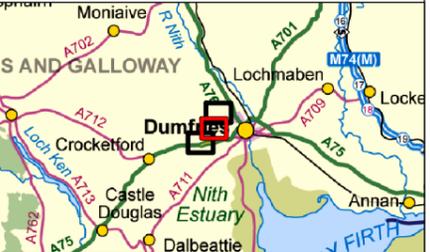


- Legend:**
- Proposed Pipeline Route
 - 1km Area of Search
 - Regional Scenic Area
 - Ancient Woodland
 - Semi Natural Ancient Woodland
 - Planning Application Boundary
 - 15m Planning Application

This map contains data from the following sources:-
 Scottish Natural Heritage
 Dumfries and Galloway Council Local Development Plan
 Coordinate System: British National Grid
 Projection: Transverse Mercator
 Datum: OSGB 1936
 Units: Meter

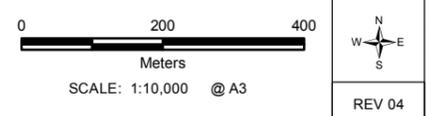


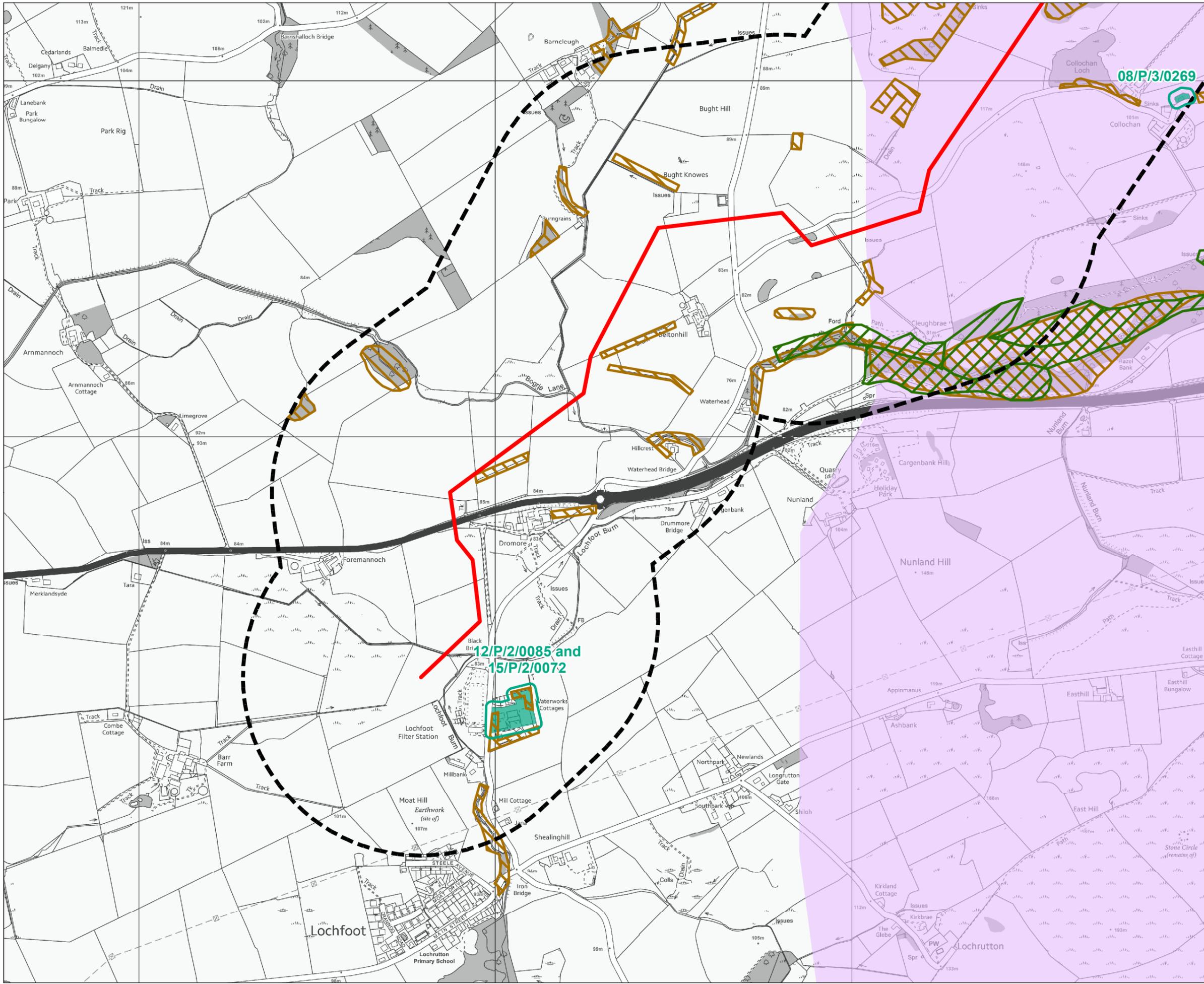
Rev	Date	Description	Drn	Chk	App
03	06/05/2015	Updated Route	FC	DJ	WH
03	14/04/2015	Updated Logo	FC	DJ	WH
02	18/03/2015	Updated Planning Apps	FC	DJ	WH

Cluden to Lochfoot Pipeline



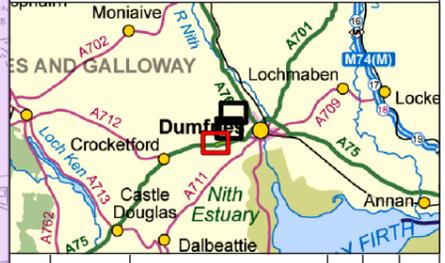
TITLE: **Figure 4.1:
 Planning Constraints
 Map 2 of 3**





- Legend:**
- Proposed Pipeline Route
 - 1km Area of Search
 - Regional Scenic Area
 - Ancient Woodland
 - Semi Natural Ancient Woodland
 - Planning Application Boundary
 - 15m Planning Application

This map contains data from the following sources:-
 Scottish Natural Heritage
 Dumfries and Galloway Council Local Development Plan
 Coordinate System: British National Grid
 Projection: Transverse Mercator
 Datum: OSGB 1936
 Units: Meter



Rev	Date	Description	Drn	Chk	App
03	06/05/2015	Updated Route	FC	DJ	WH
03	14/04/2015	Updated Logo	FC	DJ	WH
02	18/03/2015	Updated Planning Apps	FC	DJ	WH

Cluden to Lochfoot Pipeline

TITLE: **Figure 4.1:
Planning Constraints
Map 3 of 3**

SCALE: 1:10,000 @ A3

REV 04

5	LAND USE	5-1
5.1	Introduction	5-1
5.2	Consultation.....	5-1
5.3	Legislation and Policy Context	5-2
5.4	Assessment Methodology and Uncertainty	5-3
5.4.1	Establishment of Baseline Environment	5-3
5.4.2	Identification and Assessment of Impacts and Mitigation Measures.....	5-3
5.4.3	Uncertainty and Technical Difficulties Encountered	5-4
5.5	Baseline Overview	5-4
5.5.1	Residential Areas.....	5-4
5.5.2	Industrial Areas and Large Industrial Developments.....	5-4
5.5.3	Transport Network	5-5
5.5.4	Mineral Extraction.....	5-5
5.5.5	Agriculture.....	5-5
5.5.6	Notifiable Scheduled Diseases	5-8
5.5.7	Injurious Weeds.....	5-8
5.5.8	Invasive Species	5-9
5.5.9	Agri-environment Schemes	5-9
5.5.10	Organic Farms	5-9
5.6	Assessment of Impacts	5-9
5.6.1	Existing and Future Developments	5-9
5.6.2	Transport Network	5-10
5.6.3	Agriculture.....	5-10
5.7	Mitigation Measures.....	5-11
5.7.1	Developments	5-11
5.7.2	Transport Network	5-11
5.7.3	Agriculture during the Construction Phase	5-11
5.7.4	Agriculture during the Operational Phase	5-16
5.8	Summary of Residual Impacts and Significance.....	5-16
5.9	References	5-19

Tables

Table 5-1	Land Use Consultation Responses
Table 5-2	Relevant Local Development Plan Policies
Table 5-3	Significance of Residual Impacts
Table 5-4	Land Capability for Agriculture
Table 5-5	Summary of Impacts and Mitigation Measures

Figures

Figure 5.1	Land Capability for Agriculture
------------	---------------------------------

5 LAND USE

5.1 Introduction

This section considers the impact of pipeline construction on land use along the pipeline route. It describes the impacts of pipeline construction on the different types of land use along the pipeline route. The measures that GNI will take to mitigate these impacts are described along with the residual and cumulative impacts.

The pipeline route passes through mainly agricultural land, the majority of which is used for grazing. There will inevitably be some temporary disruption to farming activities. This occurs principally during the construction phase when there will be a temporary loss of use of agricultural land, possible disruption of services and the removal of sections of established boundaries.

In order to minimise any disruption, mitigation measures, such as temporary drainage systems and access provisions across the working width, will be agreed with affected landowners and occupiers under formal Pre-Entry Agreements. Measures to prevent the spread of notifiable scheduled plant and animal diseases and agricultural weeds will also be taken during construction.

After construction, normal agricultural operations can be resumed, with the working width, including field boundaries, being fully reinstated.

5.2 Consultation

Table 5-1 summarises the consultation responses that have been received to date in relation to the land use assessment methodology presented in this section.

Table 5-1 Land Use Consultation Responses

Consultee	Previous Consultation	Comment	Response to Consultation
Scottish Environmental Protection Agency (SEPA)	Meetings held on: 15.03.2007 03.07.2007 20.11.2007 25.11.2014 09.03.2015	Minimise the impact on hedgerows and trees and protect the Nitrate Vulnerable Zone	Implementation of a robust Reinstatement Plan
Scottish Natural Heritage (SNH)	Meetings held on: 15.03.2007 02.07.2007 03.07.2007 20.11.2007 21.11.2007	Minimise the impact on hedgerows and trees and protect the Nitrate Vulnerable Zone	Implementation of a robust Reinstatement Plan

Consultee	Previous Consultation	Comment	Response to Consultation
	25.11.2014 25.02.2015		

5.3 Legislation and Policy Context

The pipeline route corridor lies wholly within Dumfries & Galloway Council. Policies relevant to land use contained within the Dumfries and Galloway Council Local Development Plan are detailed in Table 5-2.

Table 5-2 Relevant Local Development Plan Policies

Policy Number	Title	Aims/Details of Policy	Project compliance
OP1	Development Considerations	Development proposals should be compatible with the character and amenity of the area and should not conflict with nearby land uses.	EIA covers all relevant aspects of this policy.
ED14	Mineral Safeguarding	Permanent development that would result in the sterilisation of mineral resources that is viable or could be extracted.	No mineral resources have been identified along the pipeline route
ED16	Protection and Restoration of Peat Deposits as carbon sinks	Safeguarding and protecting those peat deposits not already designated for habitat conservation.	The Project crosses a small area of peat, which is known to support semi-improved marshy grassland. Appropriate mitigation will be agreed with the relevant Statutory Consultees prior to construction.
NE13	Agricultural Soil	Developments located on areas of good quality agricultural soils will only be supported where they conform to the Spatial Strategy of the Plan and there is no alternative on less good quality land.	The Project crosses areas of agricultural land of varying quality. However, agricultural activities will not be affected following reinstatement of the pipeline route following construction.
T4	Freight transport	Development which generates significant volumes of haulage traffic will be encouraged to utilise	There will be a short term increase in haulage traffic during the construction of the pipeline as described in the EIA. The use of freight is not practical due to the

Policy Number	Title	Aims/Details of Policy	Project compliance
		facilities for the transfer of freight from road to rail and to locate the transfer close to main transport routes.	rural nature of the work. Impacts from transportation requirements are considered unlikely to be significant. (see Section 10: Traffic and Transportation).
T5	Former transportation routes	Presumption against any development on or adjacent to former railway routes.	No former railway routes have been identified within the Area of Search for The Project.

5.4 Assessment Methodology and Uncertainty

5.4.1 *Establishment of Baseline Environment*

The Town and Country Planning (Scotland) Act 1997, as amended by the Planning etc. (Scotland) Act 2006 requires decisions on planning applications to be determined in accordance with the development plan unless material considerations indicate otherwise. It aims to bring in a much more inclusive and efficient planning system to improve community involvement, support the economy, and help it to grow in a sustainable way.

Desk-based information has been gathered for a 1km-wide area of search centred on the pipeline route. Information on Agricultural Land Classification has been obtained and information on participation in Agri-environment Schemes sought). The Scottish Government has also been consulted for advice on animal health risks, burial pits and crop diseases. Reference has also been made to the results of the ecological survey (see Section 7).

5.4.2 *Identification and Assessment of Impacts and Mitigation Measures*

5.4.2.1 *General*

The identification and assessment of impacts has been made with reference to information received from the consultees and any particular issues highlighted by them. This has been interpreted using professional judgement and experience based on previous pipeline projects.

Mitigation measures are based on the above and incorporate relevant statutory and non-statutory legislation and guidance. These are referenced, where necessary.

5.4.2.2 *Assessment of Significance of Impacts*

With respect to potential land-use impacts, these have been identified and assessed having regard to consultee responses; the requirements of the local authorities; the magnitude of the impact, and the sensitivity of the receptor.

An assessment has also been made of the significance of residual impacts, i.e. those impacts that are predicted to remain after the mitigation measures outlined in this ES have been implemented. When making an assessment of significance, the magnitude of change and the importance/sensitivity of the receptor have been taken into account.

A large magnitude change would be one that is likely to cause a direct adverse permanent or long-term impact on the integrity/value of the receptor, whereas a small change would be

one that is likely to have a minor adverse impact on a receptor but recovery is expected in the short term.

Table 5-3 details the categories that have been used when classifying overall significance.

Table 5-3 Significance of Residual Impacts

Impact	Description	
Very Significant	Permanent change in land use, which could have an extensive effect including areas remote from the development area	Significant Impacts where monitoring may be required
Significant	Permanent or medium- to long-term change in land use, with changes to areas remote from the site (over several years)	
Moderate	Short- to medium-term changes in land use just outside the accepted limits of normal variation with little or contained off-site effects, detectable (over a period of several months)	
Slight	Change only just detectable within the site and surrounding areas over a short timescale (over a period of days or weeks)	
None	An impact causing effects that are not readily noticeable	

5.4.3 *Uncertainty and Technical Difficulties Encountered*

No particular technical difficulties have been encountered during the undertaking of this assessment.

5.5 **Baseline Overview**

5.5.1 *Residential Areas*

5.5.1.1 *Existing Residential Areas*

The pipeline has been routed to avoid residential areas as far as possible. Therefore, the main types of settlement within the pipeline Area of Search are individual dwellings, farms and hamlets.

The main centres of population in proximity to the pipeline Area of Search are Cluden, Terregles and Lochfoot. Dumfries, the regional centre of Dumfries and Galloway, is located approximately 3km east of the pipeline route.

5.5.1.2 *Planned Residential Areas*

There are no significant residential developments planned within the pipeline Area of Search.

5.5.2 *Industrial Areas and Large Industrial Developments*

5.5.2.1 *Existing*

The pipeline passes to the north west of Scottish Water's Lochfoot Filter Station (servicing the Dumfries aquifer potable supplies). However, no other substantial existing industrial areas lie within the pipeline corridor.

5.5.2.2 *Planned*

No areas within the pipeline route Area of Search have been identified for new industrial developments within the Local Development Plan.

5.5.3 *Transport Network*

5.5.3.1 *Existing*

5.5.3.1.1 *Roads*

There are two trunk roads that serve the pipeline Area of Search to the west of Dumfries. The Primary Routes close to the pipeline that will be used by construction traffic are the A75 (T) and A76 (T).

The pipeline crosses the following roads:

- A roads: A75(T) and,
- four minor roads

A schedule listing all the road crossings will be detailed in the Traffic Management Plan (see Section 10).

5.5.3.1.2 *Railways*

The pipeline Area of Search does not cross any freight or passenger rail routes or disused railway lines.

5.5.3.2 *Planned*

5.5.3.2.3 *Roads*

No potential future road schemes have been identified within the pipeline Area of Search.

5.5.3.2.4 *Railways*

No potential future rail schemes have been identified within the pipeline Area of Search.

