NIE and ESB National Grid

Arva - Drumkee 275kV Feasibility Study

ESBI Report No. PE687-R102-001-001-000.doc

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DATE 04/03/04

Northern Ireland Electricity

ESB INTERNATIONAL

File Reference: *Falcon/DMS*

Client: ESB National Grid & Networks

Project Title:

Arva - Drumkee 275kV

Report Title:

Arva - Drumkee 275kV Feasibility Study

Report No.: PE687-R102-001-001-000.doc

Rev. No.: 0

***Volume** 1 **of** 1*

APPROVED: C.Boylan ***TITLE:***	***DATE:*** 04/03/04

ESBI File Ref:	*PE687-F102*
Client:	ESB National Grid and Northern Ireland Electricity
Project Title:	Arva-Drumkee 275kV Line
Report Title:	Arva-Drumkee 275kV Feasibility Study
ESBI Report No.:	PE687-R102-001-001-000.doc
Rev. No.:	0
***Volume** 1 **of** 1*	

APPROVED: ***Cathal Boylan, ESB International*** ***Michael Hewitt, NIE***	***DATE:*** ***20/02/04***

EXECUTIVE SUMMARY

A Joint ESB National Grid (ESB) / Northern Ireland Electricity (NIE) steering committee requested that a feasibility study of potential 275kV Interconnection be carried out. This Interconnector shall be between an existing 110kV station called Arva in Co. Cavan and a proposed 275kV station called Drumkee in Co. Tyrone. ESB International (ESBI), were engaged by ESB National Grid to work jointly with Northern Ireland Electricity (NIE) on the production of same feasibility. This report details the options considered for potential overhead line route corridors between the above termination points.

The scope of the project being agreed at the outset swiftly led to the production of Desktop studies which detailed all physical and environmental constraints that might hinder a route corridor. Typical constraints included Ecological sites & Special Designated Protected areas, Archaeological & Heritage Sites, Scenic & Tourist Roads, along with all developments & Infrastructure.

Upon completion of a constraints map, natural route corridors began to emerge and became very apparent. A number of potential route corridors were marked up after various joint meetings between both teams. The potential route corridors developed during the desktop survey required on site verification however, before they could be marked as possible routes in this feasibility report.

The on site investigation took a number of weeks to complete and consisted of very basic ‘drive through’ surveys. The potential route corridors were selected based on achieving a fine balance between Environmental, Technical and Economic criteria. Road crossings were inspected to ensure adequate clearances existed at present. Most road crossings could accommodate a route corridor of at least 200m. Potential road crossings were particularly considered as ongoing ribbon development around most towns could give rise to ‘pinch points’ arising in otherwise broad route corridors. Some areas are considered to be under particular threat from unrelenting development.

The overall route corridors generally follow the shortest path, i.e. North East from Arva to Drumkee. These corridors not only create the shortest links between the two target

substations, but also avoid the listed lakes of Lough Erne. The line route proceeds North East carefully avoiding expanding towns such as Cavan, Cootehill, Clones and Monaghan. The line route corridor has a number of border crossing points, which converge onto two main route options in Northern Ireland.

These route corridors very quickly converge into one due to the physical constraints of Yellow Horn Hill plantation and Eglish Village. Over the last section towards the locality of Drumkee the topography of the landscape consists of numerous drumlins which help create two potential route corridors. One of these routes could very quickly be closed down due to ongoing development in Killyman Village beside the M1 Motorway crossing point. It is proposed to cable the last section into the proposed Drumkeee substation in line with previously made commitments to both the Planning Service and the local council.

Upon completion of the route selection, work commenced on the costings. A single circuit and double circuit option were costed.

This report recommended that if a transmission line connection is required between Arva and Drumkee 275kV station, that further detailed route assessment be undertaken based upon the potential route corridors as detailed in this report It is recommended the line (whether single or double circuit) should be constructed using standard lattice steel towers. The report finally concluded that an overhead line route corridor exists between Arva to Drumkee.

CONTENTS

1.0 INTRODUCTION

At the inaugural meeting, Electricity Supply Board International (ESBI) and Northern Ireland Electricity (NIE)' discussion focused on the potential for assessing 275kV single or double circuit feasibility studies between the existing Arva 110kV substation in Co. Cavan to the proposed Drumkee 275/110kV substation in Co. Tyrone.

The Scope of Work is defined to include:-

- Constraints map
- Desktop study
- Field study
- Cost estimate for above including ESBI and NIE cost estimates both separate and combined to give total project cost. Cost estimates in euro.
- Designs
- Programmes

Report Objective

- The objective of the report is to assess the feasibility of obtaining an overhead line 275kV route between Arva and Drumkee.
- Overhead line route will be selected based on achieving a fine balance between Environmental, Engineering and Economic criteria.
- The location of the Border will have no bearing on line route and the Border crossing point to be mutually agreed.

ESBI to study the optimum southern route to the Border and NIE to examine the Northern section to the Border. A suitable Border crossing to be agreed, both parties meeting to monitor progress.

The study area covered an area of 400,000 hectares. The affected counties are Cavan, Monaghan and Tyrone.

2.0 STUDY AREA

2.1 Introduction

The first task associated with the project was the defining of the study area. The study area is situated between Arva Substation Co. Cavan, and the proposed substation in Drumkee, Co. Tyrone.

2.2 Makeup of study area

The study area is bounded to the west by the Erne Waterways and Slieve Bragan Mountains, and to the East by the towns of Balieborough, Cootehill, Monaghan, and Armagh. It is bordered to the north by the town of Cookstown, Dungannon, Co. Tyrone and to the south by Arva Substation Co. Cavan. See Appendix Map No.1 A3 Route Map.

The study area encompasses approximately 400,000 hectares covering counties Cavan, Monaghan and Tyrone.

The typical landscape throughout this study will feature a drumlin landscape. This topography shows a high density drumlin landscape to the south of the study area and travelling northwards this gradually grows less pronounced as the hills tend to be flatter with longer views. For the most part the corridor will traverse through the valleys between these hills especially at major road crossings.

The land is mainly of good agricultural quality with tillage and pasture being the main uses. There are small pockets of peat, mixed quality land and marsh scattered throughout the extent of the study area but for the most part will be easily overcome.

Hedgerows are well established, although prevalence towards cutting the hedges throughout Cavan and Monaghan to allow for easier viewing into fields and R.E.P.S(Rural Environmental Protection Scheme) etc. is evident.

The study area includes, existing infrastructure including major roads N2 and N3 in the Republic of Ireland, M1 in Northern Ireland and numerous regional and secondary roads. It also includes overhead transmission and customer supply lines such as Flagford-Louth 220kV, 38kV and LV lines and rivers such as River Blackwater, Mountain Water and the Annalee River.

2.3 Conclusion

It was concluded that the study area of 400,000 hectares would be sufficient in size to accommodate possible overhead line route options from Arva to Drumkee.

3.0 CONSTRAINTS MAP

3.1 **Introduction**

With the limits of the study area defined, constraints need to be added so as to avoid routing the line in troubled areas. The capturing of constraints on to a single map is a very difficult task given the magnitude of this project. Some constraints were obvious while others were more difficult to quantify. The associated sections of this chapter give a more detailed account of the constraints.

Colored 1:50,000 Ordnance Survey maps were used for the production of the constraints map. The map-sheets used from 'Ordnance Survey Ireland' (Os*i)* were 27, 28, 34 & 35 and for the Ordnance Survey of Northern Ireland (OSNI) were 12 & 13, See Appendix Map No.2 North-/South Interconnector – Physical Constraints.

The constraints included;

- Landscape character.
- Land zoning, towns and rural dwellings
- Electrical Infrastructure
- General Infrastructure
- Ecological Sites and Special Designated protected areas
- Archaeological & Heritage sites
- Geology / Geotechnical
- Quarries, Mines and Airstrips
- Scenic and Tourist roads

3.2 Landscape character

The Landscape character is perhaps the single most important area when routing a transmission line. All natural parks and areas of high scenic value were marked on the map. Open expanses of water and marshland were avoided. The overhead line should not go too close to the shores of a river or natural lake. Towers should be positioned a minimum of 15 meters away from navigable waterways. Moderately open valleys with woods were selected where possible, especially where the apparent height of structures might be reduced.

