

UK TECHNICAL ADVISORY GROUP ON THE WATER FRAMEWORK DIRECTIVE

Guidance on the identification and risk assessment of groundwater dependent terrestrial ecosystems

This Guidance Paper is a working draft defined by the UKTAG. It documents the principles to be adopted by agencies responsible for implementing the Water Framework Directive (WFD) in the UK. This method will evolve as it is tested, with this working draft amended accordingly.

Working Paper Version:	(21/01/04) Version 5	Status:	Working Draft
WFD Requirement:	Article 5 report; Characterisation; Wetlands, Groundwater	UKTAG Review:	5 June 2003 wrong date Reviewed 5/110/03 wrong date
		Author:	Wetlands Task Team

1. Purpose of this Paper

1.1 The paper sets out UKTAG's guidance outlining an approach for identifying groundwater dependent terrestrial ecosystems (GWDTE); and identifying those that are at risk of significant damage.

2. The Directive's requirements

2.1 The Directive's requirements with respect to wetlands and groundwaters are linked to the environmental objectives Article 4 1b, to be applied to and monitored for achieving Good Groundwater Status (both **quantitative** and **chemical**) and as outlined in Article 4, Annex 5 of the Directive. There may be overlapping but separate obligations with respect to Article 4 (1c) for Protected Areas, to ensure that groundwater quantitative and chemical status are able to achieve "any standards and objectives" as required by the relevant legislation under which the protected areas are designated.

2.2 'Good Groundwater Status' is dependent upon there being no 'significant damage' to GWDTE caused by alterations to either the flow of groundwater, groundwater chemistry, or the concentrations of any pollutants in groundwater bodies.

2.3 If a groundwater resource or quality pressure is causing 'significant damage' to terrestrial ecosystems including wetlands, then the groundwater body will not be in "good status".

2.4 For the purposes of characterisation process, the tasks are:
(a) identifying terrestrial ecosystems dependent upon groundwaters, and
(b) undertaking an assessment of the risk that groundwater bodies will not be in "Good Status", partially determined by the damage occurring on the terrestrial ecosystems dependent upon those groundwater bodies.

3. Content of this Guidance

Tasks	Content of Guidance	Section
1. Identify where groundwater may be capable of supporting directly dependent terrestrial ecosystems.	<ul style="list-style-type: none"> Identifies typology system to support the ecological screening approach for identification of GWDTE assumed to be of high to low sensitivity to groundwater impacts 	S 5.3.1
2. Identify the most important sites which are protected for wetland or other potentially groundwater dependent ecosystems from existing heirarchy of sites already.	<ul style="list-style-type: none"> Outlines a process of hydrogeological screening to further increase confidence of identification of groundwater interaction with terrestrial ecosystems (ie GWDTE) Provides criteria for identifying GWDTE that are identified as ecological significance in order of importance 	S 5.3.3 S 5.4
3. Map the important ecosystems that may be directly dependent on groundwater.	<ul style="list-style-type: none"> Defines the forward actions to be undertaken to support mapping the important ecosystems within the characterisation process 	S 7
4. Undertake initial characterisation on assessing impact of human activity and the potential to cause 'significant damage' that may affect	<ul style="list-style-type: none"> Identifies groundwater related pressures that can impact upon GWDTE. Provide a definition of "significant damage" in the context of the 	S 6.1 S.6.2

'Good Groundwater Status' (by December 2004).	requirements of the WFD. <ul style="list-style-type: none"> • Describes a full pathway for identifying ecosystems and for undertaking the initial risk assessment, based upon sensitivity of ecosystem, where it is located and how ecologically significant it is and information from hydrological screening. 	S6.4
---	--	------

4. Limitations in the approach outlined in this Guidance

4.1 The approach will improve as more information becomes available but in the short-term the following limitations with respect to available knowledge and data must be recognised:

- (a) Apart from a small number of ecosystems, most water dependent terrestrial ecosystems lie along a continuum between always only groundwater dependent and always only surface water dependent. The source of water supply for some wetlands does not appear to be particularly critical, therefore the task of identifying dependence upon groundwaters is sometimes complex.
- (b) Information about the distribution and water supply mechanisms for these types of ecosystems is incomplete throughout the UK.
- (c) The concept of 'significant damage' due to groundwater pressures cannot be applied at the generic scale and must be viewed with a certain degree of site specificity
- (d) Many GWDTE have not been subjected to rigorous status assessments or assessments of groundwater related impacts. GWDTE can be damaged by a range of pressures (e.g. afforestation, land development) many of which may be unrelated directly to quality or quantity of groundwater supply.