5.5.4 *Mineral Extraction*

5.5.4.1 *Existing*

There are no known mineral extraction sites within the pipeline Area of Search.

5.5.4.2 *Planned*

There are no known areas of consented or future extraction sites within the pipeline Area of Search.

5.5.5 *Agriculture*

5.5.5.1 *Land Capability for Agriculture and Agricultural Land Use*

Agriculture forms the main land use within the pipeline corridor. Land Capability for Agriculture (LCA) provides a method for assessing the quality of farmland to enable informed choices to be made about its future use within the planning system. The classification is based on the long-term physical limitations for agricultural use. Factors affecting the grade are climate, site and soil characteristics, and the important interactions between them. Factors taken into account include:

- climate: temperature and rainfall; aspect, exposure and frost risk;
- site: gradient, micro-relief and flood risk; and
- soil: texture, structure, depth and stone content; and chemical properties that cannot be corrected.

The combination of climate and soil factors determines soil wetness and susceptibility to drought, which in turn influences the choice of crops and the level of consistency of yields, as well as use of land for grazing livestock. However, the LCA is concerned only with the inherent potential of land under a range of farming systems and, therefore, does not necessarily relate to the current agricultural use or intensity of use.

The LCA system classifies land into five grades, as described in Table 5-4 with the ‘best and most versatile land’ being defined as Grades 1, 2 and 3.

Table 5-4 Land Capability for Agriculture

LCA Grade	Class Descriptions	Division Descriptions
1*	Land capable of producing a very wide range of crops. Soils are usually well drained with good reserves of moisture. Sites are level or gently sloping and climate is favourable. The level of yield is consistently high. There are no or very minor physical limitations affecting agricultural use.	Not divided
2	Land capable of producing a wide range of crops. Slight workability or wetness problems and slightly unfavourable soil structure and texture compared to Class 1 land. Moderate slopes and slightly unfavourable climate.	Not divided
3 ¹	Land capable of producing a moderate range of crops. Moderate limitations of soil require careful management. There may be restrictions to rooting depth, unfavourable structure or texture, strongly sloping ground, slight erosion or a variable climate.	Land is capable of producing consistently high yields of a narrow range of crops (principally cereals and grass) and/or moderate yields of a wider range (including potatoes and other vegetables).
3 ²		Capable of average production but high yields of barley, oats and grass are often obtained. Degree of risk is involved in production of arable crops.
4 ¹	Land capable of producing a narrow range of crops. Moderately severe limitations include moderately severe wetness, occasional damaging floods, shallow or very stony soils, moderately steep gradients, moderately severe climate or interactions of these, which increase level of farming risk.	Suited to rotations which, although primarily based on ley grassland, include forage crops and cereals for stock feed. Other crop yields variable and usually below national average.

LCA Grade	Class Descriptions	Division Descriptions
4 ²		Primarily grasslands with some limited potential for other crops. Grass yields can be high, but difficulties of conservation or utilisation may be severe especially in areas of poor climate or on very wet soils.
5 ¹	Land capable of use as improved grassland. Limitations include adverse climate, wetness, frequent damaging floods, steep slopes, soil defects or erosion risks.	Establishment of grass sward and its maintenance present few problems and potential yields are high with ample growth throughout season.
5 ²		Sward establishment presents no difficulties, but moderate or low trafficability, patterned land and/or strong slopes cause maintenance problems.
5 ³		Land has properties, which lead to serious trafficability and poaching difficulties, and although sward establishment may be easy, deterioration in quality is often rapid.
6 ¹	Land capable of use only as rough grazings. This land has very severe site, soil or wetness limitations, which generally prevent the use of tractor-operated machinery for improvement. Climate is often a very significant limiting factor.	Land has high proportions of palatable herbage in the sward, principally the better grasses, e.g. meadow grass-bent grassland, bent-fescue grasslands.
6 ²		Moderate quality herbage such as white and flying bent grasslands, rush pastures and herb-rich moorlands or mosaics of high and low grazing values characterise land in the division.
6 ³		Vegetation is dominated by plant communities with low grazing values, particularly heather moor; bog heather moor, and blanket bog.
7	Land of very limited agricultural value. This land has extremely severe limitations that cannot be rectified. Limitations may result from one or more of the following; extremely severe wetness, extremely stony rock land, unvegetated soils, scree, very steep gradients and extremely severe climates.	Not divided

Data obtained from Land capability for Agriculture Sheet 84, The Macaulay Institute

The different LCA found along the proposed pipeline route is shown in Figure 5.1 and summarised as:

- 2.4km (34.4%) of the pipeline length crosses Grade 3 (both Grade 3.1 and 3.2) Agricultural Land. This is found at the northern-most point of the pipeline between Cluden Lodge and north west of Terregles. Within the area of search, 2.74km² of land is classified as either Grade 3.1 or 3.2.

- 3.8km (53.8%) of land along the route of the pipeline and 3.7km² within the wider area of search is of Grade 4 (Grade 4.1 and/or 4.2) quality. This occurs throughout the length of the route with the exception of the northern part of the pipeline.
- 0.83km (11.8%) of the agricultural land along the pipeline is classified as Grade 5.2. There are no areas of land classified as Grade 5.1 crossed by the pipeline route. Within the wider area of search, there is 1.18km² of land either Grade 5.1 and/or 5.2. There are pockets of this grade of land scattered throughout the middle and southern section of the route.
- There is no land classified as either Grade 6 or 7 either on the pipeline route or area of search.
- Waterbodies. No inland waterbodies as defined by the LCA are located along the route.

The pipeline Area of Search mainly crosses pastoral areas of grassland of varying degrees of quality. There are also a small number of fields where arable land use is in evidence, and areas of coniferous plantation, although it appears there has been little or no commercial forestry activity for a number of years.

Existing field land drainage is not currently known in detail but plans will be obtained from owners/occupiers and verified by a line walk during the detailed design phase. A full drainage survey, with recommendations for pre- and post-construction land drainage, will be undertaken before construction.

Field boundaries in the area are in the form of hedgebanks (vegetated stone walls with hedgerow vegetation to top), mature hedgerows and associated hedgerow trees, and fences. These are discussed further in Section 7.

5.5.6 Notifiable Scheduled Diseases

The Department for Environment, Food and Rural Affairs (DEFRA) has issued policy in the form of a publication titled *Protecting animal health and preventing disease, including in trade* (2013) and guidance (2003) *Biosecurity Guidance to Prevent the Spread of Animal Diseases*, the principles of which will also be adopted during the construction the pipeline.

APHA has confirmed that there are no Notifiable Disease restrictions along the pipeline corridor.

APHA has confirmed that there are no recorded carcass burial pits in the locality of the pipeline corridor. This matter will also be discussed with individual farmers prior to construction. Prior to pipeline construction, further contact will also be made with APHA to ascertain the status at that time.

5.5.7 Injurious Weeds

Guidance on preventing the spread of the five weeds covered under the *Weeds Act 1959* (spear thistle (*Cirsium vulgare*); creeping or field thistle (*Cirsium arvense*); curled dock (*Rumex crispus*); broad-leaved dock (*Rumex obtusifolius*) and common ragwort (*Senecio jacobaea*) is given in the Ministry of Agriculture, Fisheries and Food (MAFF, now DEFRA) leaflet *Identification of Injurious Weeds* (MAFF 1999, re-published DEFRA 2011).

No areas of injurious weed species have been identified during the Phase 1 ecological survey (see Section 7). However, further checks would be required prior to construction to confirm the presence or absence of such species.

5.5.8 Invasive Species

American Signal Crayfish are known to be present in a loch to the south of the proposed route and it is therefore possible that this invasive species may have migrated into some of the watercourses being crossed by the route.

This species is highly invasive and must not be spread from one area to another. Without suitable mitigation, there could be a highly significant negative impact if this species are transported between watercourses. This is discussed in more detail in Section 7.

5.5.9 Agri-environment Schemes

There are no records of any agri-environment schemes within the pipeline Area of Search.

5.5.10 Organic Farms

There are no known organic farms within the pipeline Area of Search.

5.6 Assessment of Impacts

5.6.1 Existing and Future Developments

5.6.1.1 Construction Phase: Residential

The following impacts of construction on residential areas have been identified:

- the potential for residents within the pipeline Area of Search to be subjected to noise and dust nuisance;
- the potential for residents to experience increased traffic flows and disruption due to construction traffic; and
- the potential for residents to experience short-term changes to their visual amenity (see Section 9).

Construction of the pipeline is predicted to have a *moderate* impact on residential areas in close proximity to the pipeline, due to potential noise and dust nuisance during the construction period (see Section 11). This is only likely to be the case where the pipeline runs adjacent to residential buildings at Drummore (NX 900748) and Beltonhill (NX 905753), and impacts are considered unlikely to be significant. With respect to disruption to traffic, whilst temporary increases will occur in traffic volumes these are considered unlikely to be significant.

5.6.1.2 Construction Phase: Industrial Developments

Due to there being no significant industrial developments within the pipeline Area of Search, impacts on industrial developments are considered unlikely.

5.6.1.3 Operational Phase

There will be no impacts upon existing or future developments during the operation of the pipeline.

5.6.2 *Transport Network*

5.6.2.1 *Construction*

The impact of construction of The Project on transport is discussed in Section 10. Overall, no significant impact is anticipated during construction.

5.6.2.2 *Operation*

There will be no impact on the transport network once the pipeline is operational (see Section 10).

5.6.3 *Agriculture*

5.6.3.1 *Construction*

The following construction impacts on agriculture have been identified:

- agricultural operations within the working width will be temporarily suspended (with an additional period of suspension following reinstatement) while reseeded, replanted, or semi-natural vegetation becomes re-established, or until the arrival of the next sowing season for arable land;
- sections of fences and hedgerows will be removed, and private accesses may be temporarily disrupted. There is also the potential for private water supplies to be affected during construction;
- fields will be bisected and, where small areas are left to one side of the working width, it may not be practical to farm these during construction;
- pipelines will be generally laid to a depth of cover that is below the depth of most field land drainage systems and construction is therefore likely to disturb field land drains and ditches. Successful reinstatement is essential in order to avoid the creation of wet areas, with consequent loss of soil structure and fertility;
- whilst considered unlikely to be present following ecological surveys and consultations, pipeline construction is a linear operation and therefore has the potential for carrying crop and animal diseases, ‘injurious weeds’ and invasive species between fields and farms;
- there is potential for unknown animal burial pits to be disturbed; and
- there are potential impacts from pipeline construction on soils, see Section 6.

The impacts resulting from suspension of agricultural operations, disruption of accesses, and removal of sections of land boundaries are considered likely to be *moderate* but not significant due to their short-term nature.

Impacts resulting from mishandling of soils, poor treatment and reinstatement of land drainage, and the transfer of agricultural diseases and injurious/invasive species, however, do have the potential to be *significant* without the implementation of appropriate measures and working practices.

5.6.3.2 *Operation*

After construction, normal agricultural operations can be resumed including sub-soiling. GNI will negotiate a permanent easement wayleave for the pipeline from each landowner. This permanent easement will be 10m wide. Within the permanent easement, GNI will have

the right to construct, maintain, repair and inspect the pipeline. In most instances, this will not affect the existing land use once construction is complete. However, conditions will usually be attached to the Deed of Grant between GNI and the landowner, restricting certain activities to ensure that there is no accidental damage to the pipeline. Typically, such restrictions preclude mineral extraction, the erection of buildings and the planting of deep-rooted trees.

For individual trees, the minimum distance from the pipeline route is determined by the tree species, for example, mountain ash and whitebeam can typically be planted 3m or more from the pipe and most large trees such as Scot's pine, larch and oak, 6m or more from the pipe. Where woodland blocks are being planted or exist adjacent to the route, the minimum distance, irrespective of species, is typically 10m or more.

Overall, it is anticipated that the impact of the operational pipeline on agriculture will be insignificant, as current agricultural operations are likely to be able to be continued.

5.7 Mitigation Measures

5.7.1 *Developments*

The pipeline has been designed to ensure that no buildings exist within one boundary-point definition (BPD) (91m) (see Section 3.2.1). If route alignments are required prior to construction that bring the pipeline closer than 1 BPD to buildings, thicker-walled pipes will be used.

For any planning applications submitted after the Scottish Executive has approved this ES, Dumfries & Galloway Council will be required to consider the presence of the pipeline in consultation with the Health and Safety Executive. Occupied buildings will not normally be allowed within 1 BPD of the pipeline except where 'heavy wall' (extra thick) pipe has been used. However, GNI will support planning applications by providing any detail the landowner/occupier needs to pursue planning consent, and various options are available to facilitate development where this might otherwise be refused or constrained.

Mitigation measures in respect of noise and dust emissions are described in Section 11.

5.7.2 *Transport Network*

For plant and pipe delivery, HGVs will be routed carefully in accordance with a Traffic Management Plan (see Section 10). Once delivered to site, subsequent movements will be confined to the working width, as far as possible, to minimise local road disruption. Smaller vehicles will also use the working width for travel, where possible, in order to minimise the use of public roads, and will be controlled in accordance with the Traffic Management Plan. Further information on traffic associated with pipeline construction is outlined in Section 10.

5.7.3 *Agriculture during the Construction Phase*

5.7.3.1 *Agricultural Operations*

Prior to entry onto the land, consultations will be held with each landowner/occupier to discuss how disruption to normal farming operations can be minimised, and the measures agreed will be included in a Pre-Entry Agreement. A Record of Condition Survey will also be carried out to record existing crops, fences, hedgerows, accesses, private water supplies, etc.

Where fences, sections of hedges, hedgebanks, ditches and culverts are removed or disturbed during pipeline construction, these will be fully reinstated as soon as possible after construction in consultation with the landowners/occupiers.

Where possible, the pipeline has been routed to avoid woodland, lines of trees and individual mature trees. However, in the few locations where it has not been possible to avoid an area of woodland or individual trees, specific mitigation techniques have been developed to minimise impact. Impacts and mitigation measures on trees and woodlands are outlined in Section 7 (Ecology).

Guidance on appropriate techniques of soil handling and restoration is given in DEFRA's Code of Good Agricultural Practice for the Protection of Soil, Water and Air (2009). The Code recognises that the soil is a limited natural resource, which is easily destroyed and needs to be protected against damaging farming practices, erosion, pollution and degradation caused by civil engineering works. Part of the Code assesses measures to reduce the effect of soil disturbance from the laying of pipelines. Construction and reinstatement works will be planned in accordance with this advice. Excavated and stripped soils will be also handled in accordance with the methods outlined in Section 3 and mitigation measures outlined in Section 6.

5.7.3.2 *Temporary Loss of Crop Production within the Working Width*

As identified in Section 3, construction of the pipeline will require on average a 40m working width. However, some additional space, nominally 10m, will be required at road, watercourse and service crossings to allow for extra vehicle parking and the storage of additional spoil material. Temporary fencing, erected in advance of topsoil removal, will separate this area from surrounding land. This area will remain out of production until the soil is reinstated and the fence removed. The entire procedure will be completed within a single season unless adverse weather prevents reinstatement. In such a case, reinstatement would be postponed to the following spring as restoration under wet conditions increases the risk of soil damage.

Where land is to be returned to grass, it is most likely that agricultural grass mixes, fertilisers and herbicides will be used as soon as soil and weather conditions are judged suitable. It is usual for reinstated grasslands to take longer to be re-established than non-grass crops, and temporary fencing may be retained to avoid damage by grazing animals until re-establishment is advanced. Advice on this issue will be sought at a later date when the route has been finalised and negotiations with landowners and occupiers are further developed.

Crop and grazing loss associated with the working width is likely to be unavoidable, but the extent will depend on a combination of field area, production forecasts and loss of access. Resultant financial loss is a matter for compensation, to be agreed between GNI's land agent and individual landowners and occupiers.

'Records of Condition' of land along the pipeline route prior to construction will be agreed with the landowners/occupiers as an aid to assessing compensation. The working width may cause temporary access severance from farm sprayers, large machinery, or areas made temporarily uneconomic to farm. This represents an indirect effect on either side of the working width and loss here will also be compensated.

The provision of water for stock may be interrupted temporarily while the pipeline trench cuts the existing supply. Under these circumstances the MWC will provide an alternative means of supply, where required.