The line routes should follow natural lines created by topographic change, geology, and vegetation that will help to minimise the visual impact. Where possible, the overhead line route was located on the middle slopes rather than siting them along the dominant axis and at the base of small valleys. It is preferable, where possible, to avoid breaking the skyline.

Where possible, towers should be placed near to the most vertical elements in the landscape, such as tree group or hill slopes. Where the landscape has a complex character, a great number of towers can be visually absorbed.

High land profiles and mountain ranges e.g. Slieve Bragan Co. Monaghan and Rehaghy Mountain Co. Tyrone, were avoided keeping to the lower plains and valleys as evident by the contours on the mapping used.

Landscape Character Areas were interpreted by utilizing the contour lines. The landscape character of the study area is mainly that of a drumlin nature. The ideal line of this corridor would follow as much as possible the valleys between these drumlins. Areas that posed problems ,e.g. flat areas around rivers, would indicate flood plains and silt deposits. The proposed line would be steered away from these areas as they would entail complex foundations and possible objections at planning stage. High density contours would indicate steep hills and awkward future siting of mast positions.

In Northern Ireland, there are numerous small loughs and areas of marshy ground, these were avoided. These tend to be limited to the east and west of the search area although the River Blackwater runs down the centre of the search area.

Forest parks or areas of public Amenity were marked on the map as areas to be avoided. This included Rossmore Forest Park Co. Monaghan and Favour Royal Forest Park, Co. Tyrone. Bullen Consultants (who aided NIE in the landscape assessment) had an environmental ecologist walk through 'Yellow Horn Hill Plantation' as this proved to be a major area of forest. Their initial findings indicate that it could be opened up and this would actually allow native species to reinhabit the clearing in the Pine Forest.

3.2.1 Landscape Character Areas in Northern Ireland

The study area falls into four of the landscape character areas (LCA) of Northern Ireland; no. 45 Dungannon Drumlins and Hills; no.46 Blackwater Valley; and small sections of no. 47 the Loughall Orchard Belt and no. 64 Lough Neagh Peat land. Details of the areas are set out below along with key characteristics, a landscape description, landscape conditions and sensitivity to change along with landscape management and principles for accommodating new development. This provides a framework for assessing the proposed development within the landscape types.

3.2.2 LCA 45. DUNGANNON DRUMLINS AND HILLS

3.2.2.1 Key Characteristics

- Drumlins form steep, rounded ridges with typical rounded profiles.
- In elevated areas, drumlins are separated by pasture, marsh or rounded loughs; elsewhere by gently rolling mixed farmland.
- Diverse landscape pattern; fields are irregular in shape and size, becoming smaller and more angular on steep slopes.

- Most fields enclosed by hedgerows with many hedgerow trees.
- Small broadleaf woodlands and angular conifer plantations.
- Farms and settlements sited in sheltered locations on lower slopes of drumlins, often associated with avenues and parkland trees
- Narrow winding lanes form dense network.

3.2.2.2 Landscape Description

This is a drumlin landscape, but with an unusually large scale landform. The drumlins form steep, rounded hills, some of which are linked together to form groups of hills with distinctive, rounded summits. They show no particular alignment. In more elevated areas, the low-lying land between the drumlins is marshy, often with rounded loughs which help to accentuate the height of the drumlins. Aghnahoe Hill, Ivy Hill and The Burnt Hill reach an elevation above the surrounding drumlins and offer welcome long views. There is a diverse and well maintained landscape pattern. Fields are predominantly pasture and are of irregular shapes and sizes, becoming smaller and more angular on steep slopes. Most fields are enclosed by dense hedgerows and there are numerous hedgerow trees.

The landscape has a sheltered, enclosed character, although the steep slopes and scenic loughs add a note of drama. Loughs are often fringed by patches of marsh and alder/willow scrub; many are overlooked by houses whose gardens are often a significant influence, with lawns and ornamental planting. To the south and west, towards Augher and Caledon, there are areas of low-lying land. Here the high drumlins are separated by a gently rolling lowland plains. In places there are areas of marsh, but most of this area has been drained to produce good agricultural land and arable fields are interspersed with pastures. The fields are on a larger scale than those on the drumlins to the north and many sweep up onto the slopes of the smaller drumlins from the surrounding lowlands. Areas of relatively small-scale pasture and patches of marsh remain on steeper slopes. There are some remnant orchards in flat areas near to the larger farms. Fields are surrounded by hedgerows and hedgerow trees are concentrated around farms and along the narrow lanes.

Throughout the area there are small conifer plantations, with angular shapes, and a scattering of small broadleaf woodlands and copses, although hedgerow trees are the predominant influence. Avenues of mature trees are occasional surprise features along some of the lanes. Farms are sited in sheltered locations on the lower slopes of the drumlins and there are typically groups of farm cottages along the narrow lanes. The lanes wind tortuously in areas where the drumlins are separated by loughs and marsh and become gently winding elsewhere.

3.2.2.3 Landscape Condition and Sensitivity to Change

The landscape is generally in good condition, particularly in areas of low lying land, to the south, where the farmland is well drained, with a neat, managed character. Away from the loughs, the undulating landform and relatively dense tree cover ensure that the landscape can accommodate change provided it is sensitively integrated.

3.2.3 LCA 46. BLACKWATER VALLEY

3.2.3.1 Key Characteristics

- Flat marshy vale and floodplain of the River Blackwater
- Wet meadows, pasture and bog.
- Secluded, secret landscape enclosed by drumlins, which extend as isolated rounded hills across the floodplain.
- Attractive historic designed landscapes, with woodland, lakes and grand houses, picturesque riverside settings.
- Fields separated by bushy hedgerows and trees creating an enclosed wooded character.
- Inaccessible, with few settlements; winding banked lanes give few views.
- Rural, peaceful and unspoilt landscape.

3.2.3.2 Landscape Description

The Blackwater Valley contains the flat marshy floodplain of the tortuous Blackwater River, which flows from the Clogher Valley into Lough Neagh. Numerous small streams flow between scattered drumlins which form islands on the floodplain and an abandoned canal, with numerous bridges follows the length of the valley. Drumlins enclose the valley and tortuous hedge-banked lanes allow limited views, creating a secluded landscape. The river is fringed with wet semi-improved and improved pasture and marsh. Fields are divided by mature overgrown hedgerows and trees giving the area a well wooded character.

Historic wooded designed landscapes, large estate houses, parkland and lakes enjoy an attractive riverside setting. The Caledon Estate on the border with the Republic is the largest and most impressive designed landscape, with stone walls, follies and acres of mature woodland. There are few settlements or dwellings and small twisting roads keep to the edges of the floodplain. The small village of Caledon is the principal settlement. Red roofed farm barns are a local feature. This is a rural, peaceful, undisturbed and unspoilt valley with outstanding scenic qualities.

3.2.3.3 Landscape Condition and Sensitivity to Change

The landscape is in good condition with excellent examples of wetland and parkland of both ecological and historical value. There are only limited views of this landscape on adjacent higher ground. The small scale enclosed character of the valley is susceptible to change.

3.2.4 LCA 47. LOUGHGALL ORCHARD BELT

3.2.4.1 Key Characteristics

- Low rolling drumlins falling towards Lough Neagh crossed by numerous small river valleys and streams and separated by low lying areas of moss.

- Varied rural landscape pattern, with mixed farmland and horticulture; extensive orchards on sheltered drumlin slopes.

- Wooded designed estate landscapes, parklands and attractive loughs, hilltop copses, mature trees and neat clipped hedges.

- Numerous scattered dwellings connected by hedge lined winding roads.

- Many traditional buildings including parish churches

- Long views to Lough Neagh and the Portadown area from hill tops.