Comment [p1]: Page: 2
This change is conditional upon point 5 being accommodated in the text.

4.2 In Scotland, a similar process will be required for wetlands dependent upon surface waters, however, this paper will deal with the groundwater dependent ecosystems.

5. Identification of Groundwater Dependent Terrestrial Ecosystems (GWDTE)

Definition of GWDTE

CIS horizontal guidance defines GWDTE as being “A terrestrial ecosystem of importance at Member State level that is directly dependent on the water level in or flow of water from a groundwater body (that is, in or from the saturated zone). Such an ecosystem may also be dependent on the concentrations of substances (and potential pollutants) within that groundwater body, but there must be a direct hydraulic connection with the *groundwater body*.”

Groundwater bodies are defined as (Article 2.12) as:

a distinct volume of groundwater within an aquifer or aquifers.

Defining an aquifer the HGIWB (4.2) recommends that an aquifer is a subsurface layer or layers of rocks or other geological strata that:

- *is capable of supporting abstraction of 10 cubic meters per day on average or sufficient to serve 50 or more people;*

or:

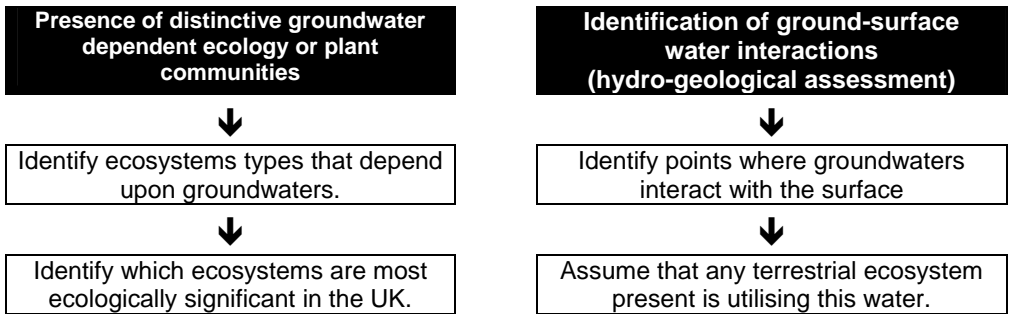
- *provides a flow of groundwater the reduction of which may result in a significant diminution of the ecological quality of an associated surface water body, or significant damage to a directly dependent terrestrial ecosystem.*

Although the definitions are apparently circular, an ecosystem must be important at least the member state level i.e. at least of national importance, for any groundwater it depends upon to be identified as an aquifer. See section 5.2.4 for clarification of this principle.

Comment on extent of obligation and prioritisation process for GWDTE identification
 The scope of the obligation under WFD for characterisation of GWDTEs does not appear to be defined within the context of any particular size of ecosystem.

However it is clearly desirable to impose some boundary or scale upon the obligation, to assist with the definition of 'significant damage' and to allow the obligation to fit into the current guidance contained within the CIS Horizontal Wetlands and HGIWB. It is also desirable that wherever possible, we use current frameworks established for protecting these types of *significant* ecosystems.

5.2 There are two complementary techniques that can be adopted to identify GWDTEs:



5.3 Competent authorities should use both ecological and hydrogeological information and data to identify GWDTE, where data is available. This should improve confidence in the process.

5.3.1 Ecological assessment using vegetation typology system

5.3.1.1. Presence of groundwater dependent plant communities (where known) can be used to identify GWDTE. Some plant communities are highly dependent upon groundwaters, others can utilise several irrigating sources.

(a) 5.3.1.3 The NVC plant communities that are of most use for identifying groundwater dependency are displayed in Annex 1 (Tables A, B and C). Each plant community has score indicating dependency on groundwater (i.e. 3=low , 2=moderate or 1=high).

