****Please note – this report must be read in conjunction with the Northern Ireland Water Framework Directive Summary Report of the characterisation and impact analyses required by Article 5****
(http://www.ehsni.gov.uk/pubs/publications/article5report.pdf)

Reference Condition Descriptions for Northern Ireland Lake Types

Northern Ireland System A Lake Typology (Lakes > 10 ha)

There are 141 lakes in Northern Ireland greater than 10 ha. On applying the Water Framework Directive (WFD, or the Directive) System A typology, a number of types have been recorded. In order to fulfil the requirements of Article 5 reporting for WFD, each of the following 5 types must have type specific reference conditions recorded.

Fish Biological Quality Element (all lake types)

The parameters for fish in Annex V of the Directive have not currently been addressed in detail, but research is planned to start in 2004 to address this shortfall through the NS SHARE project. Historically, the fish fauna of the island of Ireland was restricted to several species of salmonids, coregonids and eels following the last glaciation. Other species have been introduced in more recent history. Hence, the distribution of fish in Irish lakes is difficult to predict. It is dependent not only on ecologically suitable conditions but also on when and where introductions (deliberate or accidental) have been made or attempted. A list of fish species known or thought to be represented in Northern Ireland is appended.

Standing Water Type: Low altitude (< 200m), > 50 ha, calcareous, non-peat, Northern Ireland type 5 (12 lakes in type).

Type overview: This type is represented by 12 examples including most of the larger NI lakes. The type constitutes almost 95 % of the surface standing water in the Northern Ireland.

In reference condition state this type has solid substrata usually dominated by coarse sands and boulders.

Water quality: Waters are calcium rich due to the influence of the underlying calcareous geology and pH values are generally close to neutral. Water clarity is reasonably high but Secchi depths seldom reach 2m.

Phytobenthos: The waters are naturally productive, which can lead to periodic diffuse growths of filamentous green algae in the shallower littoral zones.

Invertebrate Fauna: Reference conditions are typified by ASPT values consistently over 5.00 reflecting the presence of pollution sensitive taxa. Mayfly nymphs of the families Heptageniidae, Leptophlebiidae (specifically *Leptophlebia* verspetine) and Caenidae are numerically well represented with numbers of *Ephemera danica* found in the sandy, littoral areas.

Cased caddis fly larvae are frequently encountered usually with representatives of the Leptoceridae, Lepidostomatidae, Limnephilidae and Hydroptilidae families. Beetles and bugs are reasonably well represented in terms of actual families but are not generally numerically abundant. Likewise molluscs tend to be well represented.

Macrophyte Flora: The dominant emergent species is *Phragmites australis* with varying amounts of *Equisetum fluviatile*. *Littorella uniflora* is common on shallow, exposed sections of the littoral zones. Typical bryophytes include *Fontinalis antipyretica* and *Cinclidotis fontinaloides* in splash areas.

Phytoplankton Flora: This lake type tends to be naturally productive with typical chlorophyll *a* values approaching 20 mgl^{-1} on occasions.

Fish: See **Fish Biological Quality Element above**

Hydrological Regime: These large lowland lakes hydrologically tend to be more groundwater dependent and closely connected to the surrounding land. In places they may connect with base rich marsh systems.

A result of the large size and connectivity is that water levels are relatively stable, but may also be dependant on the outflow regime. The lakes tend to have a reasonably long water residence time.

Morphology: The substrata will be dominated by coarse sands and boulders.

Standing Water Type: Low altitude (< 200m), > 50 ha, siliceous, non-peat, Northern Ireland type 11 (4 Lakes in type).

Type overview: This type is represented by 4 examples representing less than 3% of the NI lake population over 10 hectares. These are exclusively in Counties Armagh and Down.

In reference condition state this type has solid substrata usually dominated by coarse sands and boulders.

Water quality: Typically pH values are generally close to neutral. Water clarity is reasonably high but with Secchi depths seldom reach 2 metres.