3.2.4.2 Landscape Description

The Loughgall Orchard Belt extends from Portadown to the M1 motorway, the River Blackwater and Armagh. The area is characterised by low rolling drumlins which fall towards Lough Neagh to the north and to the slopes of the Blackwater valley to the west. It is crossed by numerous small river valleys and streams, tributaries of the Rivers Blackwater and Bann. The underlying geology is a mix of sedimentary and contemporaneous igneous rocks and gives rise to rich brown soils. The upper slopes are a mixture of pasture and arable fields, enclosed by hedgerows and some hedgerow trees. Roadside hedgerows are mostly well maintained and there are a number of short avenues of mature beech and ash trees. Blocks of attractive, well kept orchards are located on the steeper sheltered drumlin slopes of favourable aspect. There are many old knarled trees as well as some newly planted orchards and nurseries.

The very shallow northern slopes near Portadown tend to be poorly drained, with extensive areas of moss. Regenerating alder, birch and willow are found on the moss and previous peat extraction has left a typical pattern of rectangular working sites linked by access tracks.

There are numerous wooded designed estate landscapes, parklands, woodland and attractive loughs. Loughgall is the largest estate, and is associated with historic features such as crannogs and raths. Hilltop copses, mature trees and neat clipped hedges are features. There is a dense scattering of farms and dwellings scattered along the sides of lanes and at the end of access tracks, as well as villages such as Loughgall.

There are numerous large houses, and churches are a feature of the area. Stone buildings and traditional gate posts are also quite common. Dwellings are connected by hedge lined winding minor roads and roller coasting 'A' roads. The landscape pattern over much of the area to the east is influenced by the linear corridors of the M1, the A4 and by the River Bann. Two lines of pylons cross the landscape. This is a varied landscape, with a mix of scales and landscape patterns. In some areas there are pleasant long views across mixed farmland to farmsteads, churches and woodlots, but elsewhere, views are more contained by narrow tree lined roads or regenerating scrub.

3.2.4.3 Landscape Condition and Sensitivity to Change

The landscape condition is relatively good, with a well maintained hedgerow structure. The majority of the area has a rolling landform and good tree cover and is therefore not particularly sensitive to change. The more open land on the lower slopes and low lying areas is more sensitive. The landscape on the edge of Portadown is under pressure from new residential, urban and infrastructure developments.

3.2.5 LCA 64. LOUGH NEAGH PEATLANDS

3.2.5.1 Key Characteristics

- A low lying marshy landscape with small, protruding drumlins.

- The old canal, river channels and drainage patterns have a strong visual influence.

- Extensive, varied patchwork of pasture, plantations, regenerating bog areas and small settlements.

- Many scattered small holdings, villages and new residential areas on higher ground linked by embanked roads.

- High quality water edge landscape and wildlife habitats.

3.2.5.2 Landscape Description

The Lough Neagh Peatlands landscape is found on the southern shores of Lough Neagh. Much of the area has been previously worked for peat and has been extensively modified through extraction; there are distinct sharp changes of level marking areas where peat extraction has taken place. There are areas of regenerating birch and willow scrub and farmland, wherever drainage permits. The landscape is strongly influenced by the traditional road pattern, which mirrors that of the peat workings.

The M1 is the exception and cuts a swathe through the area which is contrary to the general pattern. To the south west (towards Dungannon) the pattern is of meandering roads, reflecting the more pronounced drumlin forms in this area. Pastures are mostly of medium size and are edged with hedgerows and hedgerow trees. Common species are oak, beech and ash, with silver birch, alder, sycamore and ash on wetter land. Scots pines are scattered through the area. Larger pastures are found on the farmland adjacent to the River Bann. Extensive blocks of gorse are common and many hedgerows are gappy, overgrown or have disappeared.

There are small orchards and areas of horticulture (mostly strawberries) on the old peat beds. The scattered traditional farmsteads and small lough edge and drumlin villages have been supplemented by groups of new residential dwellings.

3.2.5.3 Landscape Condition and Sensitivity to Change

Hedgerows are often neglected and some fields suffer from invasion by gorse and bramble, with areas of regenerating scrub. However this is a varied landscape with superb indented shoreline landscapes and a valuable sense of isolation and tranquillity. The wetland and shoreline landscapes on the edge of Lough Neagh are extremely sensitive and highly valued for their scenic quality and wildlife interest. They fall within the 'Lough Neagh Shores Area of Scenic Quality'. Extensive areas are designated as an ASSI and the area is part of the extensive Lough Neagh/Lough Beg Special Protection Area, which recognises its international significance as a habitat for breeding birds. Open, flat areas are particularly sensitive to the visual impact of vertical elements.

3.3 Landzoning, Towns and Rural Dwellings

Green Belts in Northern Ireland are fairly extensive. 'Green belts' surround the provincial towns of Dungannon and Armagh City. Because of their extent and particularly that of the Dungannon Green belt, routing to avoid these areas would prove unfeasible from an economic point of view, so routing towards the outskirts of these belts is preferable at this stage, see Appendix Map No.2 North-/South Interconnector – Physical Constraints.

The route corridor avoided large towns or clustered areas of settlement. In compiling the constraints map and carrying out the onsite investigations, relevant County Development Plans were consulted as to the extents and uses of land zoning around towns in the different counties. Routing was preferable outside these zones thus avoiding or reducing considerably, future conflict due to development etc. Although for the most part the route corridor is on average 3 kilometers wide, there are pinch points where the corridor extents will be reduced e.g. on crossing the N3, the corridor is approximately 1 kilometer wide due to existing development to the west and a scenic viewing point to the east of the proposed corridor route.

Scattered rural dwellings were to be avoided, keeping the proposed corridors approximately 50-75 meters away from any existing dwellings. Generally along the major arterial routes e.g. along the N3 Co. Cavan once off housing would generally be discouraged by The County Councils. Instead developments along the minor roads are less restricted by the County Councils. As a result the minor roads are more congested with once off housing developments, and building in the areas affecting the proposed route corridor will be inevitable.

3.4 Existing Transmission Lines and Substations

The Magherafelt to Tandragee 275kV circuit is present to the east of the area of search in the northern section. This line denotes the eastern boundary of the area of search as it would not be preferable to cross this existing line with a new 275kV line. There is also one 110kV portal overhead line close in to the Drumkee end of the proposed line route but this could be easily over sailed. However, there are numerous 33kV distribution lines within the study area as the rural changeover of 33kV distribution tapings along the border area has not been completed yet.

In the Republic of Ireland e.g. Shankill 110kV Station and the Arva-Shankill 110kV line crossings are to be made at or near 90 degrees. Proximity to existing lines were noted and a suitable mitigation trajectory of the Arva – Drumkee 275kV overhead line was allowed for as much as possible, e.g. at Arva Substation where there is a concentration of Overhead High Voltage Transmission lines. Also there will be a crossing of the existing Flagford-Louth 220kV line near Arva substation, see Appendix Map No. 1 A3 Route Map and Map No.2 North-/South Interconnector – Physical Constraints.

3.5 General Infrastructure

Other infrastructure to be highlighted included railways, motorways, major roads e.g. M1, A28, B45 N2, N3, N54 etc., again these need at or near 90 degree crossings. Navigable Rivers, Canals, e.g. Ulster Canal to be crossed at or near 90 degrees

3.6 Ecological Sites and Special Designated Protected Areas

Designated Areas for Flora and Fauna

In Northern Ireland, other than a small ASSI (Area of Special Scientific Interest) adjacent to Benburb, there are no sites of national or international conservation importance. Sites of local conservation importance occur predominantly near to Armagh and to the west of the search area, see Appendix Map No.2 North-/South Interconnector – Physical Constraints.

<u>Designated areas for Flora and Fauna</u>

Area of Special Scientific Interest (ASSI)

Nationally important sites of nature conservation value are designated as ASSIs, formerly under the Nature Conservation and Amenity Lands (Northern Ireland) Order of 1985, and at present under the Environment (Northern Ireland) Order, 2002. Sites may be designated because of their flora, fauna, geological, physiographic or other features. Designation as an ASSI is a required precursor to designation as a site of international importance (Special Area of Conservation, Special Protection Area). Any change in activities affecting a site must be authorised by Environment and Heritage Service (Department of the Environment) and the Department may enter into a management agreement with a landowner to protect the conservation interest of a site. Proposed development both within and without sites of national importance (where the latter is likely to affect a site) is the subject of special scrutiny under the planning process. The relevant Planning Policy Statement (PPS 2) issued by Planning Service indicates the

potential damage to habitats or species, the opportunities for alternative siting or potential mitigating measures, the possibilities for replacement sites, opportunities to enhance nature conservation and the importance of the proposed development to Northern Ireland will all be considered. Planning Service declares that where a development will have a significant adverse effect, directly or indirectly, on a site, it will not be permitted unless the reasons for the development clearly outweigh the value of the site.