As the pipeline route crosses grazing land, particular attention will be paid to ensuring that disruption to grazing activities is minimised, by:

- providing additional water supplies, as necessary; and
- maintaining access by providing gates across the working width.

In areas identified as of high ecological importance, additional ecological mitigation measures will be implemented (see Section 7). In these areas, the temporary fencing will be retained until the re-seeded sward has sufficiently recovered to the satisfaction of the ecologists undertaking post-construction monitoring.

5.7.3.3 *Field Boundaries*

Field boundaries within the working width will be partly removed to facilitate plant movement and to enable a continuous construction procedure. Where sections of hedgebanks are removed for construction, they will be reinstated according to a specification to be agreed with the landowners/occupiers.

In the event of crossing species-rich hedgerows, special restoration measures will be adopted. Hedgerow sections removed will be replanted using a mix of species, based on that found in adjacent stretches of hedgerow, using plants of local provenance, where available. Newly planted sections of hedges will be maintained by GNI for two years following construction to ensure successful re-establishment. Further details are given in Section 7. Ditches, culverts, bridges or tracks will be repaired or reinstated as appropriate.

The form and timing of replacement works will be determined in consultation with individual landowners/occupiers. This will ensure that disruption is minimised and that the replacement is acceptable. Where banks and field verges contain features of acknowledged ecological value, these will be re-seeded/replanted with an appropriate species mix or left to regenerate naturally.

5.7.3.4 *Land Drainage*

The effects on land drainage will be minimised by a system of protection and reinstatement. GNI will consult affected landowners/occupiers on all field land drainage matters.

Details of restoration will be defined on a field-by-field basis, as guided by existing records where available and supplemented by a detailed survey. For each field affected, a land drainage strategy will be prepared, to:

- delineate areas where land drainage is likely to be encountered;
- identify existing drainage systems as far as possible and design appropriate remedial measures; and
- identify areas where existing systems can be diverted to prevent water-logging of ground outside the working width during construction.

All land drains encountered during construction will be clearly marked on both sides of the working width. Reinstatement will subsequently involve either:

- reinstatement of the drain over the trench with a suitable support to prevent settlement; or
- diversion of the drains by installing a new cut-off 'header' drain above the trench to intercept the drainage pipes and convey water to a new outfall.

Field land drains will be reinstated as soon as possible after construction to the requirements of the landowners/occupiers (see Section 5).

Installation of post-construction drainage will be undertaken by an approved land drainage contractor, using approved materials and purpose made fittings. Subject to levels and outfalls, and the type of ground encountered, the land drainage system would normally be installed using approved permeable backfill. The land drainage scheme will be subject to inspection during installation by a competent, approved Agricultural Inspector.

Pre- and post-construction drainage required to maintain existing drainage schemes will be carried out as agreed with the landowners/occupiers and SEPA.

Temporary culverts and/or bridges will be installed to allow vehicles to cross watercourses, thereby mitigating disruption to both flow and water quality (subject to consent from SEPA).

It is proposed that a Drainage Plan will be implemented to investigate, design and supervise appropriate works. Where necessary, supplementary reinstatement work may be undertaken. Where there is a perceived risk from the pipeline trench being inundated with water from severed land drainage during construction, cut-off drains will be installed to intercept uncontaminated surface water and thereby prevent it from entering the working area. Agreement with SEPA will be reached regarding the satisfactory disposal of this water, and discharge consents secured where required.

Surface water or groundwater from excavations or other parts of the working area will not be pumped or discharged directly into watercourses or drains but will be treated to ensure the removal of pollutants and sediments in accordance with SEPA requirements prior to discharge (see Section 6).

The pipeline will be laid with a minimum cover of 1.2m from underside of topsoil. At least 0.15m of clearance over the pipeline will be required for any future field drainage or deep ground cultivation, such as subsoiling or mole drainage. Most field drainage is installed at between 0.7m and 0.9m depth, so it could cross over the pipeline with no constraints, except that as a precautionary measure no normal drainage trenching machinery will be used over the pipeline itself.

An aftercare programme will be implemented to ensure that any necessary work is carried out to the satisfaction of the landowners/occupiers. GNI will remain responsible in perpetuity for remedying any land drainage defects that are related to pipeline construction, unless the landowner/occupier accepts on-going responsibility under the terms of their easement agreement with GNI.

5.7.3.5 *Reinstatement*

All reinstatement measures will be discussed and agreed in advance with landowners/occupiers, and statutory and non-statutory consultees, before being incorporated into a Reinstatement Plan. The Reinstatement Plan will include details of soil handling, seed sources and mixes, plant sources and mixes and after-care regimes.

Fencing installed along the working width will be retained until the re-seeded sward has sufficiently recovered to withstand grazing pressures. These procedures will be agreed with the landowner/occupier before work begins.

5.7.3.6 *Notifiable Scheduled Diseases*

In order to prevent the spread of plant and animal diseases, pipeline construction and reinstatement procedures will be in accordance with best practice procedures. In particular,

soil will be stored only in the field from which it is lifted, and any soils imported will be tested to ensure they are free of diseases. Contact with animals will be avoided.

In the unlikely event that any burial pits should be discovered during construction work then, if necessary, the pipeline will be marginally re-routed to avoid the particular obstruction. APHA will also be informed without delay and their advice taken. Should an outbreak of animal or plant disease occur during pipeline works, GNI will consult APHA on the need for any further project precautions and prompt action will be taken, as necessary.

The general precautions include the following key requirements:

- ‘Prevent unauthorised entry’ – It is standard practice to fence the working width with post and wire stockproof or other types of fencing as the need arises, and to erect temporary access gates where the working width crosses roads and public rights of way;
- ‘Avoid damage’ – It is standard practice to avoid all unnecessary damage and to make good or replace anything accidentally damaged or removed by construction. This includes trees, hedges, fences, walls, ditches and drainage outlets;
- ‘Do not pollute’ – All watercourses and groundwater are protected from pollution during construction; the measures taken being appropriate to the risk involved. This includes preventing pollution by careful management and control of fuel and oils and ensuring that surface water run-off from the working width does not reach watercourses;
- ‘Do not drop litter’ – The MWC will keep the site tidy and collect and dispose of litter and waste construction materials, including packing, at an appropriate disposal location; and
- ‘Take out insurance’ – It is mandatory for the pipeline construction contractor to take out insurance to cover third-party damage, including loss of livestock or damage to crops arising from the works.

It is standard practice during pipeline construction to strip and store topsoil separately from the subsoil (excavated pipe trench material). Retention and restoration of the working width are again standard practices that will ensure that damage is avoided and that discernible permanent changes are absent.

5.7.3.7 *Injurious Weeds*

No injurious weeds were recorded during the ecological survey of the pipeline route. Given the time lag between the submission of the PCA and construction, such weeds, if found during subsequent pre-construction surveys, will be recorded during the Record of Condition Survey, and the owner/occupier informed of the measures to be taken to control the weed. Checks for injurious weeds in the working width will be undertaken during construction, and prompt action taken to control these.

5.7.3.8 *Liaison*

A key part of the process of minimising agricultural disruption is to maintain liaison between the landowners/occupiers, GNI and the MWC throughout design, construction and reinstatement. Qualified Agricultural Liaison Officers (ALOs) will be employed to ensure that:

- information on existing agricultural and land conditions is both obtained from the landowners/occupiers and recorded during the Record of Condition Survey of the entire route before construction;
- agricultural requirements during construction are agreed, such as maintaining water supplies and access for animals and farm machinery, which are then included in a Pre-Entry Agreement;
- reinstatement requirements are identified and agreed; and
- any special requirements or particular constraints are identified, and mitigation measures agreed.

5.7.4 Agriculture during the Operational Phase

No mitigation measures are required.

5.8 Summary of Residual Impacts and Significance

Following the implementation of the mitigation measures described above and in Section 11, impacts upon local dwellings resulting from dust and noise nuisance during the construction period is anticipated to be *slight* and not significant. Impacts will be short term and will cease upon completion of construction.

Following implementation of the mitigation measures described above, residual impacts resulting from suspension of agricultural operations, field severance, disruption of accesses, and removal of sections of land boundaries are considered likely to be *slight* due to their short-term nature and not significant. Following reinstatement, no further impacts are anticipated.

Extensive measures and best practice will be employed in handling soils, implementing land drainage (pre- and post-construction), and controlling the spread of injurious/invasive species and agricultural diseases. With such measures in place, it is considered that residual impact will be *slight* during construction reducing to insignificant following reinstatement.

Table 5-5 provides a summary of the impacts, mitigation and residual impacts.

Table 5-5 Summary of Impacts and Mitigation Measures

Aspect	Impact	Proposed Mitigation Measures	Residual Impact
During Construction			
Development	Potential noise and dust nuisance to local residents living within close proximity to working width	See Section 1.1	Slight
Traffic Network	Potential temporary traffic interruptions	For plant and pipe delivery, HGVs will be routed carefully in accordance with a Traffic Management Plan. The use of public roads will be minimised; they will be controlled in accordance with the Traffic Management Plan.	None
Agriculture	Temporary loss of use of agricultural land, temporary field severance and possible interruption of services and removal of sections of boundaries	Consultation will take place with landowners/occupiers to discuss how disruption to farming can be minimised. Mitigation measures will be included in the Pre-Entry Agreements. Provision will be made for temporary accesses across the working width, and additional water supplies for animals, as necessary. All land will be reinstated as near as possible to its previous condition. Field boundaries will be fully reinstated as soon as possible.	Slight
Agriculture	Temporary disruption and alteration of soil properties and land drainage systems	Pre-construction drainage will divert water away from the working width. During post-construction drainage, all field land drains will be reinstated as soon as possible.	Slight
Agriculture	Spread of plant and animal diseases between fields and farms	Pipeline construction will be done in accordance with guidance and precautions provided by DEFRA and the Scottish Executive. Disinfectant spray is to be used where bovine tuberculosis is an issue, or where it is required by landowners/occupiers. The situation regarding disease outbreaks in the area will be kept under regular review with the Scottish Executive.	Slight
Agriculture	Spread of injurious weeds	Checks for injurious weeds will be made and prompt action taken to control these.	Slight
Aspect	Impact	Proposed Mitigation Measures	Residual Impact

During Operation			
Development	Once operational, the pipeline is considered unlikely to significantly impact on local residents	No Mitigation Proposed	No Residual Impact
Traffic Network	Potential temporary traffic interruptions from ad hoc operations and maintenance activities	No Mitigation Proposed	No Residual Impact
Agricultural operations	Once operational, the pipeline is considered unlikely to significantly impact on local agricultural operations	No Mitigation Proposed	Insignificant

5.9 References

DEFRA 2003 Biosecurity Guidance to Prevent the Spread of Animal Diseases

DEFRA, 2009, Code of Good Agricultural Practice for the Protection of Soil

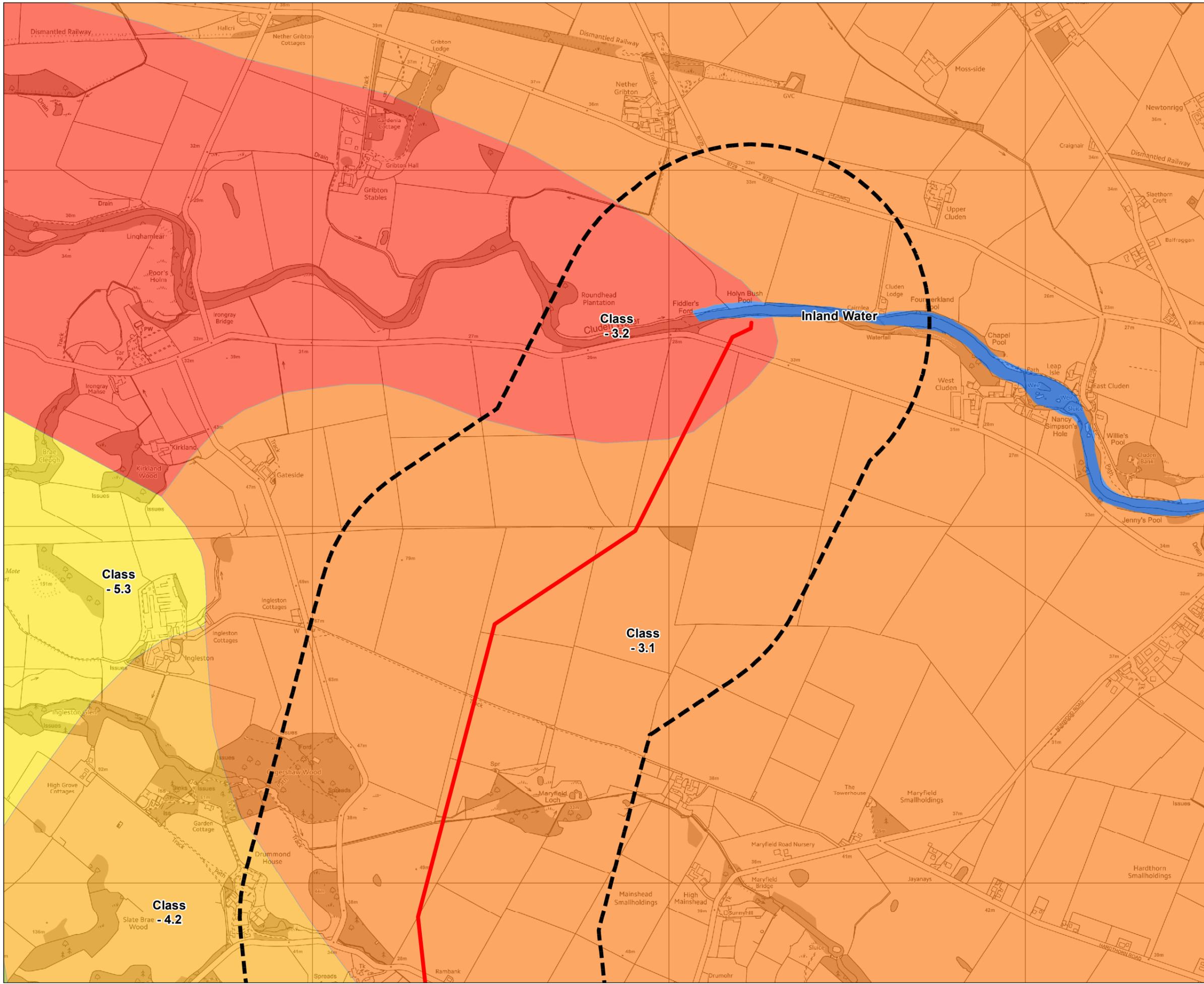
DEFRA, 2014, Protecting animal health and preventing disease, including in trade

MAFF, 1999, Identification of Injurious Weeds Precautions to Prevent the Spread of Animal and Plant Diseases (re-published by DEFRA 2011).

