

Code of Practice for Water Skiing and Noise



Foreward

This Code of Practice has been developed by British Water Ski and is to be used as a guide for all who enjoy both the sport and recreational water skiing and all who are concerned with the future development of the sport.

Development of the code has so far drawn heavily on the experience and knowledge of water ski organisations throughout this country and in Europe and the specialist advice of our professional advisers together with considerable help and advice from the Sports Council.

British Water Ski intends to request all affiliates to conform to the Code following completion of the consultation process, making this in turn a requirement of affiliation.

British Water Ski believes that the Code provides a framework for the development of new sites and for the continued use of existing sites and clubs. As our society becomes increasingly more aware environmentally we are confident that the Code will be of considerable benefit to water skiers, local authorities and environmental organisations alike. British Water Ski hopes that the Code will go a long way to dispel many of the myths and prejudices that exist about water skiing and noise.

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1.0 Introduction

- 1.1 Water skiing is a healthy sport enjoyed by members of both sexes of all ages throughout Great Britain. The movement of a ski over water creates very little noise itself, however, in most cases the skier is pulled by a boat which by necessity must cause some noise.
- 1.2 Boat noise is created by the engine and the movement of the hull through the water. Engine noise itself is a combination of exhaust noise which are muffled by water cooled manifolds, and mechanical vibration which is muffled by flexible engine mountings and sound absorbent cowlings. The development of better shapes and design characteristics by boat designers and manufacturers are contributing to a reduction in boat hull noise. Modern outboard engines properly maintained will meet the noise levels proposed in this code of practice. Inboard engines of reputable manufacture should also have no difficulty in meeting the code and first class equipment is available to individuals building their own inboard powered boats.
- 1.3 Alternative methods of towing, such as electrically driven overhead tow lines (cable ski tows) may become more wide spread in the future. Cable tow water skiing is likely to become a major part of the sport in the future as a result of being capable of use on a smaller area of water and having the ability to ski more people per hour, but it is unlikely to take the place of conventional boat towed water skiing.
- 1.4 An assessment of typical activities of both individual skiing and water ski clubs is given in Appendices D and E. **The lay person without knowledge of water skiing is strongly recommended to visit a ski club affiliated to the British Water Ski Federation to witness the activity.**
- 1.5 This Code considers water skiing at a typical club level and covers Tournament skiing which in turn embraces the three disciplines of slalom, tricks and jump, together with Recreational and Barefoot skiing. Water Ski Racing is also included in this Code but is treated separately in view of its format.
- 1.6 Whilst there are many similarities between Water Ski Racing and Recreational, Tournament and Barefoot skiing, it is as its name suggests a race usually at considerable speed depending on conditions and thus, types of boat, engines and engine size can differ fundamentally from the equipment used for the other types of skiing referred to in this Code.
- 1.7 British Water Ski gave evidence to the House of Commons Environment Committee in March 1995 which took evidence on the Environmental Impact of Leisure Activities. The report of this title and printed on the July 1995 contains considerable relevant information on the sport.
- 1.8 It is stressed that this Code will be monitored and revised on a six monthly basis as more data is acquired. British Water Ski would welcome receipt of any information derived from use of this Code so as to assist in the development of this guidance document.

2.0 Aims of the Code

2.1 The principal aims of this Code are:

- To provide guidelines for avoiding significant impact of noise from water skiing on the surrounding community for both existing and new site.
- Where concerns or complaints have arisen at an existing site, to provide a method of assessing the noise arising from current operations and to provide guidance on means of resolving the problem.

3.0 Guidance for Avoiding Significant Impact of Water Skiing Noise

3.1 The following factors should be considered where water skiing takes place or is proposed to take place.

3.2 Regard should be had to the following factors:

- Noise output of boat
- Course layout
- Hours of operation
- Number of boats in use at any one time
- Screening
- Public address systems
- Cars and car parking

These are now separately considered

- **Noise Output of Boat**

The water ski boat is singly the most important source of the noise. The most effective means of control is to use quiet boats. Recommended limits of noise emission from water boats are given in 6.1.2 and 9.9 below.

- **Water Ski Area Layout**

Since noise diminishes with distance from the source, a water ski area should be designed so as to maximise the separation distance between the water ski boats and any potentially noise sensitive premises or location(s). Note that it requires a doubling in separation distance to achieve a major noise reduction.

- **Hours of Operation**

Clubs should be aware that the impact of noise may differ according to the time of day and week, these impacts can be greater during the early morning period and late evening period, particularly at weekends. As a result, it may be appropriate in some circumstances to set limits on the hours of operation to limit activity to within reasonable daytime hours or even to certain days of the week. Close liaison with British Water Ski is necessary to establish what is considered to be suitable.

- **Number of Boats in Use at One Time**

The number of boats in use on an area of water will affect the noise emission to the surrounding area. Operators should be aware of the effect that the number of boats in use at any one time may have and apply control where necessary.