All of the relevant plant communities in ANNEX I are used to indicate the presence of GWDTE, but we recommend that all sites containing these communities are screened hydro-geologically, to further confirm the presence of a GWDTE and help identify its location within large designated sites.

Comment [p2]: Page: 3
 If this is referring to the NVC then the statement isn't really all that accurate – most of the NVC sub-communities are of wider than local applicability. Local variants of NVC communities can be identified within the overall framework of the NVC – but this isn't what you are saying here.

5.3.1.4 For GWDTE designated as Natura 2000, if NVC communities are not known, Tables A B & C in Annex 1 provide a list of equivalent Habitat Types from Annex 1 of the Habitats Directive. These should be used to indicate groundwater dependency and where more than one habitat types occurs on a site, the highest groundwater dependency score indicated should be used.

5.3.1.5 Limitations of the ecological assessment are:

- (a) Many of the communities listed above will utilise groundwater under certain circumstances the extent being determined by factors such as topography and hydrogeology.
- (b) Where there are indistinct water supply mechanism/s as associated with many NVC communities, the scheme is difficult to use for assessing damage due to inadequate groundwater supply or quality.
- (c) The assignment of the scoring based on the expert judgement of the Wetlands Task team using the approached identified in Guidance 7a.

The use of hydrogeology assessment routes will help offset these limitations of this approach and further validate the identification of GWDTE.

5.3.2 Hydrogeology assessment

Hydrogeology partially determine the conditions that allow a GWDTE to become established. Hydrogeological screening will assist the further identification of presence and location of GWDTE and is recommended as a parallel exercise.

If the hydro-geology and ecology approaches lead to different conclusions, more detailed information may be required e.g. map of plant communities.

5.4 Identification of GWDTE to be included in the Risk Assessment process

The following table list the rules of identification and inclusion in risk assessment process of GWDTE which are **listed Natura 2000 and any equivalent ANNEX 1 Habitat types**.

- (a) If a site contains any NVC community type or equivalent in Annex 1 habitat given a score of 1 or 2 for groundwater dependency but where the specific location of the community is unknown
and
during hydrogeological screening is found to be coincident with a portion of groundwater body with at least moderate surface interaction between the near-surface and the underlying groundwater body
- (b) If a site contains any NVC community or any equivalent Annex 1 habitat type given a **score of 3** for groundwater dependency in Annex 1 of this guidance
and
during hydrogeological screening is found to be coincident with a portion of GW body with a high surface interaction between the near-surface and the underlying groundwater body

5.4.2 The designation system has been used as a basis for GWDTE identification as it defines the location of both statutory and non-statutory sites/ecosystem. All GWDTE identified using Annex 1 should be reviewed including:

a) statutory sites including:

- Special Area of Conservation/Special Protection Area,
- Site of Special Scientific Interest/Area of Special Scientific Interest,
- RAMSAR site,
- National Nature Reserve (as a feature).

b) non-statutory designated sites of at least national importance (recognised through a Habitat Action Plan as a candidate for restoration or recreation):

- (UK BAP priority species or habitats) Local Nature Reserve, (Local Authority),

- NGO managed Nature Reserve (e.g. RSPB or Wildlife Trust Nature Reserve, National Trust, Wildfowl and Wetland trust),
- Biosphere Reserve

Comment on use of designation systems as basis for GWDTE identification

- Conservation value is an integrated concept based upon criteria such as rarity, importance, naturalness, size and ecological function.
- Different types of designation are recognised. In the context of this guidance, they are being only used for the **identification** of significant GWDTE, and should not be used to infer a gradation of importance/prioritisation.
- A significant limitation of using the designation system, is that in some instances, GWDTE may be so damaged, that the communities present do not qualify for protection through the designation frameworks. Separate guidance will be produced in the future to tackle this problem.
- The statutory designations system is partially hierarchical, meaning one system is sometimes used to underpin another. For example, all SAC will also be SSSI. For the site to be identified as GWDTE, it must contain NVC or ANNEX I habitat types, and they must be identified as features of the site by at least one designation system covering that site.

