

CONSTRAINTS STUDY REPORT

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APPENDICES (NOT INCLUDED)**Appendix A Extract from Road Schemes Development Guidelines and National Roads Project Management Guidelines**

Phase 2 Questionnaires

Appendix B Environmental Sub-consultants Reports and Duchas Designations

Sub-consultants Reports included are as follows:

Margaret Gowen & Co. Ltd. Archaeological Constraint Study

Roger Goodwillie & Associates Ecological Constraints

Brady, Shipman Martin Landscape and Visual Aspects

Duchas Descriptions of pNHA and cSAC areas

Appendix C Constraints Maps

Maps included with this Report are as follows:

046-011-D-1051	Study Area Key Plan
046-011-D-1052 to 046-011-D-1058	Constraints Study Showing Community Activities: Plan A to Plan G
046-011-D-1059 to 046-011-D-1065	Constraints Study Showing Drainage and Sewerage: Plan A to Plan G
046-011-D-1066 to 046-011-D-1072	Constraints Study Showing Environmental and Heritage: Plan A to Plan G
046-011-D-1073 to 046-011-D-1079	Constraints Study Showing Roads and Planning Layout: Plan A to Plan G
046-011-D-1080 to 046-011-D-1086	Constraints Study Showing Landowners: Plan A to Plan G
046-011-D-1087	Constraints Study Development Plans

1. EXECUTIVE SUMMARY

The purpose of the Limerick Southern Ring Road project - Phase II is to link the proposed Limerick Southern Ring Road Phase I, which connects the N7 Dublin Road with the N20 Adare to Rossbrien Road (which is currently being constructed), with the N18 Ennis Road.

Traffic studies carried out in recent years on behalf of the Local Authorities have indicated that significant volumes of traffic which use the N18 Ennis road are either coming from, or going to, areas east and south of Limerick City. This traffic primarily uses Shannon and Sarsfield Bridges in Limerick City to cross the Shannon leading to significant congestion in the centre of Limerick. Completion of the Limerick Southern Ring Road, by building the Phase II section, will put in place an east-west bypass of the city, allowing trans-city traffic to avoid the central area.

The purpose of this Report is to map all the identified constraints within the Study Area that might impact on choosing potential routes for the Limerick Southern Ring Road Phase II Scheme. This data collection is focussed on determining what constraints (physical, procedural, legal, environmental, etc.) exist that could affect the **design** of the scheme, that could delay the **progress** of the scheme, and that could influence the **cost** of the scheme.

The constraints noted in this section have been identified as being of primary importance for the route selection of the Limerick Southern Ring Road Phase II project. This does not of course insinuate that other constraints identified elsewhere in this Report are unimportant, rather that there are some constraints, which are identified as being of greater significance in the overall development of the scheme.

The primary constraints are identified to be the following:

Community Impact Constraints

- **Coonagh East and West**, issues of severance and social impact
- **Raheen and Ballinacurra**, implications of scheme on development of these areas

Environmental Constraints

- The **proposed National Heritage Areas (NHA) and candidate Special Areas of Conservation (SAC)** for the Ballinacurra Creek and the Shannon Estuary itself, which include the triangular club rush plant which is a protected species. Loughmore Common is also indicated by Duchas to be a proposed NHA
- The **Irish Cement tailings pond** at Bunlicky is a conservation area, proposed NHA.

Physical Impacts

- There are extensive **embankments** on both banks of the River Shannon. The highest flood level recorded in Limerick was 4.16mOD Malin in 1961, with a similar level being recorded at Christmas 1999. The embankments generally are at a design level of 5.5mOD Malin, but decreasing to 4.05mOD Malin in the vicinity of Ballinacurra Creek. These embankments will represent substantial constraints in terms of their intersection with a proposed route, particularly for low level structures connecting to a tunnel.
- The existing **Irish Cement** works provides a considerable physical constraint to any proposed route within the Study Area. Refer also to Business Interests below

- The new **Limerick Main Drainage** works within the Study Area runs parallel to Ballinacurra Creek, with proposed treatment works at Bunlicky and Corkanree.
- Existing **Utilities**, in particular water, sewage, power and telecommunications apparatus.
- Existing **Road Infrastructure**, in particular the N20 Cork Road and N69 Dock Road which are likely to be crossed by the proposed scheme. These are very heavily trafficked routes, and the short term construction disruptions and long term junction needs must be carefully considered.
- A major constraint is the existing **Irish Rail** infrastructure serving Mungret and Foynes which is required to service the Irish Cement facility and the Port of Foynes respectively. Disruption to these lines, which incorporate level crossings, would have significant consequences on the operations at Irish Cement particularly, and also at Foynes.

Business Interests

- The **Port of Limerick**, operated by the Shannon Estuary Ports Authority, and continued shipping access to the Ted Russell Dock, upstream of the crossing is a major constraint. The particular requirements for access to the dock (approximately 2 hours time window at high tide), the fact that ships cannot stop or turn around in the River and the prevailing currents are all significant constraints on a possible low level bridge option with opening section. The traffic impacts of such a crossing could be very negative and unsatisfactory. Allowing for appropriate air draft and having regard to international practice, a clearance over high water for a high level bridge of 30m is likely to be required. This clearance should satisfy all likely future requirements of pleasure craft in accessing Limerick also.
- **Irish Cement** operates a large cement works within the Study Area. Recent approved planning applications for plant and quarry extensions will provide capacity at current levels for the next 50 years or so. Irish Cement have extensive land holdings west of the current operations, currently in agricultural use. Any road route which severed the current operation from these lands to the west would be a very significant constraint on the long term strategic plans of Irish Cement.

Visual and Landscape Constraints

- The **low-lying nature of the landscape** adjoining the Shannon Estuary, down stream of the City of Limerick will result in significant visual / landscape impacts for future bridge structures, particularly high level bridge structures. These will require the most sensitive treatment in architectural and landscape terms,

These constraints in addition to other constraints within the broad categories above, and other constraints relating to cultural heritage, archaeology, landuse, leisure, recreation and general environmental factors have been identified in this study.

Potential routes will be examined as part of the Route Selection process having regard to these constraints and bearing in mind the need to mitigate adverse impact as far as possible.

2. INTRODUCTION

2.1 Overview of Proposed Scheme

The Limerick Southern Ring Road - Phase II Scheme consists of a grade separated dual carriageway. The route will include interchanges with existing and proposed roads, a river crossing of the Shannon and other structures such as overbridges and underbridges and link roads as required to allow the continued flow of traffic on the existing road network.

Phase II is a continuation of an existing project, extending the Phase I section to join the N20 to the N18. This Scheme will complete the Limerick Southern Ring Road, and link all the national roads coming into Limerick:

- N18 from Ennis
- N69 Dock Road from Foynes
- N20/N21 from Cork/Kerry
- N24 from Tipperary
- N7 from Dublin

Limerick County Council (the Client), acting on behalf of Clare County Council, Limerick Corporation and themselves, has engaged the services of M.C. O'Sullivan & Co. Ltd and COWI (MCOS-COWI JV) to:

- (a) (i) Evaluate the need for

And

- (ii) Recommend the route of

a Limerick Southern Ring Road Phase II.

In this context, the Limerick Southern Ring Road Phase II is to be taken as a route from the N18 (to the north west of Limerick City) to the proposed Southern Ring Road Phase I (on the south eastern side of Limerick City) including associated roads, junctions and links. The recommendation on route is to include carriageway recommendations and recommendations on type of River Crossing.

- (b) Satisfy the requirements of Phases 2, 3 and 4 of the Road Schemes Development Guidelines Manual produced by the National Roads Authority.

There are three stages in the process of identifying the land required for the Scheme:

- Constraints Study – this Constraints Study Report is the culmination of this stage
- Route Selection – A route Selection Report will be prepared for the Client
- Preliminary Design/CPO/EIS – sufficient design is carried out to allow the CPO process to proceed, and an EIS is prepared

The project is earmarked as a Pilot Public Private Partnership Scheme (PPP). Following on from the above the remaining stages for a PPP Scheme are Ministerial Approval, Contract Documents, Design/Build/Operate/Finance (DBOF) Tendering, the preparation of the Detailed Design, Construction, and Operation of the project by the Contractor.

Timeframe for the above stages is expected to be as follows:

- Constraints Study Report – March 2000
- Route Selection Report – September 2000
- Preliminary Design/CPO/EIS Process – April 2001
- Ministerial Approval – Late 2001

- DBOF Tendering – Early 2002
- Award of Tender – Late 2002
- Construction – 2003-2006

The process of Constraints Study followed by Route Selection is a continuation of the forward road planning process for the Limerick Southern Ring Road, which commenced almost twenty years ago and encompassed the preliminary studies carried out on route selection by DeLeuw Chadwick OhEocha in the middle 1980s. Phase I of the Limerick Southern Ring Road has been through the consultation process and is expected to go out to tender for construction this year.

2.2 Study Area

Broadly, the Study Area encompasses the area bounded by Meelick, Caherdavin, Rossbrien, Rootiagh, Barnakyle and Corbally, as indicated in Figure 2.1. This Study Area is believed to contain all likely route corridors. The drawings attached to this Constraints Report split this Study Area into 7 sections as indicated overleaf, for convenience of mapping.

A large area, encompassing the Study Area, was flown in late 1999 to provide aerial photography to aid in identification of physical constraints, and this mapping has been used as the basis for the 7 drawings which comprise the Constraints Mapping. This mapping will also be used for identification of viable alignments for potential Scheme routes at the next stage, the Route Selection Stage.

2.3 Purpose of Report

The purpose of this Report is to identify all the appropriate constraints within the Study Area which might impact on choosing potential routes for the Limerick Southern Ring Road Phase II Scheme. This data collection is focussed on determining what constraints (physical, procedural, legal, environmental, etc.) exist that could affect the **design** of the scheme, that could delay the **progress** of the scheme, and that could influence the **cost** of the scheme.

2.4 Public Information Sessions

The guidelines for road schemes are clearly laid out in the 1999 NRA Road Scheme Development Guidelines publication. These guidelines include for a Public Information session prior to issuing of the Constraints Report. Sessions were held as follows at the Greenhills Hotel on the N18 Ennis Road in Limerick:

- Session for Elected Representatives on 6th March 2000 at 8:15pm
- Sessions for the general public on 7th and 8th March 2000 (10am-12pm, 2pm-4pm, 6pm-8pm)

The following mapping was displayed at these public information sessions:

- A0 mapping
 - Discovery Series map of Study Area
 - Ordnance Survey map showing landowners
- A1 Mapping
 - Orthophotography mapping of Study Area
 - 7No. constraints maps prepared
 - National Routes map of Region

Presentations were made to the Elected Representatives by the MCOS-COWI JV, and by the National Roads Authority on the project in general and Private Public Partnerships respectively. At all sessions MCOS-COWI JV staff and Limerick County Council staff were available to answer questions on the scheme.

Approximately 15 elected representatives and 120 members of the public turned up for the various sessions. An Information Leaflet was distributed to all attendees, along with a Questionnaire to get general views on the project. Concerns related primarily to the following:

- Coonagh Village
- Land Ownership and Planning Permissions
- Boating interests in the Shannon
- Commercial use of the Shannon
- Options for Traffic to Bypass Limerick City
- Types of Crossing

There were 74 questionnaires submitted at the door. Some people took their questionnaires away with the intention of completing them elsewhere, hence more responses may be forthcoming by post.

All participants agreed in principle with the need for the proposed scheme. Some new issues were raised which have now been considered further on in this report. The clearance for yachts from Foynes Yacht Club was discussed along with the possible impact on reed harvesting during construction of a river crossing. The introduction of cycle lanes was also discussed. Other more general issues were raised repeatedly: the impact on the Coonagh area, visual impacts of a high level bridge, traffic congestion at Coonagh roundabout and the N18 Dock Road and the urgent need for the road scheme.

The public information session was an overall success and gave people from the local area an opportunity to input to the project at the outset of the scheme.

Attendees were asked in the questionnaires to rank various items in terms of importance in choosing a route for the Limerick Southern Ring Road Phase II. Figure 2.2 overleaf indicates the relative importance to the attendees of each item. In summary:

- A lot of people consider the traffic benefit of the proposed road to be the most important issue in choosing a route. Traffic Benefit received a majority of Highest Merit Factor 1 votes. No one considered traffic benefit of the scheme to be lower than a factor 4.
- A large number of people considered impact on the community to be the second most important issue.
- A large number of people considered the cost of the scheme to be the least important consideration. Cost of scheme received a majority of merit factor 6 votes.
- A large number of people considered the environmental impact to be the third most important issue.
- A large number of people considered the impact on industry to be the fourth most important consideration.
- A large number of people consider the impact on shipping to be the fifth most important consideration.
- No one considered the impact on shipping to be important enough to assign a merit factor 1.

Analysis Of Questionnaires

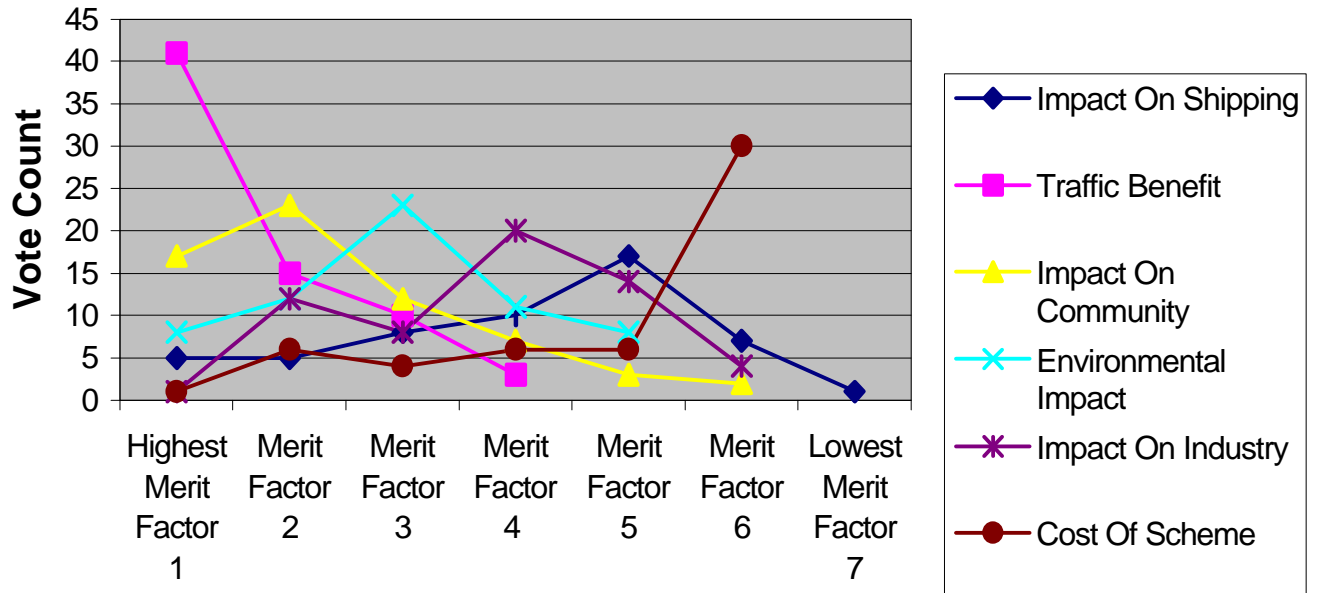


Figure 2.2 – Public Questionnaires – Importance of Issues in Choosing Route

3 ROUTE CONTEXT AND KEY ISSUES

3.1 Purpose and Need for Project

The purpose of the project is to link the proposed Limerick Southern Ring Road Phase I, which connects the N7 Dublin Road with the N20 Adare to Rossbrien Road (which is currently being built), with the N18 Ennis Road. Refer to Figure 3.1 overleaf for the national road context.

Traffic studies carried out in recent years on behalf of the Local Authorities have indicated that significant volumes of traffic which use the N18 are either coming from or going to areas east and south of Limerick City. This traffic primarily uses the Shannon Bridge in Limerick City to cross the Shannon, and then goes south either via the N20 or the N69 Dock Road. This leads to significant congestion in the centre of Limerick. It is expected that the proposed Limerick Southern Ring Road Phase II will alleviate a large proportion of this congestion by the removal of bypassing traffic, including long-distance traffic. By completing the Southern Ring Road, it will put in place an east-west bypass of the city, allowing trans-city traffic to avoid the central area.

3.2 Review of National Development Plan

Public Private Partnership (PPP)

Provision has been made for £1.0 billion of public private partnership funding to the roads sector. This is a minimum target. The objective is to maximise the use of public private partnerships consistent with the principles of efficiency and the best value for money. The Southern Ring Road Phase II is included as a Pilot PPP Project.

Infrastructure Deficits

The following is an extract from the National Development Plan (Chapter 2, National Development Strategy and Priorities for 2000 – 2006, section Infrastructure Deficits, subparagraph 2.11):

- *Roads are the dominant mode of internal transport in Ireland accounting for 90% of freight traffic and 96% of passenger traffic. Despite the investment programme under the 1994 – 1999 Transport OP the road network is still inadequate by reference to needs and EU standards. Rapid economic growth over recent years has put an even greater strain on this inadequate road infrastructure with serious congestion now a feature of parts of the network. If this congestion is not addressed promptly in a systematic fashion the competitiveness of the economy will be impaired with adverse consequences for growth and employment.*

National Roads

A strategy for national roads is outlined in Chapter 4 of the National Development Plan:

The primary road transport objectives are:

- *to improve the reliability of the road transport system by removing bottlenecks, remedying capacity deficiencies and reducing absolute journey times and journey time variance.*
- *to improve internal road transport infrastructure between regions and within regions, contribute to the competitiveness of the productive sector and foster balanced regional development.*

- ***to facilitate better access to and from the main ports and airports with the main objective of offsetting the negative effects of peripherality***
- *to contribute to sustainable transport policies, facilitating continued economic growth and regional development while ensuring a high level of environmental protection;*
- *to help achieve the objectives of the Government's Road Safety Strategy in relation to reduction in fatalities and serious injuries caused by road accidents.*

The N7, N24, N18 and the N20 are specifically programmed to undergo major improvements within the plan period. It is considered essential that the overall programme of economic infrastructure in the National Development Plan be completed within the plan period. This is necessary to reduce constraints on economic growth and to cater for traffic growth, particularly on the National Routes.