For example, assuming all boats operate in a similar manner for a specific point on the shore the noise energy received in one hour from one boat in use will be the same as that received in half an hour from two boats in use and the same as that received in a quarter of an hour from four boats in use e.g. it is the proportional changes in the number of boats in operation that are important.

- **Screening**

Screening can provide a useful reduction in noise level. The degree of reduction will vary according to the nature and the extent of the screen.

Screen can include natural rises in the terrain, man-made earth bunds, solid fences, buildings among others. Trees do not normally provide useful screening unless densely packed to a depth in excess of 50 metres between source and receiver.

For new sites, use a natural topography and its screening potential should be considered in relation to the positioning of the jetty and clubhouse which are likely to be focal points of water ski activity.

The following factors should be taken into account when considering the use of screening as a means of noise reduction.

- There must be no line of sight between source and receiver
- Screening is generally most efficient when provided either close to the source or close to the receiver
- The screen should extend horizontally in each direction a distance significantly greater than the height of the screen
- The mass of the screen should be at least 15kg/m² and it should be free from holes or gaps beneath or within the fabric.

- **Public Address Systems**

At most Water Ski Clubs public address systems are rarely used and then usually only for special events. Where they are used they should be sited and used with great care, liaising with neighbours if necessary in an attempt to minimise disturbance. Some methods for minimising annoyance include orientating loudspeakers away from noise sensitive locations, mounting loudspeakers at low level, and minimising the areas covered by the system and in turn keeping such areas away from noise sensitive locations.

- **Cars and Car Parking**

Cars arriving and departing from the facility are a potential noise source and consideration should be given to the location of the car park. The use of screening may also be appropriate to reduce noise from this source.

- **Summary of Guidance**

- Use quiet, well maintained boats
- Optimise the water ski area layout to minimise noise effects paying particular attention to the prevailing wind and the position of any turn buoys on the lake in relation to potential noise sensitive sources
- Determine the hours of operation
- Control the number of boats in operation at any one time
- Have regard to screening as a means of noise control
- Minimise the use of public address systems where possible
- Locate car park with care

4.0 Existing Facility

- 4.1 Where a site has been used for some years without causing complaint, there will be no need to require the pattern of use to be modified, unless external circumstances or the character of use alters significantly.
- 4.2 Where complaints have been received about existing sites, the Code is intended to help local authorities, water skiers and others on the ways in which practices may be modified to ensure that compliance takes place with the following time period to allow the sport to continue while at the same time taking into account the local surroundings.
- 4.3 The first action should be for a Club to discuss the nature of the complaint with the complainant in an attempt to remedy the situation. Follow this by contacting the BWS and agree how the factors listed in 3.0 can be controlled to minimise the nuisance so as to **prevent if at all possible the receipt of a Noise Abatement Notice from the local Council.**
- 4.4 Local circumstances differ, and more stringent or less stringent controls may be appropriate. In any event this Code provides guidance in 3.0 above on the factors that affect the noise received by local surroundings. Control may be applied to one or a number of the above factors in order to introduce reductions in noise levels where deemed necessary.
- 4.5 It is desirable wherever possible that control should be simple and within the guidance given in Section 3.0 of this Code. However it may be appropriate in certain cases to agree a noise limit.
- 4.6 The implementation of any noise limit should generally be avoided owing to the complex nature of noise measurement and monitoring which might be required to prove any noise target is consistently met. However, any degree of noise reduction required in decibels will depend upon individual circumstances. Agreement should always try to be reached using the guidance contained in the advice given in Sections 6.0 and 9.0 of this Code.

5.0 New Facility

- 5.1 Where the use of a new site is contemplated, the Code may be used to determine what constraints may be appropriate. In both this case and that of any existing site which has caused complaints it is recommended that the water skiers, the local Authority in the form of their Planning Department and Environmental Health Department and the near neighbours of the site should discuss, in the light of the Code, any limits which might be necessary to prevent serious disturbance. Since clubs can exert very effective control over the type, manner of use and maintenance of water ski boats on a site it is recommended that, wherever possible, those wishing to operate water ski boats, should join or form a club to arrange their activities responsibly. A local authority or landowner considering the use of a site for water skiing is strongly advised to insist on the use of the site being under the auspices of a club affiliated to British Water Ski, who will be prepared to assist in the compliance to this Code.

- 5.2 When considering the use of a new site, it will normally be necessary to evaluate the noise likely to arise from the proposed activities. For this purpose, it is necessary to identify any possible nearby noise sensitive areas likely to be affected and establish noise criteria by which to rate the acceptability of the proposed operations, see Section 6.0 and 9.0.
- 5.3 Appendix C contains a summary of some other guidance that has been provided controlling noise from water skiing. Section 6.0 and 9.0 below make recommendations on noise limits that should be applied in light of this taking account of World Health Organisation recommendations and guidance from the Department of the Environment, included in PPG 24.
- 5.4 In order to predict the noise emission expected from the proposed facilities, a prediction model may be required and advice on this is provided in Section 7.0 and Appendix G below.