Phytobenthos: The waters are not naturally productive and hence significant growths of filamentous green algae are unusual.

Invertebrate Fauna: In these naturally low productivity lakes invertebrate numbers and diversity are generally low. However, reference conditions are still typified by ASPT values close to or above 5.00 reflecting the presence of pollution sensitive taxa. Mayfly nymphs tend to be restricted to the families Baetidae and Caenidae. Cased caddis fly larvae are present especially the Leptoceridae and Limnephilidae in low numbers. Beetles and bugs are poorly represented in terms of the range of taxa and also in terms of relative abundance. Molluscs tend to be reasonably well represented in terms of the number of taxa and their individual abundances.

Macrophyte Flora: In their reference state this type does not support extensive macrophyte stands due to nutrient limitations. Emergent species tends to be restricted in terms of both species and their abundances. *Littorella uniflora* can be common on shallow, exposed sections of the littoral zones.

Phytoplankton Flora: This lake type tends to be naturally low productivity with typical chlorophyll *a* values below 10 mgl^{-1}.

Fish: See Fish Biological Quality Element.

Hydrological Regime: In these lowland lakes with catchments of low permeability the hydrology is more dependant on the climate. Water level variation is dependant on the physical characteristics of the lake especially the catchment response to rainfall entering the system. As the water level is influenced by rainfall events there tends to be a marked change between summer and winter levels.

Morphology: Shorelines are likely to consist of inorganic sediment giving way to finer material with increasing depth. Deep areas are covered with mud. The substrata, where exposed, is dominated with boulder or bedrock.

Standing Water Type: Low altitude (< 200m), > 50 ha, siliceous, peat, Northern Ireland type 12 (2 lakes in type).

Type overview: There are only 2 NI examples in this type. These are the Silent Valley Reservoir and Scolban Lough. The former is a river impoundment reservoir in a deep V-shaped valley and hence has limited biological potential by virtue of its structure and hydromorphology. Lough Scolban by virtue of its proximity to extensive calcareous deposits behaves like a Type 4 lake in terms of its biology. It has been shown to be close to reference condition.

Water quality: Waters are less hard as a result of the peat interactions with the underlying calcareous geology and pH values are closer to neutral. In contrast with type 3 above, the waters have a quite heavy peat staining despite the calcareous geology, which naturally limits the extent of macrophyte colonisation.

Phytobenthos: The waters are naturally productive, which can lead to periodic diffuse growths of filamentous green algae in the shallower littoral zones.

Invertebrate Fauna: Reference conditions are typified by ASPT values over 5.00 reflecting the presence of pollution sensitive taxa particularly cased caddis fly larvae specifically Leptoceridae, Lepidostomatidae, Limnephilidae and Hydroptilidae. Mayfly nymphs specifically of the Heptageniidae and Caenidae are numerically well represented with low numbers of *Ephemera danica* from the sandy substrate areas. Beetles and bugs are reasonably well represented in terms of actual families but not numerically abundant. Likewise molluscs tend to be well represented.

Macrophyte Flora: The dominant emergent species is *Phragmites australis*. Typical submerged species include *Myriophyllum spicatum* and floating leaved species such as *Potamogeton natans*. *Littorella uniflora* is common on shallow, exposed sections of the littoral zones.

Phytoplankton Flora: This lake type tends to be naturally productive with typical chlorophyll *a* values approaching 10 mgl^{-1}.

Fish: See **Fish Biological Quality Element**.

Hydrological Regime: In these lowland lakes with catchments of low permeability the hydrology is more dependant on the climate. Water level variation is dependant on the physical characteristics of the lake especially the catchment response to rainfall entering the system. As the water level is influenced by rainfall events there tends to be a marked change between summer and winter levels.

Although Silent Valley is grouped in this type by virtue of size and geology it's hydrological regime is not typical of type. It is a river impoundment whose level is dependant on the abstraction regime currently operating.