3.3 Review of National Road Needs Study

The National Roads Authority (NRA) published, in July 1998, the National Road Need Study, outlining the development needs of the network of National Roads for the period 2000-2019.

The key findings included the following:

- *Roads are the dominant mode of internal transport in Ireland, accounting for 89% of freight traffic and 96% of passenger traffic.*
- *The provision of an adequate transport infrastructure to support necessary economic growth is a fundamental objective of a sustainable Transport Policy.*
- *Ireland's peripheral island location, without a land link to the rest of the European Union, requires efficient access to ports and airports in order to minimise the economic disadvantage of the absence of a landlink.*
- *Development in Ireland is characterised by a dispersed pattern of human settlement and economic activity, though with increasing concentrations in the vicinity of the major coastal cities of Dublin, Cork, Limerick, Galway and Waterford, in addition to Belfast in Northern Ireland.*
- *A sustainable Road Transport Policy requires integration of development needs with environmental protection and conservation. This requires a continued focus on the elimination of bottlenecks and inefficiencies in the infrastructural system, diversion of traffic away from communities where practicable, upgrading of existing alignments where this is an option rather than new routes, identification and mitigation of adverse environmental impacts, with effective public consultation in the planning stage.*
- *The development of a sustainable Road Safety Policy has regard to the functional use of the road network, resolution as far as possible of the conflict between the different user categories, the achievement of a consistency of road type leading to predictable use and behaviour, risk assessment and the carrying out of safety audits.*
- *Reference to European and other International best practice is made in the Study with a view to informed decision making in relation to road types and capacities, having regard to long distance, mixed and commuter traffic.*

The level of service provided by the N69 Dock Road from Foynes to Limerick was measured

in the NRA Road Needs Study to be mainly level of service D to E in Limerick City, where passing becomes impossible and intense platooning occurs. Similarly, the N20 Cork Road was measured to be mainly level of service D to E. It has been recognised that traffic flows on these routes have increased since the Study was carried out.

Having regard to these findings, the construction of the Limerick Southern Ring Road inclusive of a river crossing is identified as an important requirement to relieve traffic congestion in Limerick City and environs. The proposal for the Limerick Southern Ring Road Phase II Scheme completes this objective.

3.4 Review of the County Development Plans

The Limerick Southern Ring Road Phase II scheme is being undertaken by Limerick County Council on behalf of Limerick Corporation, Clare County Council and themselves. There are development plans available for each local authority, as follows:

- * **Limerick County Development Plan (1999)**
- * **Clare County Development Plan (1999)**
- * **Limerick Corporation (1998)**

The Limerick County Council Development Plan is augmented by the **Caherdavin District Development Plan (1998)** and the **Southern Environs District Development Plan (1999)**.

Limerick County Council

The Limerick County Development Plan deals with the period 1999-2004. There are also Development Plans published for the Caherdavin District (1998) and the Southern Environs District (1999) including amendments to each. The Southern Ring Road Scheme, linking the N7 to the N18, is listed in the County Development Plan, as being one of a number of schemes which are of fundamental importance to the development of the county.

The following is an extract from the Limerick County Development Plan (1999):

Having regard for the need to promote the economic development of the County, Sustainable Development – A strategy for Ireland and the need to preserve the safety and capacity of the road network in the County, it is the policy of the Local Authority:

To provide, and allow for the provision of, and carry out major upgrading and improvements to National Routes in the county including the provision of pavements overlays to existing roads, the provision of new sections of road and the provision of bypass roads or relief routes to towns on these routes where their provision is necessary on planning, traffic or environmental grounds.

The Southern Ring Road is mentioned as follows in Chapter 11, Section 11:6 under Objectives:

N7 Dublin Road

(b) Southern Ring Road

Complete land acquisition and commence construction of the Southern Ring Road , from Rossbrien to Annacotty when funds become available. Complete design work for the remainder of the scheme.

The 'Southern Environs District Development Plan' (1999), the successor to the Environs chapter of the 1991 version of the Limerick County Development Plan, includes Phase II of the Limerick Southern Ring Road Scheme as an objective of the current plan period, which will link the new Adare-Annacotty Road to the N18 (Ennis Road). This recognises that the completion of the Southern Ring Road is essential to link the N18, Shannon Airport and the

Western City Environs to the eastern area of Limerick City, its hinterland and the major National Routes to the south and east.

Clare County Council

The County Development Plan deals with the period 1999-2004. The Limerick Southern Ring Road Scheme does not appear to be explicitly mentioned in the Clare County Development Plan (1999). However, Part 3, which lists Development Objectives, indicates the following under Section 3.3 Roads:

The following outline the Council's development objectives in respect to roads in the county for the Plan period:

R.8. The continuation of the upgrading of the N18 National Route including the design and reservation of land for and construction of so much of the Limerick Southern Ring Road Phase 2 as will lie in County Clare.

Limerick Corporation

The Limerick Corporation Development Plan refers to the Land Use and Transportation study of the Mid West Region which was presented in 1971. This study identified the need for two additional bridges to improve cross river traffic flows:

- A bridge at Corkanree as part of an outer ring road system
- A bridge at Mallow Street.

The bridge at Mallow Street has since been built and is now called the Shannon Bridge.

The following is an extract from the Development Plan relating to lands which have been reserved for roads:

R4. Outer Southern Ring Road

In addition, the following is noted in the Development Plan:

The Shannon Bridge and its associated access roads, have been completed and are contributing significantly to the improvement of the flow of cross river traffic.

The outer Limerick Southern Ring Road, including the river crossing, is needed to complete the solution.

3.5 Section 59 Agreement

Section 59 Agreements are being put in place between the Local Authorities such that Limerick County Council is to procure the Limerick Southern Ring Road Phase II Scheme on behalf of:

- Limerick County Council
- Clare County Council
- Limerick Corporation

3.6 Traffic Issues

Traffic studies for the Greater Limerick area have been carried out at various times in recent history:

- **1983 – 1987**
By DeLeuw Chadwick OhEocha on behalf of Limerick County Council.
- **1997**
By the Road Design Office of Limerick County Council on behalf of Limerick Corporation.
- **1998/1999**
By Ove Arup and Partners Ireland on behalf of Limerick Corporation.
- **1999-ongoing**
By Colin Buchanan and Partners as part of the Limerick Planning, Land Use and Transportation Study (PLUTS), on behalf of Limerick Corporation.

The PLUTS study is ongoing, and a draft report on traffic flows with recommendations is expected shortly from the Consultants.

The 1997 study by the Road Design Office of Limerick County Council indicated key concerns as follows:

- *The roads on the inner city cordon that are experiencing capacity problems were:*
 - ◇ *Dublin Road at Groody Bridge*
 - ◇ *Ballinacurra Road*
 - ◇ *Shannon Bridge*
 - ◇ *Dock Road*
 - ◇ *Corbally Road*

Three of these roads are main arterial roads carrying National Primary Routes into the City: N7 at Dublin Road, N20 at Ballinacurra Road, and N18 at Shannon Bridge, with the Dock Road connecting the National Secondary Road N69. The Dock Road acts as an access to major industrial areas and as an alternative route for traffic between the N18 and the N20, and the Corbally Road serves as the only access route to the large and growing residential area to the north-east of the city.

This study indicated that the proposed Limerick Southern Ring Road from Adare to Annacotty would relieve congestion at the Ballinacurra and Dublin roads by approximately 20%. A fourth river crossing in addition would in all likelihood remove up to 40% of traffic from the N69 Dock Road (National Secondary Road) and Shannon Bridge due to the large traffic volumes between the N18 Ennis Road and southern routes.

Thus, the indication was that a route between the Limerick Southern Ring Road Phase I and the N18 Ennis Road to the south/west of the city would be beneficial in reducing traffic congestion in the environs of Limerick City.

3.7 Tolling and Public Private Partnership Issues

There is a Government policy decision to implement the scheme as a pilot PPP project, on the basis of design, build, operate and finance (DBOF). A separate Brief on tolling is being prepared to assess the feasibility of the project for tolling on behalf of the National Roads Authority. Under the current Brief which the MCOS-COWI JV has with Limerick County Council the scheme will be developed to CPO stage both with and without tolling provision.

3.8 Legal Issues

There are many legal issues which must be considered as constraints to the overall ultimate completion of the project and which need consideration at appropriate stages. These include:

- Requirement for a Foreshore Licence, both for site investigations within the river and for any temporary or permanent structures located in or affecting the river
- Format of CPO to be followed, inclusive of any changes required under the forthcoming Planning Bill
- European and Irish environmental legislation
- EIS format and changes on foot of 1999 Regulations
- Navigation and Aviation Rights
- Rights of statutory undertakers, inclusive of who pays for moving plant if required
- Text of amendments to Local Authority Development Plans
- Affect on Aerodrome/similar facilities and ability to acquire compensatory land if required
- Railways implications and acquisition of land for rail
- Intermediate stage procurement
- Wayleaves
- Site Investigation Notices
- PPP and Tolling Legislation

Ships leaving the Ted Russell Dock for the downstream voyage are typically in ballast with a higher freeboard and are thus more sensitive to crosswinds. Ships will normally leave the dock around HW. They will in most cases face a headwind due to the prevailing westerly wind in the area and a 1-2 knot current will aid the downstream voyage. The vessel speed in the Study Area between Ballinacurra Creek and Coonagh Point is around 9 knots, with a relative speed of approximately 7-8 knots.

Pilotage is compulsory for all vessels navigating eastwards of Scatterly Island (refer to Figure 4.1). Navigation on the upper sections of the estuary can be performed both at night time and with reduced visibility by means of navigational aids in the water and on the ships (light buoys and radar). Navigation is avoided in dense fog.

The navigation route is marked with starboard/port hand buoys and light towers at critical bends.

4.2.1.1.2 Bathymetry and Hydrographic Conditions

Bathymetry

In the Study Area, the width for navigation is around 100-150 m (width with water depth exceeding Chart Datum (CD)). Normally navigation is restricted to a 50-80m zone close to the buoy markings. Turning of ships is not possible in the upper sections of the river.

The latest edition of Admiral Chart 1540: "River Shannon - Shannon Airport to Limerick" is dated 5th June 1981. A detailed survey of the bathymetry in the crossing corridors will be carried out in the next phase of the project. This will elucidate any change to the bathymetry as compared with the chart information available at present. According to information from the Harbour Master limited maintenance dredging is carried out in the Study Area, confined to clearing of bed silt which can accumulate in dry weather Summer conditions when river flows are at minimum levels for sustained periods.

Regular dredging (on average once a year) is carried out in front of the Ted Russell Dock. Quantities of 150,000-200,000 m³ are reported dredged annually. Dredged material is dumped downstream of Ballinacurra Creek. Normally the water flow in the river is sufficient to flush the dredged material away except during dry summers where accumulation may occur on the banks of the river.

Tidal information

Tidal information is available for Tarbert Island and the Ted Russell Dock. The tide tables indicate time (U.T.C. = Universal Time Co-ordinated) and predicted height of the High Water. Apart from the governing semidiurnal tidal fluctuations, the water level will also be influenced by the meteorological conditions. South to westerly winds usually increase the water level while north to easterly winds tends to decrease it. The former are the normal conditions so that tide levels in Limerick are normally at or above predictions.

The tidal levels at the Ted Russell Dock are shown in Table 4.1. Important datum relationships are outlined in Table 4.2, and indicated graphically in Figure 4.2 overleaf.

The highest recorded water level at the Ted Russell Dock is 7.32 m (above CD in 1961).

Table 4.1 Tidal level at the Ted Russell Dock (Chart Datum)

Tide	Water Level (above CD) (m)
MHWS	5.9
MHWN	4.5
MLWN	1.2
MLWS	0.4

Table 4.2 Important Datum Relationships. (OD = Ordnance Datum)

Datum	Relationship to Chart Datum (CD)
OD Malin (Project Datum)	(CD +3.173m)
OD Poolbeg	(CD +0.46m)
Limerick Dock Gauge	(CD -1.21m)

Note: Land Datum is normally expressed as OD Malin, thus $MHWS=5.9-3.173=2.727m$ OD Malin.

Currents

Little information is available on currents in the Study Area. The Limerick Main Drainage EIS contains data for one tidal cycle (12 hours) with measurements taken every 2 hours i.e. 7 records in total. It is reported that maximum currents reach 3-4 knots. In the next phase of the project a hydraulic model will be established and current speeds simulated from this. This model will be used to examine impacts from bridge or tunnel options on the flow regime in the river and thus the potential environmental impact.

The river current at the Study Area is mainly controlled by the tidal fluctuations. The Shannon River discharge from Lough Derg/Ardnacrusha and other minor upstream rivers will not significantly influence the river currents around high water at the Study Area and thus effect the shipping conditions.

The Electricity Supply Board (ESB) monitors these discharges and has found that the average release is around $140 m^3/s$. In some periods it may be as high as $4-500 m^3/s$ which would significantly increase the current speeds at low tides (no effect to shipping).

In dry summers where the discharge is low (minimum compensation flow of $10m^3/s$) some siltation takes place in the river and "sniffing" of silt in the bed of the channel can occasionally occur especially if ships wander off the main channel.

Waves

Wind generated waves in the upper section of the estuary will be limited by the reduced fetch. Due to the high number of bends and shoals in the upper section of the estuary it is considered unlikely, though not impossible, that swells from the lower ends of the estuary can propagate to the Study Area. Waves are thus not regarded a problem to the ship traffic in the Study Area.

Salinity

The salinity in the Study Area is low at approximately 1%. This indicates that the water from river discharges along the estuary is carried back with the tidal wave. Little mixing is actually taking place in the upper section of the River Shannon, with fresh water forced up by the incoming tide.

More information on the salinity will be gathered in the next phase of the project.

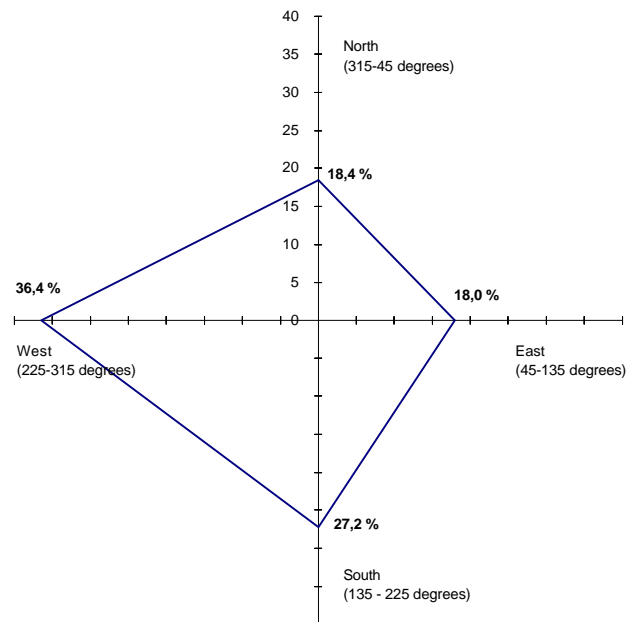
4.2.1.1.3 Climatic Conditions

Wind

Crosswinds are often a cause of navigational problems in restricted waterways. The prevailing winds in the area are from the west and southwest. Statistics based on measurements from the meteorological tower at the Shannon Airport in the period 1970-79 are reported in the "European Wind Atlas", Risø National Laboratory, 1989. Frequency distribution for the four main wind sectors is presented in Figure 4.3.

The mean wind speed is 5 m/s (12 m above ground level). Wind speeds of more than 10 m/s will on average prevail 10% of the time, the higher wind speeds being primarily from the western sector. Occasional high wind speeds of 30 m/s (mean wind) with gusts of more than 40 m/s are reported to occur on average once a year.

Figure 4.3 Wind direction distribution on wind sectors. Based on statistics from Shannon Airport (1970-79) (Ref. "European Wind Atlas", 1989).



Visibility

According to the information received from the Shannon Estuary Ports Authority navigation at night-time and during daytime with reduced visibility is not subject to any special conditions or restraints. Navigation in dense fog is generally avoided. In the event that fog descends when an approaching ship has passed "the Whelps" or has left the Ted Russell Docks then there is no option but for the ship to carry on. As pilotage is compulsory in the area it is navigators with extensive local experience that will decide whether or not to venture into the challenging upper sections of the estuary under poor visibility conditions and thus avoid to be caught in dense fog.

Data on visibility will be collected from the Shannon Airport in the next phase of the project.

4.2.1.2 Ship Traffic

4.2.1.2.1 Ship Data and Statistics

The ship traffic in the Study Area is composed of commercial traffic to and from the Ted Russell Dock and a smaller number of leisure boats.

The commercial ship traffic consists of Coasters, Bulk carriers and Oil Tankers transporting oil, fertiliser, cement, timber/reinforcement for construction industries and export of peat moss. The size of the ships vary but at present both depth, length and width are restricted as the maintained depth in the Dock is 5.5 m (above CD), the maximum berth length is 152m and the width of the dock gate is 21.3m – refer to Figure 4.4.



Figure 4.4 Ted Russell Dock in Limerick.

Based on the information received, ships entering the dock are on average around 3,000 DWT with lengths of 70 - 90m. Maximum vessel size is understood to be 6,000-7,000 DWT.

Statistics received for the Ted Russell Dock for the years 1998 and 1999 show that the yearly number of berths are in the order of 200 (188 in 1998 and 200 in 1999) i.e. the number of vessel movements passing the Study Area is around 400. Statistics for these ships are presented in Figures 4.5 and 4.6. Roughly 1/3rd of the ships are Oil Tankers with the number increasing.

A slight growth in shipping through the port has been noted in recent years. The highest possible number of arrivals and departures in one tidal cycle is 5 (3 outgoing and 2 incoming). The recorded maximum number of arrivals/departures in one week was 24, in December 1996. Shannon Estuary Ports Authority have indicated that the maximum capacity of ship arrivals in the dock in one year is around 400 i.e. double the amount at present, and equivalent to 800 shipping movements per annum.