National Joint Utilities Group (NJUG), 1995. Publication No:10 – Guidelines for the Planning, Installation and Maintenance of Utility Services in Proximity to Trees

Soil Survey of Scotland, Land Capability for Agriculture, map 1:50 000 scale, Dumfries, Sheet 84

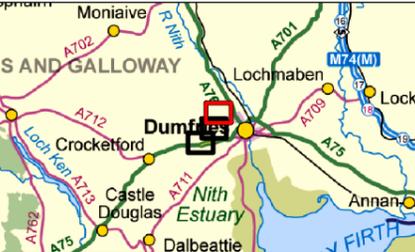
The Disease Control (Interim Measures) (Scotland) Amendment Order 2003



Legend:

- Proposed Pipeline Route
- 1km Area of Search
- Land Capability for Agriculture**
- Class 3.1 - Arable Agriculture
- Class 3.2 - Mixed Agriculture
- Class 4.1 - Mixed Agriculture
- Class 4.2 - Mixed Agriculture
- Class 5.1 - Improved Grassland
- Class 5.2 - Improved Grassland
- Class 5.3 - Improved Grassland
- Inland Water

This map contains data from the following sources:-
 Scotland's Soils - Land Capability for Agriculture (1:250,000) copyright and database right The James Hutton Institute 1981. Used with the permission of The James Hutton Institute. All rights reserved.
 Coordinate System: British National Grid
 Projection: Transverse Mercator
 Datum: OSGB 1936
 Units: Meter



Rev	Date	Description	Drn	Chk	App
02	06/05/2015	Updated Route	FC	DF	JS
01	14/04/2015	Updated Logo	FC	DF	JS
00	02/03/2015	First Draft	FC	DF	JS

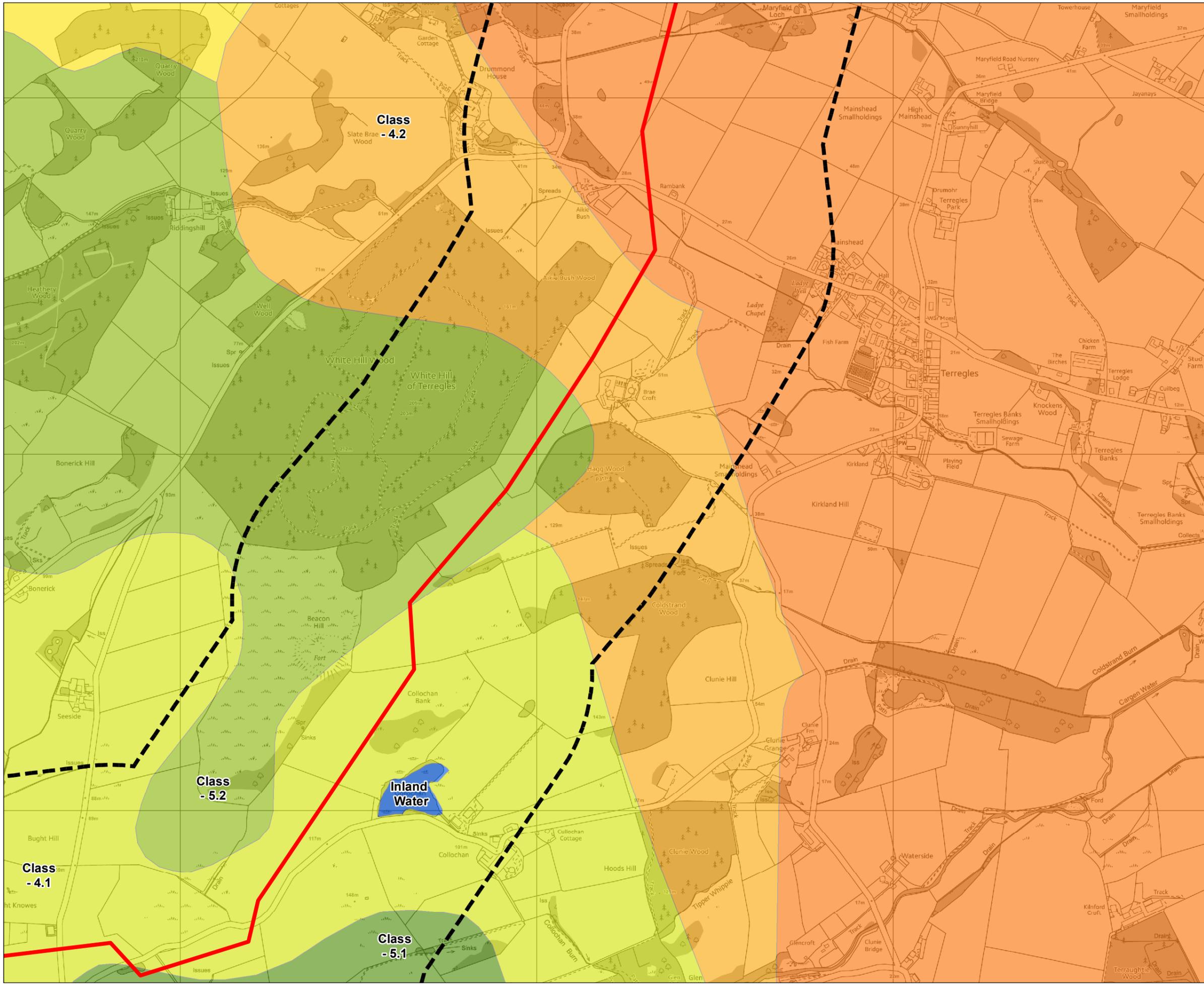
Cluden to Lochfoot Pipeline



TITLE: **Figure 5.1: Land Capability for Agriculture Map 1 of 3**

0 200 400
 Meters
 SCALE: 1:10,000 @ A3

REV 02



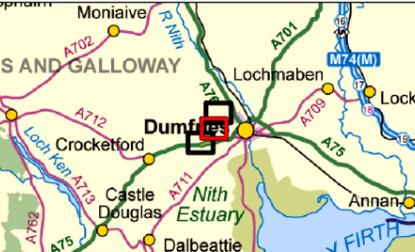
Legend:

- Proposed Pipeline Route
- 1km Area of Search

Land Capability for Agriculture

- Class 3.1 - Arable Agriculture
- Class 3.2 - Mixed Agriculture
- Class 4.1 - Mixed Agriculture
- Class 4.2 - Mixed Agriculture
- Class 5.1 - Improved Grassland
- Class 5.2 - Improved Grassland
- Class 5.3 - Improved Grassland
- Inland Water

This map contains data from the following sources:-
 Scotland's Soils - Land Capability for Agriculture (1:250,000) copyright and database right The James Hutton Institute 1981. Used with the permission of The James Hutton Institute. All rights reserved.
 Coordinate System: British National Grid
 Projection: Transverse Mercator
 Datum: OSGB 1936
 Units: Meter

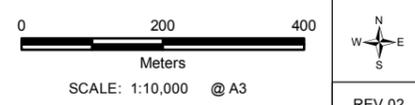


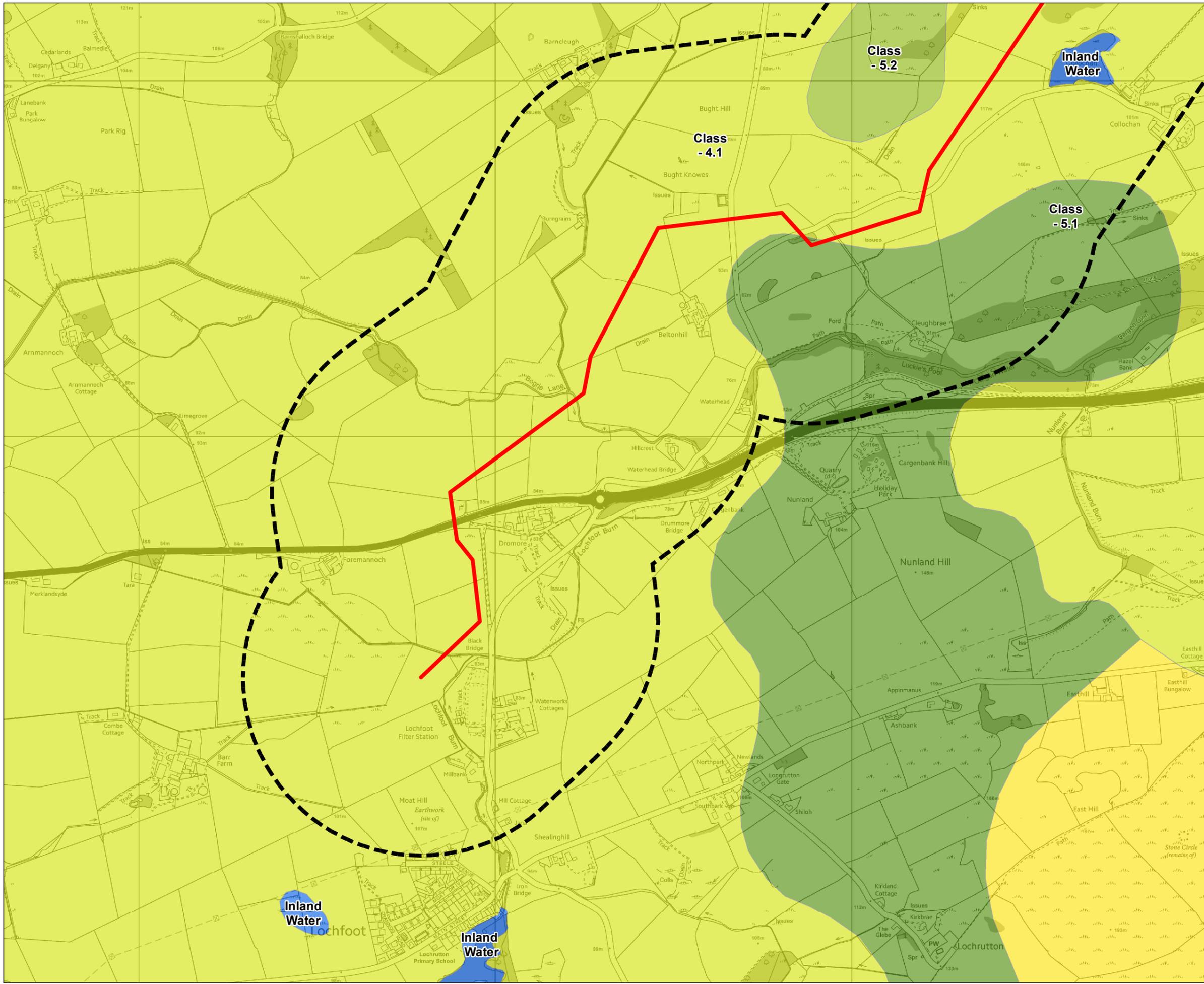
Rev	Date	Description	Drn	Chk	App
02	06/05/2015	Updated Route	FC	DF	JS
01	14/04/2015	Updated Logo	FC	DF	JS
00	02/03/2015	First Draft	FC	DF	JS

Cluden to Lochfoot Pipeline



TITLE: **Figure 5.1: Land Capability for Agriculture Map 2 of 3**





Legend:

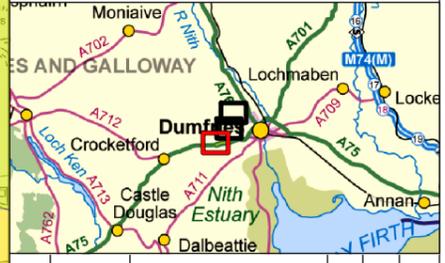
- Proposed Pipeline Route
- 1km Area of Search

Land Capability for Agriculture

- Class 3.1 - Arable Agriculture
- Class 3.2 - Mixed Agriculture
- Class 4.1 - Mixed Agriculture
- Class 4.2 - Mixed Agriculture
- Class 5.1 - Improved Grassland
- Class 5.2 - Improved Grassland
- Class 5.3 - Improved Grassland
- Inland Water

This map contains data from the following sources:-
 Scotland's Soils - Land Capability for Agriculture (1:250,000) copyright and database right The James Hutton Institute 1981. Used with the permission of The James Hutton Institute. All rights reserved.

Coordinate System: British National Grid
 Projection: Transverse Mercator
 Datum: OSGB 1936
 Units: Meter

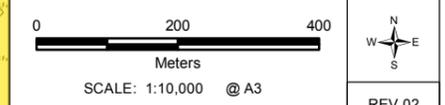


Rev	Date	Description	Drn	Chk	App
02	06/05/2015	Updated Route	FC	DF	JS
01	14/04/2015	Updated Logo	FC	DF	JS
00	02/03/2015	First Draft	FC	DF	JS

Cluden to Lochfoot Pipeline



TITLE: **Figure 5.1: Land Capability for Agriculture Map 3 of 3**



6	PHYSICAL ENVIRONMENT	6-1
6.1	Introduction	6-1
6.2	Consultation	6-1
6.3	Legislation and Policy Context	6-2
6.3.1	Key Legislation	6-2
6.3.2	Other Legislation	6-4
6.3.3	Pollution Prevention Guidance Notes	6-4
6.4	Assessment Methodology and Uncertainty	6-5
6.4.1	Establishment of Baseline Environment	6-5
6.4.2	Identification and Assessment of Impacts and Mitigation Measures	6-5
6.4.3	Uncertainty and Technical Difficulties Encountered	6-7
6.5	Baseline Overview	6-7
6.5.1	Topography	6-7
6.5.2	Climate	6-7
6.5.3	Geology	6-7
6.5.4	Mining and Mineral Extraction	6-9
6.5.5	Soils	6-9
6.5.6	Ground Contamination	6-10
6.5.7	Surface Water	6-11
6.5.8	Groundwater	6-16
6.5.9	Nitrate Vulnerable Zones	6-17
6.5.10	Springs	6-17
6.5.11	Flood Risk	6-18
6.5.12	Bathing Waters	6-18
6.6	Assessment of Impacts	6-18
6.6.1	Introduction	6-18
6.6.2	Topography	6-18
6.6.3	Geology	6-18
6.6.4	Soils	6-19
6.6.5	Ground Contamination	6-21
6.6.6	Surface Water and Bathing Waters	6-21
6.6.7	Groundwater	6-22
6.6.8	Flood Risk	6-22
6.7	Mitigation Measures	6-23
6.7.1	Site management	6-23
6.7.2	Topography	6-23
6.7.3	Geology	6-23
6.7.4	Soils	6-23
6.7.5	Ground Contamination	6-24
6.7.6	Surface Water Quality	6-25
6.7.7	Surface Water Discharges	6-26
6.7.8	Disposal of Accumulated Rainfall/Surface Water	6-27
6.7.9	Permitted Discharges	6-28
6.7.10	Groundwater	6-28
6.8	Summary of Residual Impacts and Significance	6-28
6.8.1	Topography	6-28
6.8.2	Geology	6-28
6.8.3	Soils	6-28
6.8.4	Ground Contamination	6-29
6.8.5	Surface Water Quality	6-29

6.8.6	Groundwater	6-29
6.9	References	6-35

Tables

Table 6-1 Physical Environment Consultation Responses

Table 6-2 Key Legislation

Table 6-3 Classification Criteria

Table 6-4 Soil Associations of the Route Corridor

Table 6-5 Principal Watercourse Crossings

Table 6-6 Current status of waterbodies in study area

Table 6-7 Groundwater Abstraction Details

Table 6-8 Summary of Impacts and Mitigation Measures

Figures

Figure 6.1 Solid Geology

Figure 6.2 Superficial Geology

Figure 6.3 Hydrological and Hydrogeological Features

Figure 6.4 Groundwater Vulnerability, Source Protection and Flood Risk Areas

6 PHYSICAL ENVIRONMENT

6.1 Introduction

This section commences with an outline of the legislation and planning policies that are relevant to the control of impacts of pipeline construction on the physical environment.

The baseline physical environment for the pipeline corridor of The Project, a 500m corridor centred on the pipeline route, is then described. This has been based on a study of the topography, the solid and superficial geology, soils, areas of mining and mineral extraction, and areas of potentially contaminated land. The position and quality of surface watercourses and the sensitivity of the underlying groundwater has also been assessed.

Environmental impacts that have been identified as particularly relevant to this project and any resulting project-specific mitigation measures that may be necessary are considered. The anticipated residual impacts and their significance are then discussed.

6.2 Consultation

Table 6-1 summarises the consultation responses that have been received to date in relation to the physical environment assessment methodology presented in this section.

Table 6-1 Physical Environment Consultation Responses

Consultee	Previous Consultation	Comment	Response to Consultation
Dumfries and Galloway Council	Meetings held on: 15.03.2007 03.07.2007 20.11.2007 24.11.2014 27.02.2015	Protection of the Groundwater Source Protection Zone around Terregles Bore Hole	To ensure appropriate pollution prevention measures are in place to avoid ground contamination
Scottish Environmental Protection Agency (SEPA)	Meetings held on: 15.03.2007 03.07.2007 20.11.2007 25.11.2014 09.03.2015	Control of abstraction and discharges	All abstraction and discharge of water required for hydrotests to be in accordance with established SEPA procedures
		Protection of the Groundwater Source Protection Zone around Terregles Bore Hole	To ensure appropriate pollution prevention measures are in place to avoid ground contamination
		Pipeline to be in accordance with	Design and construction works at the water

Consultee	Previous Consultation	Comment	Response to Consultation
		Water Regulations 2011	crossings and in proximity to boreholes must take this into account
		Minimise impact on watercourses and their downstream salmon fisheries and designated bathing waters at the coast	To ensure appropriate water management/silt mitigation measures are in place to avoid site runoff
Scottish Natural Heritage (SNH)	Meetings held on: 15.03.2007 02.07.2007 03.07.2007 20.11.2007 21.11.2007 25.11.2014 25.02.2015	Minimise impact on watercourses and their downstream salmon fisheries and designated bathing waters at the coast	To ensure appropriate water management/silt mitigation measures are in place to avoid site runoff
Scottish Water	Meetings held on: 14.03.2007 25.11.2014 Scoping Letter issued 17.02.2015	Protection of existing water pipeline from Glenkiln Reservoir to the service reservoir at Clunie, near Terregles.	Proposed gas pipeline will cross under this water pipeline.
		Protection of private water boreholes	Landowners to be contacted to identify private water boreholes
		Protection of the Groundwater Source Protection Zone around Terregles Bore Hole	To ensure appropriate pollution prevention measures are in place to avoid ground contamination

6.3 Legislation and Policy Context

6.3.1 Key Legislation

Key legislation regarding the physical environment is detailed in Table 6-2.