6. Pressures and Significant damage

6.1 Definition of ‘Significant Damage’ in the UK

- 6.1.1 Significant damage can be defined as a function of the
- (a) Degree of damage occurring to a GWDTE (caused by groundwater pressure),
 - (b) The ‘significance’ of the ecosystem itself as a nature conservation resource.
- 6.1.2 The ‘Degree of damage’ on a statutory designated site should be judged as ‘significant’ when any groundwater dependent ecosystem for which the site is designated is judged as being in “unfavourable condition”.

This can be determined by the application of common standards agreed by the Joint Nature Conservation Committee or determined by the Nature Conservation agency as failing to reach any site specific conservation objectives.

Comment on extent of obligation to undertake assessment of significant damage

As a means of determining ‘significance’, the identification of GWDTE has been linked to the full UK designated sites system. It is therefore the unequivocal view of the Wetlands Task Team that the obligation to GWDTE is not restricted to only selected types of designated sites, as the designation system in this instance is being used to facilitate, not drive, the identification of GWDTE. Clarification needed.

However, for the purposes of characterisation (identification and risk assessment) it is unlikely that all the sites from all designation systems can be included prior to 2004, and therefore a prioritisation process is required (as addressed in 6.2.3 below).

- 6.1.3 Ideally, a prioritisation process would focus on criteria such as level of groundwater dependence and risk of damage to ecosystem. Since this information is not available, and taking into account the statement above, we recommend the following order of priority.

GWDTE	Definition of “Significant Damage”
GWDTE associated with Natura 2000 sites	Any ground water dependent feature (terrestrial ecosystem) that is not in “favourable condition” as determined by the application of common standards agreed by the Joint Nature Conservation Committee or

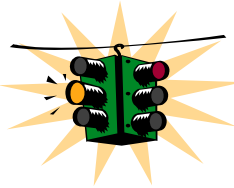
	by site-specific conservation objectives established by the relevant conservation agencies.
SSSI/ ASSI that contain GWDTE	Any site not in "favourable condition" (as determined by the Nature Conservation Agency), is deemed to be suffering "significant damage"
All other statutory nature conservation sites that contain GWDTE	Any site not in "favourable condition" (as determined by the Nature Conservation Agency), is deemed to be suffering "significant damage"
Non-statutory designation of importance to the Biodiversity Action Planning process	The determination of "significant damage" is likely to be site specific and may rely on site investigation

Comment on identification of groundwater related pressure

The failure to meet objectives and/or the unfavourable condition must be wholly or mostly due to a **groundwater related pressure on the ecosystem** as determined by investigation or prior knowledge.

This places a considerable responsibility on the JNCC and country agencies to ensure that any outputs are sufficiently precise for this purpose.

It should be noted that GWDTE designated under the Natura 2000 framework are already covered by the obligations in Article 4 (1C), therefore permanent exclusion of other types of GWDTE will take the GW risk assessment obligations no further than is already required. GWDTE on all types of designated sites will need to be identified for transposition of this obligation.



Comment [V3]: I think we need to make it clear somewhere that the damage assessment may not be available and that the risk assessment will then have to be predictive as per Fig 2

6.2.4 In England and Wales, Natura 2000 sites have already been subjected to a risk assessment process to determine the risk of 'significant damage' as part of the Review of Consents process. It is recognised that this process can be used in place of the process outlined in Figure 2. Any N2K site at stage 3 for groundwater abstraction consents should automatically be placed in the At risk (Category 1b), unless stage 3 has been completed and concluded no adverse impacts .

PUT FLOW CHART HERE!!!

Dual purpose for risk assessment process (Figure 2)

The above process can be used for:

- Determining those GWDTE which are at risk of significant damage from abstractions; or
- To meet the obligations in Article 4 (1C) for Natura 2000 sites and setting of associated standards and objectives (i.e. as these are incorporated into the environmental objectives of the WFD).

7. Future work in characterisation

7.1 There are a series of tasks that should be started immediately in order to begin characterisation. These are set out below:

- (a) Conservation Agencies to query statutory site databases to produce list of sites that containing ecosystems that are of High, Moderate and Low groundwater dependence. The condition of all statutory designated groundwater dependent features should also be identified.