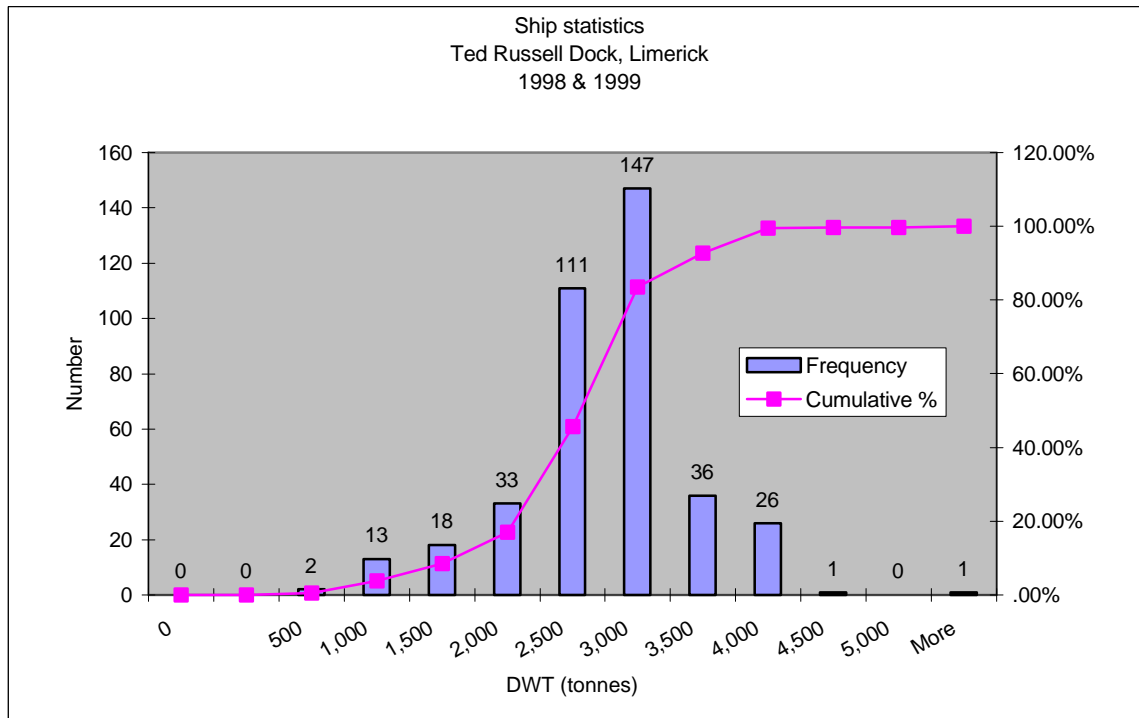


Figure 4.5 Histogram of DWT distribution for ships berthing in the Ted Russell Dock.

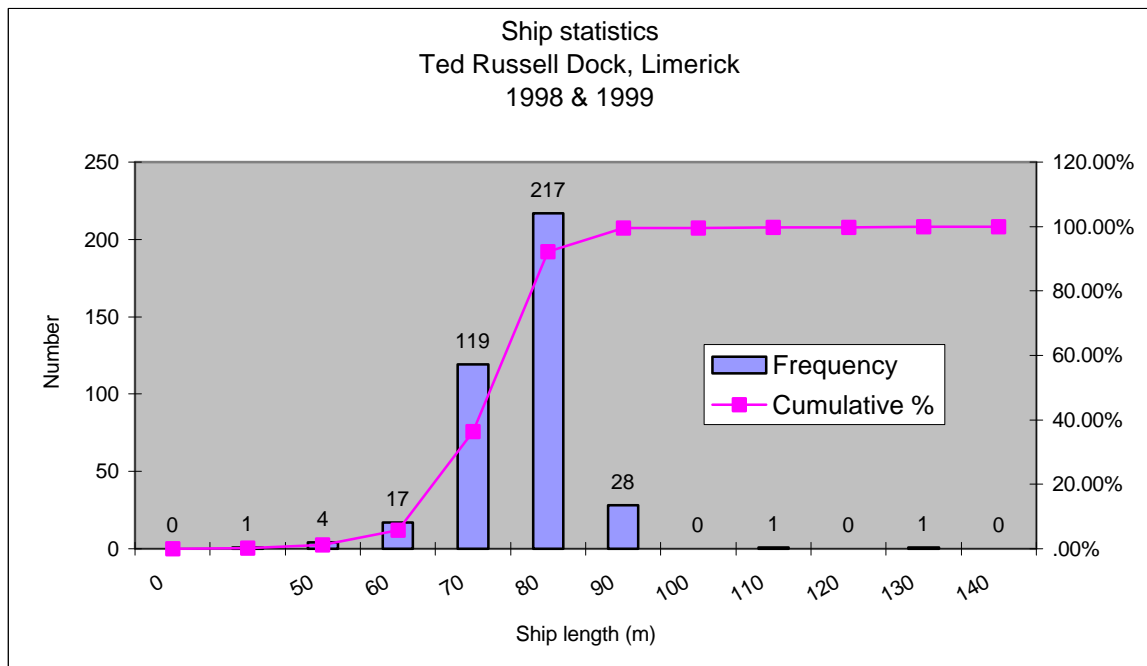


Figure 4.6 Histogram of length distribution for ships berthing in the Ted Russell Dock.

No information is yet available on physical height of the ships. However, with reference to the international ship database established in connection with the construction of the Great Belt East Bridge the maximum air-draft for the typical vessels berthing in the Ted Russell Dock will lie in the range 15-30 m. This range should cover differences in vessel type and construction and the load condition (loaded or in ballast).



Figure 4.7 Russian carrier at berth in the Ted Russell Dock.



Figure 4.8 Peat moss on the Ted Russell Dock quay ready for export. The Study Area for the proposed river crossing is seen in the background.

Rather large vessels do occasionally visit the Ted Russell Dock. An example is "Dallington" which arrived on 31.03.98 in Ted Russell Dock. The ship characteristics are: length (138m), beam (18,7m), max. draft (7,9m) and DWT (12,139 tonnes). It is likely that the air-draft of a ship with this size would exceed the above range.

4.2.1.2.2 Leisure Craft/Boat Clubs

There are only a small number of pleasure craft using this section of the river at present.

River traffic generally stays upriver while sailing boats operate in the estuary downstream. However, the development of the Abbey River weir could lead to more pleasure craft entering the city and using this reach of the river. An increase in number of sailing boats coming up river to Limerick must be expected. With regard to air-draft of the pleasure crafts coming from up stream, the existing bridges in Limerick already set height limitations (< 3.3m at MHWS).

4.2.1.2.3 Expected future developments

Shannon Estuary Port Authority has reported that between 1992 and 1999 there have been a total of 3300 ship movements into and out of Limerick. This gives an average number of movements of 413 per year which is close to the average of the years 1998 and 1999 of 390 movements. This figures excludes the operational movements of the dredger to dump dredge spoil and repair/replace river lights, which accounts for another 1350 movements in the period between 1992 and 1999 or an average of 169 movements per year.

According to: "Lloyds Ports of the World, 1987" the number ships to Ted Russell Dock in 1984 was 416 with a total volume of cargo handled of 2.96 million tonnes. This suggests a substantial decrease in ship traffic from the mid eighties until now which would be in line with the general international decline in bulk sea-freight, with fewer but larger vessels in use. The EU has a declared policy to transfer as much freight to train and vessels as possible to relieve the already congested European road system. Whether this will result in an increase in sea-freight remains to be seen.

The Foynes Port downstream is a competitor to the Ted Russell Dock. There are constraints imposed by the existing road network (which the NRA have plans to upgrade). Discussions are ongoing to amalgamate Foynes Port with the Shannon Estuary Ports Authority. A major review of the operations on the Shannon, published by the Department of the Marine and Natural Resources (2000), has recommended the setting up of a single ports company (called the Shannon and Foynes Port Company) to manage seaports on the estuary. The amalgamation has received ministerial approval and is expected to proceed as soon as possible.

Regarding the pleasure crafts currently about 100 boats a year go through Ardnacrusha upstream. When the Limerick Navigation Project is complete this number is expected to rise to 500.

4.2.2 Form of Shannon Crossing Constraints

4.2.2.1 General

Hydrography Shannon Estuary

The construction of a tunnel or a bridge across the Shannon may induce permanent as well as temporary changes in the hydrography, which may affect navigation or the environment. These would have to be looked at carefully in the design appraisal.

Impact on water level

Structures, like bridge piers, will introduce a resistance to the flow. Depending on the degree of blocking the structure may give rise to higher water levels at rising and falling water on the upstream side of the crossing. Impact is expected during and after construction, and will be addressed in the design appraisal.

Flow fields

Due to possible flow contraction in the alignment the local velocity distribution may be changed. Locally the flow velocities may increase. Effects on navigation will be considered in the design appraisal.

Sedimentation

Any changes in velocity distribution will give rise to permanently changed sedimentation-and erosion conditions. Locally scour development may occur. During construction temporary changes can be expected. The degree and extent of impact is highly dependent on the choice of design.

Debris

Due to possible changes of the velocity distribution, formation of lee-wakes can be expected that create accumulation zones for debris, seaweed or wastewater. Such accumulation can give rise to permanent impact such as negative visual impression, oxygen deficiency and smell. The design of the structure, again, will determine the degree of impact.

The hydrographical modelling, which will be carried out in connection with this study will determine the extent of these impacts for various solutions.

Port Authority Requirements

The Shannon Estuary Port Authority at a meeting on 17th December 1999 outlined their basic requirements for the River Shannon crossing. In brief these are stated as follows:

Basculé (low level opening) bridge:

- Width of navigational opening minimum 40m at straight section of the river,
- Locating of bridge in bends should generally be avoided otherwise the navigational opening must be increased substantially (>> 40m),
- Ship manoeuvring simulation at the crossing to be carried out before final layout is adopted,
- Radar to be installed on the bridge,
- Lay-by berths to be established both up and down stream of the bridge with operational personnel in hand to assist in case of emergency,
- Operational communications to be established between the bridge and the port,
- Bridge opening to take place before ships leave the Ted Russell Dock on its journey down stream. This means that the bridge would be closed to road traffic for between 10 and 20 minutes approximately to allow a ship through, depending on bridge location on the Shannon. Such a closure would be likely to occur on average thirty-five times a month, with four or five times a month occurring during peak rush hours.

High level bridge:

- Minimum free clearance from highest recorded river tide level to be 30m,
- Width of navigational opening minimum 40m at a straight section of the river,
- Locating of bridge in bends should generally be avoided otherwise the navigational opening must be increased substantially (>> 40m),
- Ship manoeuvring simulation at the crossing to be carried out before final layout is adopted.

Tunnel:

- The crown of the tunnel must be below zero chart datum i.e. < -3m OD Malin over the full width of the navigational channel which is approximately 80m.

The horizontal and vertical clearances requested by the Shannon Estuary Ports Authority for high level bridge and tunnel solutions are indicated in Figure 4.9 overleaf.

Environmental Aspects

The environmental impact of the various crossing types both during construction and during operation will be examined and reported in the EIS. Environmental optimisation of the structural layout will be carried out such as streamlining of pier to reduce blocking effect as part of the Preliminary Stage design. The environmental constraints for the river crossing are described in detail in Section 5.

Aesthetical Aspects

Some of the crossing types e.g. high level bridge, will have a significant visual impact on the flat estuary landscape. Each crossing type will be evaluated and optimised with regard to architectural layout not only to secure a harmonic co-existence with the surroundings but also to make the crossing a pleasant experience for the users.

Risk Aspects

The risk to users and third party (e.g. ship traffic) will be assessed for the different crossing types. Best practices will be used in the design to reduce the risk to acceptable levels.

Irish Cement

Irish Cement Ltd. has had approved a Planning Application for an extension to the Cement Works. The lands owned by Irish Cement have been identified and their development plans discussed. These primarily relate to expansion to the west of the present site.

4.2.2.2 Basculé (Low-Level Opening) Bridge

The basculé bridge option comprises a low-level approach bridge with piled pier foundation. Span length between piers would be optimised with regard to cost, environmental impact and aesthetic appearance. Free height clearance for the approach spans in the navigational part of the river channel to be determined with consideration to river traffic. In the central part of the river where the main navigational route is located a basculé bridge must be established. Span length (free navigational clearance) and layout to be determined primarily with consideration to the requirements of safe navigation.

The main constraints or uncertainties related to the basculé bridge option are:

- Requirements for free navigational clearance (width),
- Free clearance under bridge (approach spans),
- Optimal span length between approach piers,
- Level of limestone rock, and its foundation characteristics,
- Strength and deformation characteristics of upper soil strata,
- Requirements for scour protection,
- Extent of approach bridge (extent of viaducts/acceptable heights of embankments),
- Operational aspects,
- Number of and times required for openings of the bridge,
- Traffic impact of proposed opening, and loss/diversion of traffic,
- Financial aspect of disrupted service for tolling system/revenues,
- Location and operational aspects of lay-by berths,
- Soil and groundwater chemistry (bridge foundation),
- Installation and bearing capacity of piles in limestone,
- Ship collision risk,
- Malfunction of opening span (high winds, mechanical failure etc.), emergency procedures,
- Impacts on the Special Areas of Conservation, both in the river and on the river banks.

4.2.2.3 High Level Bridge

As for the basculé bridge the high level bridge comprises an approach viaduct with piled pier foundations with a steeper gradient (maximum 4% is recommended). Span length between piers to be optimised with regard to cost, environmental impact and aesthetical appearance. In the central part of the river where the main navigational route is located a main span would be established. Span length and free navigational clearance and layout to be determined primarily with consideration to the requirements of safe navigation. A single span crossing of the Shannon would obviate the need for piers in the foreshore, and this possibility will be considered as well as the option with shorter spans with piers in the river and

foreshore.

The main constraints or uncertainties related to the high level bridge are:

- Requirements for free navigational clearance in main span,
- Free clearance under bridge,
- Level of limestone rock, and its foundation characteristics,
- Soil and groundwater chemistry (bridge foundation),
- Strength and deformation characteristics of upper soil strata,
- Requirements for scour protection,
- Installation and bearing capacity of piles in limestone,
- Extent of approach structures (extent of viaducts/acceptable heights of embankments),
- Ship collision risk,
- Aesthetical appearance,
- Optimal gradient to be used (travelling speed/tolling aspect),
- Impacts on the Special Areas of Conservation, both in the river and on the river banks.

4.2.2.4 Tunnel

4.2.2.4.1 Unsuitable Tunnelling Techniques

Bored tunnel techniques in hard rock using Tunnel Boring Machines are generally only used where there are very long stretches to be tunnelled. The cost of fabrication and establishment on site of a TBM would be in the range of £50-70M. This excludes the actual construction costs. For the Shannon Crossing two TBM's would be needed to complete the job within a reasonable time frame. Hence, for the Shannon Crossing it is felt that hard rock tunnelling using a TBM is not a preferred option.

Tunnelling can also be carried out using the so-called NATM (New Austrian Tunnelling Method) technique, where the tunnel is excavated by blasting and subsequently provided with an internal lining. This is a very slow technique and requires a substantial cover of limestone, greater than the diameter of the tunnel. This would require the Ring Road Phase II alignment to be lowered significantly, with attendant implications for interchanges with existing infrastructure. Hence, NATM techniques are considered technically unsuitable for the crossing. In addition, this option is relatively expensive and time consuming.

4.2.2.4.2 Suitable Tunnelling Techniques

The tunnel crossing type would possibly involve the construction of a double tube rectangular concrete section with double lane in both directions and a separation wall between the two tubes. Two different construction techniques exist. The tunnel can be cast in-situ (Cut & Cover) which requires the establishment of a temporary enclosure bund. This would involve blocking of half the river channel during the construction process and realignment of the navigation channel. The process would be reversed for the second half of the tunnel. The other method is using the immersed tunnel technique where tunnel elements of say 100m length are cast in temporary dry-docks (probably to be located at the land falls). When the tunnel sections are cast and ready for installation, the dry dock is flooded and the tunnel elements floated into place and immersed by gradual water filling of the ballast tanks. The elements are joined by pumping out the water between the bulkheads of the two adjoining tunnel elements. The active water pressure at the seaward side will create a compressive force between the elements that will secure a watertight joint. The immersed tunnel technique would also require movement of the navigational channel to facilitate temporary construction works. This technique was used for the Jack Lynch Tunnel in Cork.

The main constraints or uncertainties to the tunnel crossing type are:

- Depth and characteristics of the limestone rock,

- Extent of the immersed part below the river channel and the maximum allowable longitudinal gradient for the road of 4% on the approaches,
- Tidal variations in relation to construction,
- Type of approach ramp structure (drained or gravitational type),
- Cut-off of the drain channel to the pond east of Irish Cement and of Ballinacurra Creek (Ballinacurra Corridor),
- Risk of siltation of tunnel trench during dredging and installation,
- The potential fill requirements in the tailings pond to the east of Irish Cement (Central Corridor) to build tunnel structures,
- Requirements for the realignment of the navigational channel for the Cut & Cover construction method,
- Adequate area for construction yards and the temporary dry dock (immersed tunnel method),
- Permeability of the upper soil strata,
- Soil and groundwater chemistry,
- Strength and deformation characteristics of upper soil strata,
- Requirements for scour protection,
- Requirements for silt/mud excavation and disposal techniques (type and timing),
- Information on bathymetry, soil strata, river currents, extreme water levels and salinity variations in the various corridors,
- Tolling facilities if close to the river,
- Impacts on the Special Areas of Conservation, both in the river and on the river banks.

4.2.3 Other Issues

4.2.3.1 Dredging and Dumping Regime

Dredging for bridge pier foundations (if located in the river) or especially for the tunnel elements will require the removal of substantial amounts of silt/mud and most likely also some rock cutting in the limestone. The disposal of silt/mud will require identification of an appropriate dump site at sea to be licensed by the Department of the Marine and Natural Resources and may involve down river transport for a distance of more than 10 miles. Rock from excavations might be stored at a temporary site for potential use later. There are both environmental and economic implications for dredging and dumping of dredged materials:

- The dredging associated with the crossing would be considered capital dredging. Disposal of this material in the marine environment would currently require a license from the Department of the Marine and Natural Resources and Dúchas approval. There is at present the Planning and Development Bill 1999 passing through the Dáil, which may transfer responsibility from the Department of the Marine and Natural Resources to An Bord Pleanála.
- Capital dredging and dumping at sea involves complex environmental issues. Dumping licenses can be difficult to acquire, depending on potential alternatives (OSPAR convention) and possible environmental effects.
- The granting of licenses is usually conditional e.g. at Dingle pier an archaeologist is stationed full time on board the dredging plant and will delay work in the case of finding something of Archaeological interest. The cost is borne by the developer.
- Magnetic surveys and diving surveys are provisionally provided for in the site investigation contract documents for the Limerick Southern Ring Road Phase II contract, in order to assess the marine archaeological potential within the Study Area.
- Capital dredging is taking place currently at Foynes Island. Some 500,000 tones of silt are expected to be dredged at Barneen Point and to be dumped across from Mount Trenchard approximately two miles downstream.
- Maintenance dredging is carried out by the Shannon Estuary Ports Authority at the west dock area. This material has been dumped at Corkanree. Their new dumpsite will probably be close to Newtown Point. However the volume of material dredged is relatively small.