Site of Local Nature Conservation Importance (SLNCI)

Where a site is not of national importance due to its conservation value, but is important in a more local context, Planning Service may designate the area as a SLNCI. The Environment and Heritage Service (Department of the Environment) is in the process of submitting a series of such sites to Planning Service for inclusion in Local Area Plans. This process is proceeding on a council area by council area basis, and not all parts of Northern Ireland have as yet been surveyed for potential SLNCIs. PPS 2 indicates that careful consideration will be given to the nature conservation implications of any development proposal where that proposal may threaten any significant feature of nature conservation value.

In the Republic of Ireland, such areas are formally designated, or proposed for designation, under EU Directives or national legislation, such as the Wildlife Act, 1976. They are administered by The Department of Environment, Heritage and Local Government (National Parks and Wildlife). The following is a summary of their main implications, see Appendix Map No.2 North-/South Interconnector – Physical Constraints.

Proposed candidate Special Area of Conservation (pcSAC)

This is a statutory designation which has legal basis in the EU Habitats Directive (92/43/EEC) as transposed into Irish law through the European Communities (Natural Habitats) Regulations, 1997 (S.I. 94 of 1997). The main implication of this designation is that any project likely to have a significant adverse impact on the integrity of the

pcSAC may only be carried out for "imperative reasons of overriding public interest, including those of a social or economic nature". Where a pcSAC includes a "Priority Habitat" or a "Priority Species", as indicated in Annex I and Annex IV of the Directive, then "the only considerations which may be raised are those relating to human health or public safety or, further to an opinion from the Commission, to other imperative reasons of overriding public interest".

Designated Special Protection Area (SPA)

This is a statutory designation, which has legal basis in the EU Wild Birds Directive (79/409/EEC) as transposed into Irish law through the European Communities (Conservation of Wild Birds) Regulations, (various dates). Most (though not all) of these sites are wetlands or coastal areas, which have significant concentrations of birds. The implications of this designation are similar to the pcSAC but there is a provision in the statutory regulations to prevent "pollution or deterioration of habitats or any disturbance whatsoever" affecting the birds which use a SPA.

Proposed Natural Heritage Area (pNHA)

This is presently a non-statutory designation which replaced the previous designation, Area of Scientific Interest (ASI), about 1994. It will become a statutory designation when the Wildlife (Amendment) Bill, 2000 becomes law. Most local authority development plans include an objective to protect pNHAs within their jurisdiction so this gives the designation some legal status under the Planning and Development Act, 2000. An application for planning permission for any development, which may have impacts on a pNHA, will be referred by the planning authority to the Department of Environment, Heritage and Local Government (D.o.E.H.& L.G.) for comment.

Statutory Nature Reserve (SNR)

This is a statutory designation which can cover either state or private land which is of scientific interest. Reserves are designated under the Wildlife Act, 1976. There is an obligation to manage the land in accordance with the objectives for which it was designated. Most nature reserves are in state ownership and are managed by Dúchas, the Heritage Service. Any state agency which is involved in activities that may affect a

reserve is required to consult with D.o.E.H.& L.G. and to take all practical steps to avoid or minimise any damage.

Ecological areas of interest were highlighted from Department of Environment, Heritage and Local Government. These include NHAs (Natural Heritage Areas), SPAs (Special Protection Areas) and pcSACs (proposed candidate Special Areas of Conservation). These areas should be avoided as crossing them would be contrary to a future Planning Permission acquirement.

'These sites are areas of importance to birds and other wildlife. The EU Birds Directive (79/409/eec) requires designation of Special Protection areas. Special Protection Areas along with Special Areas of Conservation collectively form part of 'Natura 2000', a network of protected areas throughout the European Union.
It is the policy of the Planning Authority to conserve and protect Special Protection Areas through the regulation of all development. Development that may threaten the integrity and value of the designated sites will not be allowed. Development that is close to a designated Special Protection Area will be assessed rigorously and where it is deemed that it negatively impacts on a site such development may require an Environmental Impact Statement.', Cavan County Development Plan 2002.

3.7 Archaeological & Heritage Sites

In Northern Ireland, twelve archaeological sites were identified in the area of search which are either scheduled or in State care. Numerous other unprotected archaeological sites are scattered throughout the search area. Many of these are raths, although forts and enclosures are also common. Other archaeological sites include holy wells, the site of the Battle of Benburb, tombs, graveyards and tree rings.

In the Republic of Ireland, archaeological heritage sites are administered by the Department of the Environment, Heritage and Local Government, (D.o.E.H.L.G.). The most recent boundaries of these designated areas were obtained from the departments' web site.

These include protected buildings, heritage sites including; Megalithic Monuments Earthworks, Ringforts and other types of enclosures, Ecclesiastical remains, crosses, holy wells and burial grounds, Stone fortresses, castles, tower, houses, bawns and forts etc.

For this study archaeological sites are not considered a major constraint due to the high degree of flexibility in locating overhead line structures.

3.8 Geology / Geotechnical

A review of ground conditions likely to be encountered was undertaken by examination of the surface/drift geology shown on the quaternary edition of the geological map of Northern Ireland. No site walkover was undertaken, no further records were sought from geological survey of Northern Ireland and no further site investigation was undertaken. It is concluded that the area through which the proposed overhead lines may pass is predominantly boulder clay although glacial sands and gravels will be encountered south west of Dungannon and should the route follow the Blackwater Valley it will pass over alluvial deposits. Pockets of peat also exist within the area of search predominantly north-west of Caledon.

On the basis of the above information it is considered that ground conditions for the construction of foundations to the overhead lines are generally good within the search area. The localised pockets of peat are unlikely to affect a significant number of towers and increased foundation costs to a limited number of towers should have only marginal effect on project costs. Should it be decided to construct the line through the Blackwater River Valley, suitable foundations for the towers can be designed but costs are likely to be greater than foundations for towers constructed on boulder clay.

3.9 Quarries, Mines and airstrips

Most quarries were already marked up from the Ordnance Survey mapping and were highlighted for the constraints study to be avoided. Whilst during the on site investigation one previously unmarked quarry came to the fore in a selected corridor, i.e. in the townland of Cornamahan, Co. Cavan, see Appendix Map No. 1 A3 Route Map. There was no evidence to date, from the councils or from onsite scrutiny that there were any mines or airstrips within the study area.

3.10 Scenic and Tourist Roads

Relevant County Development Plans were consulted and information noted. Urban/Residential zones were marked up to be avoided in the corridor selection. At this stage e.g. scenic viewing points were noted but not marked as the exact position and effect on desktop corridor could not be determined until field study was carried out. Field study would also allow for visiting the County Council Offices for further detailed investigation e.g. possible gas pipelines in the study area.

3.11 Conclusion

Using the above constraints plotted onto 1:50,000 map of the study area, corridors became apparent through which a provisional initial 275kV overhead line could be routed and studied, see Appendix Map No 2 North-/South Interconnector – Physical Constraints.

The ideal general direction from Arva to Drumkee will travel in a north-easterly direction avoiding these constraints. This enabled corridors to be marked up onto the map.

While this gave an indication of the broad corridor for this project, an onsite investigation needed to be carried out to check for obstacles not evident from the constraints map e.g. once off housing etc.

Route options will now be discussed as verified and supported by field study.

4.0 ROUTE OPTIONS

4.1 Introduction

The constraints map completed in the office was the foundation for selecting a suitable corridor from which field study will verify that this route would be a viable one in which to run an overhead transmission line, See Appendix Map No. 1 A3 Route Map and Map No. 2 North-/South Interconnector – Physical Constraints.

This corridor is 'brought out' into the field where, for example, all proposed overhead crossings on roads will be checked for sufficient clearance from existing dwellings, lakes, or quarries etc.

Other information may be gleaned from this visual inspection onsite such as finding more suitable crossing points on major roads such as the N3 and picking up local knowledge from County Councils and people such as the plans for the proposed incinerator site near Emyvale Co. Monaghan.

