mainline	Balavil

C.4 Encroachments and proposed compensatory storage datasheets



DATASHEET KEY

- NNR
- RAMSAR
- SSSI
- SAC
- SPA
- Mainline and Access Road/Track Encroachment
- SUDS Pond Encroachment
- CSA Final Proposed Option
- Discarded CSA

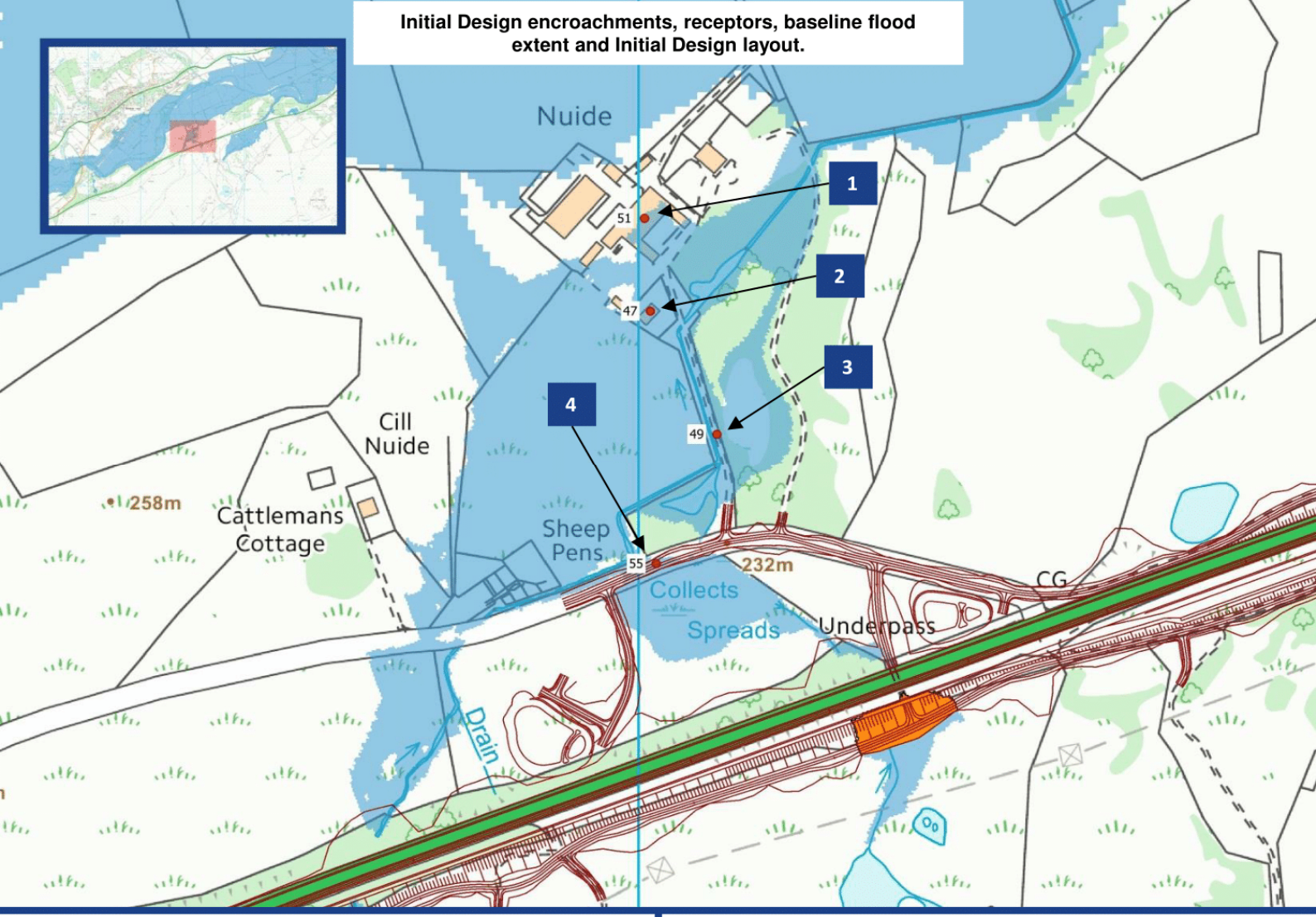
Introduction

Contained within the following datasheets are the details of the compensatory storage proposed following the Initial Design and the process that has been gone through to avoid or reduce encroachments where possible, and mitigate remaining encroachments were practical.

The changes between the Initial Design and the Assessment Design have been identified, considered in the development of the compensatory storage areas and the Proposed Scheme Design approach is included in the datasheets below.

Where compensatory storage areas have been modified or discarded for any reason they are shown in addition to the final design.

Each compensatory storage area has been given an ID and this document examines them in order of south to north.



Initial Design Encroachment Details

Encroachment occurs as a result of widening of the A9 mainline to the south and the addition of an access track on the south side of the road which must be protected to 1:200 year levels as it is the sole access to a residential property.
The flood plain storage which is encroached into is the result of an undersized culvert at ID146 becoming surcharged.
There are various receptors immediately downstream (north) of the A9 mainline which are negatively impacted as a result of the lost flood plain storage.