- Irish Cement Limited use the pond at Bunlicky to dump inert waste material from their plant, and hold an EPA Licence to do so. The ground water sensitivity of this pond is limited. The pond is situated in alluvium and clay deposits of very low permeability and is isolated from the underlying bedrock aquifer. Infilling of the pond with inert material should have no effect on water quality in the area.
- Further study would be required to establish the feasibility of dumping dredged material at the pond from proposed river excavations associated with the Limerick Southern Ring Road Phase II Project.

4.2.3.2 Foreshore Licences

The foreshore is defined as the area of the sea and sea bed below the High Water mark and is currently the responsibility of the Department of the Marine and Natural Resources. Any development interfering with the foreshore within the Study Area requires either a foreshore lease or a foreshore licence.

- The foreshore within the Study Area is state owned.
- Foreshore licences along the river are currently issued by the Department of the Marine and Natural Resources. Proposed legislation in the form of the Planning and Development Bill 1999, currently going through the Dáil, will if successful allow An Bord Pleanála to decide on infrastructure projects which cross the foreshore without the need to apply for a separate foreshore licence from the Department of the Marine and Natural Resources.
- A foreshore licence is required for temporary or permanent occupation of state owned foreshore, to carry out works.
- A foreshore lease is required where the foreshore is privately owned.
- Any application to the Department of the Marine for a Foreshore Licence requires public advertisements and public display of plans.
- An application for a foreshore lease, dredging license and dumping license may be required for the permanent works associated with the crossing.
- Every application is referred to Dúchas and other statutory bodies who may be concerned.
- There is no specific time frame within which an application will be determined. All such applications will have to be accompanied by detailed environmental appraisal or an Environmental Impact Statement (EIS).

4.3 Land Based Constraints

4.3.1 Community and Business Issues

4.3.1.1 Community Activities

Police Boundaries

The Study Area is covered by three Garda sub-districts. These are:

- Patrickswell sub-district, served by Patrickswell Police Station
- Roxboro sub-district, served by Roxboro Road Police Station
- Mayorstone sub-district, served by Mayorstone Street Police Station

Townlands within each of these sub-districts are as follows:

- Patrickswell sub-district – Cloghkeating, Islandduane, Camheen, Rathmale, Mungret, Baunacloka, Corbally, Castlemungret, Conigar and Tervoe.
- Roxboro sub-district – Gouldavoher, Dooradoyle, Rossbrien, Ballykeeffe.
- Mayorstone sub-district – Clonmacken, Caherdavin, Clondrinagh, Coonagh East and Coonagh West. Mayorstone station also serves the area of County Clare included in the Study Area.

The route of the Limerick Southern Ring Road Phase II will dissect at least two of these sub-districts and possibly all three. It is therefore important that personnel in these stations are kept informed of possible routes, etc.

Hospitals

There are no hospitals situated within the Study Area but because of the close proximity of Limerick Regional Hospital in particular it is important that any change to the existing road network will not result in emergency vehicles having to make journeys of excessive length. It is also important to note that Coonagh Airfield, which is within the Study Area, is used occasionally to air-lift patients to and from Hospitals in the region.

Schools

There are a number of schools located within, or immediately adjacent to, the Study Area:

- Mungret area – St. Nessans National School caters for 750 students. Mungret College is no longer used as a school.
- Dooradoyle – Crescent College Comprehensive which caters for 950 students, St. Paul's National School which caters for 450 students, and St. Gabriel's School on Springfield Drive.
- Ballinacurra area – Laurel Hill Secondary School, Scoil Mhathar De, St. Philomenas Private Primary School, Mary Immaculate College and St. Clements, which are all on the South Circular Road. Mount Carmel Secondary School is on O'Connell Avenue, while Catherine McAuley School is near the Racecourse at Ashbourne Avenue.
- Derravoher area – Villiers School on the North Circular Road which caters for 450 students.

It is important to recognise that bus routes are already established to service each of these schools and care should be taken to try and limit the effect of new roads on these routes.

Churches

There are four churches located within, or immediately adjacent to, the Study Area namely; St. Nessian's Church at Raheen Cross, Church of St. Oliver Plunkett in Mungret, St. Pauls Church in Dooradoyle, and Church of Jesus Christ of Latter Day Saints also in Dooradoyle. Maintaining ease of access to these churches is a constraint on future road developments, especially as many of the churchgoers are elderly and walk to church.

Shopping Centres

The Crescent Shopping Centre in Dooradoyle is the only major Shopping Centre within the Study Area. This shopping complex is located on the existing N20 National Primary Route and incorporates over 60 shopping outlets. Free car parking is available for over 1600 vehicles. Other facilities include:

- a) 12-screen cinema
- b) Library operated by Limerick County Council
- c) Restaurants, financial services, filling station, garden centre and recycling centre
- d) Creche facilities are provided

The centre is open from 9:30am to 10:00pm on Thursday and Friday, from 12noon to 6:00pm on Sunday and from 9:30am to 8:00pm the rest of the week. As a result of so many activities occurring in one area traffic flows in the vicinity of the Crescent Shopping Centre are higher than might otherwise be expected. For this reason any new road network should not hinder and if possible it should improve the flow of traffic to and from the Shopping Centre.

Pedestrian and Cyclist Access

It is important to note that where existing pedestrian access along designated existing pedestrian paths becomes segregated that measures will have to be taken to maintain or replace these. This will be particularly important in the vicinity of schools, churches and hospitals where large numbers of people access these facilities by walking.

The new road may be a standard dual-carriageway. This will depend on the traffic modelling data which is currently being prepared by Colin Buchanan and Partners. Pedestrian and cyclist use of dual-carriageways is permitted by law, although the Jack Lynch Tunnel in Cork does not permit such usage. Cyclist and pedestrian access will be considered for all crossing options.

4.3.1.2 Sports, Leisure and Tourist Activities

Playing Fields

There are a number of playing fields within the Study Area which are used in a wide variety of sports including, hurling, football, rugby and soccer. There are two different GAA clubs located within the Study Area namely Mungret GAA Club and Na Piarasigh GAA Club in Clonmacken. Shannon Rugby Football Club has their clubhouse/changing rooms and four playing fields in Coonagh West, with a 5th pitch under construction.

The Coonagh Sports and Social Club is located in Coonagh East, and new changing rooms are being built at present. Limerick Corporation has a number of soccer fields at Portland Park in Ballinacurra.

A number of schools also have playing fields on their lands, including Crescent College Comprehensive in Dooradoyle, Villiers School in Derravoher and also Mungret College.

These clubs etc. are an integral part of their respective communities and it is important that any potential interference with these playing fields is kept to a minimum.

Golf

Limerick Golf Driving Range is located in Coonagh. It has been open for 8 to 9 years. The Driving bays are at the South end of the area mapped. For the golfing activity, a length of 300 to 400 yards is required.

Limerick Golf Club is located at Ballyclough, to the Southeast of the Study Area.

Coonagh Equestrian Centre

Coonagh Equestrian Centre is at Coonagh East. It comprises indoor facilities including stables and arena, an outdoor arena and a cross country course. It is essentially a riding school where mostly students between the ages of 5-15 years learn to horse-ride. There are 30 horses and 2 employees. There is no other equestrian centre in such close proximity to Limerick. The centre opened in 1992.

Coonagh Sports and Social Club

The Sports and Social Club is situated at Coonagh East, where changing rooms are currently under construction. The Coonagh residents association is carrying out this development. A playing field there is used for Gaelic games and soccer.

Leisure Craft on the Shannon

The Shannon river and associated canal routes is highlighted in the Government's **Operational Programme For Tourism** as a product target. This would involve financial support for cruising bases at various locations thereby providing a framework to entice tourists to take cruising holidays on the River Shannon.

In conjunction with the Limerick Main Drainage project and deepening of the Abbey River a new weir will be constructed from Sarsfield lock across to Curragour Point. This will mean that, for the first time, boats will be able to moor in central Limerick and negotiate the difficult stretch between the city and Killaloe with ease. Local expectations are that boat traffic in Limerick may increase five-fold as a result of the greatly extended new route.

There are 4 city rowing clubs: Shannon Rowing Club, Limerick Boat Club, Athlunkard Boat Club and St. Michael's boat club. These boat clubs use the river regularly and would be directly affected by the works associated with the construction of a Shannon Crossing. In addition, there would be a minimum clearance required to pass under a bridge. Baals Bridge, an old arch bridge across the Abbey River, already presents a vertical height restriction on pleasure craft.

The yachts from Foynes boat club, amongst others, head up the Shannon occasionally. They use the Ted Russell Dock to dismantle masts, some of which extend 60 ft into the air. This then permits these yachts to progress further up the River Shannon. An opening low level bridge option would need to consider locations for dismantling of yacht masts, if the mast

heights exceeded the vertical clearance under the structure (only if leisure boats with masts constitutes a large number crossing the bridge alignment - it should be possible to open the bridge for rare visits of leisure boats with high masts).

Tourism

The N20 and N69 are the main tourist routes to and from the Cork/Kerry region which link with the Limerick area. The N18 links the city with Shannon, Bunratty and Co. Clare in general. Shannon Airport, which is to the west of the Study Area, handles approximately two million passengers per annum, of whom 1.4 million are terminal journeys. There is potential for a significant increase in the tourist numbers using Shannon Airport especially if any new road infrastructure eases access to traditional tourist areas in the south of Ireland (Kerry and Cork).

There is very little of direct tourist interest in the Study Area, with the exception of leisure pursuits involving the River Shannon.

Recreation

The Limerick County Development Plan seeks to facilitate the expansion of the network of walking routes throughout the county. However, no routes are listed within the Study Area.

The Caherdavin District Development Plan includes a **Priority Walk** along the North Shore of the River Shannon. This links with a long-term walkway route which, combined, encompass the North Shore area and go through Coonagh East and West.

The Limerick Southern Environs District Development Plan refers to the 1997 Government document on '**Sustainable Development – A Strategy for Ireland**' which emphasised the importance of preserving semi-natural open spaces in urban areas. Accordingly, an open space area of 27 acres has been proposed along the Ballynaclough River (from the N20 to the rail-line) in association with large-scale residential development. This is ultimately intended to include walkways and sports pitches.

4.3.1.3 Business and Industry Activities

There are existing business/commercial developments throughout the greater conurbation area, most notably at Raheen and along the Dock Road (N69) where the cement works is the dominant feature. The Raheen Industrial Estate is expanding continually, with approximately 220 acres out of an available total of 400 acres currently developed.

There is an Industrial Estate at Clondrinagh on the Ennis Road (N18) adjacent to the Crompaun River. There is also an Industrial Estate at Corkanree on the Dock Road (N69) adjacent to the Ballinacurra Creek. Construction of the new Limerick Wastewater Treatment Works is underway north of the N69 at Bunlicky and will be completed before the end of 2001. There are large areas of land designated for Industrial use but which have not yet been developed. The area south of the N18 between Coonagh roundabout and Crompaun River is zoned for industrial development.

Along the route of the Ballinacurra Creek open space, recreational, and agricultural zones apply. However south of the Dock Road (N69) is zoned industrial.

Employment

There are four main areas of industrial activity within the Study Area. These are as follows:

- **The Dock Road (N69)**, including the Corkanree Business Park. There are 14 businesses registered with Shannon Development. The total number of

employees is estimated at 600.

- **Mungret Area.** There are two major businesses registered with Shannon Development, including Irish Cement Ltd. The total number of employees is estimated at 200. Irish Cement Ltd. have recently been granted planning permission to extend their production works, and this may lead to an increase in employment locally.
- **Raheen Business Park.** There are 22 businesses registered with Shannon Development, including Dell Products Europe. The total number of employees is estimated at 6000. Thus far 220 acres of a potential 400 acres have been developed and it is likely that Dell will continue to expand short-term, potentially leading to an increase in employment locally.
- **Clondrinagh on the Ennis Road (N18).** There are 4 businesses registered with Shannon Development. The estimated total employment created here is 170. There are also busy hotels and restaurants at this area along the Ennis Road.

Outside, but close to and impacting on, the Study Area there are other areas of activity in Limerick e.g. at the National Technology Park in Castletroy, where there are 56 businesses registered with Shannon Development. Shannon Airport in County Clare has plans to increase its capacity by 50% in the next few years. Currently there are two million passengers per annum at Shannon Airport, and any increase in these numbers would be likely to lead to significant direct / indirect job creation.

It is expected that the Southern Ring Road Phase II would serve to alleviate a proportion of the traffic congestion generated by these industrial centres. In addition, an economic benefit would be a reduction in the delays to goods transportation caused by traffic congestion.

4.3.1.4 Irish Cement Issues

Irish Cement Ltd. operates a cement production works and quarry at Conigar/Tervoe. Quarried limestone along with shale/gypsum are the primary inputs in the cement making process, with coal used to fuel the process. Limestone is the principal raw material and, for economic reasons, the location of the cement works is based on its proximity to suitable limestone reserves.

The quarry is operated in 18m benches. Initially an 18m bench is quarried and then lowered to extract a second bench. The depth from the surrounding ground to the base of the quarry is generally 36 m. Groundwater is extracted throughout the operation of the quarry and pumped to the pond at Bunlicky to be released through a sluice drain to the Shannon Estuary.

800,000 tonnes of cement are produced at the plant per annum currently. Planning permission was obtained by Irish Cement in 1999 for an extension of the plant which, in conjunction with an approved 1991 application to extend the quarry, would enable production capacity to be almost doubled. The present quarry extent will supply the needs of Irish Cement, at current production rates, for approximately the next 25 years.

The Irish Cement land holdings extend westward to beyond Cooper Hill and North to the Shannon River. This land, pending its use as a possible future source of limestone supply for the works, has been generally maintained in agricultural use. Irish Cement have indicated that a Southern Ring Road Phase II Project that severed this future source of limestone from the current Quarry would impact on their long term strategic plans. In addition, any road project would be likely to impose constraints on blasting and other cement production operations in the vicinity of the road. Refer to section 4.3.2.2 for transport implications relating to Irish Cement.

The Bunlicky Clay Field Pond

The Bunlicky clay field pond is a man made pond owned by Irish Cement. The pond was

formed by the extraction of clay which was previously used for the cement production process. The pond is located in the flood plain of the Shannon Estuary. It covers an area of approximately 500,000m². The pond holds approximately 2.5 million m³ of water and receives approximately 14,000m³ per day from various sources.

Based on existing information from Irish Cement, the lake has a variable depth with a maximum depth of 8m. The water surface is approximately at a level of 0.0m OD Malin. The pond is in alluvium clay deposits approximately 5 metres in depth, overlying a layer of pink gravelly clay, approximately 1m to 3m in depth, and limestone bedrock. As a part of the site investigation for the Limerick Southern Ring Road Phase II there will be a hydrographic survey of the lake. Currently Irish Cement use the lake to dump inert waste material from the cement manufacturing process, and have a dumping licence from EPA for this.

4.3.1.5 Coonagh Aerodrome and Aviation Activities

Coonagh Aerodrome comprises a runway that is 496m long and two hangars for storage. There is a 50m long overrun at the western end. The land is owned by Daniel Lehane who also holds the private Airfield License. The runway runs east-west. A planning application for a second runway NNE to SSW was refused previously.

The Aerodrome has the use of air space within the Shannon Control Zone. The air space delegated to Coonagh Aerodrome, along with the Shannon Control Zone and the No-Fly Zone over Limerick, is mapped on Figure 4.10. There is a no-fly zone over Limerick, primarily due to security concerns regarding Limerick Prison.

Limerick Flying Club uses the aerodrome free of charge, although the Club pays aerodrome operations indemnity insurance. Three planes are owned by the Club while five other planes, privately owned by club members, also regularly use the facility.

The aerodrome is regularly used for VIP trips with, for example, the Irish President recently using the Aerodrome to visit Limerick. Coonagh Aerodrome is also nominated as an alternative landing area for the Air Sea Rescue Helicopter, serving the Regional Hospital.

Landing and taking off operations are usually into the wind. Westerly winds are prevalent at this location.

To the east of the runway there is a new ring road bypassing the Caherdavin area. This is located a distance of over 400 metres away from the road. The safe distance based on Annex 14 of the ICAO (International Civil Aviation Organisation) Code, both vertically and horizontally, for landing and take-off is defined within the Aerodrome license file. This drawing is included in Figure 4.11.

To the west of the runway there exists a clear corridor to allow aircraft to safely land and take off. Limerick Flying Club have successfully objected to planning applications on this side. It is worth noting that although a clear corridor is maintained on the western side, the ICAO code is not strictly adhered to. Development in the vicinity of the Aerodrome would need to be below a plane defined as follows to avoid endangering pilots and aircraft:

- Taking a long section of the runway, define a line from a point 30metres outside the end of the runway and inclining at 5 percent for a distance of 1600m. On plan this clear corridor would be 60m wide at the end of the runway and 320m at the outside. Refer to Figure 4.11.

Very approximately, assuming a level of 2.5mOD at the end of the runway, a minimum finished pavement level of 5.2mOD and 5.3m for bridge clearance, the centre line for a proposed road development would have to be approximately 200m east of the end of the existing runway to comply with ICAO requirements. The same applies on the western side.

There is, at present, a review of air space being undertaken by the Irish Aviation Authority. The results of this will be available in the coming months. Limerick Flying Club members have indicated that any relocation of the Aerodrome necessary to facilitate the Southern Ring Road Phase II Project would require an alternative location in close proximity to Limerick, and a new application for a private airfield License. Such an application would more likely be successful at a location outside the Shannon Control Zone.

4.3.1.6 Agricultural Activity

The rural part of the Study Area is a landscape of agricultural activity typified by relatively small to medium sized field. The primary land-use is as pasture for livestock. Reed harvesting is evident in places along the Shannon Estuary. The generally low-lying nature of the rural area is revealed by the growth of rushes in fields and wet localised ground conditions.