Table 6-2 Key Legislation

Topic	Act/Regulation	Key Relevant Provisions
	<p><i>Flood and Water Management Act 2009</i></p>	<p><i>The Flood and Water Management Act provides for more sustainable and modern approach to the management of flood risk for people, homes and businesses, helps safeguard community groups from unaffordable rises in surface water drainage charges, and protects water supplies to the consumer. The Act is designed to create a more joined up and coordinated process to manage flood risk at a national and a local level.</i></p> <p><i>Serious flooding can happen at any time. Climate projections suggest that extreme weather will happen more frequently in the future. The activities required under this act aim to reduce the flood risk associated with extreme weather.</i></p>
<p>Contaminated Land</p>	<p><i>Environmental Protection Act 1990, Part IIA</i></p>	<p>Part IIA provides the legislative framework for the identification and remediation of contaminated land, introducing a statutory definition of contaminated land. It is aimed at addressing land which has been historically contaminated and which poses unacceptable risks to human health or the wider environment in the context of the current land use.</p>
<p>Water Quality</p>	<p>EU Bathing Water Directives 76/160/EEC and 2006/7/EC</p>	<p>Directive 76/160/EEC requires each member state to identify bathing waters and to take all necessary measures to bring these waters up to the quality standards prescribed. A ‘bathing water’ is defined as “... fresh or sea water where bathing is either explicitly authorised and is traditionally practised by a large number of bathers or is not prohibited”.</p> <p>The environmental quality standards are set to protect the environment and public health, and include safe limits for microbiological measures. The directive lays down requirements for sampling frequency, analysis methods, bathing areas inspection and the interpretation of results.</p> <p>The Bathing Waters (Scotland) Regulations 2008 introduces the requirements of the revised Bathing Waters Directive (2006/7/EC), and will come into effect in a phased manner over the coming years. The key features of the regulations will be tighter microbiological standards to be met by 2015 with monitoring started by 2012, and an increased provision of public information.</p>

6.3.2 *Other Legislation*

Other relevant legislation which has been taken into account includes the following:

- SEPA Guidance Note 4 – Planning Advice on Windfarm Developments – 2014;
- Environmental Protection Act 1990 - establishes the legislative framework for identifying and dealing with contaminated land and water;
- Environment Act 1995 - created a number of new agencies including the Scottish Environment Protection Agency and set new standards for environmental management;
- Groundwater Regulations 1998; and
- Environmental Liability (Scotland) Regulations 2009 - aim to prevent and remedy damage to land, water and biodiversity.

6.3.3 *Pollution Prevention Guidance Notes*

Section 11 describes the Pollution Prevention Guidelines (PPGs), jointly issued by SEPA, the Environment Agency and the Environment and Heritage Centre, Northern Ireland, which are particularly relevant to the prevention of pollution of soils during construction of the pipeline. Relevant provisions from these PPGs will be incorporated into the method statements (including the Pollution Prevention Plan, the Water Management Plan and the Waste Management Plan), which will be prepared by the MWC and agreed with SEPA and the local planning authority prior to commencement of construction.

Further key PPGs applicable to this project will include:

PPG 1: General Guide to the Prevention of Pollution

As a basic introduction to pollution prevention, this guidance signposts to other PPGs and publications.

PPG 5: works in, is near, or is liable to affect watercourses

How to avoid pollution when working in or near watercourses: this guidance is being reviewed and will be amalgamated with PPG 23 Maintenance of Structures Over Water, to be called Works and Maintenance in or Near Water.

PPG 6: working at construction and demolition sites

This guidance provides pollution prevention information for the construction and demolition industry.

PPG 21: Pollution incident response planning;

PPG 22: Incident response – dealing with spills;

6.4 Assessment Methodology and Uncertainty

6.4.1 Establishment of Baseline Environment

Information on the physical environment within a 500m-wide pipeline corridor was collected from the following sources:

- British Geological Survey (BGS) geological maps and published information;
- Soil Survey of Scotland, done by the Macaulay Institute for Soil Research;
- The Landmark Envirocheck environmental database;
- Ordnance Survey (OS) maps;
- Scottish Environmental Protection Agency (SEPA) flood maps and data;
- Scotland River Basin Management Plan;
- Strategic Flood Risk Assessments; and
- Preliminary Flood Risk Assessments;

In addition, further information was requested from SEPA, the Local Authorities and landowners/occupiers along the route of the pipeline. Further information regarding climate was also sourced from the Met Office online database.

6.4.2 Identification and Assessment of Impacts and Mitigation Measures

6.4.2.1 Assessment of Significance of Impacts

Potential effects of The Project on the water environment have been identified and assessed using criteria from the Institute of Environmental Management and Assessment (IEMA 2011).

The identification and assessment of impacts has been made on the basis of the desk-based assessments. These have been interpreted using professional judgement and experience based on previous pipeline projects.

Mitigation measures are based on the above and incorporate relevant statutory and non-statutory legislation and guidance, such as the MAFF (now DEFRA) soil code. These are referenced where necessary.

An assessment has also been made of the significance of residual impacts, i.e. those¹ impacts that are predicted to remain after the mitigation measures outlined in this Environmental Statement have been implemented.

When making an assessment of significance, the magnitude of change and the importance/sensitivity of the receptor have been taken into account.

A large magnitude of change would be one that is likely to cause a direct adverse permanent or long-term impact on the integrity/value of the receptor, whereas a small change would be one that is likely to have a minor adverse impact on a receptor but recovery is expected in the short term.

A judgement has also been made on the importance/sensitivity of the receptor(s) involved. In the context of impacts on the physical environment, highly important/sensitive receptors include geological SSSIs and areas of contaminated land.

In the context of impacts to water resources, highly important and/or sensitive receptors include:

- public water supplies;
- Groundwater Source Protection Zones;
- major aquifers;
- areas of high groundwater vulnerability;
- rivers with a Grade A water classification;
- salmonid rivers;
- designated areas, e.g.: sites of special scientific interest (SSSI) where water quality/hydrology is key to the designation;
- areas of flood risk; and
- areas of known/confirmed contaminated groundwater.

Table 6-3 details the categories used when classifying overall significance.

Table 6-3 Classification Criteria

Impact	Description	
Very Significant	Permanent change which could have an extensive effect and include areas remote to the development area	<i>Significant Impacts where monitoring may be required</i>
Significant	Permanent or medium- to long-term change with changes to areas remote from the site (over several years)	
Moderate	Short- to medium-term changes just outside the accepted limits of normal variation with little or contained offsite effects, detectable (over a period of several months)	
Slight	Change only just detectable within the site and surrounding areas over a short timescale (over a period of days or weeks)	
None	An impact causing effects that are not readily noticeable	

Where the residual impact is uncertain, this is stated, along with the measures that will be taken to address this.

6.4.3 *Uncertainty and Technical Difficulties Encountered*

No particular technical difficulties have been encountered and no significant uncertainties remain.

6.5 *Baseline Overview*

6.5.1 *Topography*

The topography along the pipeline route is important since it affects the soil drainage and dictates the type of agricultural activity, which may take place. The steeper the slope, the greater the potential for run-off, with less water being retained in the soil. Where the topography is flat, or hollows are present, there is greater potential for waterlogging and gleying. Physical features such as farms are referred to throughout this section in order to describe the position of sections of the pipeline corridor, and these can also be seen on Figure 6.3.

The topography between Cluden Lodge Ground and Terregles lies between 40m and 60m Above Ordnance Datum (AOD) with a particularly steep gradient as the route passes Braecroft. From here, ground levels rise to around 180m AOD as the proposed pipeline route passes White Hill Wood and crosses Beacon Hill. From the west of Collochran Farm to Lochfoot the terrain is gently undulating. The majority of this part of the route area is at 90m AOD.

6.5.2 *Climate*

Met Office data indicates the average annual rainfall for the Cluden Water catchment, (the eastern part of the proposed pipeline route) to be 1,400mm. This would also be expected to be the case for the remainder of the route, although higher rainfall might be anticipated in localised areas in the higher central part.

Temperature data collected at the Dumfries weather station indicates an average temperature (January to December) of 8.5°C. The average temperature in January (the coldest month) is +3.2°C. July is the warmest month with an average of +14.7°C. Clearly these temperatures would be expected to vary with altitude. Average sunshine hours recorded by the Met Office at Eskdalemuir are greater than 100hrs per month between April and September but drop to a minimum of 34.7hrs in December.

6.5.3 *Geology*

6.5.3.1 *Solid Geology*

The Institute of Geological Sciences' (IGS) map of the area (Thornhill, Scotland, Sheet 9) indicates that the majority of the western part of the pipeline route (Lochfoot to Terregles) is underlain by bedrock of Silurian greywackes and Shales (Llandoverly series). The remainder of the route (Terregles to Cluden Water) is underlain by bedrock of New Red Sandstone (Upper Carboniferous) comprising breccias with wind-faceted pebbles of greywacke and granite.

At Terregles, the pipeline route crosses the geological boundary of the Llandoverly series and the New Red Sandstone, and at this location (approximate National Grid reference NX 923 777) there is a fault orientated in a north-west to south-east direction corresponding with the position of the geological boundary. The solid strata are shown on the geological map, Figure 6.1.

6.5.3.2 *Superficial Deposits*

The IGS mapping data relating to the superficial deposits across the pipeline route is limited to the western part (Lochfoot to Beltonhill farm) and the eastern part of the route (Terregles to Cluden Lodge). Superficial deposits on the central part of the route (approximately 40% of the route corridor) have not yet been mapped (see Figure 6.2).

The western part of the route and a short section of the pipeline route to the west of Terregles is underlain by glacial till, and it is considered possible that this superficial deposit also underlies much of the central part of the route together with isolated areas of peat. Glacial till is shown by the map to underlie at least 20% of the route corridor.

Short sections of the route (8%) in proximity to tributaries of Cargen Water including Bogrie Lane are underlain by alluvium. The eastern part is mostly underlain by glaciofluvial deposits (32%) with a short section to the west of Maryfield underlain by alluvium. Where present, the alluvial deposits may be underlain by glacial till.

Four borehole logs were obtained from the BGS. These boreholes are located at distances ranging between 100m and 850m from the proposed route. Two boreholes on the eastern part of the route near Terregles, located 100m and 500m from the proposed route, reported superficial deposits of sandy glacial till of between 3.5m and 7.35m in thickness. The underlying bedrock at both borehole locations, proven to a depth of 100m bgl is reported to comprise alternating horizons of red sandstone and conglomerates (breccia). A third borehole drilled near Terregles, 850m away and somewhat removed from the pipeline route, confirms a similar pattern of superficial deposits and bedrock.

The record of a borehole drilled as part of the A75 Gretna – Stranraer improvement works, located approximately 700m south east of the western part of the route, indicates a thickness of clay and boulders (glacial till) of 3.0m. The underlying bedrock is proven to comprise weathered siltstone and mudstone to a depth of 20m bgl. A horizon of greywacke is reported at 13.2 to 15.2m bgl.

6.5.3.3 *Ground Stability Hazards*

The Envirocheck database, referred to for the purposes of this assessment, contains an assessment of the following stability hazards:

- collapsible/compressible ground;
- ground dissolution;
- potential for landslides;
- potential for running sands;
- potential for shrinking or swelling clay; and
- shallow mining.

The report indicates that the risk of the above hazards along the pipeline route ranges from non-existent to low.

6.5.3.4 *Geological Exposures Designated as SSSI*

There are no geological exposures designated as SSSI within 500m of the proposed pipeline route.

6.5.4 Mining and Mineral Extraction

The desk based research has revealed no potential hazards associated with shallow mining. The pipeline route is not within an area which is affected by coal mining. No evidence of surface clay or other mineral extraction is shown in the historical maps.

6.5.5 Soils

The soils along the western and central part of the route (64%) are of the Etrick soil association, which are developed on drift derived from Lower Paleozoic greywackes and shales.

The eastern part of the route (28%) is underlain by the Holywood soil association, which is derived from sandstones and conglomerates of Permian age, which also reflects the underlying geology. At the extreme eastern end of the pipeline route (8%) adjacent to Cluden Water, soils of the Yarrow Fleet soil association are present, which are derived from fluvio-glacial gravels.

The component soils of all of the above associations are described as brown forest soils with some rankers and gleying. These soils are generally free draining and, according to the Soil Survey of Scotland, are among the most fertile in Scotland. Alluvial soils are present adjacent to Cluden Water.

In general terms, the gentle slopes and undulating lowlands of the western part of the route provide suitable conditions for arable and permanent pastures. At the central part of the route, steep slopes and rugged terrain largely restrict cultivation, but the dominant acid, bent-fescue grassland provides quality rough grazing. The soils also favour small coniferous plantations. The gentle slopes on the eastern part of the route again favour arable and permanent pasture.

The following table (Table 6-4) provides more detail of the soils and the typical landforms and vegetation.

Table 6-4 Soil Associations of the Route Corridor

Approximate Section of Pipeline Route (%) West to East	Soil Association	Component Soils	Typical Landforms	Vegetation
Start of route at Lochfoot to Drummore Farm (1%)	Etrick	Brown forest soils with some rankers*	Drumlins and complex gentle slopes; non-rocky and moderately rocky	Acid, bent-fescue grassland Arable and permanent pastures
Drummore farm to Beacon Hill Fort (29%)	Etrick	Brown forest soils with some gleying**	Foothills and undulating lowlands with gentle and strong slopes	Acid, bent-fescue grassland; arable and permanent pastures
Beacon Hill Fort to 'Braecroft' (23%)	Etrick	Brown forest soils with brown rankers	Hills with strong and steep complex slopes; moderately to very rocky	Acid, bent-fescue grassland; dry Atlantic heather moor

Approximate Section of Pipeline Route (%) West to East	Soil Association	Component Soils	Typical Landforms	Vegetation
Braecroft to east of 'The Grove' (11%)	Ettrick	Brown forest soils	Hills and valley sides with steep and strong slopes	Acid, bent-fescue grassland; dry Atlantic heather moor; oak and birchwood
The Grove to Irongrey Road (28%)	Hollywood	Brown forest soils	Hills and valley sides and undulating lowlands with gentle to steep slopes	Arable and permanent pastures
Irongrey Road to Cluden Water (8%)	Yarrow/Fleet	Brown forest soils/alluvial soils	Terraces of fluvioglacial and riverine origin with gentle slopes	Arable and permanent pastures; soft rush pasture
* Soils derived from non-calcareous material, usually rock				
** The process of forming a hydric soil under conditions of saturation, flooding, or ponding, long enough to develop anaerobic conditions				

6.5.6 Ground Contamination

6.5.6.1 Potential Contamination Sources

Contaminated soil and groundwater may be encountered on or adjacent to sites that have a previous or current industrial use, or a land use which involves the bulk storage of potential contaminants (e.g. petrol filling stations). In order to identify such potential sources, Ordnance Survey maps dating to 1854 have been reviewed.

Records of pollution incidents are maintained by SEPA, and from these records, sources of ground contamination can occasionally be identified, although more commonly the records refer to isolated pollution of watercourses.

The Proposed Route

Historical maps indicate that the proposed route has predominantly remained undeveloped greenfield land since at least 1854. The route is not shown to cross land which has been previously been developed, and the potential for ground contamination as a result of historical land uses is considered to be low.