Initial Design – Encroachment Summary

Component	Area (m^2)	Volume (m^3)	No. Downstream Receptors Affected
Mainline + Access Tracks	1790	4170	4
SUDS Pond Embankments	N/A	N/A	N/A
Total	1790	4170	4

CSA ID Number: 1 + 2

Chainage: Ch.46+025
Location: 273180E, 798380N

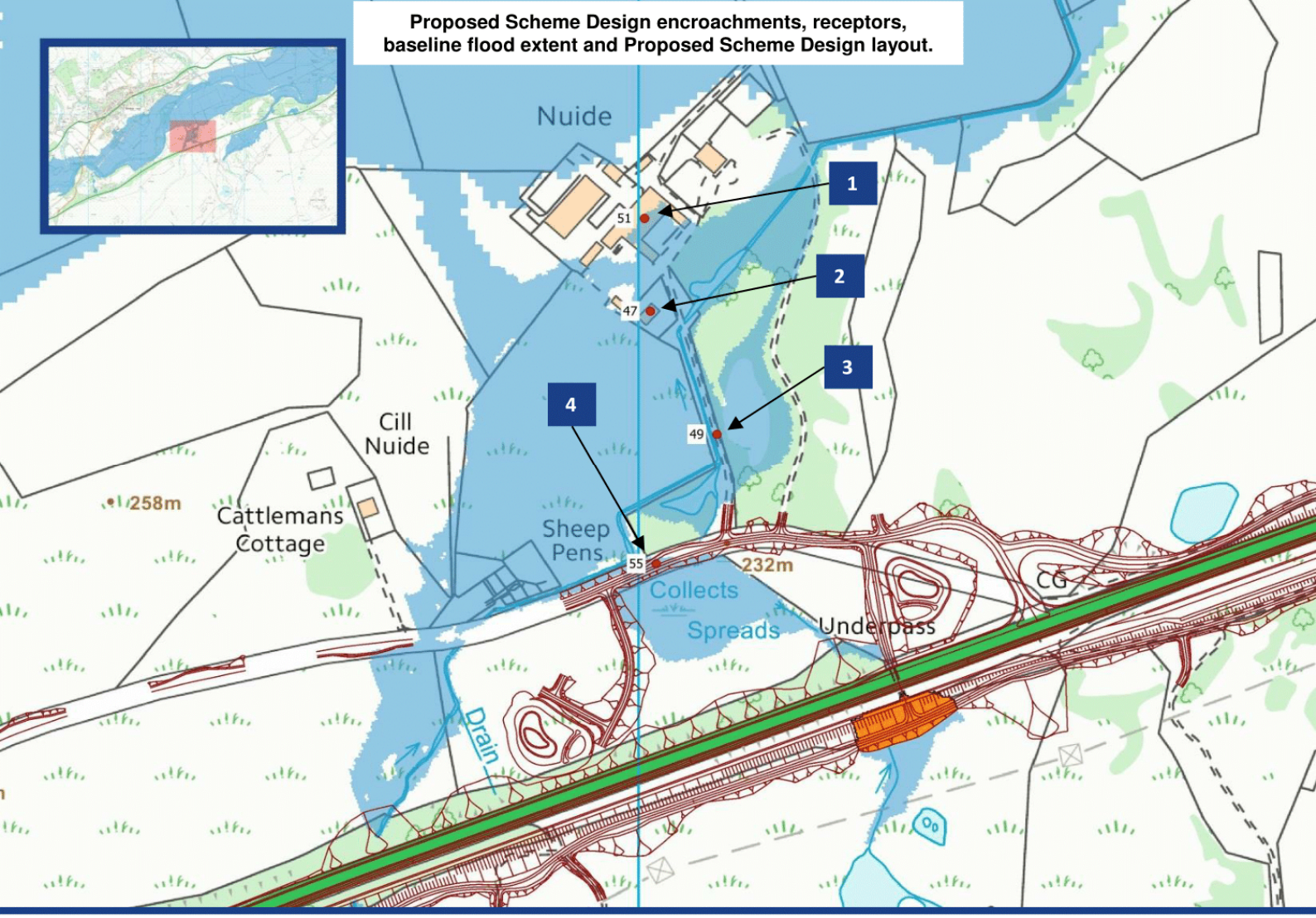
Receptor Impact Details

4no. receptors downstream are affected as a result of the loss of flood plain storage. The magnitude of these changes, the type of receptor and an approximate depth at each receptor are summarised in the table below.

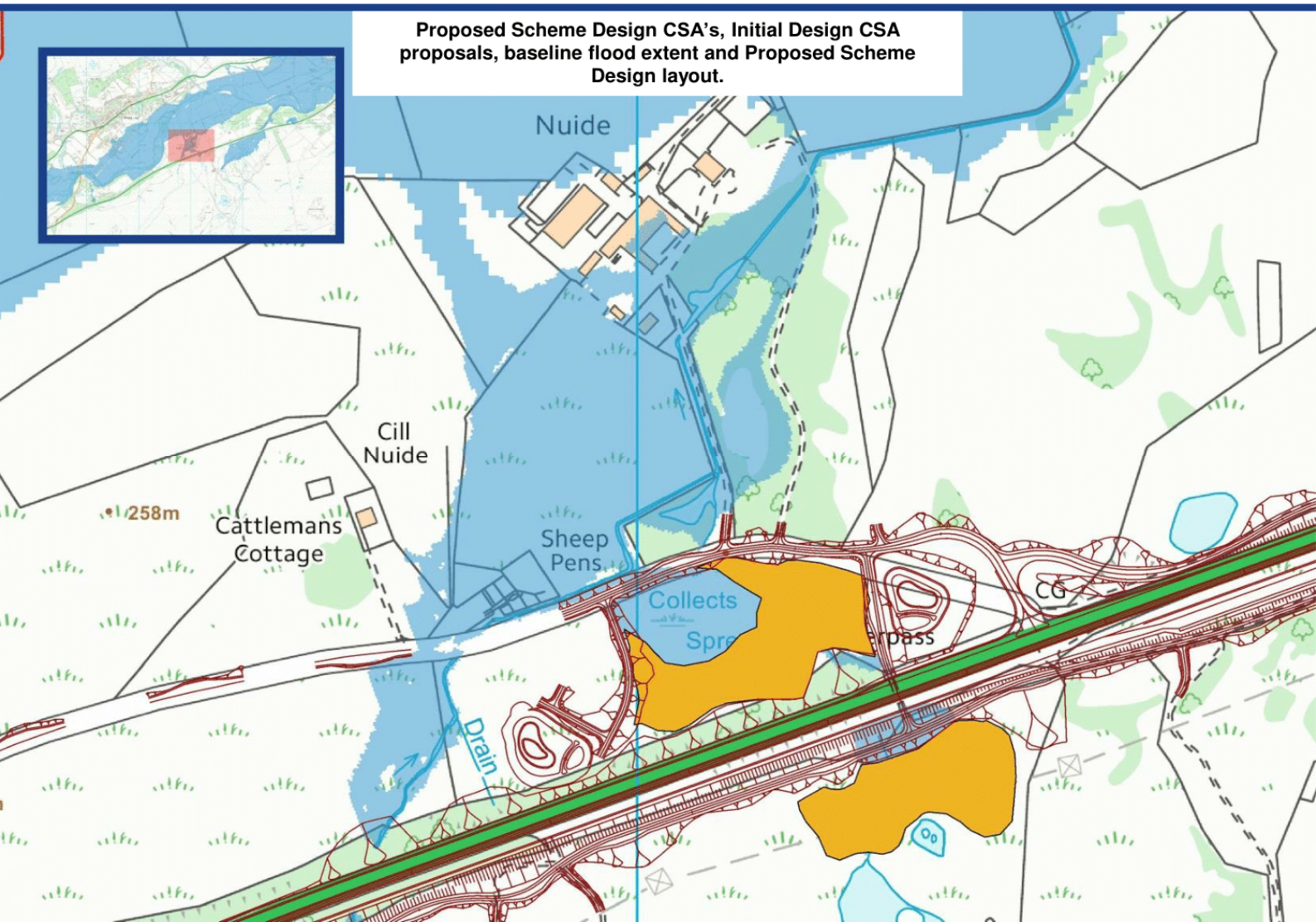
These increases are attributed to both the flood plain encroachment and the upsizing of the culvert under the A9 to accommodate the 200 year return period flow and the individual impacts of each of these cannot be separated.