According to the Limerick County Council Development Plan (1999) 75% of the land in County Limerick is used for agricultural purposes and its importance to the economy of Limerick is significant. It is estimated that the total value of agricultural output to the Limerick economy is £200 million per annum, with dairying accounting for over £100 million. The amendments to the Caherdavin District Development Plan (1999) zone Coonagh generally as agricultural with long term walkways.

The Clare County Council Development Plan (1999) states that 64% of the land in County Clare is suitable for agriculture. The land quality varies from excellent/good in some areas of the East and South and is poor in large areas of the West and North of the County. Fragmentation of holdings is a serious problem and all of County Clare is listed by the EU as disadvantaged.

There is little agricultural activity in the Limerick Corporation area within the Study Area. Land is an important natural resource and care should be taken to minimise the impact of any new route on the farming community.

4.3.2 Transport Issues

4.3.2.1 Road Network

There are five national primary routes into the city of Limerick:

- The N7 from Dublin
- The N18 from Ennis and Shannon
- The N20 from Cork which includes the N21 from Kerry joining it at Patrickswell
- The N24 from Waterford

There is one national secondary route, the N69 from Tarbert/Foynes/Askeaton, locally referred to as the Dock Road. Refer to Figure 3.1.

There are four river crossings for traffic of the Shannon in the city of Limerick. The Thomond Bridge carries the N7 (to Dublin), the Sarsfield Bridge carries the Ennis Road, Shannon Bridge carries the N18 (to Ennis) and there is a crossing to Athlunkard.

The N69 Dock Road serves as an access to a major industrial area at Mungret and as an alternative route for traffic between primary routes N20 and N18. The Adare – Annacotty Road scheme will relieve traffic on the N20, the N24 and the N7. A river crossing at the western end of Dock Road would relieve traffic at the Dock Road, at Shannon Bridge and on the N18 Ennis Road in Caherdavin, together with other routes.

4.3.2.2 Rail Network

There are five rail lines leading in to Limerick city. These are Limerick-Dublin via Limerick Junction, Limerick-Dublin via Birdhill joining the main line at Ballybrophy, Limerick-Ennis, Limerick-Foynes and Limerick-Irish Cement Ltd. There are three lines within our Study Area. These are: Limerick-Ennis, Limerick-Foynes and Limerick-Irish Cement Ltd.

There is some potential for local rail services in Limerick. However the line configurations and pattern of development are unfavourable. The pattern of development in Limerick to date has taken place without an eye to urban transport on existing rail infrastructure. The following is an extract from the Review of Transport Infrastructure Investment Needs, published by DKM Consultants in February 1999. This report is a forerunner of the Operational Programme for Transport 2000-2006:

The Ennis Line is 39km long, goes through undeveloped Northwestern outskirts of Limerick, through sparsely populated areas, to Ennis which, with hinterland, has a population of circa 15,000. However the line does not serve Shannon Airport or town, or Newmarket-on-Fergus, the only significant areas of development between Limerick and Ennis.

The Limerick-Ennis line carries 30,000 passengers per annum and 100,000 tonnes of freight. If this freight traffic were to be carried by road then it would mean 16 round truck trips per day and 3 return bus trips per day. The levels of passengers and freight are low.

The Foynes Line: This line is 43km in length, and there are no possible station locations with significant population catchment.

The Foynes Line has just one or two trains per week. On the Limerick to Foynes line there are an average of 0.33 train journeys per day. The volume of freight annually on the Limerick to Foynes Line is 36,160 tonnes. This corresponds to 4 return truck trips per day if the freight was carried by road.

Iarnród Éireann have sought a high level of investment mostly for renewal of existing unimproved lines and purchase of rolling stock. It is considered that the levels of passenger, freight and revenue generated should justify any investment. Also DKM have indicated that such an investment should be offset by a reduction in spending on the roads programme. DKM Consultants have recommended to the Government that the budget for rail in the next programme should be appreciably lower than the figures sought by Iarnród Éireann, and that the budget should be concentrated on suburban services for Dublin and Cork. Hence, it is unlikely that there will be significant changes to rail service in the Limerick area in the near future.

A dual rail track exists from Limerick going south to Rossbrien where there is a spur west to Irish Cement Ltd. At Rossbrien the other rail track continues out to Foynes Harbour.

The Irish Cement line passes at grade through Ballinacurra to the north of the Crescent Shopping Centre. The track is generally one metre above surrounding ground level. There are no plans to construct a second rail track from Limerick to Irish Cement. Any disruption of rail service on this line would have serious implications for Irish Cement limited. Shale and gypsum raw materials are brought by rail and up to 30% of cement product is transported by rail. An increase in Irish Cement production would mean an increase in train carrying capacity (longer trains). The clearance required for a bridge crossing over the track would be in the order of 5.15m. The planning approval recently received by Irish Cement Ltd to extend their works has a condition attached limiting the number of train movements to 160 per week.

The railway line crosses the road infrastructure using level crossings at:

- N69, at entrance to the Cement Works – Automatic crossing
- Road between Ballykeeffe and Gouldavoher – Automatic crossing
- N20, by Ballinacurra Bridge – Manually operated crossing, required upgrade to automatic when Irish Cement approved plant expansion proceeds
- Greenfield Road at Rossbrien – Manually operated crossing

With future expansion of the cement works the closures at these level crossings may increase in duration and/or number. The railway line to Irish Cement, therefore, imposes a constraint.

Foynes Port has an east and a west jetty. There is a water draft of greater than 7.5m to facilitate larger vessels (Maximum draft at the Foynes Island Jetty is approximately 12m). Recently a sum of more than £10 million pounds has been spent on a west jetty extension and ancillary works. Currently a sum of £2 million is being spent on a capital dredging contract that will widen the channel at the west jetty. These improvements have the potential to double the freight turnover at Foynes from 1.25 to 2.5 million tonnes in the coming years. A significant amount of traffic, both road and rail, will be generated as a result of this. Rail traffic is expected to increase on the Foynes line. Iarnród Éireann currently have no plans to construct a second rail track from Limerick to Foynes.

4.3.2.3 Traffic Issues

Potential Road Traffic on River Crossing West of Limerick City

Assessments of road traffic in the general Limerick area have been carried out in recent years by both Limerick County Council and Limerick Corporation:

- Limerick County Council: *Interim Report on Origin Destination Survey Results, 1997*
- Limerick Corporation: *Proposed Limerick Fourth Crossing – Traffic Impact Assessment, 1999*

Some of the observations are as follows:

- 21% of traffic crossing the Shannon Bridge into Limerick City is heading south/southwest, with 18% heading for the southern environs
- 38% of Dock Road traffic is heading across the river to areas northwest of the inner city
- 18% of traffic on the Dublin Road is heading towards Ennis
- 22% of inbound traffic from the northwest is heading for the Dublin Road

Based on the 1999 report noted above, the following predictions for traffic on a river crossing west of Shannon Bridge are made by the report authors:

- Projected AADT 1997 = 15,750 to 21,800
- Projected AADT 2003 = 25,000
- Projected AADT 2023 = 37,800

The above predicted figures are based on growth rates as follows:

- 1997-2000 : 6% per annum
- 2000-2005 : 4% per annum
- 2005-2023 : 2% per annum

Irish Cement Traffic

The Irish Cement facility is located on the N69 Limerick to Foynes Road, to the west of Limerick City. A substantial percentage of the produce is dispatched by road to customers in the west and south of Ireland, approximately 29% and 54% respectively.

The weekly HGV figures arising from existing activity, including delivery of raw materials and dispatch of product, are given overleaf:

	Bulk Trucks	Bag Trucks	Iron Ore	PFA Trucks	Shale	Pet Coke
N18 West	232	66		134		
N20 Cork	158	14				
N24 Tipperary	120	40				
N69 Foynes	92	22			132	834
N21 Killarney	90	14				
Dock Road			120			

As a result of the proposed cement factory extension the weekly dispatch of product to customers along with the import of shale and PFA is likely to increase. However the weekly import of iron ore and pet coke is not affected, as it takes place over a more prolonged period.

The predicted HGV figures arising from the cement works extension are given below:

	Bulk Trucks	Bag Trucks	Iron Ore	PFA Trucks	Shale	Pet Coke
N18 West	464	132		268		
N20 Cork	316	28				
N24 Tipperary	240	80				
N69 Foynes	184	44			264	834
N21 Killarney	180	28				
Dock Road			120			

The construction of the Limerick Southern Ring Road Phase II would help to generally alleviate any increased traffic congestion in Limerick, although increased traffic flow from the cement works would be likely on the N69.

Existing rail traffic per day, along with potentially increased traffic flows after completion of the plant extension, expressed as movements per day are:

	Existing	Predicted
Shale	3	6
Gypsum	1	2
Cement Dispatch	<u>4</u>	<u>7</u>
Total	8	15

The car traffic from the plant equates to approximately 200 PCU per day.

Road Traffic Accident Data

There are three safety principles outlined in the Road Needs Study (1998) which, if applied, would reduce the probability of encounters with implicit risk. These three principles are:

- Functional use of road network, preventing unintended use.
- Homogeneous use, by preventing large differences in vehicle speed, mass and direction of movement.
- Predictable use, preventing uncertainty among road users by enhancing the predictability of the road's course and enabling the behaviour of fellow road users to be anticipated.

The most recent NRA publication on accidents is Road Accident Facts Ireland (1998). This indicates that 43% of all fatal accidents in 1998 occurred on the national primary and secondary routes which is an increase of 3 per cent on 1997.

The national primary routes within the Study Area have total accident rates per million

vehicular kilometres as indicated in the chart below. The national average accident rate in 1998 per million vehicular kilometres is 0.174. Hence, the N21 and N24 exceed this national average. The accident rates for the N7, N18, N21 and N24 have all decreased from figures published in 1992, while the N20 rate has increased slightly.

The N69 secondary route has an accident rate of 0.21 per million vehicular kilometres. The national average value (1998) for secondary routes is 0.195 per million vehicular kilometres, hence the N69 accident rate is slightly higher than the national average. The accident rate for the N69 has reduced from the figure published in the 1992 report.

The COBA Manual (DMRB Vol. 13) lists the average accident rates for various types of roads in the UK. These include:

- Dual 2-lane Motorway - 0.123 per million vehicle kms
- Dual 3-lane Motorway - 0.088 per million vehicle kms
- Dual 4-lane Motorway - 0.088 per million vehicle kms
- Single 2-lane Roads, no Hard Shoulder and Speed Limit of 30/40mph - 0.231 per million vehicle kms
- Single 2-lane Roads, no Hard Shoulder and Speed Limit of 50/60/70mph - 0.156 per million vehicle kms
- Single 2-lane Roads, with Hard Shoulder and Speed Limit of 30/40mph - 0.231 per million vehicle kms
- Single 2-lane Roads, with Hard Shoulder and Speed Limit of 50/60/70mph - 0.124 per million vehicle kms

These figures compare quite well with the accident rates reported for the national roads in Limerick.

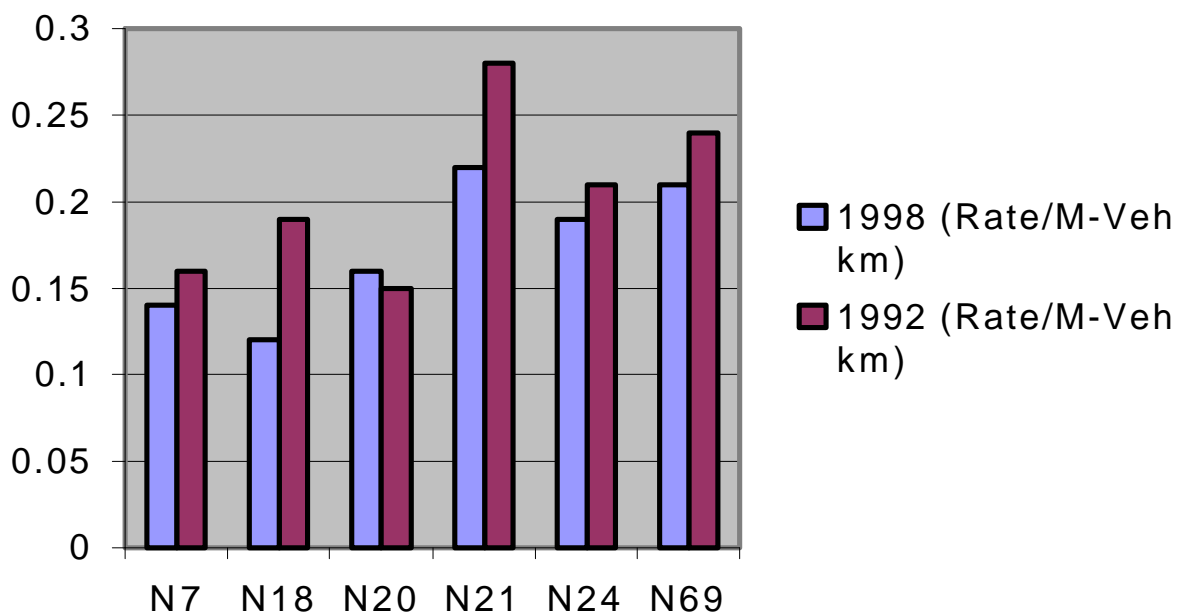


Table 4.3: Accident Rates on National Primary and Secondary Routes in Limerick

It is difficult to correlate accident rates with causal factors. An accident is a rare, random event where people have failed to cope with a given situation. There are many contributory factors. If a proportion of by-passing traffic is removed from the urban roads and city streets as a result of the Limerick Southern Ring Road, the accident rate may decrease in the city and environs.

The NRA publication 'High Accident Locations: The National Routes (1984 – 87)' identifies sub sections of road where there is a higher risk of an accident occurring. The NRA also compiles a GIS database of accidents for the country at large, based on 1997 figures and published in 1998. This is the basis for mapping of accidents in the Study Area. Specific data includes:

- N69 Dock Road – In 1997 there were 8 serious injury accidents between Mungret and Bawneys bridge on the Dock Road, along with one fatal accident at Bawney's bridge. There were a lot of minor injury accidents in the built up areas. The N69 is, at this location, a reduced two-lane carriageway with many at grade junctions. The section of the N69 between roughly Bawney's bridge and Mungret is identified as having a higher accident risk. It is not clear whether or not there are specific black spots along this section of road which contribute greatly to this.
- N20 Cork Road – In 1997 there were 2 fatal accidents and 9 serious injury accidents on the N20 between Patrickswell and Ballinacurra Bridge. There was a large number of minor injury accidents at Patrickswell and Dooradoyle. The section of road between Patrickswell and Limerick was identified as a high risk accident location.
- N24 Tipperary Road – In 1997 2 fatal accidents were recorded around Ballysimon on the N24 between Childers Road and Milltown. Six serious injury accidents were recorded along with a large number of minor injury accidents. The N24 will be realigned in conjunction with Limerick Southern Ring Road Phase I.
- N7 Dublin Road – In 1997 5 fatal accidents were recorded on the N7 between Limerick and Lisnagry. There were 8 serious injury accidents along with a large number of minor injury accidents.
- N18 Ennis Road – In 1997 there were no fatal accidents recorded on the N18 between the Clare/Limerick county boundary and Limerick. There were 5 serious injury accidents along with a number of minor injury accidents. There was a high density of minor injury accidents at the Coonagh roundabout and 2 minor injury accidents at the switch backs near the Two Mile Inn. The Gardai have requested that these switch backs be closed as they impose a greater potential for accidents than at-grade or grade separated junctions.

4.3.3 Geology and Drainage Issues

4.3.3.1 Site Investigation and Geology

Several site investigations have been carried out in the Study Area in recent years for other Contracts. A site investigation contract is currently out to tender for this project, but preliminary results will not be available until early Summer 2000. The following geological data is based on available previous results.

The general Study Area is underlain by bedded Carboniferous Limestone. Geological maps for the area shows much of the centre, south and west portions of the Study Area to be underlain by rock of volcanic origin, with glacial drift deposits of varying thickness covering the limestone. While most abundantly developed on the lower ground, the glacial deposits are found overlying the solid rock in every part of the district and at all elevations. The general overburden geology of the area consists of soft alluvial and estuarine silts, clays, peats and muds underlain by glacial tills including gravels and boulder layers in the lower lying areas with firmer glacial clays and dense gravels in the more elevated parts. Depths of overburden vary significantly over the area, and also over short distances.

The Area between the Cromptaun River and the River Shannon

A large portion of this area is covered with a thick deposit of alluvial mud, which attains its greatest development on the West and South. Most of the remaining ground consists of Boulder Clay with minor areas of bare Limestone. The most extensive sheet of alluvium occurs between Clonmacken House and the Cromptaun River, and covers an area of some 5km². Probes to a maximum depth of 12m were carried out by Irish Cement Limited in the South-western part of this area near Coonagh Point and rock was found within 2m of the surface in one hole and in others, on average, at a depth of 8m. No rock was encountered in some probes i.e. no rock within 12m of the surface.

The Area between the River Shannon and the Dock Road

The average ground level in this area is about 2.40mOD. Rock levels vary from -6.00mOD at Dock Road to -13.50mOD on the Southern bank of the River Shannon. The overburden consists of greyish brown silty clay on soft grey silt on gravel with layers of boulder clay on Limestone rock.

The Area from the Greenpark Racecourse to Rossbrien

This area runs just north of the Ballinacurra Creek. From the Dock Road to Rossbrien railway crossing the land is generally below the flood level of 4.15mOD. Rock levels vary from -1.00mOD at approximately 500m West of the level crossing to -10.00mOD just South of the Racecourse.

The Area from Castlemungret to Derryknockane

The ground level in this area varies from about 2.00mOD on the Southern bank of the River Shannon to about 19.00mOD adjacent to the N20 at Cloghkeating. The area near the river is poorly drained and consists of greyish brown silty clay on soft grey silt on brown silty clay on rock at a depth of 5.10m. Elsewhere in this area brown sandy clay or boulder clay overlies limestone rock. The depth to rock is about 1.00m at Rathmale and Conigar and adjacent to the N20 at Cloghkeating and about 4.00m at Derryknockane.