Amalgamating this information may change the original routing of the proposed corridor of the constraints study to reflect this data and so alter the route(s) to avoid or mitigate these additional constraints, see Appendix Map No. 3 North-/South Interconnector – Route Options.

4.2 ESB Route from Arva to Border

4.2.1 Choosing a route out of Arva station

Arva Substation is strategically placed in Co. Cavan as it is positioned close to a number of transmission lines including the now called Arva-Shankill, Arva-Gortawee, Arva-Carrick-on-Shannon, Arva-Navan 110kV lines and the Flagford Louth-220kV line. All except the 220kV line feeds into Arva station, see Appendix Map No. 1 A3 Route Map. All lines feed into the north-side of the station with the 220kV paralleling the north face of the station. Due to the space required to locate a 275kV line and its associated equipment, this portion of the station is unsuitable. The southern section of the station has space to accommodate this newly proposed line.

The most direct line was chosen from Arva 110kV Substation to the proposed 275kV Substation at Drumkee, Co. Tyrone. The 'ideal' straight line scenario would travel in a north-easterly direction to Dungannon, Co. Tyrone from Arva Substation, see Appendix Map No.3 North-/South Interconnector – Route Options. Heading unduly east, west or south would make the proposed line much longer. It is prudent to avoid if possible routing the line over high ground e.g. Slieve Bragan (north-west Monaghan). Even possible routing west of this mountain range would be unfeasible both from an environmental and economic point of view. The proposed line would have to route through a myriad of pNHA and NHA listed lakes of Lough Erne (Lough Oughter and associated Loughs). This area is also a designated Special Protection Area (SPA). It is described as 'An extensive area of inland lakes within the Erne drainage system…A unique landscape in Ireland in its extent and scenic quality. Providing an important ecology with a habitat generally under threat throughout Europe. Listed as an Area of Outstanding International Importance. (Special Protection Area – EC Directive on Bird Conservation 1979)'. Further it would add many more extra kilometers of overhead line over rocky terrain and proximity to lakes might indicate the need for complex foundations, see Appendix Map No.2 North-/South Interconnector – Physical Constraints. This possible route was rejected at desktop study stage.

Figure 1. Arva Station looking north towards Bruse Hill (pNHA) to Upper Left background. The proposed corridor will exit Arva station traveling south, i.e. through the wooded area as seen at the centre of this photograph and onto the green in the foreground before it turns east.

The proposed route corridor instead exits Arva 110kV Substation in a southeasterly direction. Other contributing factors in taking this direction out of the station was the close proximity of the NHA Bruse Hill positioned north of the substation. This effectively restricts routing the proposed line northwards. To the south-west of the Substation; Lough Gowna is another listed NHA thus curtailing routing through here plus it would not make economic sense to head in a south-westerly direction as the natural line of this route will take the corridor in a north-easterly direction. To the north-west of the Substation the expanse of the Erne drainage system (Lough Oughter and Associated Loughs) virtually inhibits a possible route corridor as this is a NHA. Looking at this overall constraint, the extents of the watercourse and its proximity to Cavan town it would be prudent to steer the corridor to the east of Cavan town and preempt and avoid planning restrictions that would incur by routing it through NHA's. It would be beneficial at this stage when exiting Arva Substation to avoid heading west of Bellananagh or Cavan town as the Erne drainage system nearly reaches into the outskirts of north-west Cavan town. Further to the north of Bellananagh there is a scenic viewing

point (known as Fleming's Folly) with extensive views overlooking the surrounding countryside. Any proposed overhead line would encroach upon the views in this area, and invite planning restrictions at a later stage, see Appendix Map No.1 A3 Route Map.

4.2.2 Line route from Arva to Lisclone

Following the generally easterly exit out of Arva Substation the route turns in a Northeasterly direction at reference pt. 1 – R154 crossing, this north-east direction is the optimum direction for the line route from Arva to Drumkee.

The line route encounters the existing Flagford–Louth 220kV line and a crossing angle of approximately 90 degrees is achieved.

The proposed corridor then travels north for approximately 4 kilometers before skirting a quarry known as 'Nulty's Quarry' reference point 2, see Map No.1. The line will become more exposed as the land becomes more elevated as is characteristic of the general vicinity. Here the proposed corridor is also closest to the existing Arva-Shankill 110kV line, lying approx 300m from the corridor line. The land profile however is such that both lines will not be in the same sightline from the road.

There is quite an amount of ribbon development in the general area. Crossing some large farms, the line will travel this elevated section descending into a valley in the townland of Glencorran, crossing a 38kV line and follow this valley for approx 3 kilometers. See figure 2 below.

Figure 2. Townland of Glencorran road crossing, routing along centre of valley shown looking north-east. The corridor will follow in line approximately with the gate to the pole in the centre of the photograph and beyond. Existing 38kV line is visible to upper right foreground.

The line then makes its way towards the N3 (Dublin – Cavan road). The landscape here is characterised by rolling hills, with medium to high hedgerows providing good screening from the proposed line. Due to constraints of commercial development along the N3 nearer the town, the road crossing will be approximately 6 kilometers east of Cavan town centre. There are a number of potential crossing points here. East of this intended crossing point will encroach upon a scenic viewing point looking east and north over Lisnanagh Lough See Point No.3 on the map. Planning restrictions would occur here as a result of encroaching on this aspect. The view is extensive and looks down into a valley, and so was avoided for this study. Another factor in considering the crossing point over the N3 was the position of Shankill 110kV Station. Its location was studied and as a result the proposed line was angled away from the station.

There is also the possibility of a future Arva - Shankill 110kV No. 2 line being built in the near future. This new 110kV line may encroach on the selected 275kV route corridor. It is not expected this encroachment would have a severe impact on the proposed 275kV route corridor.

A multiplicity of lines in the area would lead to a saturation of high voltage lines within a small area and possible planning/wayleave objections in the future. Therefore taking on board all the restrictions, the actual crossing point of the line over the N3 is approximately 1 kilometer east of Poles Post Office, and approximately 2 kilometers west of Stradone village, see figure 3 below. Due to the constraints, the width of the corridor is approximately 1 kilometer, see Point No.4 Crossing Appendix Map No. 1 A3 Route Map.

Figure 3 Proposed road crossing on the N3 east of Cavan town looking south. The proposed line will travel through the centre line of this photograph heading north. Shankill 110Kv station lies to the west of this location.

North of the N3 lies Shankill 110kV / 38kV Substation. Associated with this station are two existing 38kV lines. These are Finea-Shankill-Toneymore 38kV line, and Ballyjamesduff-Shankill 38kV line. The line route corridor avoided these lines by passing east of them. The corridor also routes east of the existing Arva-Shankill 110kV line. The proposed line then travels in a northeasterly direction for approximately 2 more kilometers reaching Intersection Point 1 on Map No. 1 A3 Route Map. Here the corridor diverges into two options as discussed below.

4.2.3 Line route from Lisclone to Newbliss (Option 1A)

On reaching the Intersection Point 1 see Appendix Map No.1 A3 Route Map, the line diverges into two line options.
Option 1A route corridor heads in a north-east direction from Intersection Point 1 on Map No.1. The first obstacle encountered is the R188 (Main Cavan – Cootehill road). This is a particularly complex road to cross as it contains a listed scenic viewing point, mature deciduous and evergreen forests, and amenity areas along with a major river crossing namely the Annalee River. Suitable crossing points were examined. West of Drung village see point No.5, however lies an actively mined quarry known as 'Clarke's Quarry', see map. Further along this road towards Cavan town is the County Landfill site. The overhead line corridor was positioned between Clarke's Quarry and the Landfill site. The corridor widens to approximately 3 kilometers keeping 1 kilometer east of the Landfill site and 3 kilometers west of Drung village.

North of the aforementioned R188 road the line route reverts back to the original and optimum direction i.e. North – East. While maintaining this direction the route bears East of Ballyhaise town, while at the same location crosses the Annalee River at a good crossing angle of 90 degrees.