The Surrounding Area

At the extreme westerly part of the proposed route adjacent to Lochfoot Burn a small saw mill is indicated on the map of 1854, approximately 250m to the south east. Subsequent maps from 1910 onwards show waterworks close to this location to the east of Lochfoot Burn. The map of 1957 shows the waterworks to include filter beds; the waterworks' premises are shown as Lochfoot filter station on subsequent maps. There is the potential that small quantities of fuels (e.g. diesel) associated with pumping equipment are likely to have been stored at this location.

The proposed pipeline route also passes within 250m of farmsteads, or large residential developments, namely: Drummore, Beltonhill, Brae Croft, Aikie Bush (see Figure 6.3). In general terms the potential for such developments to have caused widespread ground or groundwater contamination is low. However, the potential for localised ground contamination as a result of the bulk, above-ground storage of heating oils or fuel for farm machinery cannot be discounted.

The desk based review revealed no records of pollution incidents at or within 500m of the proposed pipeline route. No current waste sites or closed landfill sites have been identified within 500m of the proposed pipeline route.

6.5.7 Surface Water

6.5.7.1 Watercourses

The 7.2km route commences to the south of Cluden Water and, whilst not crossed by the route, this watercourse has been considered as part of the assessment. The principal watercourse crossings of the pipeline route are listed in Table 6-5 below and shown on Figure 6.3.

Table 6-5 Principal Watercourse Crossings

Watercourse	Main/Ordinary	Requiring Consent
Tributary of Lochfoot Burn	Ordinary	Yes
Bogrie Lane	Ordinary	Yes
Tributary of Bogrie Lane (originating at Beltonhill farm)	Ordinary	Yes
Tributary of Cargen Water (originating at 'The Grove')	Ordinary	Yes
Two tributaries of Maryfield Loch (originating at Cogershaw wood)	Ordinary	Yes

In addition to the crossings identified above there are several other watercourses within or near the pipeline corridor that may be affected by construction activity.

Lochfoot Burn (which originates at Lochrutton Loch) is not crossed by the pipeline route, although it is within the pipeline corridor and flows within 100m of the pipeline route near to Lochfoot filter station. The burn is also a tributary of Cargen Water, which ultimately reaches the River Nith, south of Dumfries.

A small tributary flows into Bogrie Lane some 75m to the north west of the pipeline route.

The OS mapping shows another small drainage ditch, apparently draining an area of marshy ground to the north of the pipeline route, 500m north of Cleughbrae. The ditchwater appears to flow southerly across the pipeline route, however, it is likely to be within in a culvert since it issues 60m south of the pipeline. This drainage ditch flows into Cargen Water.

The pipeline route lies 200m north of Collochán Loch, which flows into Collochán Burn, a tributary of Cargen Water.

A small stream originates at Brae Croft 150m south of the pipeline route. This joins another small watercourse east of Terregles, which flows past a small fish farm (at NGR 2927 5772 to which it may provide water) and then ultimately flows into Cargen Water.

Maryfield Loch is an area of marshland with some small ponds, which drains via a small tributary to Cargen Water.

6.5.7.2 Surface Water Quality

Cargen Pow / Bogrie Lane (Bogrie Lane) is crossed by the pipeline and according to the Solway Tweed RBMP is classified as having an overall status of Bad with a Medium confidence in 2008 with overall ecological status of Bad and overall chemical status of Pass. SEPA produces an annual classification for all water bodies in Scotland in part to monitor progress under the WFD. As of the 2012 classification results Cargen Pow / Bogrie Lane is classified as having an overall status of Moderate, with overall ecological status of Moderate.

The unmitigated construction of the pipeline could have impacts on the water quality of the Cargen Pow / Bogrie Lane, predominantly stemming from the release of miscible and immiscible materials into the watercourse, bank degradation and increased siltation of the watercourse.

SEPA hold information on the current status of the designated waterbodies in the study area, this data is shown in Table 6-6.

Table 6-6 Current status of waterbodies in study area

Water body name	Reporting parameter	Class
Cluden Water/Cairn Water	pH	High
	Acid Neutralising Capacity	High
	Biological elements	Good
	Overall ecology	Poor
	Ammonium	Pass
	Ammonium (5 band class)	High
	New Hydrology	High
	Hydrology impoundment impacts	High
	Hydromorphology	Poor
	Pre-HMWB test overall status	Poor
	Modelled Hydrology	High
	Fish (combined)	High
	Macro-invertebrates (combined)	High
	Hydrology abstraction impacts	High
	Alien species	Good
	Macro-invertebrates (ASPT)	High
	Macrophytes	High
	Morphology	Poor
	BOD	High
	Combined Phytobenthos	Good

Water body name	Reporting parameter	Class
	Benthic Diatoms	Good
	Specific pollutants - tier 6	Pass
	Overall status	Poor
	Physico-chem	High
	Fish barrier	High
	Soluble reactive phosphorus	High
	Temperature	High
	Acidity	High
	Dissolved Oxygen	High
	Macro-invertebrates (NTAXA)	High
	Macro-invertebrates (RiCT)	High
	Specific pollutants	Pass
	Lochfoot Burn	Modelled Hydrology
Hydromorphology		Good
Pre-HMWB test overall status		Poor
Hydrology abstraction impacts		High
pH		High
Benthic Diatoms		High
Dissolved Oxygen		High
Temperature		Good
Macrophytes		Good
Fish (combined)		High
Morphology		Good
Hydrology impoundment impacts		High
Acid Neutralising Capacity		High
Macro-invertebrates (combined)		Poor
Overall ecology		Poor
Macro-invertebrates (NTAXA)		Good
Ammonium (5 band class)		High
Alien species		Moderate
Fish barrier		High
Macro-invertebrates (ASPT)		Poor
Ammonium		Pass
Combined Phytobenthos		Good
New Hydrology		High
Acidity		High
Soluble reactive phosphorus		Good
Biological elements		Poor
BOD		High
Physico-chem		Good

Water body name	Reporting parameter	Class
	Overall status	Poor
	Macro-invertebrates (RiCT)	Poor
Cargen Pow/Bogrie Lane	Dissolved Oxygen	High
	New Hydrology	Good
	Overall status	Moderate
	Hydrology abstraction impacts	Good
	Macro-invertebrates (combined)	Good
	Soluble reactive phosphorus	Good
	pH	High
	Acid Neutralising Capacity	High
	Pre-HMWB test overall status	Moderate
	Temperature	High
	Physico-chem	Good
	Ammonium	Pass
	Modelled Hydrology	Good
	Hydromorphology	Moderate
	Morphology	Moderate
	Biological elements	Good
	Overall ecology	Moderate
	Ammonium (5 band class)	High
	Benthic Diatoms	High
	Fish (combined)	High
	Acidity	High
	Combined Phytobenthos	High
	Hydrology impoundment impacts	High
	Fish barrier	High
	BOD	High
	Macro-invertebrates (ASPT)	Good
Macro-invertebrates (NTAXA)	High	
Macro-invertebrates (RiCT)	Good	

6.5.7.3 Surface Water Abstractions

There are no records of abstractions from surface waters in the vicinity of the pipeline route. In addition, consultations with Dumfries & Galloway Council have confirmed that there are no recorded private water abstractions.

During a field walkover, however, south west of Braecroft at NX 919769, one large partially submerged plastic tank was noted. This appeared to be being used for storing water for livestock. In the same vicinity, south of this tank, was another large plastic tank, again considered likely to be for livestock drinking water. A fenced off well was also noted in this location with concrete slabs partially covering it. All features lie directly on the proposed route of the pipeline.

6.5.7.4 *SEPA Consented Discharges*

A number of discharges have been identified within the study area:

1km Radius of NX 93232 79573

CAR/R/1063373	Nether Gribton Dairy Cottage, Holywood Dumf - Discharge
CAR/R/1063379	Nether Gribton Farmhouse, Holywood, Dumfries - Discharge
CAR/R/1088401	4 West Cluden Cottages, Dumfries - Discharge
CAR/R/1075063	1,2 & 3 West Cluden Cottages, Irongray - Discharge
CAR/R/1075079	West Cluden, Irongray, Dumfries - Discharge
CAR/R/1075316	Eastlin Cott +3, East Cluden Village, Dumfries - Discharge
CAR/R/1075143	Burnfoot of Cluden, East Cluden Village, Dumfries - Discharge

1km Radius of NX 89792 74325

CAR/R/1073451	Hillcrest, Crocketford Rd, Dumfries - Discharge
CAR/R/1068020	Southpark, Lochfoot, Dumfries - Discharge
CAR/R/1110533	Plot 2, Lochrutton Gate, Lochfoot, Dumfries - Discharge
CAR/R/1054247	Lochrutton Gate, Lochfoot, Dumfries - Discharge
CAR/R/1105665	Plot 2, Lochrutton Gate, Lochfoot, Dumfries - Discharge
CAR/R/1022008	Plot 2, Northfield, Lochruttongate, Dumfries - Discharge
CAR/R/1022005	Plot 3, Northfield, Lochruttongate, Dumfries - Discharge
CAR/R/1021808	Plot 1 Northfield, Lochruttongate - Discharge
CAR/R/1086896	Lochrutton Gate, Lochfoot, Dumfries - Discharge
CAR/R/1050252	northpark, Lochfoot, Dumfries - Discharge
CAR/R/1053830	Newlands, Lochfoot, Dumfries - Discharge
CAR/R/1073564	Managers Cottage, Cargenbank, Dumfries - Discharge
CAR/R/1054311	plot 1 Northpark, Lochrutton, Lochfoot - Discharge
CAR/R/1067703	Mill Cottage, Lochfoot, Dumfries - Discharge
CAR/R/1056767	Millbank House & Office, Dumfries - Discharge
CAR/R/1112746	Former Water Works, Lochfoot, Dumfries - Discharge
CAR/R/1054714	2 & 3 Waterworks Cottages, Lochfoot, Dumfries – Discharge
CAR/L/1003561	Lochfoot S/T, Lochfoot, Dumfries – Sewage Overflow Discharge

6.5.8 Groundwater

6.5.8.1 Groundwater Vulnerability

Groundwater is contained within underground strata (aquifers) of widely differing properties. Abstraction from these aquifers provides water both for potable supplies and also varied industrial and agricultural uses. Some aquifers may be highly productive (major aquifers) and of regional importance as sources for public water supply, while lower-yielding or poorer-quality aquifers (minor aquifers) may also be important on a more local basis. Groundwater is vulnerable to contamination from both diffuse and point source pollutants and from either direct discharges into groundwater or indirect discharges into or onto land.

SEPA classifies geological strata in terms of permeability ranging from highly permeable to weakly permeable. The southern half of the route is underlain by geology (Llandoverly series), which is classified as weakly permeable (approximately 60% of the route), whereas the northern part is underlain by geology classified as highly permeable (the New Red Sandstone) (approximately 40% of the route). Consultations with SEPA have confirmed that, correspondingly, the areas of high permeability are also considered areas of high sensitivity (see Section 6.5.8.3 below).

6.5.8.2 Groundwater Abstractions

There is one known groundwater abstraction operated by Scottish Water for public water supply at Terregles approximately 1.6km to the east of the pipeline route as described in Table 6-7 below.

Dumfries & Galloway Council has confirmed that they are not aware of any private water abstractions in the area. However, SEPA has indicated that there are likely to be numerous private wells and boreholes as well as septic tank discharges within the area. SEPA has advised that, whilst under the *Water Environment (Controlled Activities) Regulations 2011*, they are required to licence and register new abstractions and discharges. Whilst SEPA has advised that no new abstractions or discharges have been recorded along the proposed corridor, older features may persist, which should be accounted for prior to construction.

Further consultation is required in relation to private groundwater abstractions in the vicinity of the pipeline corridor, records of which would be expected to be held by the local authority.

Table 6-7 Groundwater Abstraction Details

Licence	Purpose	OS Grid Ref.	Distance from Pipeline	Source
N/A	Public water supply	NX 940 767	1.6km	Groundwater

6.5.8.3 *Drinking Water Protection Zones*

Information was requested from Scottish Water relating to a possible drinking water/source protection zone associated with the Dumfries Aquifer. Such zones indicate the sensitivity of the source of water to pollution. Figure 6.4 shows the extent of the protection zone associated with the Dumfries Aquifer, as defined by Scottish Water. This aquifer supplies approximately 60% of the freshwater for Dumfries, over 7 mega litres per day. An approximate 1km section of the pipeline route lies within the drinking water protection zone between NX 930792 and NX 923782.

6.5.9 *Nitrate Vulnerable Zones*

A Nitrate Vulnerable Zone (NVZ) is an area of surface water or groundwater that has, or is at risk of having a high nitrate concentration (greater than 50mg/l). NVZs occur where the most arable farming takes place. Some of the largest NVZs are upstream of drinking-water abstraction points, or where groundwater reserves should be protected. Within Scotland, action programmes have been established within NVZs to change land-use practices (primarily agricultural), which seek to reduce nitrate run-off and leaching. In such areas, farmers are typically required to control their application of nitrate to the land, as are sewage-treatment works.

The pipeline route is located within the Lower Nithsdale Nitrate Vulnerable Zone (see Figure 6.3).

6.5.10 *Springs*

Springs tend to occur where permeable geological units, underlain by less permeable or non-permeable units, intersect the ground surface. The OS maps for the route corridor indicate the locations of numerous features, variously identified as springs, issues, and wells, and these are shown on Figure 6.3, however, some springs are likely to exist which are not mapped. Springs are likely to be present along the whole pipeline route, although they are more common in the western half of the route, especially where permeable drift deposits overlie bedrock of lower permeability.

6.5.11 Flood Risk

A number of areas in the vicinity of the pipeline corridor are shown on the SEPA online indicative flood map as being areas of fluvial floodplains. These are indicative areas, which are potentially at risk from flooding from rivers. The data is based upon historical flood records, survey records and computer models.

However, the majority of the pipeline corridor is not within an indicative fluvial floodplain. The maps show that there is a risk of flooding at the location at which the pipeline crosses the tributary of Lochfoot Burn, and Bogrie Lane. The 100yr flood depth is indicated to be up to 2m. The route corridor may also be affected by flooding of the tributary of Bogrie Lane and also by flooding of Cargen Water at Cloughbrae. This flooding would, however, be mostly confined to the immediate environs of each of these watercourses. The extreme eastern part of the pipeline corridor is not shown to be within the floodplain of Cluden Water.

A number of areas along the route have been highlighted as being at potential risk of flooding from pluvial/surface water events (Figure 6.4). The main area is around Maryfield Loch is an area of marshland with some small ponds, which drains via a small tributary to Cargen Water. Generally the areas shown to be at risk at low lying areas where precipitation collects and creates low depth conveyance routes.

6.5.12 Bathing Waters

The downstream section of the overall route is located around Brighthouse Bay, which is designated bathing water under the EU Bathing Waters Directive. This waterbody met the mandatory standard for the last nine years, and met the more stringent guideline standard, for the first time in 2012 since its designation in 1999. An average of 20 samples are collected annually from this source.

6.6 Assessment of Impacts

6.6.1 Introduction

The following section considers the potential impacts on the physical environment during the construction phase of The Project. Once operational, the pipeline is considered unlikely to significantly impact on the physical environment. Thus, the operational pipeline is not considered further below.

6.6.2 Topography

Pipeline construction will require the excavation of topsoil and subsoil, and disturbance to surface vegetation as a result. Some benching of the land may also be required where side slopes dictate i.e. a levelling of the land to facilitate safe movement of vehicles and plant. No buildings will be directly affected by the construction works, and any large tracts of woodland will be avoided.

As part of the construction process, all subsoil and topsoil will be reinstated and the ground re-profiled to match the surrounding gradient and terrain. Therefore, impacts on topography as a result of construction of the pipeline are considered likely to be *slight* and not significant.

6.6.3 Geology

The published geological records provide an indication as to the anticipated geological succession along the route corridor. The actual ground conditions will be confirmed through a detailed site investigation at detailed engineering design stage, comprising

boreholes and trial pits. The available BGS borehole logs located nearest to the pipeline route indicate a thickness of superficial deposits (typically clay) of approximately 3.0m on the western and eastern parts of the route corridor, and as such bedrock may not be encountered in these areas. No borehole logs were available for the central part of the route, and given the topography and higher altitude of this part there is the potential for bedrock to be shallower. Indeed, during a field walk of the pipeline route, rock at surface was recorded on Beacon Hill and Collachan bank (NX 915765 and NX 915763). The BGS borehole log at the western end of the route corridor indicates that the upper layers of the bedrock (shale) are weathered, which is likely to render it rippable in some areas. Some pre-splitting may be required.