Morphology: Lough Scolban: The shoreline consists of organic material and fines such as sand and gravel. Deeper areas are likely to be covered by mud.
Silent Valley: The shoreline is dominated by hard engineering; where exposed the substrate is boulder or bedrock.

Standing Water Type: Medium altitude (> 200m), > 50 ha, calcareous, peat, Northern Ireland type 18 (1 lake in type).

Type overview: The only example in this type is Lough Fea, which is a river impoundment reservoir and hence is included in the pHMWB dataset. As there is no available biological data for this standing water only limited reference conditions are shown.

Water quality: Waters are less hard as a result of the peat interactions with the underlying calcareous geology and pH values are closer to neutral. The waters have a quite heavy peat staining despite the calcareous geology.

Phytobenthos: The waters are not naturally productive and hence significant growths of filamentous green algae are atypical.

Invertebrate Fauna: The austere low productivity and heavily managed conditions are reflected in a very restricted fauna where pollution sensitive taxa and mayfly families tend to be absent. The low diversity and abundance community tends to consist of a few specimens of the cased caddis-fly larvae of the Limnephilidae family and low numbers of beetles, molluscs and worms. The fluctuating water levels of the littoral zones tend to produce ASPT values of less than 4.00. Further research is required to establish the ASPT values that would equivocate to reference conditions.

Macrophyte Flora: Due to nutrient limitations extensive macrophyte stands are not typical of this type of water and emergent species tend not to be present. *Juncus bulbosus* is commonly associated with this type of oligotrophic waterbody and the Floating Bur-reed *Sparganium angustifolium* also occurs. *Littorella uniflora* can be common on the shallow, exposed sections of the fluctuating littoral zones.

Phytoplankton Flora: This lake type tends to be naturally low productivity with typical chlorophyll *a* values below 10 mgl^{-1}.

Fish: See **Fish Biological Quality Element**.

Hydrological Regime: The hydrological regime of this type is dependant on both rainfall and groundwater. With higher rainfall recorded at mid-latitude water levels will respond more quickly to rainfall events than lowland lakes and will generally be higher in winter than summer.

As Lough Fea is an impoundment reservoir its water level will also be dependant on the abstraction regime currently operating.

Morphology: The shoreline is composed of peat.

Standing Water Type: Medium altitude (> 200m), > 50 ha, siliceous, non-peat, Northern Ireland type 23 (1 lake in type).

Type overview: The only NI example is the river impoundment reservoir - Spelga Dam, this is included in the pHMWB dataset. As there is no available biological data for this standing water only limited reference conditions are shown.

Water quality: Typically pH values are generally close to neutral. Water clarity is reasonably high.

Phytobenthos: The oligotrophic waters are not naturally productive and hence significant growths of filamentous green algae are atypical.

Invertebrate Fauna: The austere low productivity and heavily managed conditions are reflected in a particularly restricted fauna where less than 5 families and ASPT values of 3.00 to 4.00 are typical of the fluctuating littoral zones. The Limnephilidae cased caddis-fly family can be present in numbers but tend to be accompanied by very low numbers of beetles, midges and worms. Further research is required to establish the ASPT values that would equivocate to reference conditions.

Macrophyte Flora: Due to nutrient limitations extensive macrophyte stands are not typical of this type of water and emergent species tend not to be present. *Juncus bulbosus* is commonly associated with this type of oligotrophic waterbody and the Floating Bur-reed *Sparganium angustifolium* also occurs. *Littorella uniflora* can be common on the shallow, exposed sections of the fluctuating littoral zones.

Phytoplankton Flora: This lake type tends to be naturally low productivity with typical chlorophyll *a* values below 10 mgl^{-1}.

Fish: See **Fish Biological Quality Element**.

Hydrological Regime: The hydrological regime of this type is more dependant on rainfall and the physical characteristics of the lake. With higher rainfall recorded at mid-latitude water levels will respond much more rapidly to rainfall events than lowland lakes and will generally be higher in winter than summer. As Spelga Dam is an impoundment reservoir its water level will also be dependant on the abstraction regime currently operating.