Details of Previous Site Investigation Work carried out in the Area:

- Orrje and Co. carried out a Site Investigation at Corcanree (South side of the River Shannon at Ballinacurra Creek) for a proposed Wharf during October/November 1964. Piling records from Corcanree Industrial Estate indicate rock at an average depth of 6.00m from average ground level of +3.00mOD.
- Orrje and Co. carried out a Site Investigation at Courtbrack (South side of the River Shannon opposite Coonagh Point) for a proposed Wharf during October/November 1964. The river bed rises from about -4.80m OD in the middle of the Shannon to about +2.20m OD near the river bank. The following strata were encountered from river bed level:
 - (i) Very soft organic soil of thickness 1.00m to 1.20m over the entire site.
 - (ii) Grey clayey silt to a depth of -8.80mOD in the Southwest part of the site to about -14.70mOD in the Northwest part.
 - (iii) Clayey silty sand and gravel with stones and boulders from 1.50m to 3.40m thick.
 - (iv) Limestone bedrock at depths varying from -9.90mOD to -17.30mOD.
- Irish Cement Ltd. carried out probes just West of Ballinacurra Creek. These probes indicate rock at depths varying from 4.50m to 11.00m below ground level. The limestone rock is overlain by an average of 7.50m of soft silty clay loam, poorly drained and of high base status. Much of this clay has been excavated for use in the

manufacture of cement.

- 8 no. boreholes were carried out in various locations in the River Shannon by Site Investigations Ltd., in June/July 1978 for the proposed Mallow Street Bridge. The profile of bedrock across the river was found to be very consistent at a level averaging -4.90mOD and not exceeding -5.10mOD
- A Site Investigation was carried for the Northern Approach Road to Mallow Street Bridge between January and March of 1983 and reported on by Geotechnical Consulting Services Ltd. in September 1983. The area covered extended along the Northern bank of the Shannon from 350m west of Barrington's Pier to 500m downstream from Sarsfield's Bridge. Results from the Barrington's Pier area indicate 7m of soft grey silt with some shells underlain by stiff brown gravelly silty clay with cobbles and boulders (Boulder Clay). Limestone rock level was found to vary from 6.6m to 9.5m below the surface corresponding to levels of -4.00mOD to -5.70mOD .
- Details of a Preliminary Site Investigation are given in Interim Report No. 2 (February 1985) of the Limerick Southern Ring Road Feasibility Study carried out by DeLeuw Chadwick OhEocha for Limerick County Council. The site work was undertaken by a Site Investigation team from Westmeath County Council between November 1983 and May 1984 and consisted of 39 shell and auger boreholes and 4 rotary drillings – two on either side of the Shannon. In conjunction with this, 208 mechanical probes to bedrock were carried out by Mercury Analytical Ltd. in March 1984.
- Irish Drilling Ltd., carried out 56 no. shell and auger boreholes and 19 no. rotary drillings between February and August 1998 as part of the Site Investigation for the Limerick Main Drainage Scheme. Most of this work was carried out at the proposed location for the Waste Water Treatment Plant adjacent to the Dock Road.
- Two no. shell and auger boreholes were carried out for Clare County Council at Lansdowne Bridge in July of 1981. Both of these boreholes were carried out at 6.30mOD approx. and revealed 1.50m of grey/brown silty clay over 12.0m of very soft grey organic silt over 0.50m of peat over 0.70m of pinkish laminated clay over 0.20m of boulder clay over limestone rock. The rock was encountered at -8.70mOD .

4.3.3.2 Limerick Main Drainage

The site for the proposed waste water treatment plant at Bunlicky is presently under surcharge in order to consolidate the ground to increase the bearing capacity and limit settlement of the treatment plant after construction. The settlement of the ground under the surcharge is being monitored at the moment and the readings indicate that as the pore water pressure is released the settlement recorded during a weekly period is on average 50 to 60 millimetres. For the period between March 99 and January 2000 settlements of up to 1000mm have been recorded at some locations.

The new wastewater treatment plant is expected to be under construction before the end of the year. The southern interceptor sewer is presently under construction. The Shannon crossing comprises a sewer, a gas distribution pipeline and a watermain. The construction of the crossing is expected to commence in the coming months.

4.3.3.3 Drainage/Flooding

Areas of land at Bunlicky and Coonagh and Ballinacurra are reclaimed lands. These areas are defended using high embankments that protect them from flooding at high tide. The maintenance of these embankments is generally carried out by the OPW. Irish Cement Ltd. maintains the embankment on the south bank of the River Shannon from Bawney's Bridge to

Tervoe opposite Coonagh Point.

There are embankments at the River Shannon and along Ballinacurra Creek. These defend the surrounding ground at high tide. In 1961 the embankments were maintained at a level of 3.9m OD Malin. These were topped during floods caused by Hurricane Debbie. Subsequent work was carried out by the Office of Public Works to raise the level of the embankments. The OPW decided to raise the level of the embankments to 5.5m OD Malin, giving a freeboard over the 1961 flood level of approximately 1.3m.

Along the Shannon River within the Study Area the embankments are currently at 5.5m OD Malin. Along the Ballinacurra Creek this level varies. Between the estuary and Bawney's Bridge they are at 5.5m OD Malin. From Bawney's Bridge to Ballinacurra Bridge the level is at 4.9m OD Malin and from the Ballinacurra Bridge to where the embankments end West of the railway at Rossbrien the level is 4.050m OD Malin. Evidently there is a higher risk of overtopping of these embankments.

The extent of the embankments is mapped along with back drains, sluice drains and general drainage schemes. The back drains serve as a storage facility. For approximately three hours of the tidal cycle no water can drain through the sluice drains. Then, as the tide recedes, the water drains from the back drains of the embankments through the sluice drains into the river.

The OPW require approval under section 50 of the 1945 Arterial Drainage Act for any interference with their drainage schemes. The existing falls, invert levels and discharges will be constraints on the vertical alignment of any proposed road. The highest recorded tide level of approximately 4.2mOD Malin is clearly an extreme level with a low probability of occurrence (1961, 1999), and represents a coincidence of extreme factors (tide, barometric pressure, adverse wind and river flows). Nevertheless the probability of flooding to this level is a design constraint on the road.

It is noted that much of Limerick is under the highest recorded tide level.

In February 1997 there was some flooding along the Ballinacurra Creek as result of topping of the embankments. The tide level recorded was approximately 4.1m OD Malin. There was no major flood damage recorded. The OPW had no reports of flooding, suggesting that no material damage occurred.

At Christmas 1999 there was a water level of approximately 4.2mOD Malin. As a result there was minor flooding at Ballykeeffe. Some gardens were flooded but no buildings. The reason for this given by the Office of Public Works was a temporary lowering of embankments by Limerick Main Drainage Contractors. This was done for ease of construction work associated with the Southern Interceptor Sewer. The Ballinacurra Gardens housing development is situated where the embankments are at there lowest. There has never been flooding there.

On the 23rd of December 1999 the predicted early morning tide was 2.617mOD with a water level of 3.417mOD recorded at Ted Russell Dock. The atmospheric pressure was recorded at 1004mb. The predicted tide on 25th of December 1999 as per Shannon Estuary Tide Tables was 2.617mOD Malin. The water level recorded at the Ted Russell Dock was approximately 4.2m OD Malin. The barometric pressure was recorded at 981mb.

Atmospheric pressure has a significant influence on the water levels along with other factors such as wind speed/direction and river flows. Assuming the density of sea-water to be 1000kg/m³, a fall of 1 mbar in atmospheric pressure should support an elevation of almost 1cm in water level. The difference in atmospheric pressure would account for approximately 230mm of the difference in actual water levels recorded in both the above instances.

Other locations in Limerick are at a lower level and experience flooding regularly. Sir Harry's Mall, Westbury, Clancy's Strand and O' Callaghan's Strand flood almost biennially. At the Abbey River Limerick Main Drainage construction site there was extensive flooding of the cofferdams at Christmas 1999.

The River Shannon is the longest river in Ireland. From its source, in Co. Leitrim, to its estuary, the river is 259km long and has a catchment area of 15,532km². The total length is 344km from the source to Loop Head. Lough Derg is in the Lower portion of the river. The water level in this lake is controlled by the power station at Ardnacrusha situated just to the North of Limerick. The daily discharge of fresh water into the Shannon rivers estuary is dependant on rainfall and the amount of water diverted through the Electricity Supply Board's turbines at the Ardnacrusha power station, which in turn depends on the public demand for electricity. In winter the demand for electricity is highest. The maximum flows also occur in winter. In winter at a time of high river flow when the headrace canal of the power station has reached capacity, the remainder of the flood water has to be released down to Limerick. This prevents flooding upstream. There have been flows recorded of up to 817m³/s. The compensation flow (minimum flow) is 10m³/s in the summer. The large river flows in winter due to increased rainfall have an impact on water levels recorded.

The winds in the region are variable both in magnitude and direction, but are predominantly from a Westerly and South-Westerly direction. A steady wind onshore causes a piling up of the sea against the coastline. In the estuary a steady wind in a Westerly or South-Westerly direction will have a large fetch (surface area of water upon which the wind may act). This causes a rise in the river water level at Limerick. An off shore wind reduces sea level. In this case an Easterly wind will act to lower the water level at Limerick.

4.3.3.4 Groundwater

According to the Geological Survey of Ireland, the bedrock aquifer within which the Study Area is located is classified as locally important, generally moderately productive, with the vulnerability being 'Probably High'.

In low land areas the water table is often within 10m of the ground surface, but unsaturated zones of up to 30m have been reported. The levels are variable depending on the permeability and elevation of the rock and are subject to seasonal fluctuations.

Groundwater storage and movement is via a secondary permeability created by fractures and fissures which in the limestone may be further enhanced by the enlargement of the fractures by karstification. The karstic nature of limestone in general ensures rapid movement of groundwater through the aquifer. This, along with the frequent absence of adequate protective subsoil cover, renders these aquifers very vulnerable to contamination.

In relation to the road construction, road usage and road drainage, the risk of contamination of groundwater is a constraint.

Studies on the groundwater movement around Bunlicky have been carried out in connection with Irish Cement dumping waste at Bunlicky Pond. Groundwaters perched in the alluvial clays overlying the limestone bedrock flow to this pond. These studies also concluded that there is an upper vertical head between the underlying bedrock aquifer and the pond which inhibits the downward migration of the pond water. The hydrogeological assessment of Bunlicky pond was carried out in 1998 and concluded that the pond is essentially isolated from the underlying bedrock aquifer.

Irish Cement Ltd., in the course of their quarrying activity, extract groundwater from the floor of the quarry. They continually extract groundwater using pumps and the water (approx. 5000m³ per day) is discharged to the Bunlicky Pond which drains to the River Shannon. They have recently been successful with their planning application to extend the works and this will mean an intensification of the quarrying activity and an accelerated extraction of groundwater. Irish Cement have given an undertaking to the Planning Authority to make good any third party loss of water through the lowering of the water table in the vicinity of the site. They are unaware of any wells in the area and no such incidents of loss of water have been recorded to date.

Loughmore Common in the South of the Study Area lies in a shallow basin elongated in an east-west direction and floods shallowly in winter (approx. 300mm). Thus, the groundwater table rises above ground level in winter. Loughmore Common is apparently drier today than it has been in the past due to increased irrigation in the surrounding land.

Karstification

At the South East of the Study Area, south of Limerick, there is a place called Sluggary derived from the Irish word *Slogaire*, most likely to mean swallow hole in this instance. Karstification is the chemical solution of limestone rock to form cavities or swallow holes. Evidence of extensive karstification is not recorded within the Study Area. Generally some karstification may occur in isolated instances. The project team on the Adare to Limerick Road Scheme has not encountered any evidence of karstification.

The geophysical surveys which will be carried out as part of the site investigation contract will help to confirm whether or not extensive karstification is evident.

4.3.3.5 Rivers, Streams, Bridges, Culverts and Wells

The Crompaun River (Meelick Creek) meets the River Shannon from the North while the Ballynaclough River (Ballinacurra Creek) meets the Shannon from the South. Barnakyle River traverses the south-western corner of the Study Area.

There are four road bridges currently crossing the Shannon in Limerick:

- Shannon Bridge
- Sarsfield Bridge
- Thomond Bridge
- Athlunkard Bridge

Bawney's Bridge on the N69 and Ballinacurra Bridge on the N20 cross the Ballinacurra Creek. Meelick Bridge and Landsdowne Bridge on the N18 cross the Crompaun River.

The OPW records for the Study Area have been studied. The bridges and culverts along the OPW drainage scheme lines will be mapped at route selection stage. These are extensive and will be considered when defining the vertical alignment of any proposed roads.

Large areas along the Shannon Estuary are subject to flooding which is controlled by embankments along the river and its tributaries.

Loughmore Common Turlough, is situated in the Southern section of the Study Area to the west of the N20.

Houses in the Study Area are generally supplied by group water schemes. Elsewhere there is a mains water supply.

The area of the quarry at Irish Cement Limited is approximately 160 acres. The quarry water abstracted comprises surface run-off within the quarry site plus ground water. Obviously this has lowered the water table in the area. Irish Cement has had no difficulties with loss of water to wells used for domestic supply in the area.

4.3.3.6 Rivers and Drainage Catchments

The Crompaun River (Meelick Creek) joins the Shannon from the Clare side, while the Ballynaclough River (Ballinacurra Creek) joins the Shannon from the Limerick side at Corcanree. Further east, outside the Study Area, there are the Groody and Mulkear rivers while the Mague River joins the Shannon just west of the Study Area.

The drainage catchment area of the Ballynaclough River is approximately 46km². The

Ballynacloagh River discharges to the Shannon Estuary through the Ballinacurra Creek. Flooding occurs regularly in areas of the catchment, opposite the Crescent Shopping Centre north of the railway, in the vicinity of the Rossbrien Road and at Ballysheedy. The main cause of this flooding is the tidal influence at Ballinacurra Creek. At high tide, no surface run-off can discharge to the Shannon causing flooding further upstream along the Ballynacloagh river. The Limerick Southern Ring Road Phase I, currently at Tender stage, will incorporate the construction of a storm water storage facility. This will alleviate the flooding noted above.

Any proposed road infrastructure within this area will also be subject to this tidal influence. Adequate pollution control will also have to be considered.

4.3.3.7 Land Form

The wider landscape, both urban and rural, has a gently undulating appearance with the exception of those areas along the Shannon Estuary, which are flat and low lying, generally below the 10mOD contour.

The agricultural land to the South-West of the Study Area is generally between the 20mOD contour with some local high points around 25, 30 and 35mOD. The land in the South-East sector is above the 10mOD contour, rising to a high ground level at the 30m OD contour.

The land rises gradually on the approach to the city along the N20.

Most of the area to the North of the Shannon is low-lying and generally below the 10mOD contour.

4.3.4 Planning and Land Ownership Issues

4.3.4.1 Planning Constraints

Planning applications which have been approved within the past five years are indicated on the Constraints Maps. Important applications, approved or proposed, include:

- Shannon Development is proposing to develop their landholding at Rossbrien for industrial development. This proposal is at pre-planning and Consulting Engineers in Limerick have carried out a preliminary storm water discharge design.
- Irish Cement Limited have planning to extend their plant capacity and quarry within their current land holding. These applications were approved in 1991 and 1999 respectively. Long term Irish Cement intends to expand Westward. The quarry extension, as with the existing quarry, will be developed below the level of the water table and is likely to be flooded when quarrying is completed.
- Shannon Rugby Club have received planning permission to develop club facilities at Coonagh West. They have 5 pitches, a clubhouse and a car park.
- There are proposals to develop the old racecourse for mixed use.
- Limerick Flying Club were refused planning to construct a second runway running Northeast to Southwest
- The Two Mile Inn, in Clare, have applied for a development of tourist apartments & facilities.
- There is a proposal, currently at planning, to construct a large residential

development at Ballykeeffe.

- A planning application from Chieftain Development is expected for development of a large area North of Coonagh roundabout opposite the Ferndale development. The land is currently zoned for retail, commercial and community use.
- Shannon Development is seeking a site for an industrial park between Limerick and Shannon close to the N18 Ennis Road.

4.3.4.2 Land Holdings

A land search at the Land Registry Offices, in Waterford revealed the extents of the majority of the land holdings in County Limerick within the Study Area. The average farm size in County Limerick is 70 acres (28 hectares) and land holdings within the Study Area are predominantly larger than average except for the Townlands of Rathmale and Baunacloka where the holdings appear to be smaller.

The largest land holding within the County Limerick Study Area is that owned by Irish Cement Limited (almost 800 hectares) who have lands at Bunlicky, Castlemungret, Conigar, Corbally and Tervoe. This area of land is known locally as the Bunlicky Clayfield. Clay was traditionally extracted from this area for use in the manufacture of cement at the nearby works. Outside of the lands owned by Irish Cement Limited the vast majority of land within the Study Area is zoned as agricultural land. Some of the land in the Gouldavoher, Baunacloka, Skehacreggaun and Dromdarrig areas is zoned residential.

A land search at the Land Registry Offices, in Dublin revealed the extents of the majority of the land holdings in County Clare within the Study Area. Farms in County Clare are predominantly small with 50% of the farms having less than 20 hectares and only 20% having an area in excess of 40 hectares.

Whatever route option is eventually chosen for the Limerick Southern Ring Road Phase II will probably impact on at least 40 land holdings most of which will be in County Limerick. These land holdings will vary in size and function while the impact felt by individual landowners is likely to vary from minor to very serious.

4.3.4.3 Listed Buildings

The various Development Plans for the Local Authorities within the Study Area list a number of structures for preservation within the Study Area, (See Figure BSM/1 in Appendix B for location of item no.) namely:

1. Thatched Cottage, possibly 18th century, at Coonagh
 2. Thatched house, at Ballykeeffe
 3. OPW Regional Offices (previously Templemungret) mid-19th century, Tudor gothic house at Skehacregghun.
 4. Mungret Castle, site of medieval tower house
 5. Mount Mungret, C of I Glebe House of 1832 at Mungret.
 6. Mungret College, Lodge etc.,
 7. St. Nessian's Church, medieval at Dromdarrig
 8. Mungret Abbey, medieval remains at Dromdarrig
 9. Dooradoyle House, 19th century house with veranda.
 10. Raheen Church, 1845.
 11. Roche Castle, small gothic revival castle circa 1830 at Ballycummin.
- No # School, mid-19th century gothic with rusticated limestone at Mungret.

The CAAS Draft List of Protected Buildings (January 1998 update) includes the following listings within the Study Area.