Receptor type and location ID	Assessment Design Change in water level	Watercourse crossing relating to receptor impact
Non-Residential [1]	51mm	ID146
Residential [2]	47mm	ID146
Access Track [3]	49mm	ID146
Local Road [4]	55mm	ID146

Proposed Scheme Design encroachments, receptors, baseline flood extent and Proposed Scheme Design layout.



Proposed Scheme Design CSA's, Initial Design CSA proposals, baseline flood extent and Proposed Scheme Design layout.



Changes: Initial Design – Proposed Scheme Design

Access track has been pulled tighter against the mainline reducing the encroachment volume. Culvert size has been informed by hydraulic modelling and CSA design to maximise upstream storage potential.

Proposed Scheme Design – Encroachment Summary

Component	Area (m^2)	Volume (m^3)	No. Downstream Receptors Affected
Mainline + Access Tracks	1720	4030	4
SUDS Pond Embankments	N/A	N/A	N/A
Total	1720	4030	4

Initial Design CSA Mini Assessment Comments

Ecology: CFS 1- Impacts on areas of dry heath (Annex I habitat which, whilst relatively common in Scotland, is rare across Europe). Reduce extent from areas of dry heath, or remove completely.
If dry heath can be reinstated then impact will be lessened. Should ground levels be reduced, it is unlikely that there will be suitable conditions to restore the full extent of dry heath. Details of required excavation depths will determine final assessment outcome.

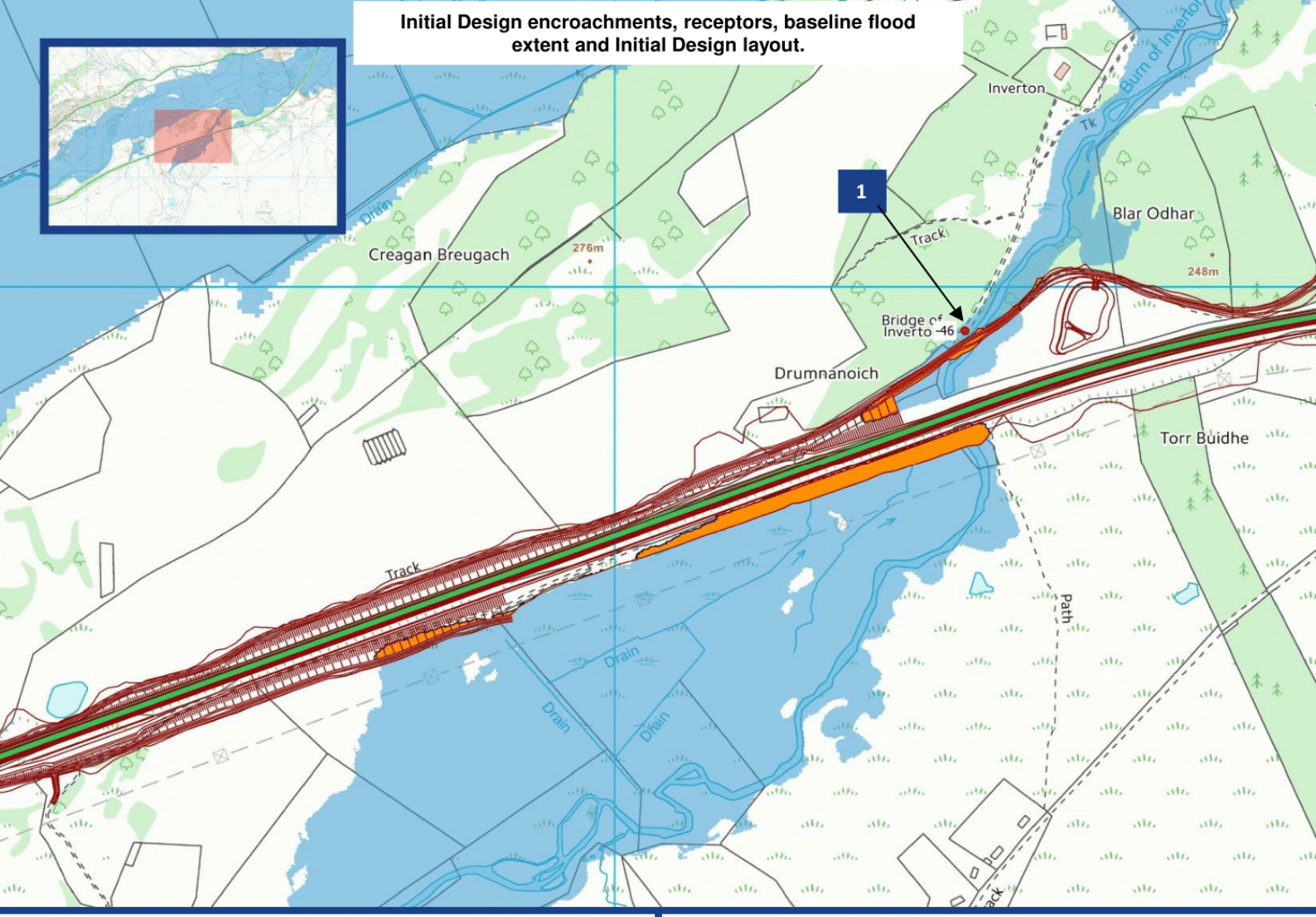
C&PA: CFS 2 - In close proximity to access track to Nuide Farm; potential for track to flood. Move area away from track.