Morphology: The shoreline consists of inorganic sediment giving way to finer material with increasing depth. Where exposed the substrata is dominated by boulder or bedrock.

List of Freshwater Fish species found in the wild in Northern Ireland			
Latin name	**English name**	**Native or Introduced**	**Notes – habitats and distribution**
Petromyzon marinus	Sea lamprey	Native -	Anadromous. Enters lower reaches of rivers to spawn
Lampetra fluviatilis	River lamprey	Native	Both anadromous and lake dwelling forms
Lampetra planeri	Brook Lamprey	Native with probable internal transfers	Widespread in smaller streams
Anguilla anguilla	Freshwater eel	Native	Found in almost all freshwaters with access to the sea
Coregonus autumnalis	Pollan	Native	Lough Neagh and Lower Lough Erne only. LLE population threatened
Salmo salar	Salmon	Native	Anadromous. Spawning and Juveniles in fast flowing smaller streams. Adults and juveniles in lakes and rivers on passage
Salmo trutta	Brown or Sea trout	Native with considerable stock also in aquaculture	Very widespread and a variety of life habits, anadromous and also purely freshwater forms. Spawns in fast flowing rivers, adults in rivers, estuaries, lakes and coastal sea areas
Onchorhynchus mykiss	Rainbow trout	Introduced as an aquaculture and sport fish	Insignificant natural breeding. Numerous populations in lakes dependent on stocking from farms.
Salvelinus alpinus	Arctic charr	Native	Only remaining population shared with Republic of Ireland in Lough Melvin. Extinct Loughs Neagh and Erne
Esox lucius	Pike	Introduced (>400 years)	Widespread in lowland lakes and rivers
Cyprinus carpio	Carp	Introduced (>400 years)	Introduced into a small number of lowland lakes. Does not breed reliably
Tinca tinca	Tench	Introduced (>400 years)	Introduced into lowland lakes. Widespread but not highly abundant. May breed regularly
Abramis brama	Bream	Introduced (>400 years)	Widespread in lowland rivers and lakes
Gobio gobio	Gudgeon	Introduced	Widespread , mainly low to medium gradient rivers and

			connected larger lakes
Phoxinus phoxinus	Minnow	Introduced	Widespread but patchy distribution. locally common in streams and rivers
Rutilus rutilus	Roach	Introduced to Ireland 1889. In NI circa 50-100 years	Widespread and abundant in most all low gradient rivers and lakes of all sizes.
Scardinius erythrophthalmus	Rudd	Introduced (>400 years)	Typically in isolated small lakes without roach. Formerly abundant but replaced by roach in many sites since 1960. Tolerates roach only in weed cover.
Neomacheilus barbatulus	Stoneloach	Introduced (>400 years)	Very widespread in streams and rivers of all gradients.
Gasterosteus aculeatus	Three spined stickleback	Native	Widespread and common in almost all types of water body
Pungitius pungitius	Ten spined stickleback	Probably native	Widespread but patchy distribution. Prefers more weed choked habitats than G. aculeatus
Perca fluviatilis	Perch	Introduced (>400 years)	Common in many lakes and larger rivers
Chelon Lbrosus	Thick lipped grey mullet	Native (Marine)	Enters estuaries and brackish water from the sea in the warmer months
Platichthes flesus	Flounder	Native	Catadromous. Enters rivers from the sea and reaches well inland in major river systems
Other possibles (not confirmed)			
Leuciscus luciscus	Dace	Introduced to Ireland 1889	Spreading in Republic of Ireland. Could transfer to NI.
Liza ramada	Thin lipped grey mullet	Marine	Unconfirmed reports in estuaries and tidal reaches of rivers
Liza aurata	Golden grey mullet	Marine	Unconfirmed reports in estuaries and tidal reaches of rivers