All sites identified as containing ecosystems should be screened hydro-geologically for probable GW/surface interactions. Those sites containing ecosystems of high or moderate dependency are included in risk assessments if screening shows at least a moderate interaction with GW. Sites containing low dependency GWDTE are only put forward for risk assessment if hydro-geological screening indicates a high probability of GW/surface interaction.

- (b) Undertake Risk Assessment as per Figure 1, using feature condition information.
- (c) The methodology should be repeated for the non-statutory sites indicated in 6.1.3.
- (d) All Agencies to compile an inventory of statutory and non-statutory designated sites containing GWDTE and wetlands with surface water interactions.

ANNEX 1:

NVC plant communities and dependency on groundwater

Table A: Mires, swamps and mesotrophic grassland

NVC Community	Principle corresponding Habitats Directive Annex I type/s	Dependence of community/ habitat on groundwater. 1=High, 2=moderate, 3=low	Comments
M1 <i>Sphagnum auriculatum</i> bog-pool community.	Active & degraded Raised Bog	3	Occur more 'typically' as components of ombrogenous systems.
M2 <i>Sphagnum cuspidatum/recurvum</i> bog pool community.	Active & degraded Raised Bog	3	
M3 <i>Eriophorum angustifolium</i> bog-pool community.	Blanket bog,	3	
M4 <i>Carex rostrata</i> - <i>Sphagnum recurvum</i> mire.	Transition Mire & Quaking Bog	2	May occur as component of blanket bog.
M5 <i>Carex rostrata</i> - <i>Sphagnum squarrosum</i> mire.	Transition Mire & Quaking Bog	2	
M6 <i>Carex echinata</i> - <i>Sphagnum recurvum</i> mire	None directly applies.	2	May occur as component of blanket bog.
M9 <i>Carex rostrata</i> - <i>Calliergon cuspidatum</i> / <i>C. giganteum</i> mire	Alkaline fen <i>pp</i> Calc. fen <i>pp</i> Transition Mire & Quaking Bog	1	Runoff may be more important for base-poor examples.
M10 <i>Carex dioica</i> - <i>Pinguicula vulgaris</i> mire	Alkaline fen	1	
M13 <i>Schoenus nigricans</i> - <i>Juncus subnodulosus</i> mire.	Alkaline fen	1	May withstand elevated N in groundwater due to mechanism of P limitation at some sites.
M14 <i>Schoenus nigricans</i> - <i>Narthecium ossifragum</i> mire	Alkaline fen	1	
M15 <i>Scirpus cespitosus</i> - <i>Erica tetralix</i> wet heath	European wet heath	2	
M16 <i>Erica tetralix</i> - <i>Sphagnum compactum</i> wet heath	European wet heath	2	
M17 <i>Scirpus cespitosus</i> - <i>Eriophorum vaginatum</i> blanket mire	Active raised bog and blanket bog	3	Occasionally occur in topogenous systems
M18 <i>Erica tetralix</i> - <i>Sphagnum papillosum</i> raised & blanket mire.	Active raised bog and blanket bog	3	
M21 <i>Narthecium ossifragum</i> - <i>Sphagnum papillosum</i> valley mire.	<i>Rhynchosporion</i> ? <i>pp</i>	2	
M22 <i>Juncus subnodulosus</i> - <i>Cirsium palustre</i> fen meadow	None	2	
M23 <i>Juncus effusus/acutiflorus</i> - <i>Galium palustre</i> rush-pasture.	None	3	
M24 <i>Molinia caerulea</i> -	Eu-Molinion	2	

Comment [V4]: Quality or quantity dependency? Can we assume that only the #1 sites are dependent on quality? If so, can this working assumption be stated in the risk assessment process. It would be much better for WTT to do this than for the groundwater people to make the assumptions themselves.