Geology: CFS 1 - Partially located on shallow peat (0.5 - 1.0m) and encroaches swamp/ mire. Reshape to avoid above areas or relocate 20m north.

Mitigation Options Developed Following Initial Design

Option (Preferred Options)	Discussion	Viable
Avoid flood plain encroachment	Avoidance of flood plain encroachment is not possible due to the alignment of the road.	No
Reduce Encroachment through design.	Encroachment has been slightly reduced for the Proposed Scheme Design by steepening earthworks and moving the access track closer to the A9 mainline.	Yes
Maintain existing culvert size to displace storage upstream of A9.	Underpass is essential access to a property in the proposed road design therefore it must be protected against the 200 year flood. Maintaining the existing culvert is not possible due to the minimum permissible culvert size being 900mm and at this size the culvert will become surcharged and the underpass will be inundated.	No
Compensatory storage through excavation upstream.	The proposed culvert is sized to pass the 200 year flow. To achieve the full volume of storage required for the water depth at the culvert inlet would require very large earthworks in steep constrained topography with environmental sensitivities.	Yes
Accept changes in water level at local receptors.	Local receptors are already significantly inundated in the 200 year flood. Local lost storage will have limited impacts on wider Spey flood levels. Impacts of significant excavation for CSA's may be greater than that of the lost storage.	Yes
Compensatory storage through excavation downstream of A9.	As shown in the above map this option involves excavation of a 9896 m^2 area of ground. This would provide sufficient storage to compensate the lost flood plain storage volume.	Yes
Compensatory storage through displacement by raising the local road and controlling flow under it.	Raising the local road and controlling the flow under it would mobilise a greater depth of storage upstream allowing storage to be achieved without excavation. It would also prevent the inundation of the local road.	Yes

Final CSA Proposed Scheme Design Comment:
The final option selected is for there to be an upstream CSA which will provide as much storage as is feasible at detailed design with a second downstream CSA which will provide the remaining required compensation. This will mitigate the impacts resulting from the loss of floodplain storage.



Initial Design Encroachment Details

Encroachment occurs as a result of widening of the A9 mainline to the south and the raising of an access track within the functional flood plain on the north side of the road which must be protected to 1:200 year levels as it is the sole access to a residential property.
The flood plain storage which is encroached into is the result of extensive backing up of watercourse ID147 from the 3no. arch culvert under the A9 and the undersized crossing under the existing access track to the north of the A9.

Initial Design – Encroachment Summary

Component	Area (m^2)	Volume (m^3)	No. Downstream Receptors Affected
Mainline + Access Tracks	11200	14270	1
SUDS Pond Embankments	N/A	N/A	N/A
Total	11200	14270	1

Receptor Impact Details

1no. receptors downstream are affected as a result of the loss of flood plain storage. The magnitude of this change, the type of receptor and an approximate depth at the receptor are summarised in the table below.

These increases are attributed to both the flood plain encroachment and the upsizing of the culvert under the A9 to accommodate the 200 year return period flow with freeboard and the individual impacts of each of these cannot be separated.

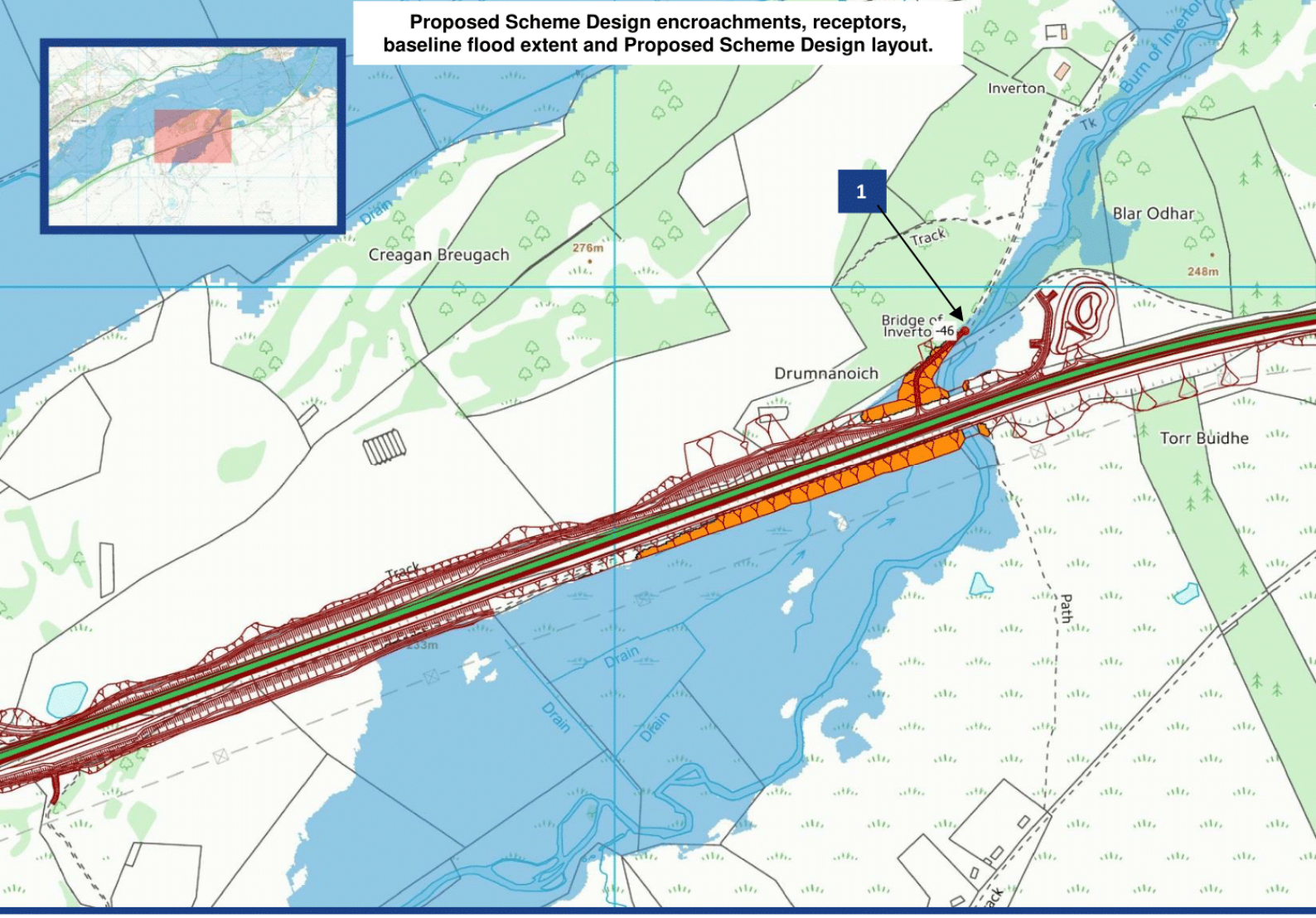
The hydraulic model does not extend far enough downstream to assess impacts at Kingussie.