Further north the line corridor positions itself quite close to but avoids crossing the R212, i.e. Ballyhaise to Scotshouse road. In order to minimize the visual impact of the line it is routed up a small river valley at the Cavan Monaghan county border. The land in the general area is sparsely populated which is a benefit for the line corridor. At this same location the line corridor crosses a feature known as 'Black Pig's Dyke', see Point No 7 Appendix Map No.1 A3 Route Map.

The Black Pig's Dyke dates back to the Iron Age and is a fortification that was built from the west coast to the East coast of Ireland. Remnants of this fortification are still in evidence today but due to erosion and the natural effects of time, some of the structure

has disappeared. In some areas it has been restored. The Black Pig's Dyke is listed as a National Monument.

Because of the linear nature of the Black Pig's Dyke, crossing it is unavoidable. A crossing may be available where the structure of the Dyke has disappeared thus mitigating the archeological impact on the Dyke. This area will require careful archeological assessment. For this report no detailed investigation has been carried out. It is assumed it can be crossed, possibly with conditions that no structure would be placed on it. The crossing angle was fixed at approx. 90 degrees. However, from an archaeological point of view and for future reference no mast structures should be positioned in close proximity to or straddle this feature.

The route continues in a northeasterly direction, following the lower slopes of the rolling drumlin landscape. The proposed line corridor travels roughly parallel to the existing Shankill-Finnea 110kV line for approx 4 kilometers and then makes it way to Intersection Point 2, see Appendix Map No.1 A3 Route Map where option 1A & 2A converge just south of Newbliss.

4.2.4 Line route from Lisclone to Newbliss (Option 2A)

This option is the original desktop study route. The route corridor heads in a north-easterly direction traveling along near the valley of the Larah River. It crosses a number of minor roads. The area has extensive ribbon development and difficulty was experienced locating suitable road crossings.

Unlike option 1A, the corridor crosses the R188 East of Drung village see Point No. 5 on map. A scenic viewing point exists which would have had an extensive view overlooking any proposed overhead lines at this crossing. See Point No.6 on Appendix Map No.1 A3 Route Map. Figure 4 below shows this viewing point.

Figure 4. Scenic Viewing Point on the R188 that conflicted with initial desktop study route option 2A. The route would have crossed this road in the valley to the background of this photograph. At this point our location is east of Drung village, See Point No. 6 on map.

The corridor continued northwards before orientating North-west to provide a suitable crossing angle over the existing Lisdrum–Shankill 110kV line. The line route corridor then orientated back to north- east to Intersection Point 2 to join Option 1A.

4.2.5 Newbliss to Scotstown (Option 1B)

Option 1B heads in a north-west direction from the intersection point with option 1A to avoid Newbliss on the east. The main advantage of going West of Newbliss is that it avoids 3 major road crossings, namely the R189 to Cootehill, R183 to Ballybay and the R189 to Monaghan. Option 2B as discussed below travels east of Newbliss and unfortunately encounters all 3 road crossings.

The corridor travels north-east along the slopes of the Finn River valley so as to avoid highlands. The corridor than crosses the N54 (Clones – Monaghan Road), two kilometers west of Smithborogh, with a good crossing angle of approximately 90 degrees.

Just north of this road crossing see Point No.8 on the map there are two pNHA's, Mullaglassen Lough and Killcarren Lough. There is a very narrow opportunity in which to route the corridor through both pNHA's, i.e. approximately 150 meters. Instead there are other crossings further east of this point with the corridor of Option 1B converging with Option 2B giving a 3 kilometer corridor. This area would require careful investigation at detailed route selection stage.

4.2.6 Newbliss to Scotstown (Option 2B)

Alternatively a corridor was investigated heading east of Newbliss, i.e. Option 2B, so giving a broader scope for detailed route selection in the future. Similar to option 1B this route starts at Intersection Point 2 just south of Newbliss, but avoids it by bearing east of the town. As can be seen on Map No. 1 A3 Route Map the route corridor has to cross 3 major roads in succession, namely the R189 to Cootehill, R183 to Ballybay and the R189 to Monaghan. Following the road crossings the route crosses a dismantled railway.

The proposed route corridor is within very close proximity to the existing Shankill-Finnea 110kV line (closest 100m), however it does not cross it. Further north the corridor bears slightly west and thus avoids a listed Secondary Amenity Area known as Annaghmakerig Lough and Surrounds including the forestry. It is important to note that the 1999 Monaghan County Development Plan states that "Such areas are to be kept free from intrusive development and only buildings on unobtrusive sites and compatible amenity development will be permitted."

It will cross an elevated section between Effernagh and Raderry townlands and possibly overlook Annagose Lough on its way towards the east of Smithborough. This area is characterised by smaller drumlins that will help screen the line however there is extensive ribbon development on the some of the minor roads.

The route corridor then crosses the N54 (Clones – Smithborough road) approx. 1 kilometer East of Smithborough. Figure 5 below details the actual crossing location. The general area is well farmed where the holdings appear to be quite large.

Figure 5. Proposed crossing on the N54. This section lies approximately 2.5 kilometers west of Smith borough taking Option 1B See map. Both sides of the road have good hedgerow cover bearing in mind that this photograph was taken in winter months so visual absorption is quite good to incorporate the proposed line into the landscape.

The route corridor will continue to travel northwards, cross the R187 (Rosslea to Monaghan Road) and eventually meet Intersection Point 3, see Appendix Map No.1 A3 Route Map, south of Scotstown. This section of route is a more elevated.

4.2.7 Scotstown to final intersection south of Border

Both options 1B & 2B converge at Intersection Point 3. From here the route corridor proceeds northerly keeping over 1 kilometer west of Scotstown. A minor road from Scotstown to Knockatallon exhibits extensive ribbon development and crossings are limited. Along this road is the River Blackwater which is described in Monaghan County Development Plan as an area of Secondary Amenity value, is crossed.
The route traverses northerly following the lower slopes of the land along valleys skirting the lowest slopes of the Slieve Bragan Mountain Range. The route may be forced to infringe on some forestry in the townland of Caldavnet.

The route proceeds north-east again for approximately 2 kilometers before crossing the R186 (Monaghan-Seskinore Road) in the townland of Derrykinnigh. Along this road is the River Mountain Water. Monaghan Development Plan lists this valley as a Secondary Amenity Area. At this point the route corridor lies 6 kilometers west of Emyvale.

Figure 6. Typical shows typical topography in Monaghan. The hills are becoming flatter and the views are longer

The Emyvale area is particularly sensitive now as there are plans for a proposed incinerator in the townland of Killycarran, 2 kilometers east of the route corridor and nearly 4.5 kilometers west of Emyvale town, see Point No. 9 in Appendix Map No. 1 A3

Route Map. There are strong objections to the proposed incinerator in the broad environs of Emyvale. Also planning permission is currently been sought to erect a wind farm in the vicinity of the Bragan Mountains west of the route corridor.

Approximately 1kilometer east of the corridor lies Emyvale 38kV Substation with more crossings of existing 38kV lines probable. The route corridor is then at Intersection Point 4 and where there are a number of route options for crossing the border as discussed below.

4.2.8 Border crossing point East of Aughnacloy and West of Caledon

The preferred option from both NIE and ESBI is for the route corridor to traverse between Aughnacloy and Caledon. There are a number of options available within this area. These Options require two major roads to be crossed, the N2 between Emyvale and Aughnacloy and the A28 between Aughnacloy and Caledon. Available crossings on both the N2 and the A28 would need to be studied to achieve near 90 degree crossing angles.

There are approximately five crossing points available along the N2 between Aughnacloy and Emyvale. Whilst there are some existing houses along this arterial road there are lesser restrictions to house building along the secondary roads in this area. As a result the minor roads are more congested and future house building in the area is inevitable and may impact on the final route chosen in the future.

The actual Border between Northern and Southern Ireland in this area is marked by the River Blackwater. The Blackwater River Valley is described by the Monaghan County Development Plan 1999 as an area of Secondary Amenity Value and generally ‘these areas are to be kept free from intrusive development’. But because of the extent and nature of this river and that it marks the Border it has to be crossed at some point.

Just North of the Border the route corridor encounters the A28 (Aughnacloy – Caledon road). There are a number of crossings available along this road. Figure 7 below shows a typical crossing point.