<i>Cirsium dissectum</i> fen meadow			
M25 <i>Molinia caerulea</i> - <i>Potentilla erecta</i> mire	Degraded raised bog <i>pp.</i>	3	
M26 <i>Molinia caerulea</i> - <i>Crepis paludosa</i> mire	Eu-Molinion	3	
M27 <i>Filipendula ulmaria</i> - <i>Angelica sylvestris</i> mire	None	3	
M28 <i>Iris pseudacorus</i> - <i>Filipendula ulmaria</i> mire	None	3	Often associated with seepage zones.
M29 <i>Hypericum elodes</i> - <i>Potamogeton polygonifolius</i> soakway	<i>Rhynchosporion</i>	2	
M30 <i>Hydrocotylo</i> - <i>Baldellion</i>	None	2	Some examples known to be strongly dependent upon carbonate aquifers.
M32 <i>Philonotis fontana</i> - <i>Saxifraga stellaris</i> spring	None	1	Requires more or less continuous discharge, but probably not from main aquifers.
M37 & 38 <i>Cratoneuron commutatum</i> springs.	Petrifying springs with tufa formation (<i>Cratoneurion</i>)	1	
S1 <i>Carex elata</i> sedge-swamp	None	2	Cited association with WETMECH #3.
S2 <i>Cladium mariscus</i> swamp & sedge beds.	Calc. fen <i>pp</i>	2	
S3 <i>Carex paniculata</i> sedge swamp.	None	2	Some examples strongly associated with spring heads.
S4 <i>Phragmites australis</i> swamp	None	3	
S5 <i>Glyceria maxima</i> swamp	None	3	
S6 <i>Carex riparia</i> swamp	None	3	
S7 <i>Carex acutiformis</i> swamp	None	2	Can be an important component of soligenous systems.
S8, S9, S10 & S12-S23	None	3	
S11 <i>Carex vesicaria</i> swamp	None	1	Some examples known to be strongly dependent upon carbonate aquifers.
S24 <i>Phragmites australis</i> - <i>Peucedanum palustre</i> tall-her fen	Calc. fen <i>pp.</i>	2	
S25 <i>Phragmites australis</i> - <i>Eupatorium cannabinum</i> tall-herb fen	None	3	
S26 <i>Phragmites australis</i> - <i>Urtica dioica</i> tall-herb fen	None	3	
S27 <i>Carex rostrata</i> - <i>Potentilla palustris</i> tall-herb fen	Transition Mire & Quaking Bog	3	
S28 <i>Phalaris arundinacea</i> tall-herb fen	None	3	
MG4 <i>Alopecurus pratensis</i> – <i>Sanguisorba officianalis</i>	Lowland hay meadows	2	

Table B: Woodlands

NVC Community	Principle corresponding Habitats Directive Annex I type/s	Dependence of community/habitat on groundwater. 1=High, 2=moderate, 3=low
W1 <i>Salix cinerea</i> - <i>Galium palustre</i> woodland	Alluvial woodland <i>pp</i> Bog woodland <i>pp</i>	2 2
W2 <i>Salix cinerea</i> - <i>Betula pubescens</i> - <i>Phragmites australis</i> woodland	Alluvial woodland <i>pp</i> Bog woodland <i>pp</i>	2 2
W3 <i>Salix pentandra</i> - <i>Carex rostrata</i> woodland	Alluvial woodland <i>pp</i> Bog woodland <i>pp</i>	2 2
W4 <i>Betula pubescens</i> - <i>Molinia caerulea</i> woodland	Bog woodland <i>pp</i>	2
W5 <i>Alnus glutinosa</i> - <i>Carex paniculata</i> woodland	Alluvial woodland <i>pp</i>	2
W6 <i>Alnus glutinosa</i> - <i>Urtica dioica</i> woodland	Alluvial woodland <i>pp</i>	3

Comment [V5]: Quality or quantity dependency? Can we assume that only the #1 sites are dependent on quality? If so, can this working assumption be stated in the risk assessment process. It would be much better for WTT to do this than for the groundwater people to make the assumptions themselves.

Table C: Montane & sub-montane mires

NVC community	Principle corresponding HSD Annex I type/s	Dependence of community/habitat on groundwater. 1=High, 2=moderate, 3=low
M11 <i>Carex demissa</i> – <i>Saxifraga aizoides</i> mire	Alpine pioneer formations of <i>Caricion bicoloris-atrofuscae</i>	1
M12 <i>Carex saxatilis</i> mire Alpine pioneer formations of <i>Caricion bicoloris-atrofuscae</i>	Alpine pioneer formations of <i>Caricion bicoloris-atrofuscae</i>	1

Risk Assessment Methodology for Directly Dependent GWDTEs