Receptor type and location ID	Assessment Design Change in water level	Watercourse crossing relating to receptor impact
Access Track[1]	-47mm	ID147

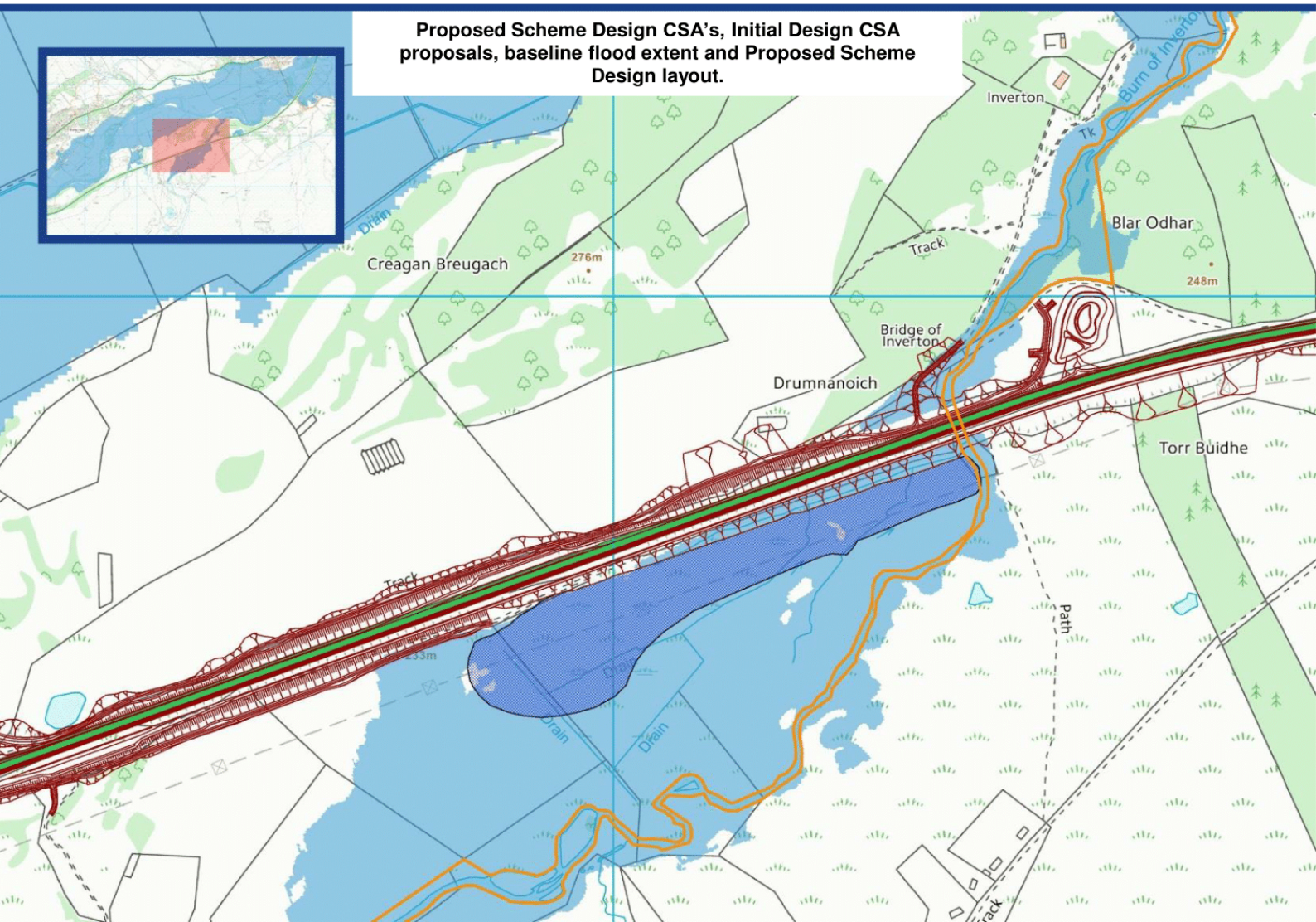
CSA ID Number: 3

Chainage: Ch.47+300
Location: 274340E, 798810N

Proposed Scheme Design encroachments, receptors, baseline flood extent and Proposed Scheme Design layout.