The impact to the underlying geology will be limited to ground disturbance comprising the removal of topsoil from the working width and the excavation of a trench to a depth of 2.5m. Some disturbance to shallow bedrock may result. No designated sites of geological interest (SGI) or SSSI will be affected. As an integral part of the works, soil arisings will be stored in separate stockpiles adjacent to the trench, with subsoil materials being replaced in the trench and topsoil materials over the working width.

No significant impact to the underlying geology is considered likely.

6.6.4 Soils

Soils along the pipeline route will be disturbed both by the excavation of the pipeline trench and by supporting groundworks such as the creation of access roads. The soils crossed by much of the pipeline route are of agricultural value and as such are considered to be an important resource, albeit only a small proportion of which lies within the most sensitive agricultural land classifications (see Section 5). The following are considered to be potential impacts to soils during construction:

- changes to topography of route following construction;
- loss of topsoil during soil-stripping operations and reinstatement, leading to poor crop establishment and lower yields;
- damage to the structure of topsoils, creating difficult rooting conditions at reinstatement;
- mixing of topsoil and subsoil during reinstatement to produce areas of lower fertility;
- for ground in which subsoils have a high gravel content, restored topsoils may contain more gravel than before disturbance;
- compaction of subsoils which may produce slowly permeable layers, restrict root extension and alter the soil hydrology;
- changes in drainage caused by soil handling, compaction, reinstatement and the pipe trench itself;
- contamination of soils during construction by on-site activities; and
- accidental import or spreading of contaminated materials within the working width.

Weather, acting upon the soil cover, will have an overriding influence on construction largely determining the ground conditions throughout the construction. The period that soils are potentially wet, referred to as the field capacity, varies with altitude. Well-drained soils have a shorter field capacity period, but some of the wetter soils, particularly those that are not artificially drained, may remain wet throughout the construction period.

Soil wetness will therefore be a major limitation to soil handling and trafficability over much of the route and may be considered significant over the bulk of the route corridor. Peat soils which may be encountered in the central part of the pipeline route may remain totally waterlogged throughout the construction period.

Borehole logs provided by the BGS indicate that the thickness to bedrock on the eastern and western part of the route is anticipated to be in the order of 3.0m, but the thickness has not been proven at the centre of the route. The presence of rock at shallow depth, while giving potential difficulties with excavation of the trench, will generally produce firm trafficable surfaces, which are relatively permeable allowing excess water to drain rapidly.

In broad terms the well-drained soils are easily worked when moisture contents are at or below the lower plastic limit. The presence of large quantities of stone in many profiles will also help produce a firm surface for construction traffic. Worked in wet conditions, the weakly structured subsoils will easily compact and the ground surface may become ponded leaving large areas of standing water during construction. These soils are often ploughed, either for reseeded or for cereal crops, and provide a good depth of soil for reinstatement. Some slight loss of fertility might be expected due to anaerobic conditions in the storage bunds.

Seasonally wet soils are only likely to be dry enough for working for a short period in mid-summer under normal weather conditions. Much of the land covered with these soils will have to be drained to allow excess water to move off the worked ground. Excavation of the subsoil in these soils may disrupt the hydrology of the profiles leading locally to areas of poor drainage because the slowly permeable subsoil clay is the primary solution pathway for lateral water movement in these soils.

Soils affected by groundwater over the main areas of alluvium are generally permeable with good vertical drainage. They present a firm surface, but the weakly structured soils will become deeply rutted in weak, spongy materials creating poor trafficking conditions. Deep excavations for river crossings in these soils will produce large volumes of very wet materials, which will be difficult to restore; extra time will be required to allow voids to coalesce, and permeability to be restored. The narrow stream floodplains will be wet throughout the construction period.

The areas of peat present particular difficulties for reinstatement, as they are susceptible to compaction and will shrink if they are allowed to dry out.

Overall, pipeline construction could result in potentially *significant* impacts.

6.6.5 Ground Contamination

Whilst the potential for localised contamination to be encountered cannot be discounted, the baseline study has identified no significant sources of ground contamination. Therefore, no impacts are anticipated in relation to disturbance of significant sources of contamination. However, in the event that localised contamination is encountered, *slight* to *moderate* impacts could arise if such contamination is not identified and controlled appropriately.

As discussed in Section 11, there is the potential for ground to become contaminated due to the storage and use of fuel and oils for construction vehicles, chemicals, lubricants and other potentially hazardous substances. Imported material, e.g. topsoil, crushed aggregates, etc., also has the potential to be contaminated, depending on its source. Therefore, without adequate controls in place there is the potential for there to be *significant* impacts upon the immediate and surrounding environment of the pipeline.

6.6.6 Surface Water and Bathing Waters

Surface waters will be vulnerable to potential pollution during pipeline construction and will have the potential to be impacted as a result of:

- contamination by sediment laden run-off from the working width following topsoil stripping;
- spillage of fuels, chemicals, lubricants and hazardous materials, giving rise to potential pollution incidents to ground and then into surface waters (see Section 6.6.5 above); and
- sediment release during open-cut crossings of the watercourses.

The main watercourses that could be affected by The Project are Cargen Pow / Bogrie Lane, Lochfoot Burn and Cluden Water. It is also worthy of note that there is a fish farm located on the Cargen Water (NGR 292630 575510) downstream of The Project. Furthermore, the pipeline route is located within the Lower Nithsdale Nitrate Vulnerable Zone. The presence of springs near to or within parts of the pipeline under

construction may also result in soils remaining wet; this has implications for site traffic and may increase the potential for sediment run-off. Particular regard will be required to be paid to the tanks and well identified during the site walk over which lie directly on the route.

Although the study area for this assessment is located several kilometres from the bathing water designated Brighthouse Bay, consideration should be given to the potential impacts on water quality.

Therefore, the sensitivity of the potential receptors in this area is considered to be high. The magnitude of impact would depend upon the scale of incident incurred but could be potentially high under certain circumstances without suitable measures in place, e.g. at times of high rainfall. Therefore, *significant* impacts could result.

6.6.7 *Groundwater*

The underlying groundwater is potentially vulnerable to potential sources of contamination arising from the pipeline construction activity, contamination primarily relating to spillages and drilling-mud break-out. The sandstone bedrock on the eastern part of the route is of high permeability and is capable of supporting large-scale abstractions. This is evidenced by the presence of the Dumfries Aquifer, which supplies a large proportion of the potable water source for Dumfries. A drinking-water protection zone has been designated in association with the abstraction borehole of the Dumfries Aquifer at Terregles within which part of the proposed route is located. The pipeline route is also located within the Lower Nithsdale Nitrate Vulnerable Zone.

Therefore the groundwater in the eastern area of the pipeline route could be considered to be highly sensitive. However, the proven presence of 3m of glacial till (primarily clay) close to the route indicates that a natural barrier is likely to exist between the surface and the aquifer, significantly reducing such sensitivity. The risks to groundwater on the western part of the route underlain by the weakly permeable shales and greywackes are considered to be lower.

It is important to remember that the justification for The Project originates from the desire to minimise the amount of aquifer (and its protection zone) crossed by the Beattock to Brighthouse Bay Interconnector 2 Pipeline. This has largely been achieved thus reducing the risk significantly when compared to the consented Interconnector pipeline route. However, as discussed above, some of The Project pipeline route remains within the protection zone and NVZ, and so impacts cannot be completely avoided without the implementation of appropriate measures. Therefore impacts upon groundwater along the pipeline route are anticipated to be *moderate*.

6.6.8 *Flood Risk*

The pipeline route lies largely outside any flood-risk areas identified by SEPA. However, flooding may be possible at the western end of the pipeline route around the Lochfoot Burn and Bogrie Lane. If the pipeline working area in these flood-risk areas remains active for a sustained period, then there is a higher risk of silt being washed into watercourses. Whilst such flooding would be confined to the immediate environs of these watercourses, it is considered that *significant* impacts could result from the effects of siltation in this area without the implementation of appropriate measures.

As shown in Figure 6.4 the proposed pipeline route crosses a number of areas shown at potential risk from surface water flooding. During construction, the works could collect surface water and act as a conduit conveying water along the route. Therefore

impacts upon surface water flooding along the pipeline route are anticipated to be *moderate*.

6.7 Mitigation Measures

6.7.1 Site management

A Pollution Prevention Plan will be produced, and agreed in consultation with SEPA and Dumfries & Galloway Council, to control pipe trenching and construction operations along the whole route. An Emergency Response Plan will also be prepared, to ensure that arrangements are in place to deal with any incidents. The plan will include the provision of an emergency response team on site. General mitigation measures that will be employed include:

- compliance with SEPA best practice guidelines for fuel storage and re-fuelling; and
- providing adequate facilities for the collection, treatment and disposal of waste and sewage.

Any pipeline repair works carried out during the operational phase, could have similar impacts to those identified for the construction phase, albeit in a localised area and on a short-term basis only. All the practical site construction mitigation methods listed below, particularly those relating to soil contamination and reinstatement, will also be used if any excavation work becomes necessary during the operational phase.

6.7.2 Topography

The generic mitigation measure of effective planning and control of reinstatement will be adequate to ensure that there is a negligible long-term effect on topography along the pipeline route. A Reinstatement Plan will be developed by the MWC to control effective reinstatement to the original contours, to ensure there is a negligible long-term effect on topography along the pipeline route or on surface-water run-off patterns.

6.7.3 Geology

Minimal impact to the underlying geology is anticipated during the construction of the pipeline, and no mitigation measures are considered necessary.

6.7.4 Soils

The pre-entry soil survey will provide information to inform the construction team of the particular localities in which the mitigation measures detailed below will be required.

Careful timing of groundworks to coincide with the driest parts of the year is required to minimise the damage to soils. Groundworks will cease during periods of continuous heavy rainfall and the ground allowed to drain for a suitable period to allow excess water to move from the surface.

Construction of the pipeline may have a significant effect upon soil drainage. This is less likely to be the case on freely draining soils, which according to the soil descriptions in Section 6.5.5 comprise much of the pipeline route. Where soil drainage is compromised through compaction, dense layers will be removed in the freely draining soils by use of standard agricultural subsoiling techniques at a moisture content that allows compacted layers to become loosened effectively. In areas of wetter

ground subsoiling may not be a practical solution and additional post-construction land drainage may be required to remove excess water from the surface.

The Reinstatement Plan will be developed to include details of soil handling and seed mixes appropriate to the differing soils encountered along the route. Loss of fertility due to disturbance of topsoils and immediate subsoil will be remedied by careful land management immediately following reinstatement. This will include minimal trafficking over the reinstated ground and suitable fertilizer management on newly sown crops. Any programmed application of fertiliser will take due regard of the existing land-management arrangements in relation to the Lower Nithsdale Nitrate Vulnerable Zone.

Immediate sowing when topsoils are replaced should help reduce the effects of erosion on sloping ground. A roughened surface will help reduce water movement across the surface and any wheel ruts over the slope will be removed to reduce the risk of concentrated flow along the locally compacted surface. Where necessary, the use of other soil-stabilisation methods, such as pre-seeded matting, will be considered to reduce erosion. Early re-seeding of the reinstated ground will also be carried out to help re-establishment of structure in the topsoils.

Soil stoniness is often a superficial problem and noticeable in newly disturbed ground. There may be excess stone along the trench line and some removal of excess stone off-site, in accordance with the Duty of Care, may be necessary.

6.7.5 Ground Contamination

The specific mitigation measures to be employed to prevent contamination of the site soils during construction will include:

- fuels and lubricants will be stored in appropriately bunded static tanks at the Site Establishment Areas, which will be located to avoid highly sensitive locations;
- refuelling on the working width will be carried out using contained mobile bowsers, with lockable nozzles, which will be returned to the Site Establishment Areas each night;
- drip trays will be used when refuelling at all locations;
- adequate spill kits will be maintained in working areas, and staff carrying out refuelling will be trained in their use;
- site security will be maintained at an adequate level in areas where fuel and lubricants are stored, to ensure that contamination does not occur as a result of vandalism or theft;
- soils will not be transferred between fields/landownerships; and
- all secondary materials imported to the site – such as recycled aggregates for roadways and hardstandings; pipe-bedding material and clinker for cathodic protection systems – will be analysed for the presence of leachable contaminants before being brought to site, to ensure that they present a minimal risk of contamination to soils.

Whilst it is not anticipated that significant existing ground contamination will be encountered, construction staff will be briefed to ensure that all excavations are

regularly inspected for any visible made ground, contamination, or odour, to provide an early indication of unforeseen areas of contamination which, through excavation and movement of materials within or off the site, could spread contamination. The following measures will also be adopted in relation to unforeseen ground contamination:

- if contaminated material is encountered, a risk assessment will be completed to determine whether the excavated material can be safely re-used on site. If acceptable, it will be replaced in the same location after pipe-laying. If not, a remedial action plan will be developed and agreed with SEPA and Dumfries & Galloway Council, detailing treatment and disposal methods;
- the contaminated soil may be remediated on site under a suitable waste management licence or mobile plant licence, prior to re-use; or
- if it becomes necessary to dispose of contaminated material off site, disposal will be carried out in accordance with the Duty of Care legislation.

6.7.6 *Surface Water Quality*

Mitigation will include the use of appropriate measures as outlined in the Scottish Environmental Protection Agency Pollution Prevention Guidance (PPGs) to prevent spillage of potentially polluting substances, including the following guidance.

Guidance for storing and handling materials and products:

PPG2: Above ground oil storage tanks;

PPG 6: Working at construction and demolition sites;

PPG 7: Refuelling facilities; and

PPG 26: Drums and intermediate bulk containers.

Guidance for site drainage, dealing with sewage and trade effluents:

PPG 3: Use and design of oil separators in surface water drainage systems;

PPG 4: Disposal of sewage where no mains drainage is available; and

PPG 13: Vehicle washing and cleaning.

Guidance on general good environmental practice:

PPG 1: General guide to the prevention of pollution;

PPG 5: Works in, near or liable to affect watercourses; and

PPG 21: Incident response planning.

There is the potential for contamination of surface waters by sediment/silt run-off from the working width following topsoil stripping, during the excavation of open-cut crossings, from directional drilling and from spillages of fuels, chemicals and hazardous substances. Mitigation measures for the control of spillages are detailed in Section 6.7 above. Measures to control the remaining risks to surface water are discussed below.

Steep slopes in the central part of the route, and high rainfall in particular, could potentially lead to local sediment release to watercourses during the construction period. Risk assessments will be carried out prior to construction by the MWC and, if receptors of high sensitivity and susceptibility are identified close the route, enhanced silt control methodologies as described below will be considered. Surface waters of high sensitivity or tributaries thereof will be monitored to confirm the success of silt control, and:

- excavating a series of grips or channels to divert clean water (originating upgradient of the pipeline route towards existing watercourses or grassed areas) so that it does not collect silt from exposed soil surfaces;
- using straw bales in and around streams to filter large particles from run-off water;
- fluming the surface water over the working width to prevent it picking up sediment/silt;
- installing lagoons or bunds to retain water temporarily; and
- using agricultural sprays to disperse water over a wide area, allowing it to soak into grassed areas of ground.

Site staff will be briefed to ensure that all excavations are regularly inspected for any visible contamination or odour within the underlying soils, to provide an early indication of unforeseen contamination which may affect surface watercourses.

Before any works are carried out, an application(s) will be submitted to carry out works under the *Water Environment (Controlled Activities) Regulations 2011*. This will include all discharges, abstractions and all river engineering works. No works will commence until all relevant licences are obtained to the satisfaction of SEPA.

Although several kilometres downstream of the study area of this assessment, Brighthouse Bay is a designated waterbody under the EU Bathing Waters Directive, for the purpose of this assessment has been based on the same criteria as the surface waters in the study area, which if suitable mitigation is adopted will result in negligible impact on the bathing waters.

6.7.7 Surface Water Discharges

Construction activities may adversely affect the quality of surface water or ground water as a result of contaminated runoff from, or spillages on the construction site.