Country Houses

• 16B	Ballyclough	17.R.57.52.		B13(26)
• 17B	Ballyclogh House			B6(10)
• 20B	Ballycummin (Roaches Castle)	17.R.56.52.	S.Env.	B13(22)
• 32A	Ballynoe	17.R.43.32.		B38(26)
• 58B	Castle Mungret			B13(01)
• 66B	Clarina Lodge			B12(29)
• 67B	Clonmacken House	C'davin		B5(01)
• 74B	Cooperhill House			B4(18)

Industrial & Institutional Buildings (Coded L)

• 32	Tervoe			L4(17)
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Town Listing (Coded M)

“Mungret: Retains the outline of an early monastic enclosure: this should be carefully resolved in all planning considerations”

- B1 Mungret Jesuit College. (No. 7 on Figure BSM/1 – see Appendix B)
- A2 Gothic School.
- A3 College Gate Lodge. (No. 6 on Figure BSM/1)
- A4 Mungret Abbey 2 Chambers (**National Monument**) (No. 8 & 9 on Figure BSM/1 – see Appendix B)

4.3.4.4 Planning Land Usage

The amendments to the Caherdavin District Development Plan (1999) zoned Coonagh generally as agricultural with long term walkways. The area immediately south of the N18 between Coonagh roundabout and Crompaun River is zoned for industrial development.

The amendments to the Southern Environs District Development Plan show a change at Rossbrien to the Shannon Development site from industrial to residential zoning.

A large portion of the land in the Mungret, Gouldavoher, Dromdarrig, Baunacloka and Dooradoyle has been zoned for residential development. At Coonagh the Clonmacken link road appears to define the extent of residential development zoning.

Along the route of the Ballinacurra Creek open space recreational, and agricultural zones generally apply. However, an industrial area is zoned on the Ballykeeffe side of the N69 Dock Road, between Bawneys Bridge and the roundabout at Irish Cement.

The Raheen Industrial Estate is expanding rapidly. Approximately 220 acres out of a total of 400 acres are developed.

Loughmore Common is a proposed National Heritage Area. Bunlicky Pond is a candidate SAC as well as a proposed National Heritage Area, and is used as a landfill for inert waste material from Irish Cement. It is a conservation area for birds.

4.3.5 Utilities

ESB Infrastructure

The ESB infrastructure, which is mapped on the Constraints maps, comprises high voltage

lines and 2 No. 110 kv stations.

The lines are overground. The main areas where a conflict would have a significant impact on cost are at station sites and angle positions on the line routes.

The relocation of a substation should, where possible, be avoided on technical and cost grounds.

Eircom Infrastructure

The Eircom infrastructure, which is mapped on the Constraints maps, comprises underground ducting containing communications cabling (copper, fibre optic or C.P.M.).

These lines follow the main roads and the cost of diverting and or realigning these is directly proportional to the density of cables. Larger costs would be associated with diversion or realignment of cables at Ballinacurra Bridge. There are 1200 and 1050 pair trunk cables along with C.P.M. cable and other smaller trunk pair cables at this location. The cost of realigning cables assuming the worst case scenario is labelled on the mapping.

Impact to the cost of the Southern Ring Road Phase II scheme is the principal telecommunications constraint to be considered.

Gas Infrastructure

The Gas infrastructure, which is mapped on the Constraints maps, comprises transmission lines, above ground installations and distribution lines.

A distribution line is planned which will cross the Shannon River in conjunction with the Limerick Main Drainage. A future high pressure transmission line is proposed to cross the Shannon but will not be carried out in the Southern Ring Road Phase II Study Area.

The distribution lines are PE pipes and under a pressure of less than 7 bar. These are routinely diverted and realigned.

The transmission lines are steel pipes under high pressure. The transmission line between Barnakyle and Ballinacurra is under pressure of 19 bar. To carry out work on transmission lines such as these is a considerable undertaking, with major cost and programme implications.

Impact to the cost of the Southern Ring Road Phase II scheme is the principal Bord Gais Éireann constraint to be considered.

Sanitary Services

The existing watermains, foul and storm sewers have been mapped on the Constraints maps.

In the Dooradoyle area there are a 750-mm diameter main and a 450mm diameter main. These serve the Dooradoyle area including the Regional Hospital. A conflict with these is unlikely.

Other mains within the Study Area are smaller and the cost of accommodating these in fill or cut should be considered as a constraint.

The programming of the Limerick Main Drainage project should be considered a constraint along with the actual pipe runs themselves. For the inner corridor options the impact of construction in respect of major sewers is considerable. Diverting and realigning of existing sewers will have a cost impact.

5. Environmental Constraints

5.1 Introduction

The purpose of this section of the report is to describe the environmental conditions in the Study Area which need to be considered to enable selection of a route which will cause least impact on the environment. The Study Area is located within the Shannon estuary the largest estuary in Ireland extending for over 100km from the mouth of Ireland's largest river the Shannon to the Atlantic. The estuary is bounded by County Clare to the north and by Counties Limerick and Kerry to the south. There are numerous tributary estuaries and embankments branching from the main channel, the largest of which is the River Fergus to the west of the Study Area.

The Study Area, which is shown in Figure 3.1, is located on the western outskirts of the city extending to west of Coonagh Point. The area east of Bunlicky lake is urban in character with the area to the west predominately rural.

5.2 Legislation and Guidelines

The design of the project is being carried out in a phased approach as recommended by the National Roads Authority Guidelines (1999). This approach requires that the project be carried out according to the following phases:

- Phase 1 Pre-Planning
- Phase 2 Constraints Study
- Phase 3 Route Selection
- Phase 4 Preliminary Design including Environmental Impact Statement
- Phase 5 Construction Documents Preparation/Tender/Award
- Phase 6 Scheme Construction

The Constraints Study is thus carried out prior to the Environmental Impact Statement and its purpose is to identify the local issues that must be taken into account so that the more technical phases to follow can be properly planned. An Environmental Impact Statement (EIS) will be required under the Roads Act, 1993. Prior to the EIS, an environmental appraisal will be carried out as part of the Route Selection stage. The EIS will then be prepared according to the Roads Act 1993 which incorporates the requirements of the European Commission Environmental Assessment Directive 85/337/EEC in relation to road projects. The scope and content of the EIS will be determined by reference to the European Communities (Environmental Impact Assessment) (Amendment) Regulations, 1999 and the Advice Notes on Current Practice published by the Environmental Protection Agency.

5.3 Water Quality Management Plan

The Local Government Act (Water Pollution) of 1997 has provided in Section 15 for the preparation of Water Quality Management Plans. A Water Quality Management Plan is a tool to assist policy makers in the management of water bodies, takes account of present and potential beneficial uses and sets quality objectives to meet these demands. A water Quality Management Plan was prepared for the Shannon estuary by Clare County Council, Kerry County Council, Limerick County Council and Limerick Corporation in June 1988. The Plan provides a comprehensive overview of the status of the estuary at the time in terms of water quality, beneficial uses, and waste loads. Furthermore the Plan provides useful background information on the estuary. A mathematical model was also developed to assist with the prediction of future proposed effluent discharges. The Plan set a preliminary list of water quality standards for the estuary as follows:

Parameter	Units	Water Quality Standards
Aesthetic Qualities		All waters free from substances attributable to wastewater or other discharges that: (a) Settle to form objectionable deposits, (b) Float as debris, scum, oil, or other matter to form nuisances, (c) Produce objectionable colour or odour, (d) Injure, are toxic to, or produce adverse physiological responses in humans, animals or plants, and (e) Produce desirable or nuisance aquatic life.
B.O.D.	mg/l	4
Cadmium***	mg/l	5
Chlorine	mg/l	0.01
Chromium	mg/l	100 (50) ++
Copper*	mg/l	50
Cyanide	mg/l	10
Dissolved Oxygen	mg/l O ₂	(a) General standard of not less than 7 mg/l D.O. in 50% Of samples. (b) General standards of 5 mg/l D.O. in 95% of samples. (c) No samples to have less than 4 mg/l D.O.
Fluoride	mg/l	1.5
Lead	mg/l	100
Manganese	mg/l	100
Mercury+++	mg/l	0.1
Nitrate**	mg/l	1.0
Oil and Grease		Oils and grease should not be present in quantities as to: (a) form visible films on the surface of waters, (b) form coatings on the beds of watercourses, benthic biota or food-sources, (c) have deleterious effects on aquatic life, (d) impart a detectable taste or odour to edible aquatic species.
PH		6.5 to 8.5 but no change more than 0.2 units from natural.
Phenol	mg/l C ₆ H ₅ OH	0.001
Silver	mg/l	10
Sulphide	mg/l Un-dissociated H ₂ S	0.002
Temperature	°C	Summer thermal maxima should not be increased by artificial means. In the absence of records of such maxima, 21.5 ⁰ C may be taken as the temperature above which artificial increases in temperatures should not be allowed, except for periods which are sufficiently brief to prevent injury to or emigration of fish life, i.e. periods of one or two hours in later afternoon on the warmest days. Subject to the above criterion, the ambient water temperature should not be increased artificially by more than 1.5 ⁰ C outside the immediate mixing zone of the thermal discharge.
Zinc*	mg/l	100

Source: Water Quality Management Plan for the Shannon Estuary

Notes:

- * Recommended values for these parameters apply to waters whose hardness is greater than 50 mg/l as CaCO₃.
- ** Higher concentrations may be permissible near the entry points of rivers.
- *** Based on C.E.C. Directive on limit values and quality objectives for cadmium discharges (68).
- : The values for chromium, copper and zinc may not provide sufficient public health protection in the case of edible shellfish. For the toxic parameters in the table bioassay procedures should be followed whenever possible (35).

The values given in the table apply to the entire waters covered by the plan. In addition, the mandatory values given in the C.E.C. Freshwater Fish Directive (40) shall apply where the water is fresh. For other specific zones of the estuary, e.g. future shellfish waters, further local standards may apply, this would apply also to designated bathing waters.

- N.B. + Formal adoption of the standard for any parameter should not be made before sampling has been carried out over a period of years. The recommended standards shall be subject to regular review - in particular those for copper, zinc, ammonia and B.O.D.
- ++Temporary standard of 50 mg/l chromium in potential mariculture areas, subject to review; in general, more stringent standards for chromium are likely to follow future review.
- +++Recent C.E.C. Directives on mercury state that the mercury in solution in estuary waters affected by discharges must not exceed 0.5 mg/l as the arithmetic mean of the results obtained over a year, and that the quality of mercury in sediments or shellfish must not increase significantly with time (72, 73)

5.4 Protected Areas

It is necessary to consider protected areas when planning for new developments. There are a number of such areas which need to be considered and these are described below.

5.4.1 Natural Heritage Areas

The National Parks and Wildlife division of Dúchas (part of the Department of Arts, Heritage, Gaeltachta and the Islands) has prepared a list of proposed Natural Heritage Areas (pNHAs). A pNHA can be defined as an area deemed to be of special interest containing important wildlife habitat and often containing rare or threatened species. They may also be selected on the basis of their geology or geomorphology. Examples of pNHA's across the country include blanket bogs and wetlands. On the basis of the information available to date 1,200 pNHAs are likely, covering an area of approximately 750,000ha. pNHA's do not have any statutory protection yet but are protected under many of the relevant County Development Plans. An amendment to the Wildlife Act (1976) has been proposed which will give legal backing to pNHA's. The Wildlife Amendment Bill was published in 1999 and is expected to be debated in the Dáil shortly.

Information has been obtained from Dúchas, in the form of mapping and site synopsis for numerous pNHAs in the Study Area. These are illustrated on the Environmental Constraints Maps with the Dúchas site synopses given in Appendix B.

5.4.2 Special Areas of Conservation

Based on an extensive survey of pNHAs conducted between 1992-1994, candidate SACs that have met scientific criteria as set out in the Habitats Directive were identified. Of the pNHA's selected, the best sites have been designated as Special Areas of Conservation (SAC). These will be the prime wildlife conservation areas in the country and are protected under the Habitats Directive (92/43/EEC).

The European Communities (Natural Habitats) Regulations, 1997 (Statutory Instrument 94/97) transposed the Directive into National Legislation in February 1997. These regulations place the responsibility for protecting the sites on the Minister for Arts, Heritage, Gaeltacht and the Islands.

The initial step in the SAC process is to publicly announce the proposal to put a particular site forward as a candidate SAC. Sites to which there are no objections will be 'designated' two months after the date of public advertisement. From the time of listing in a newspaper a proposed SAC is protected in law from damage. Dúchas, the Heritage Service of the Department of Arts, Heritage, Gaeltacht and the Islands has publicly advertised 207 sites including the Shannon estuary, which it has proposed for designation as SACs. They have also commenced the transmission of candidate Special Areas of Conservation to the European Commission, as required by the EU Habitats Directive of which 104 sites have been transmitted to date. The candidate sites have to be formally approved as designated SACs by the European Commission. The Shannon estuary is a candidate SAC, as is Ballinacurra Creek to a point part way between the Dock Road and Ballinacurra Road (N20), and Bunlicky Lake just to the east of the Irish Cement plant.

5.4.3 Special Protection Area

Another group of sites under legislative protection are the Special Protection Areas (SPAs). Ireland is required to conserve the habitats of two categories of wild birds under EU Directive 92/42/EEC on the conservation of natural habitats and of wild flora and fauna (Habitats Directive). This supersedes the European Directive 79/409/EEC on the Conservation of Wild Birds and the Conservation of Wild Birds Regulations (S.I. 291 of 1985). The Birds Directive has been transposed into Irish law by means of the European Communities (Natural Habitats) Regulations 1997, which provides for SPA protection measures.

Two categories of birds are protected:

- Listed rare and vulnerable species
- Regularly occurring migratory species

In 1997, 109 SPAs covering 230,000 hectares had been designated and a number of others are scheduled for designation.

The Directive also obliges Ireland to conserve wetlands, especially those of international importance. The most important of these wetlands are already, or will in the future be designated as SPAs.

The selection of SPA sites is based on scientific information and present EU standards. Developments, which might significantly impair the wild bird usage of these sites, will not be allowed. All sites once officially designated will become part of the EU List of Natura 2000 sites. It is the responsibility of the National Parks and Wildlife Service to see that these SPAs are protected from significant damage.

A small section of the extreme north-western portion of the study area is an SPA, in the vicinity of the Crompaun River/Meelick Creek, and the opposite river bank.

5.4.4 National Parks

National Parks have been established for the conservation of areas, which hold considerable biodiversity interest. All are state owned and are managed by the National Parks and Wildlife Service. There are currently five National Parks in Ireland including Killarney, Wicklow, Glenveigh, Connemara and the Burren National Parks. A sixth park is proposed for North Mayo in the Owenduff/Nepin area. National Parks have no legal backing, except for the Killarney National Park. The proposed scheme does not impinge upon a National Park and this category is not therefore a constraint.

5.4.5 Statutory Nature Reserves

Statutory nature reserves are protected by the Wildlife Act 1976. Statutory nature reserves provide the strictest means in Ireland for the protection of wildlife sites. All statutory nature reserves are pNHAs and a proportion will be designated as SACs.

Statutory nature reserves may be established and managed on State lands or on private lands in agreement with the owner, which meet certain specific criteria and comprise wildlife habitats worthy of protection. Most nature reserves are on state owned land. In 1997 there were 78 nature reserves covering 18,095 hectares. Most damaging activities can be legally protected in them. The proposed scheme does not affect any Nature Reserve.

5.4.6 Refuge for Fauna

Under the Wildlife Act, 1976 the Minister may designate refuges for wild birds or wild animals and impose restrictive measures to conserve both the species and their habitats.

Protective measures include control on all potentially damaging activities that could take place in such inaccessible places. There are seven sites in Ireland and all are designated on islands and cliff faces to protect breeding seabirds. There are no refuges for fauna in the Study Area.

5.4.7 Wildfowl Sanctuaries

These are sanctuaries that have been excluded from the 'Open Season Order' so that game birds such as ducks, geese and waders can rest and feed undisturbed. Shooting of game birds is not allowed in these sanctuaries. There are 68 wildfowl sanctuaries in Ireland. However, their habitats cannot be protected unless by some other measure. Wildfowl sanctuaries have little significance in planning and development and are not normally recognised by local authorities. Wildlife Sanctuaries are designated on state or private land by S.I., under Section 24 of the 1976 Wildlife Act. Seventeen existing SPAs are at least partly covered by Wildfowl Sanctuaries. There are two wildfowl sanctuaries within the Shannon estuary but none in the Study Area.

5.4.8 Relevance of Above to Study Area

In summary the majority of the above types of Protected Areas are not within the Study Area of the proposed scheme. The Study Area does however contain proposed NHA's, candidate SAC's and a small portion of the area is within an SPA. In terms of significance to the study area the SPA only represents a small area and can possibly be avoided so its presence will not cause a major constraint. The candidate SAC's are currently the most important designation in terms of the legal protection to the study area as the pNHA's do not currently have legal protection. However this is expected to change very shortly.

The banks on both the north and south side of the Shannon Estuary are a pNHA. The significance of this area is due in particular to the Triangular Clubrush (*Scirpus triquetus*) which is a protected plant species with its only Irish distribution in the Shannon estuary. The pNHA's are not currently protected by law, however, when the pending amendment to the wildlife bill has been passed the NHA's shall be legally protected and any development upon them shall not be supported by EU funding.

The Shannon Estuary (north and south shore) is at present a candidate SAC, however Dúchas have verbally indicated that the scheme as it stands is not deemed to have a significant impact upon the SAC. In such a case, the official adoption of the area as an SAC will not see it considered a major constraint upon the proposed development. Under the terms of the Directive any plan or project likely to have significant adverse impact on a SAC must be subject to an assessment of its implications. The Minister is given powers to decide if a development should proceed in an SAC if there are overriding health and safety reasons or for imperative reasons of overriding public interest.

Loughmore Turlough was originally designated as a proposed SAC as turloughs are priority habitats due to their very limited distribution. A formal appeal was made in early 1999 by the local residents which resulted in Dúchas revising the designation to proposed Natural Heritage Area. The protected plant (*Groenlandia densa*) is the main reason for the status as pNHA however Dúchas still consider the area to be a turlough although it is not perhaps the most typical example of the habitat type.

5.5 Archaeology and Heritage Sites

A preliminary archaeological review of the Study Area was carried out by Margaret Gowen & Co. Ltd. and is contained in Appendix B. This review is based on information supplied by the Sites and Monuments Record (SMR) section of Dúchas the Heritage Service of the Department of Arts, Gaeltacht and the Islands. Further information was obtained from literature sources. As part of the route selection and EIS a detailed archaeological survey will be conducted on the preferred routes to compliment this initial appraisal.