Figure 7. Typical Road Crossing East of Aughnacloy on the A28

The road has an enclosed nature with medium to high hedges and tree cover providing relatively good screening. The ‘Ulster Way’ designated walking route also features along this corridor. Because of the linear nature of this walkway, crossing it may be unavoidable, only crossing it where it causes least impact visually and environmentally.

4.3 NIE Route from Drumkee to the Border

4.3.1 Introduction

The point of connection for the additional interconnection with the Electricity network in Republic of Ireland to the existing NIE 275kV grid will be from NIE's proposed new 275/110kV Substation located in the townland of Drumkee, near Dungannon, Co Tyrone to the mutually agreed border crossing locations.

As part of NIE's environmental commitments to Dungannon and South Tyrone Borough Council and indeed to the DOE Planning authority, in the Environmental statement which accompanied the planning application for the above project it was agreed that no additional overhead lines would be connected directly to the substation hence reducing the potential for the 'Hub and Spoke' effect of lines leaving the substation.

Following the initial desktop study the potential route corridors were assessed by field studies, which focused on three main criteria, namely Environmental, Engineering and Economic considerations. This exercise brought together issues of visual impact and technical achievability on the ground. Technical considerations included road crossings, distance and aspect from dwellings, topography of the landscape, woodlands and marshlands, to minimize route length and angle locations.

Applying these factors has resulted in some changes to the potential route corridors developed from the desktop study. This is only to be expected due to such factors as ongoing ribbon and rural development since OS maps were last updated and tree plantations and woodland areas can look much different in reality. Also the aspect of newly constructed dwellings to any potential route corridor has a major influence during technical investigations.

4.3.2 Overhead line route options

A major factor in determining the location of the starting point of the overhead line will be the availability of a suitable crossing point on the nearby M1 Motorway. If a suitable overhead crossing point is available the first section of underground cable out from Drumkee Substation could be as short as 0.75 kilometers, whereas if it proves necessary to cable beyond the M1 Motorway crossing point, potentially 4 or 5 kilometers of cable could be required to exit beyond the extensive greenbelt area located in and around Dungannon town as shown in Appendix Map No.2 North-/South Interconnector – Physical Constraints.

Figure. 8 M1 Motorway Crossing

Visual impact will be quite significant at either of the two motorway crossing locations and also along the Killyman road which runs parallel with the M1 at this point with little in the line of natural tree screening availability.

Exiting from Drumkee Substation (new) the proposed new line will run in a southerly direction in close proximity and run parallel to the existing Magherafelt to Tandragee 275kV tower line as far as Moyroe Corner where it will swing into a southwesterly direction for most of its course. Difficulty could occur in crossing both the B34 and the B106 roads as limited crossing points are available due to ongoing ribbon development. The alternative option in this section would route the proposed line much deeper into the Dungannon Green belt area.

Appendix Map No. 2 North-/South Interconnector – Physical Constraints details the scope of the potential line route corridors which are deemed suitable of further investigations. Where options or part alternatives within routes are available these have been included.

There are marked similarities between the desktop survey and the on site investigations along some areas of the routes. In some instances such as the middle section of Eglish village only one potential route corridor is reported.

On the southwestern side of the A29 road crossing on Dungannon to Moy to Yellow Horn Hill Plantation the drumlin type topography starts to become more pronounced and has both positive and negative effects. Running parallel with the A29 road and on the southern side is the main 33kV sub distribution line which interconnects the adjacent Killyman Central 33/11kV substation with the Armagh City network. It should be noted that this is one of only two major 33kV lines to be crossed along the entire 25 kilometers route in Northern Ireland. Numerous 11kV and LV crossings are encountered but this report will not consider what action is to be considered regarding under-grounding etc.

Figure 9 A29 Moy to Dungannon Road Crossing

The positive effects of drumlin type topography are that it helps hide and breakup the tower line and its support structures and diffuse long visual aspects of the proposed line.

Negative effects of the Drumlin type landscape include those of low lying land and hence enforce more line deviations or raising the line profile by over sailing the side or top of the drumlin hence incurring increased visual impact.

This line section passes through mainly rural hinterland with no major striking features of significant interest apart from the fact that both line route corridors converge into one main route corridor to the south of Eglish village, and just north of Oona Bridge. This one southwesterly route corridor remains until it reaches Yellow Horn Hill Plantation.

The line route corridors splits at the northern aspect of the plantation with one of the most likely preferred route corridors proceeding due west until it crosses the Border just south of Aughnacloy in the town lands of Tullyblety, Mulnahorn or Cavanleckagh.

Another 33kV distribution line is located on and runs parallel along the southern side of the Aughnacloy to Caledon A28 trunk road. All of the various route options towards the border crossings would cross both this major trunk road and the 33kV overhead line in this general vicinity.

Fig. 10 A28 Aughnacloy to Caledon Road crossing

The other more southerly route could either pass through the middle of the yellow horn hill development and help open the forest up or can pass it to the north and west of the plantation in a wide open and reasonable flat valley and proceed towards the border

through the townlands of Mullyneill, Killynaul, Dromore, Derrycourtney as it over sails the A28 Aughnacloy to Caledon main road. Other options are shown due south of this route but through joint discussions with the ESBI staff it became apparent that whilst the northern side of the border could sustain this route problems would quickly arise on the southern approach near to Emyvale town and Lough.

4.3.3 Line Routing Conclusion

At this stage no preferred line route option has been chosen over others mainly due to the inbuilt flexibility provided in the final stage of the route as five potential border crossing point options were considered to permit joint discussion over the best crossing point.
Once the border crossing point has been agreed, the preferred line route corridor(s) can quickly be established.

Several potential route corridors have been identified from the initial desktop constraints mapping exercise, Appendix Map No. 3 North-/South Interconnector – Route Options. These corridors have been identified because of the lack of constraints and also because the landscape has the ability to incorporate such a development with minimal impact on landscape and visual features. One of the primary drivers was to attempt to keep the towers from being set against the skyline.

It is however important to note at this stage that these potential route corridors have only been supported by drive though surveys and not detailed on-site investigations.

It is accepted that the scale of the proposed 275kV would be highly visible in the landscape, however, with careful route selection its impacts can be reduced. The countryside, through which the proposed route would pass, is generally of a high quality where landscape character and visual amenity are potentially sensitive to change from a development of this nature.

Dungannon Drumlins and Hills

- Use was made of the natural screening potential of the drumlin topography.
- Gaps between drumlins were used to provide potential corridors.
- Where possible, pylons/lines would be seen against a backdrop of drumlins.
- Drumlin landscape creates special difficulties in route selection due to the nature of changes in levels
- There is difficulty in creating straight lines in a drumlin landscape which is constantly changing.
- There are numerous dwellings scattered throughout the area, and so potential routes were chosen to avoid these where possible.
- Numerous hedgerows, individual trees and pockets of woodland, help to create intermittent enclosure in the landscape which can be exploited for route selection.
- Avoid the higher ground so that the pylons/lines are not seen on the skyline.

Blackwater Valley

- There is the potential to create a straight route way through part of the study area down the wide valley of the river Blackwater as the drumlins are of low elevation.
- Ground conditions for pylons on the valley floor may not be suitable.
- There are few dwellings on the valley floor. Dwellings tend to be along the roads which are higher up the valley sides away from the flood plain.
- The valley is classified as a secluded secret landscape, rural, peaceful and unspoilt. The inclusion of power lines and pylons running down the river valley would have a significant impact on the above and should be avoided.
- The Ulster Way skirts a large section of the valley. Loughgall Orchard and Lough Neagh Peatland
- In these areas the landscape is much flatter so that the route would be highly visible.
- To avoid two 275kV power lines close together by the proposed Drumkee Grid Sub Station, it is recommended that part of the new 275kV line be placed underground.
- The M1 motorway is a major constraint and a suitable crossing point needs detailed study.
- The urban area of Dungannon and the existing green belt are important constraints on route selection in this area.

4.4 Assumptions / Caveats of Route corridor

This section details the assumptions, comments and caveats associated with the aforementioned route corridors.