Proposed Scheme Design CSA's, Initial Design CSA proposals, baseline flood extent and Proposed Scheme Design layout.



Changes: Initial Design – Proposed Scheme Design

Access track at the western end has been pulled tighter against the mainline and embankments steepened reducing the encroachment volume in this area. Access track downstream of the crossing has been realigned against the mainline however a connection to the existing access track has been introduced in the floodplain resulting the overall decrease in encroachment volume being less than could be achieved with further design consideration. Crossing size has been informed by extensive hydraulic modelling to not pass more flow downstream at any return period or storm duration.

Proposed Scheme Design – Encroachment Summary

Component	Area (m^2)	Volume (m^3)	No. Downstream Receptors Affected
Mainline + Access Tracks	10000	14090	1
SUDS Pond Embankments	N/A	N/A	N/A
Total	10000	14090	1

Initial Design CSA Mini Assessment Comments

Ecology: Impacts on River Spey SAC. Reshape to avoid River Spey SAC at eastern extent. If this cannot be reshaped, it will result in Likely Significant Effect (LSE) in the Habitats Regulations Appraisal (HRA) and an appropriate assessment, a more stringent assessment compared to EIA, will have to be carried out. If the area can be reshaped, a positive may be that breeding birds would benefit from locally deep excavations, providing ephemeral wetland features (e.g. scrapes, ditch, etc.).

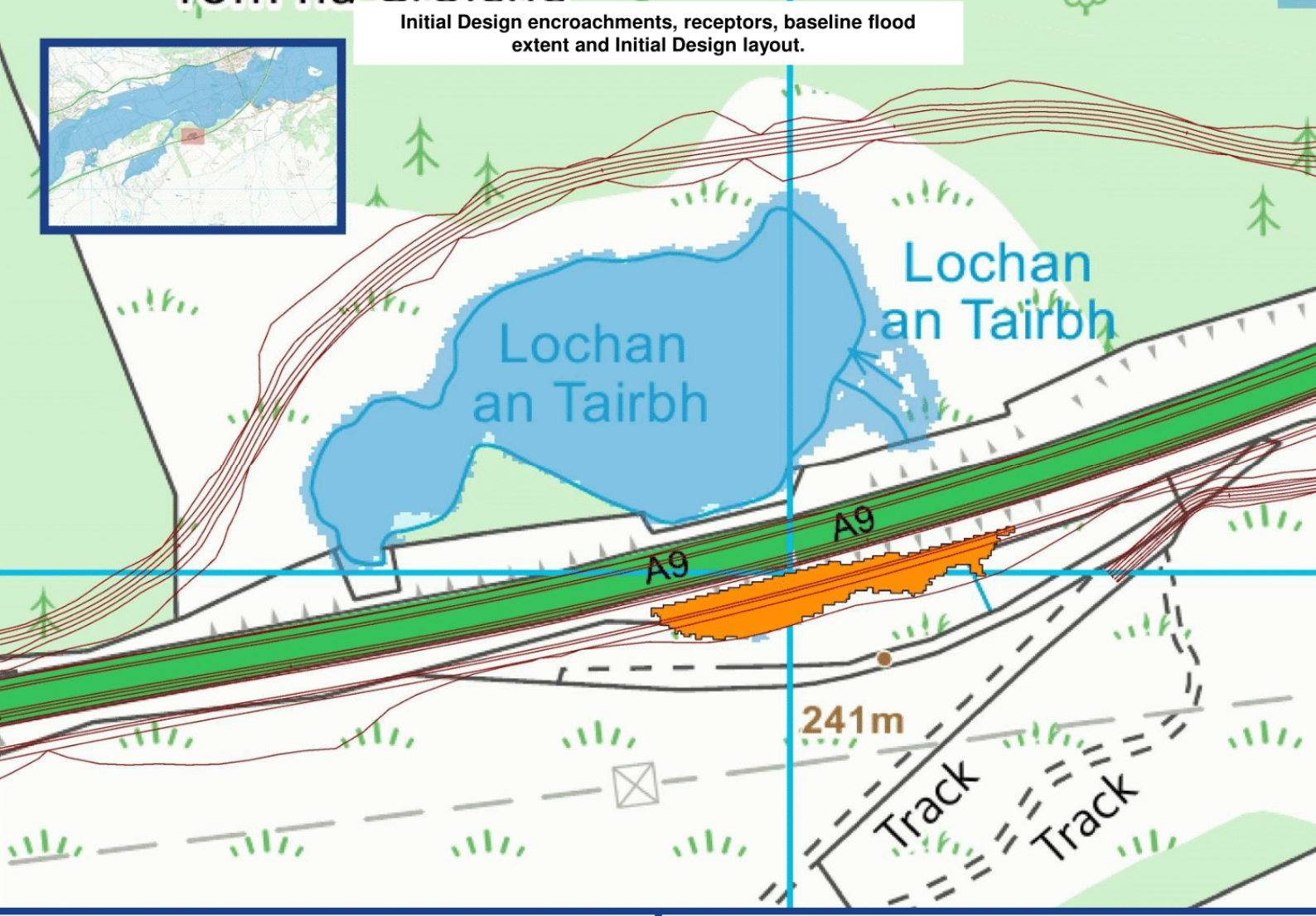
Geology: Partially located on peat (up to 1.5m) and M23 mire. Reshape to avoid above areas or relocate 550m west or 650m east. If peat can be reinstated then impact could be lessened; to reinstate, over-excavation would be recommended. Details of required excavation depths will determine final assessment outcome.