Prior to any discharge it will be necessary to ensure that the water meets appropriate quality criteria. Discharge of water pumped out from excavations will, wherever possible, be to land after filtration to remove sediment and will be controlled under a 'permit to pump' that will define pump location, discharge point and filtration measures in advance and in accordance with best practice.

Control and mitigation measures to be implemented to prevent pollution include:

- dewatering of all excavations to be subject to a permit from the SEPA and the process proactively managed to meet at least the permit conditions;
- no silty water to be pumped directly into any watercourse but to be allowed to settle out (for example, in settlement lagoons) or filtered (for example, using

straw bales to filter out coarse particles) prior to discharge, in accordance with permit conditions;

- where settlement or filtering is not practicable or effective, alternative disposal options will be considered for example, discharge onto a grassed area (with consent from the landowner and following SEPA consultation), and discharge to foul sewer (with consent from the local sewerage undertaker);
- if clean water is discharged into a watercourse, a baffle will be fitted to the discharge point to prevent disturbance of the watercourse bed;
- watercourses will be protected from contaminated surface water run-off by using French drains, cut off ditches, grips, silt fences or bunds round the edge of watercourses. Numerous small, passive mitigation measures will be installed in preference to one large treatment system to prevent large-scale water build-up;
- existing and new surface water drains will be kept clear of silt or weed buildup;
- roads and hard surfaces will be kept clean, to prevent a build-up of mud and sediment that could contaminate surface water; and
- implementation of a monitoring schedule to ensure that measures taken to protect watercourses, boreholes and wells are effective in accordance with SEPA.

Working areas, where possible will not be within 9m of watercourses. Where this is not possible, approaches will follow guidance in PPG5: Works in, near or liable to affect watercourses.

In addition, the mitigation relating to site drainage will be employed. All surface water abstractions, particular private water supplies, will be recorded and taken account of in order to avoid disruption to and contamination of supplies.

6.7.8 Disposal of Accumulated Rainfall/Surface Water

Rainwater and surface water may accumulate in a number of locations on site, for example in uncovered bunds and drip trays. This has the potential to become contaminated. To reduce this risk, the following measures will be included:

a) bunds or drum pallets will be covered, where possible, to prevent the accumulation of rainwater. Where this is not possible, (c) will be followed;

b) interceptor type drip trays will be provided rather than standard drip trays (for locations where drip trays will be permanently in place) or plant nappies (for mobile plant);

c) if a standard drip tray or uncovered bund is used, the contractor will:

ensure it is regularly inspected (daily) and emptied either via tanker and disposed of immediately off site at an appropriately licensed facility (for large quantities) or to an on-site, bunded, storage facility for later off-site disposal (small quantities). The inspection frequency will increase during times of frequent rainfall;

check water from uncovered bunds for obvious signs of contamination (for example, visible oil and smells) in order that the correct disposal option can be identified;

ensure that only uncontaminated water is disposed of by draining it onto a grassed or stoned area on the site which is at least 10m from any drains and 50m away from any boreholes or wells. If contaminated, it will be disposed of as Hazardous Waste; and

ensure that any oil present is absorbed using a spill kit and disposed of as Hazardous Waste.

6.7.9 Permitted Discharges

Discharges, other than uncontaminated surface water run-off, will require a permit from the Scottish Environmental Protection Agency (for discharges to controlled waters, including rivers, other watercourses and soakaways) or the local sewerage undertaker (for discharges to sewer). Discharges will not be made without prior consent from the SEPA or sewerage undertaker. To ensure discharges are appropriately authorised, the following measures will be followed:

consult with the appropriate consenting body before any discharge is expected to be required from the site and obtain a permit, or where a permit is not required, obtain written confirmation that one is not required;

ensure that any permitted discharge is sampled and analysed at the frequency specified in the permit to ensure compliance and that monitoring results are kept. More frequent analysis may be required if analytical results indicate that limits are being approached or exceeded; and

ensure that the consenting body is advised if results indicate that limits are being exceeded, and report the occurrence as an incident. Take immediate steps to rectify the situation; check receiving water for pollution resulting from exceedance; carry out any remediation works necessary.

6.7.10 Groundwater

The mitigation measures described in Section 6.7.5 above will prevent potential impacts to groundwater.

Water stops may be required to control groundwater levels in peat areas and also at sites of high ecological importance (see Section 7), where biological diversity is based on maintaining the existing groundwater regime.

6.8 Summary of Residual Impacts and Significance

6.8.1 Topography

The ground contours will be restored to their pre-existing shapes, therefore no residual impact on topography is anticipated.

6.8.2 Geology

No residual impacts are anticipated in relation to the underlying geology.

6.8.3 Soils

The mitigation measures outlined will minimise the loss of topsoil, but some importation of topsoil may be necessary to replace soil lost during stripping or spreading. Although there may be some short-term loss of fertility, the residual impact on topsoil is considered likely to be *slight* and not significant.

Grazing land will be left with fences in place to allow soil structures to reform, and permeability to re-establish naturally, so that the grass is capable of withstanding grazing pressure before stock is allowed back onto the land. The residual impact on soils in this regard is considered likely to be *slight* and not significant.

Soil compaction may affect large lengths of the pipeline route; however, the mitigation methods described will reduce compaction to acceptable levels. The residual impact on soils in this regard is considered likely to be *slight* and not significant.

Disruption of natural drainage in the alluvial soils will be a problem for a period after construction. Generally disruption will be temporary – therefore *slight* to *moderate* but not significant.

Overall, residual impacts upon soils are anticipated to be *slight* and not significant.

6.8.4 Ground Contamination

The potential for encountering existing ground contamination is considered low. The mitigation measures proposed will provide a high level of confidence that the potential impact of all aspects of contaminated land on the physical environment will be *slight* and not significant.

6.8.5 Surface Water Quality

Adoption of the mitigation measures discussed above will ensure that residual impacts to surface water, rivers and streams – considered to be sensitive receptors because of their generally high water quality – from release of silts/sediments, fuels, lubricants and chemicals, will be reduced to *slight* and will not be significant.

It is also anticipated that there will be no residual impacts upon the physical structure and flow patterns of watercourses.

Overall, providing the above mitigation measures are implemented during the lifetime of the pipeline, The Project should not be detrimental to the ability of the Cargen Pow / Bogrie lane to achieve Good Status by 2027, thus meeting the objectives of the WFD. The mitigation measures provided would be technically feasible and should not be disproportionately costly.

6.8.6 Groundwater

Adoption of the groundwater impact mitigation measures discussed above will be effective in ensuring that the other residual impacts on the quality of groundwater from the accidental release of fuels and chemicals and from contaminated land (if present) are *slight* and not significant.

Table 6-8 provides a summary of the impacts and mitigation measures.

Table 6-8 Summary of Impacts and Mitigation Measures

Aspect	Impact	Proposed Mitigation Measures	Residual Impact
During Construction			
Topography	Topsoil and subsoil, and disturbance	Subsoil and topsoil will be reinstated and the ground re-profiled to match the surrounding gradient and terrain.	Negligible
Geology	The impact to the underlying geology will be limited to ground disturbance comprising the removal of topsoil from the working width and the excavation of a trench to a depth of 2.5m. Some disturbance to shallow bedrock may result.	Minimal impact to the underlying geology is anticipated during the construction of the pipeline, and no mitigation measures are considered necessary.	Negligible
Soils	<p>The following are considered to be potential impacts to soils during construction:</p> <ul style="list-style-type: none"> • changes to topography of route following construction; • loss of topsoil during soil-stripping operations and reinstatement, leading to poor crop establishment and lower yields; • damage to the structure of topsoils, creating difficult rooting conditions at reinstatement; • mixing of topsoil and subsoil during reinstatement to produce areas of lower fertility; • for ground in which subsoils have a high gravel content, restored topsoils 	<p>Careful timing of groundworks to coincide with the driest parts of the year is required to minimise the damage to soils. Groundworks will cease during periods of continuous heavy rainfall and the ground allowed to drain for a suitable period to allow excess water to move from the surface.</p> <p>Immediate sowing when topsoils are replaced should help reduce the effects of erosion on sloping ground.</p>	Slight to Moderate

Aspect	Impact	Proposed Mitigation Measures	Residual Impact
	<p>may contain more gravel than before disturbance;</p> <ul style="list-style-type: none"> • compaction of subsoils which may produce slowly permeable layers, restrict root extension and alter the soil hydrology; • changes in drainage caused by soil handling, compaction, reinstatement and the pipe trench itself; • contamination of soils during construction by on-site activities; and • accidental import or spreading of contaminated materials within the working width. 		
Ground Contamination	No impacts are anticipated in relation to disturbance of significant sources of contamination.	Whilst it is not anticipated that significant existing ground contamination will be encountered, construction staff will be briefed to ensure that all excavations are regularly inspected for any visible made ground, contamination, or odour, to provide an early indication of unforeseen areas of contamination which, through excavation and movement of materials within or off the site, could spread contamination.	Slight
Surface Water	<p>Contamination by sediment laden run-off from the working width following topsoil stripping.</p> <p>Spillage of fuels, chemicals, lubricants</p>	Excavating a series of grips or channels to divert clean water (originating upgradient of the pipeline route towards existing watercourses or grassed areas) so that it does not collect silt from	Slight

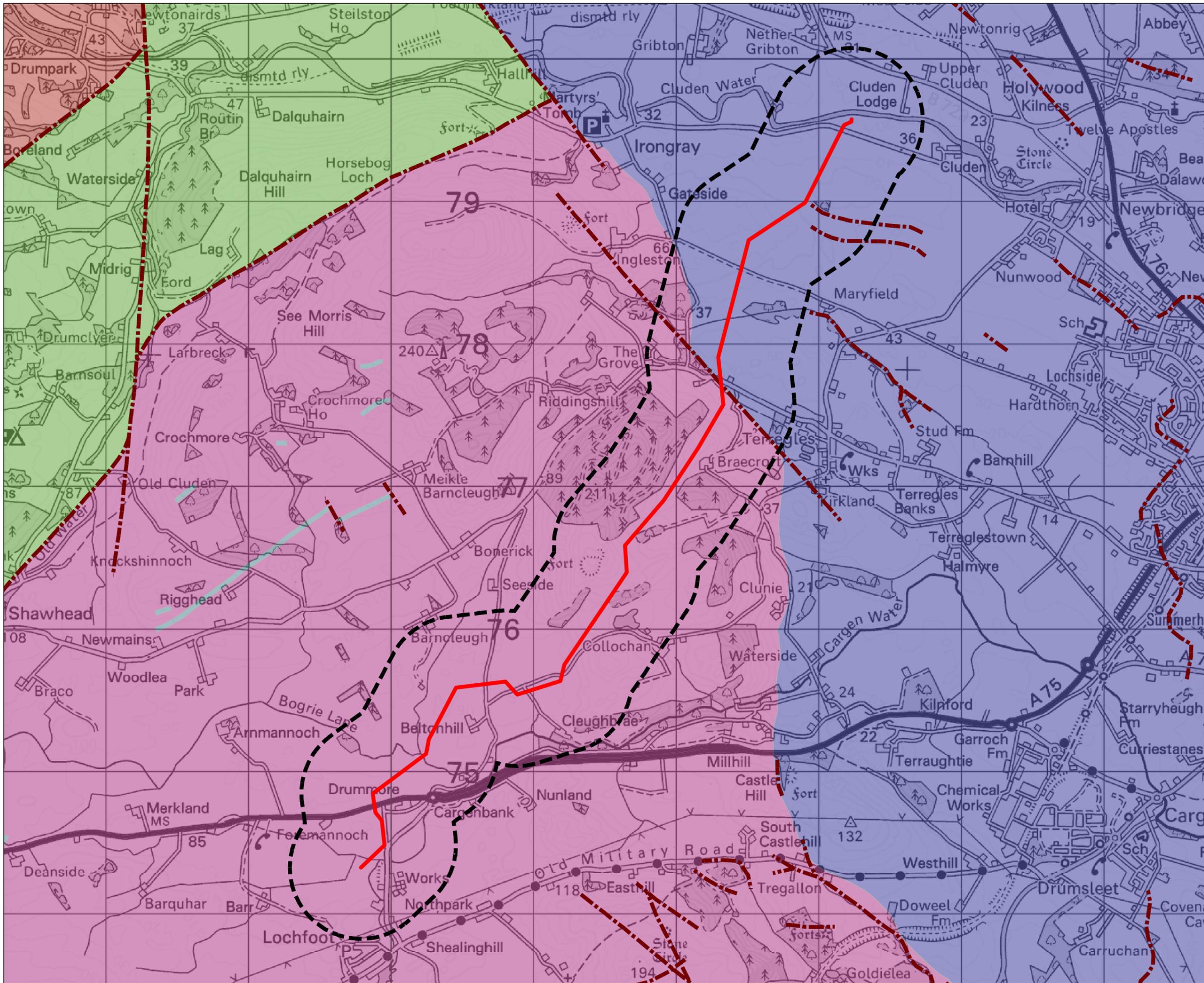
Aspect	Impact	Proposed Mitigation Measures	Residual Impact
	<p>and hazardous materials, giving rise to potential pollution incidents to ground and then into surface waters.</p> <p>Sediment release during open-cut crossings of the watercourses.</p>	<p>exposed soil surfaces.</p> <p>Using straw bales in and around streams to filter large particles from run-off water.</p> <p>Fluming the surface water over the working width to prevent it picking up sediment/silt.</p> <p>Installing lagoons or bunds to retain water temporarily.</p> <p>Using agricultural sprays to disperse water over a wide area, allowing it to soak into grassed areas of ground.</p> <p>Control and mitigation measures to be implemented to prevent pollution include:</p> <ul style="list-style-type: none"> • dewatering of all excavations to be subject to a permit from the SEPA and the process proactively managed to meet at least the permit conditions; • no silty water to be pumped directly into any watercourse but to be allowed to settle out (for example, in settlement lagoons) or filtered (for example, using straw bales to filter out coarse particles) prior to discharge, in accordance with permit conditions; 	

Aspect	Impact	Proposed Mitigation Measures	Residual Impact
		<ul style="list-style-type: none"> • where settlement or filtering is not practicable or effective, alternative disposal options will be considered for example, discharge onto a grassed area (with consent from the landowner and following SEPA consultation), and discharge to foul sewer (with consent from the local sewerage undertaker); • if clean water is discharged into a watercourse, a baffle will be fitted to the discharge point to prevent disturbance of the watercourse bed; • watercourses will be protected from contaminated surface water run-off by using French drains, cut off ditches, grips, silt fences or bunds round the edge of watercourses. Numerous small, passive mitigation measures will be installed in preference to one large treatment system to prevent large-scale water build-up; • existing and new surface water drains will be kept clear of silt or weed buildup; • roads and hard surfaces will be kept clean, to prevent a build-up of mud and sediment that could contaminate 	

Aspect	Impact	Proposed Mitigation Measures	Residual Impact
		surface water; and <ul style="list-style-type: none"> implementation of a monitoring schedule to ensure that measures taken to protect watercourses, boreholes and wells are effective in accordance with SEPA. 	
Groundwater	The underlying groundwater is potentially vulnerable to potential sources of contamination arising from the pipeline construction activity, contamination primarily relating to spillages and drilling-mud break-out.	See Surface water mitigation.	Slight
During Operation			
Topography	Once operational, the pipeline is considered unlikely to significantly impact on the physical environment.	None Proposed	No Residual Impact
Geology			
Soils			
Ground Contamination			
Surface Water			
Groundwater			

6.9 References

The Landmark Envirocheck® is a commercially available geographical information system database, which collates environmental information from many sources and can provide detailed reports of all records within a specified corridor.



Legend:

- Proposed Pipeline Route
- 1km Area of Search
- Fault
- Cairnharrow Formation
- Carghidown Formation
- Doweel Breccia Formation
- Gala 7
- Siluro-Devonian Calc-Alkaline Dyke Suite

Coordinate System: British National Grid
 Projection: Transverse Mercator
 Datum: OSGB 1936
 Units: Meter



Rev	Date	Description	Drn	Chk	App
03	06/05/2015	Updated Route	FC	DL	WH
02	14/04/2015	Updated Logo	FC	DL	WH
01	19/03/2015	Updated geology data	FC	DL	WH

Cluden to Lochfoot Pipeline



TITLE: Figure 6.1 - Solid Geology