General Assumptions / Comments

- No survey took place of the proposed corridor nor was it walked. Only a drive by survey of all road crossings to check as to the feasibility of the corridor along with ensuring adequate clearances from existing developments.
- It is assumed no additional quarries, mines, airstrips, gas lines, landfill sites will come on stream. Existing quarries will not extend beyond present geographical limits.
- Rights of way, historical trails etc. were not marked up on constraints maps. It is assumed walking routes (Walk ways) e.g. 'Ulster Way' walking route can be crossed without wayleave / planning problems.
- The Route has not been agreed with the Planning authorities, Public bodies or landowners at this stage.

Planning permission for Substations

- It is assumed Planning permission will be received for proposed Drumkee 275kV Substation.
- It is assumed that Arva Substation will be able to accommodate the proposed 275kV line and associated equipment in through the south face of the compound.

Protection of route corridor

- The corridor varies in width from 2 - 3 kilometers in some locations to pinch points of approx 300m elsewhere.
- It is assumed that the route corridor will not be further encroached by development including, Ribbon housing, Transmission lines, Roads etc.

- No additional areas are added to the NHA's, SAC's listings.
- No additional archaeological sites/monuments are added to listings.
- Urban commercial/residential zones are not expanded beyond present limits in towns e.g. Cavan, Scotstown, Smithborough etc.
- Additional scenic viewing points, scenic drives etc are not added by County Councils etc.
- Proximity to Secondary Amenity Areas will not incur planning restrictions e.g. minimum distance in sight lines etc.
- No planning restrictions on routing through Designated 'Greenbelts' in Northern Ireland.
- Dismantled railways are not refurbished and used commercially again on or near the proposed route corridor.
- The proposed incinerator site near Emyvale will not be relocated and no other commercial/industrial developments will take place in or near route corridor e.g. wind-farms, manufacturing plants, etc.

Electrical Infrastructure

- Crossings of existing transmission lines were not investigated
- Conflicts with existing distribution network including 38kV, 33kV, 11kV, 10kV and LV have not been investigated or quantified
- Conflicts with existing communication lines including Eircom & B.T have not been investigated or quantified.
- No future transmission/networks lines are built in the corridor area.

4.5 Conclusion

This feasibility study identifies possible overhead line route options from Arva to proposed Drumkee substation. The last remaining section of line into Drumkee will be cable already discussed. The total length of route is approximately 100 kilometers. This route is dependent on a number assumptions as listed above in section 4.4.

The approximate route length in the Republic of Ireland is 75 kilometers. There is only one viable route corridor exiting Arva station.
This route extends approximately 20 kilometers and splits into two options East of Cavan town. These two options converge and diverge into two further options just south of Newbliss, before finally converging again just south of Scotstown. From here the route corridor heads to the border to link with the NIE route.

The route above will be dependent on a number of factors amongst these, the proposed Arva-Shankill 110kV line No. 2. This new 110kV line may encroach on the selected 275kV route corridor. It is not expected this encroachment would have a severe impact on the proposed 275kV route corridor. Another factor to be considered is the crossing of the Black Pig's Dyke and whether it would be possible to over sail this both from an archeological and planning point of view. A more detailed investigation is needed to ascertain this, possibly at planning stage, refer section 4.2.3. Also of concern is the extent and spread of ribbon development that may impact on the route corridor chosen for this project especially around urban areas, e.g. Cavan town. Also the rapid growth of houses in the country side in the route corridor area will in time restrict the corridor chosen at this time.

In Northern Ireland there are two main route corridors. Similar to the ESB route in the Republic of Ireland the main threat to these corridors is the relentless ribbon development along the main arterial routes and some rural roads.

The L8 pylons are typically 35-45m in height and given that the terrain is mostly undulating drumlins of varying heights it should help break up short and medium impact. The negative side of this type of landscape is due to the loose scattering of drumlins which make it virtually impossible to reduce the number of angle towers and bends without compromising visual impact by moving onto higher ground.

5.0 COSTINGS

5.1 Introduction

This section provides the budgetary estimates of the project. The costs are split between station, overhead line and cable works. The costs are subject to a number of caveats as detailed below.

5.2 Caveats

The caveats associated with this project are divided into various categories as detailed below:

Financial

- All costs are preliminary and gross based on Unscoped Estimates
- The costs assume February 2004 construction rates.

Technical

- The costs are unscoped, i.e. the scope of the project has not been defined.
- The costs only assumed a nominal amount of difficult foundations for transmission line structures.
- The costs assume standard materials will be used for construction, i.e. no special camouflaged conductor, no cold formed steel on towers, no camouflage painting of towers.

Third Parties

- The costs assumed only nominal difficulty from wayleaves, with Easement purchasing at most road crossings.
- The costs assume no financial burden associated with organized objection groups.

Construction

- The costs assume zero delay during construction phase.
- The costs assume no new archaeological site impacting upon the development will be discovered during construction,
- Scaffolding requirements for major and minor road crossings are an unknown entity.

5.3 Conclusion

From Table 1 it can be seen that the approximate cost of construction for the single circuit option is 86 million, this excludes the cable section into Drumkee station. This figure compares to 128 million for the double circuit, which again excludes the cable section.

The percentage increase from single circuit to double circuit line excluding cable costs is 48%, this compares to an increase of 56% for the stations element.

Table 1 Budgetary Estimates for Arva - Tyrone 275kV Line

		Single circuit 275kV Lattice tower	Double Circuit 275kV Lattice tower
		Total	Total
		€	€
Overhead Line	75km in Republic.	58,500,000	85,500,000
	25km Northern Ireland	14,895,833	23,298,166
Station	Arva Substation	12,250,000	18,750,000
	Drumkee Substation	794,500	1,588,900
Total (Lines & Stations)		86,440,333	129,137,066
Cable	Option 1: 0.75km from Drumkee	556,111	953,333
	Option 2: 4.0km from Drumkee	3,177,777	5,561,111

Produced by: NIE & ESBI
Date: February 2004.

Assumptions / Notes:

All costs are preliminary and gross based on Unscoped Estimates
Arva substation costs assume that sufficient space is available in the station site or is easily available adjacent to station site
It is assumed that there are no excessive costs arising from the planning process, planning conditions or foundations
Overhead Line costs include allowances for wayleave compensation
A rate of €1.43 to £stg is assumed
All other notes as detailed in section 5 of this report.

6.0 RECOMMENDATIONS

If a transmission line connection is required between Arva and Drumkee 275kV station it is recommended that further detailed route assessment be undertaken based upon the potential route corridors as detailed in this report. The line connection will remain overhead from Arva to a few kilometers south of Drumkee station. From here it is recommended to cable the final section. The exact distance depends on the option chosen.

From an Environmental perspective there is good merit in choosing single circuit lattice tower design, as smaller structures would perhaps blend into the environment. However if System planning has identified the necessity for double circuit, then it is recommended to construct one double circuit line as opposed to single circuit lines.

It is recommended the line (whether single or double circuit) should be constructed using standard lattice steel towers.

The final connection into the proposed Drumkee substation will be by a short length of underground cable. This may dramatically increase should difficulty be experienced obtaining suitable crossing points over the M1 Motorway and in particular the ‘pinch point’ at Killyman village.

It is recommended detailed site investigation, independent route evaluation and costing be undertaken if these route corridors are to be considered for future interconnections.

7.0 CONCLUSION

This feasibility report concludes that after investigating the requirement of additional transmission interconnecting route corridors between Northern and Republic of Ireland, that potential route corridors are currently available as detailed in this report and shown on the attached Maps No.1 A3 Route Map and Map No. 3 North-/South Interconnector – Route Options.

These route Corridors can accommodate an overhead line from the existing Arva 110kV station in County Cavan to a cable interface location a few kilometers south of the proposed Drumkee substation in County Tyrone.

The route corridor will remain under threat from expanding infrastructural development and one off housing. The corridor varies in width from 2 – 3 kilometers in some locations to a reduced width of approximately 300m at various pinch points.

Continuing commercial sensitivity of this proposal should be strictly adhered to as planning permission has not been granted for the proposed ‘target’ Drumkee substation.

APPENDIX I

- **Map No. 1 A3 Route Map**
- **Map No. 2 North-/South Interconnector – Physical Constraints**
- **Map No. 3 North /South Interconnector – Route Options**