Mitigation Options Developed Following Initial Design

Option (Preferred Options)	Discussion	Viable
Avoid flood plain encroachment	Avoidance of flood plain encroachment is not possible due to the alignment of the road.	No
Reduce Encroachment through design.	Encroachment has been reduced for the 5th iteration design by steepening mainline earthworks as much as possible moving the access track against the A9 mainline.	Yes
Compensatory storage through excavation upstream.	A large area (~36300m^2) of excavation would be required to compensate for the lost floodplain encroachments and tie the storage into the channel. Existing crossing size would have to be maintained to allow this to work properly.	Yes
Accept changes in water level at local receptors.	Local receptors are already significantly inundated in the 200 year flood. Local lost storage will have limited impacts on wider Spey flood levels. Impacts of significant excavation for CSA's may be greater than that of the lost storage.	Yes
Design proposed culvert size under the A9 mainline to displace water upstream such that there is no increase in peak downstream.	Design of the culvert to act as a control on the flows passed downstream would allow the required storage to be achieved without large excavation and as a result of the topography of the ground there would be limited increases in the area inundated in a 200 year flood.	Yes

Final CSA Proposed Scheme Design Comment:

The final option selected is for compensatory storage to be provided by upstream displacement. Extensive hydraulic modelling has been carried out to inform the mainline crossing size such that it does not pass more flow downstream at any return period or storm duration. The crossing size determined is a twin 4.2m x 3.6m box culvert arrangement.



Initial Design encroachments, receptors, baseline flood extent and Initial Design layout.

Initial Design Encroachment Details

Encroachment occurs as a result of widening of the A9 mainline to the south.
The flood plain storage which is encroached into is the result of the undersized existing culvert on watercourse ID148 backing up and spilling out of bank upstream of the A9.

Initial Design – Encroachment Summary

Component	Area (m^2)	Volume (m^3)	No. Downstream Receptors Affected
Mainline + Access Tracks	1560	1200	0
SUDS Pond Embankments	N/A	N/A	N/A
Total	1560	1200	0

Receptor Impact Details

There are no receptors downstream.

Lochan an Tairbh does not have a formal outflow and the topographic spill route is ~4m higher than normal loch levels. The loch is thought to drain via sub surface flow through the sands and gravels that surround it.

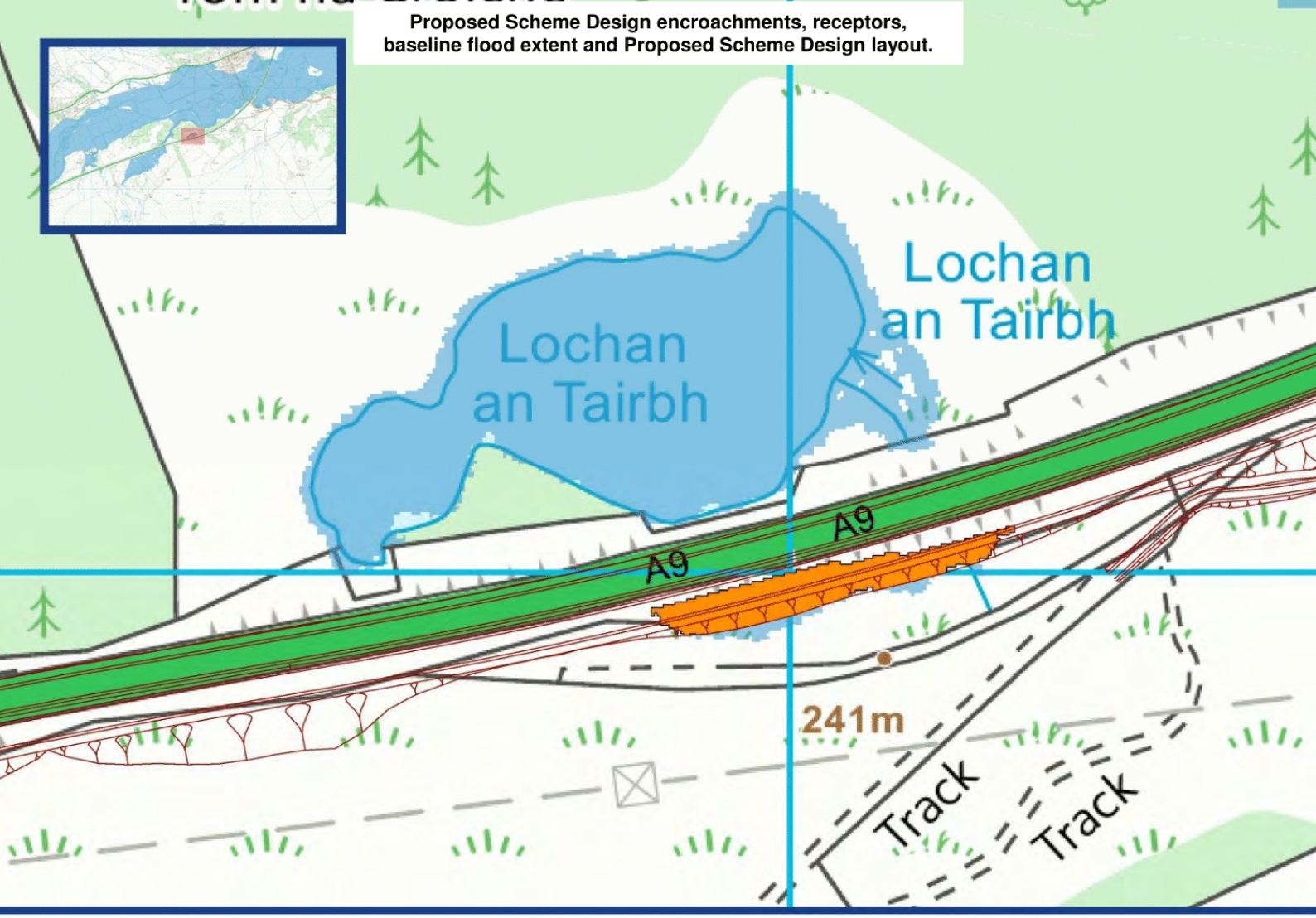
Removing the upstream storage and passing all the flow downstream through a culvert sized to accommodate the 200 year flow results in <100mm increase in water levels in the loch for the 200 year flow (critical at the A9 crossing).