5.5.1 Land Based

The most common archaeological site found within the Study Area is the enclosure/ringfort; forty-three sites and possible sites have been recorded. Ringforts are the classic Early Christian settlement type and are among the commonest archaeological monuments in the country. Other sites include castles (11), churches (3) standing stones (3) and two *fulachta fiadh* (SMR LI012:126 and LI012:125), a possible cairn (SMR LI013:149), a possible deserted settlement (SMR LI005:102), a possible site for a seventeenth-century house (SMR LI005:04401), a mill (SMR LI013:116) and a bridge (SMR LI013:012).

The Study Area is very rich in archaeological monuments. All the SMR sites within the area will have a constraint area around them of at least 120m. The location of a known SMR site also increases the likelihood of there being other related unidentified sites in the vicinity. The number of ringforts in particular is very substantial. These monuments are also evenly distributed across the Study Area. Some of the sites are only possible examples, but a field inspection should be able to identify the actual monuments from natural features.

The number of castles, tower houses and possible sites for castles is also quite substantial. These sites and a substantial area around them are a constraint due to the likelihood of finding related features associated with the castle such as bawn walls, barns and smaller, less substantial dwellings. The three churches, and in particular the large ecclesiastical establishment at Mungret, also impose a constraint.

5.5.2 Marine

The River Shannon, particularly its estuary and intertidal zone is considered to have good archaeological potential. Three sites have been recorded by the SMR within this zone. The sites relate to the need of humans to exploit a huge natural resource. A prehistoric occupation site (SMR LI004:003), a trackway (SMR LI004:034) and a fish weir (SMR CL026:036) have all been recorded. As well as monuments, the Topographical Files of the National Museum of Ireland record thousands of artefacts from the River Shannon, ranging in date from the prehistoric to the late medieval period. Provision has been made for an archaeological investigation of the estuarine environment as part of the site investigation for route selection which will commence shortly.

5.5.3 Ballinacurra Creek

All rivers and streams in the Study Area should be treated as salmonid waters according to the Shannon Fisheries Board and Ballinacurra Creek discharging at the eastern crossing alternative, is an important location for Shannon estuary stocks of glass eels between February and May. It is a small river which enters the main channel of the River Shannon within the Study Area and is included within the candidate SAC and proposed NHA Shannon estuary south shore. It has a number of features of ecological importance with the predominant plant being common reed *Phragmites australis* with summer snowflake a rare plant in Ireland *Leucojum aestivum* also characteristic of the Ballinacurra area. A rare plant, triangular clubrush *Scirpus triqueter* has also been found there, although its exact distribution will have to be subject to further investigation.

Locally there may be a risk of permanent impacts on fish e.g. due to local changes in current velocity induced by bridge piers. One of the proposed solutions for crossing involves the re-laying of Ballinacurra creek. One cannot preclude the risk of quite serious impacts on the Shannon estuary stocks of glass eels, for which the Ballinacurra creek is an important location. Fish and fisheries may temporarily be affected by suspended and settled material dispersed during the construction phase. It is known especially from laboratory studies that fish may avoid sediment plumes implying that migration routes for fish may be blocked if the concentrations of suspended sediments are too high.

5.6 Known Significant Flora and Fauna

5.6.1 Estuary

The construction of a tunnel or a bridge across the Shannon includes dredging for tunnel trenches, bridge piers etc. During dredging sediment will be spilled and dispersed with the currents. Sediments may also be spilled at deposition sites for dredge spoils and during infilling of sand and other resources. The spilled sediment may temporarily affect flora and fauna in the estuary. However, a significant or full recovery of affected flora fauna is expected after the construction phase.

The degree and extent of impacts on the flora and fauna in the Shannon will depend on:

- The amount of material which will be dredged, deposited and reclaimed
- The dredging methods applied
- Seasonal variation in spill rate
- The nature of the sediment combined with the sensitivity of the exposed species and the ability of the communities of species to recover.

Flora and fauna may be permanently impacted due to burial and excavation or as a result of changes in current patterns induced by bridge piers etc. The degree and extent of impacts on the flora and fauna in the Shannon of the different options for the river crossing will be

assessed in detail in connection with the preparation of the route/crossing selection report and the EIS of the chosen solution. Flora and fauna, which may be affected in the estuary due to the construction of the Shannon crossing is presented below.

Vegetation

Triangular club rush (*Scirpus triqueter*) which is protected by the Flora Protection Order of 1999 is encountered in the crossing corridor e.g. at the mouth of Ballinacurra creek. This species is one of the reasons for designating the area a candidate Special Area of Conservation. The Shannon crossing may affect this species.

Benthic fauna

The benthic macrofauna comprises the invertebrate fauna burrowed in- and living on the sediment. The crossing corridor holds an impoverished benthic macrofauna comprising low species numbers. The diversity is low and the abundance decreases dramatically along the stretch from Churchfield to Tervoe immediately downstream of the planned Shannon crossing. Further upstream the abundance increases dramatically. The abundance of true estuarine species (*Corophium volutator*, and *Nereis diversicolor*) decrease and the abundance of freshwater species (*Pericoma sp* and *Pisidium spp.*) increase, indicating that the area is situated in the transition zone between oligohaline estuarine water and freshwater. The impoverished fauna is a natural phenomenon and is typical for the highly variable environmental conditions found in the inner parts of estuaries.

The abundance and species diversity gradually increase further downstream of the crossing corridor. It is expected that the fauna will be temporarily affected during the construction of the crossing. The recovery potential of estuarine benthic species is very high and full recovery of impacted fauna is expected within a short time after the completion of construction works. It is expected that permanent impacts will be insignificant.

Temporary impacts on the impoverished benthos in the crossing corridor are not expected to cause severe ecological impacts. However, the feeding potential for wintering birds may be temporarily affected if benthic species, which are prey for the birds, are affected. The area in the crossing corridor is not important for wintering birds, but if there is a risk that feeding grounds for birds further downstream may be affected, seasonal restrictions on dredging or other mitigating measures may be prescribed (Cf. below). The risk of impacts on feeding grounds for birds will be assessed in connection with the preparation of the route/crossing selection report and the EIS.

Birds

The Shannon and Fergus estuaries are of international importance for birds. The tidal mudflats so rich in invertebrate food are ideal feeding grounds for thousands of wintering waders and ducks. The two estuaries host the largest number of wintering waterfowl in Ireland. However, the inner part of the estuary where the crossing corridor is situated is not important for wintering waterfowl. This is due to the fact that mudflats are narrow and that the benthic fauna is naturally impoverished

The birds are mainly concentrated in the middle part of the estuary where the principal areas of mudflat occur and where the benthic fauna is richer.

The results of a survey in January 2000 conducted by Birdwatch Ireland are given in the Ecological Constraints Report in Appendix B. The area was found to have nationally significant levels of three species Cormorant, Teal and Redshank at least occasionally. However, to qualify for designation as a 'nationally important' wetland, an area must hold qualifying numbers 'regularly' and not just occasionally. With three species frequently present in sufficient numbers, there may be a basis for regarding the area as 'nationally important', subject to a detailed assessment as part of the Irish Wetland Bird Survey scheme.

As stated above seasonal restrictions on dredging or other mitigating measures may be prescribed if there is a risk that feeding grounds for birds further downstream of the crossing corridor are affected.

There is a recent example of the halting of a dredging operation due to impacts on wintering birds. In October 1999 dredging by the Drogheda Port Company in the Boyne Estuary was halted following complaints that part of a Special Protection Area (SPA) for wildbirds was seriously damaged. It was alleged that the dredging was depriving birds of some of their food supply just as they were arriving from Greenland to spend winter in the Boyne Estuary.

Fish

The crossing corridor is important for fish and fisheries. The Shannon estuary is of major importance as a migratory route for salmon, sea trout and eel. All migrating salmon and sea trout must pass the crossing corridor in order to reach spawning grounds in the rivers upstream. In addition the upper reaches of the Shannon estuary hold stocks of smelt and pollan, which are rare species listed in the Irish Red Data Book as vulnerable in Ireland.

The **Atlantic salmon** migrate from feeding areas in the sea through estuaries and up into the upper reaches of the rivers and streams to spawn. Spawning takes place in shallow gravel areas of rivers and streams from November to January. After spawning the spent fish return to the sea. The eggs hatch in March or April. The salmon fry stay in freshwater for about three years before becoming smelts that migrate to the sea to feed. The Shannon has two runs of salmon:

- In March - May there is a run of "spring fish". Spring fish are fish that have stayed at sea for two or more winters to feed.
- In late May-July, there is a run of grilse, the peak period being late May and June. Grilse are fish returning to freshwater having spent only one winter at sea.

After immigration, the fish lurk in the rivers until the onset of the breeding season in November-January. All salmon having spawning grounds in the tributaries upstream of Limerick must pass through the crossing corridor at Limerick.

The **European eel** spawn in the Sargasso Sea, east of the Bahamas. The North Atlantic current carries larvae and elvers across the Atlantic and the elvers arrive to the Irish coast in the beginning of January. After arrival they stay in the coastal waters for a month, estuaries being particularly favoured areas. From early February to July the elvers migrate from the estuaries to rivers and lakes where they grow up and remain until they are sexually mature at an age of about nine years. The peak month for migration of elvers is May. Ballinacurra Creek discharging at the eastern crossing alternative, is an important location for Shannon estuary stocks of glass eels between February and May.

In the autumn, the sexually mature eels migrate down the river and most of the mature eels will have reached the coast by September-October.

The **smelt** migrates into clean rivers to spawn just above the estuarine limit before returning to the sea. The stocks of smelt are declining in coastal waters and estuaries and there are only three known breeding populations left in Ireland. The species is listed as vulnerable in Ireland in the Irish Red Data Book. There is one breeding population in the Fergus, which is discharging to the Shannon, and one in the Shannon. The latter population spawns in the tailrace of the hydroelectric power station at Ardnacrusha and it is found extensively downstream of the crossing corridor from the Whelps to Bird Rock.

Pollan is another rare species of fish listed as vulnerable in the Irish Red Data Book. The pollan is normally found in freshwater lakes but has been found in the Shannon as far as Limerick City. It has been suggested that spawning of pollan takes place in the Shannon estuary but details are not available.

There are significant numbers of licensed salmon nets downstream of the crossing corridor. Angling for salmon and trout in rivers and streams is a popular sport. Angling holidays are very popular and are important for the tourist industry. The salmon passing the future Shannon crossing are important for angling in a large area upriver of the crossing. Upstream of the crossing corridor between Thomond Bridge and Sarsfield Bridge there is a significant

amount of recreational angling for both game and course fish. One of the most prestigious Salmon Fisheries in Ireland is located at Castleconnel 11 km upriver of Limerick City. International fly anglers have described this fishery as one of the best fly waters in the world. Angling for Salmon also take place at the following rivers upriver of the crossing: Plassey and the Longshore River Shannon at Limerick, river Mulchair, the Nenagh and the Ollatrim, the Camcor river, the Little Brosna, the Brosna, Silver River and river Suck.

Given the importance of the corridor as a migration route for salmon, trout, smelt, pollan and eel, seasonal restrictions on dredging or other mitigating measures to reduce temporary impacts on fish and fisheries may be prescribed. The risk of impacts on fish and fisheries will be assessed in connection with the preparation of the Route Selection report and the EIS.

5.6.2 Land

A preliminary appraisal of the Study Area was carried out by Mr. Roger Goodwillie, Consultant Ecologist, as part of this Constraints Study and is contained in Appendix B. A detailed assessment will be carried out as part of the Route Selection and EIS.

The ecology of the area has been influenced by the embankment of the Shannon estuary itself to prevent flooding of the hinterland so that natural vegetation occurs only on the sea side of the embankments where extensive reedbeds occur. Behind the embankments excavation of clay for the cement works has created Bunlicky and Cooperhill lakes, the latter just to the west of the Study Area. These augment the aquatic vegetation which is also found in toe drains close to the embankments, particularly on the northern side. Across the estuary a fringe of willow trees is characteristic of the back of the reedbeds and embankment, spreading into a discrete woodland at Tervoe House. Other habitats of note are the Ballinacurra Creek leading into the Ballynaclogh River, and Loughmore Common, a dryish turlough crossed by a stream in aqueduct.

A number of interesting habitats were found in the Study Area and the most important are summarised below:

Shannon Estuary South Shore

The reedbeds along the south shore run from Ballinacurra Creek west to Cooperhill with their broadest expanses on the bends of the estuary. Thus there is a large area around and west of Ballinacurra and another major area from Tervoe to Cooperhill. The predominant plant is common reed *Phragmites australis*. Summer snowflake *Leucojum aestivum* is characteristic of the Ballinacurra area where frogbit *Hydrocharis morsus-ranae* and narrow-leaved bulrush *Typha angustifolia* also occur. A rare plant, triangular clubrush *Scirpus triqueter* which grows only in the vicinity of Limerick follows the side estuary up to the bridge as well as growing on both sides of the entrance. It is absent off the Bunlicky lake and reappears at Tervoe running sporadically to a dense area at Cooperhill where freshwater comes in. A map of its distribution (indicative only) is shown on the Constraints Maps in Appendix C, and an indication of its distribution generally in the Limerick Area is given in Appendix B. The marginal vegetation of highest quality is thought to lie around and north of the Ballinacurra Creek and east of Cooperhill but this would have to be proven by more extensive fieldwork.

All the southern shore of the estuary extending in as far as the marginal embankment is included in a pNHA (#435) and is also a candidate SAC.

Bunlicky Lake

The flooded clay pits, which now form Bunlicky Lake, are up to 8m deep in places. A peninsula extends in from the southern edge and there has been recent infill here with building waste and rock. Submerged vegetation is limited with three species of charophyte, other algae and two pondweeds (Central Fisheries Board 1986). The sloping shoreline limits marginal vegetation but there are narrow reedbeds of common reed *Phragmites australis* or narrow-leaved bulrush *Typha angustifolia*. The southern edge is shallower and wetland vegetation extends back into the ditches to produce a tall herb vegetation and then a

transition to nutrient-poor fen grassland with fleabane *Pulicaria dysenterica*, yellow sedge *Carex viridula* and fragrant orchid *Gymnadenia conopsea*. The toe drain along the Shannon embankment where deeper water adds broad-leaved pondweed *Potamogeton natans*, horned pondweed *Zannichellia palustris*, bulrush *Typha latifolia* and fool's watercress *Apium nodiflorum*. Bunlicky Lake is included in the pNHA (#435), and is also a candidate SAC.

This area is also important for birds and diving ducks, Cormorants, Mute swans, and marshland birds use it as a feeding area.

Loughmore Common

Loughmore Common (described in more detail above) is the only large turlough in Limerick as far as is known. In recent years it has suffered from a decline in the ground watertable with the result that it now floods shallowly if at all in winter. In previous years it supported quantities of wildfowl and must have had water of up to 1m. Its vegetation retains significant interest with a variety of turlough plants and some more characteristic of fens. The site was proposed as a candidate SAC but in view of the artificial habitat changes is now a pNHA (#438).

Shannon Estuary (North)

This area naturally resembles the southern shore in many regards except that the mudflats are more sloping and the deep water channel therefore nearer the shore. The fringing reedbeds are narrower though there is a continuous line from Westfields to Cratloe. The widest band lies at the inflow of the Crompaun and Cratloe Creeks. The plant species are the same with a transition from the more freshwater types at the eastern end, for example summer snowflake *Leucojum*, water dropwort *Oenanthe fistulosa* and fool's watercress *Apium nodiflorum* to a more maritime flora to the west. Common reed *Phragmites australis*, sea clubrush *Bolboschoenus maritimus* and pond sedge *Carex riparia* are ubiquitous with a general presence of triangular clubrush *Scirpus triqueter*. The plant grows south-east and south-west of Clonmacken in four separate places with further colonies around the Crompaun/Cratloe Creek inflows. It seems to be absent from the shore around Coonagh Point.

All the shoreline to the top of the embankment is included in a pNHA - Fergus Estuary and Inner Shannon, north shore (#2048) and is also a candidate SAC. The drains behind the embankments are poorer in nutrients than on the southern side and may have a more varied flora. This could include the pondweed *Groenlandia densa*, listed by the Flora protection Order 1999. There are no existing records however.

5.6.3 Fisheries

The Central Fisheries, Fisheries Research Centre and the Shannon Regional Fisheries Board were all contacted regarding the fisheries potential of the Study Area. The Shannon Fisheries Board indicated that all the rivers and streams in the Study Area should be treated as salmonid waters, no specific sections stood out as a major constraint in the route selection process. However, the Barnakyle River is one of the more valuable freshwaters in the Study Area from a fisheries perspective. The Barnakyle is a tributary of the Maigue which O'Reilly (1993) states as one of Ireland's premier trout rivers up to the starting of arterial drainage schemes in the 1970's. A certain amount of rehabilitation has been carried out by the Shannon Regional Fisheries Board and trout stocks have made a comeback in certain areas. Reynolds (1998) attributes the disappearance of large trout from the Maigue to the loss of its deep pools. Duchas states that the protected white-clawed Crayfish has been found in the Maigue River as have lampreys which are listed in Annex II of the EU Habitats Directive 92/43/EEC. It would therefore seem not unlikely that these species occur in the Barnakyle which is a tributary of the Maigue, and about 1.5 km of which falls within the Study Area.

With regard to all the estuarine waters the Board are satisfied that 'slob trout' will come down and feed in these areas. Where there are no sluices fish will migrate up and down. Salmon net men also use the small river/stream estuaries to moor boats and this is an important

amenity for them. On both sides of the river Shannon quite a number of people earn a livelihood by harvesting reeds. Bunlicky/Tervoe on south and Cloomacken to Crompaun and up the Crompaun River are very important on the west side. The Shannon estuary is a major zone of passage for a wide variety of fish (see Section 5.6.1), some on route to spawning others for feeding.

6. Conclusions

This Report has considered the key constraints which could impact on the possible routing of the proposed Limerick Southern Ring Road Phase II. These are explained within the text of the report, and summarised in the Executive Summary at the start of the Report.

The next stage in the Limerick Southern Ring Road Phase II Project is Route Selection, in accordance with the NRA Road Scheme Development Guidelines publication. This will include a further Public Consultation to get public comment on potential route locations.