The hydraulic model has not been run taking into account the critical storm duration at the loch however it also does not account for any infiltration outflow.

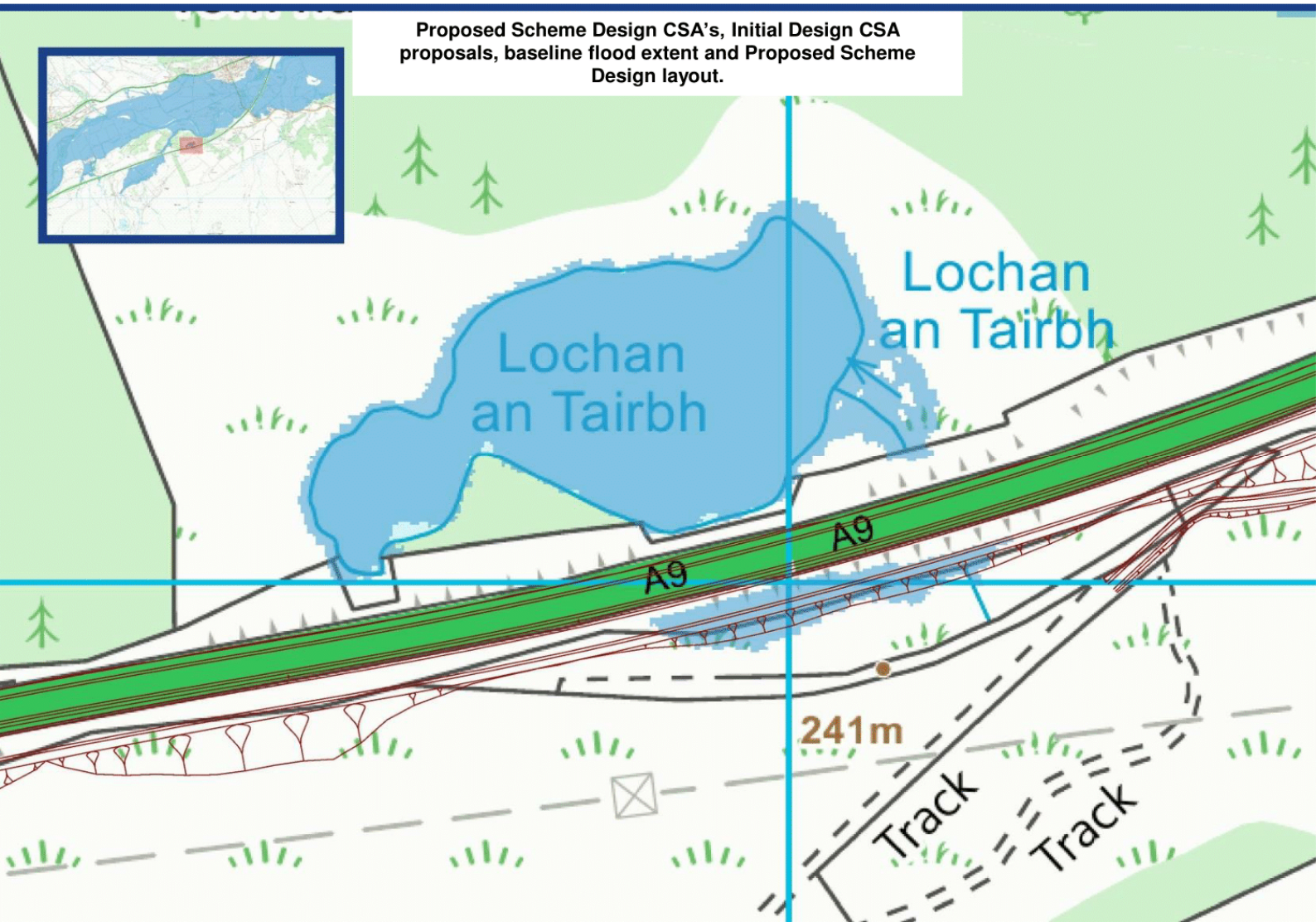
CSA ID Number: 4

Chainage: Ch.48+000
Location: 275020E, 798990N

Proposed Scheme Design encroachments, receptors, baseline flood extent and Proposed Scheme Design layout.



Proposed Scheme Design CSA's, Initial Design CSA proposals, baseline flood extent and Proposed Scheme Design layout.



Changes: Initial Design – Proposed Scheme Design

Road embankments have been steepened to minimise encroachment volumes.

Proposed Scheme Design – Encroachment Summary

Component	Area (m^2)	Volume (m^3)	No. Downstream Receptors Affected
Mainline + Access Tracks	1360	1150	0
SUDS Pond Embankments	N/A	N/A	N/A
Total	1360	1150	0

Initial Design CSA Mini Assessment Comments

Ecology: Impacts on areas of dry heath (Annex I habitat which, whilst relatively common in Scotland, is rare across Europe). Reduce extent from areas of dry heath, or remove completely.

C&PA: Impact on track leading to Milehouse of Nuide; potential for impact upon access. Reshape to avoid track.

Mitigation Options Developed Following Initial Design

Option (Preferred Options)	Discussion	Viable
Avoid flood plain encroachment	Avoidance of flood plain encroachment is not possible due to the alignment of the road.	No
Reduce Encroachment through design.	Encroachment has been reduced for the 5th iteration design by steepening mainline earthworks as much as possible.	Yes
Compensatory storage through excavation upstream.	Due to the reduced depth slices resulting from the upsizing of the crossing a disproportionately large area would require excavation to achieve compensatory storage for the lost storage volume.	No
Accept changes in water level at local receptors.	No receptors. Loch level will be slightly increased by lost storage. Impacts of significant excavation for CSA's may be greater than that of the lost storage.	Yes

Final CSA Proposed Scheme Design Comment:

The final option selected is for compensatory storage not to be provided as there are no downstream receptors and the increase in loch level is only slight. Water level monitoring is being carried out recording the loch level and the surrounding groundwater levels to better understand the hydrogeology of the loch.