6.0 Noise Limits

6.1 Source Limits

- Noise control at source is the most effective method of controlling noise affecting the environment. Operators of boats should ensure wherever possible that boats have recommended exhaust muffling systems and that these systems are in good working order. Appendix A describes a noise testing method which can be used to rate the noise output of a water ski boat under specified controlled conditions.
- In addition, the maximum noise emission from individual boats used for towing water skiers should not be more than 75 dB (A) measured from the shore when the boat is travelling at 22 miles per hour (35 KPH), 25 metres from the measuring instrument under the conditions described in Appendix A. This paragraph does not apply to Water Ski Racing. Please refer to Section 9, paragraph 9.9 which relates to Water Ski Racing Noise Emission.
- Under certain circumstances, for example, where the limits delineated on 6.2 below might otherwise be exceeded, it may be appropriate for a limit slightly lower than the above to be adopted as a criterion for acceptance of boats using a water ski facility.

6.2 Environmental Noise Limits

- This Code aims to provide guidance on ways of ensuring that noise emissions from water skiing is maintained below levels which are acceptable to the local community.
- Noise limits which will protect the amenity of the local community have been suggested in the past together with various rating methods. A selection of these are described in Appendix C.
- This Code complies with recommendations given in BS 7445:1991 "Description and measurement of environmental noise", it recommends that the $L_{aeq,T}$ unit of measurement is used to set noise limits for environmental control purposes. This unit of measurement is now adopted in the UK for the assessment of railway noise, industrial noise, community noise and aircraft noise.
- Water skiing is principally a daytime activity and therefore, in line with guidance related to criteria given in Planning Policy Guidance 24 "Planning and Noise" ⁽¹⁾, noise arising from such activities may be described in terms of the daytime noise index, $L_{aeq,16h}$ which covers the 16 hour period from 07.00 - 23.00h. The PPG suggests a limit of 55 $L_{aeq,16h}$ as the level below which noise from mixed sources need not be considered as a determining factor in granting planning permission for new residential development. In the absence of any social survey suggesting an alternative unit it is considered that the guidance relating to criteria given in

PPG24 is appropriate i.e. noise etc. However there may be a case for making an assessment over a much shorter time period i.e. when only limited activity is expected during the daytime (see 6.2.10 below).

- The World Health Organisation ^(who) ⁽²⁾ provides the following guidance regarding the environment of the general population:

“The result of social surveys on the extent of annoyance can be used as guidance concerning the relation between different types of outdoor noise and the extent of dissatisfaction or annoyance in the community. Available data indicate that daytime noise levels of less than 50 dB(A)_{L_{eq}} cause little or no serious annoyance in the community daytime noise limits in the region of 55 dB(A) _{L_{eq}} might be considered as a general environmental health goal for outdoor noise levels in residential areas.”

- During 1990, a noise incidence study ⁽³⁾ was undertaken to establish the noise climate outside homes in England and Wales. The study found that 56% of the sample population were exposed to a greater daytime noise level than 55 dB(A)_{L_{Aeq}} and 89% exposed to a greater daytime noise level than 50 dB(A)_{L_{Aeq}}.
- Adoption of a noise limit of 55 dB(A)_{L_{Aeq, 16h}} for water skiing outside noise sensitive locations would be in line with WHO recommendations for preventing significant community annoyance. However, given that this is a limit as opposed to a desirable level, and taking into consideration that water skiing is often carried out in rural locations where the ambient levels are often lower than normally found in urban areas, it is recommended that the following noise limits should not be exceeded as a result of water skiing activities:
 - 50 _{L_{Aeq, 16h}}. (free field) as measured outside any potentially noise sensitive buildings e.g. dwellings, school, library.
 - 55 _{L_{Aeq, 16h}}. (free field) as measured in gardens, parks or other countryside areas where there is general public access, excluding footpaths and bridleways.

The above limits relate to operations throughout the day during a typical busy summer's day at a water ski site.

- The above criteria are provided for guidance purposes in assessing noise from water skiing arising from existing facilities and for establishing the suitability of a site for future water ski use.
- In some circumstances, for example in noise sensitive rural areas, it may be appropriate to consider a reduction in the above limits. Equally, in areas where the ambient noise levels are already close to the above limits or above, it may be appropriate to consider an increase in noise limits.
- If a typical busy summer day's activities at a site falls significantly short of 12 hours duration, for example, where activity takes place for the morning period only, it may be appropriate to modify the noise limits by reducing the assessment period of 16 hours but where any reduction is made the assessment period must encompass the full period of activity.

6.3 Noise Abatement

The Environmental Protection Act 1990, Section 80, enables a local authority to serve a notice requiring the abatement of noise which it is satisfied amounts to a nuisance, or prohibiting or restricting the occurrence or recurrence of such noise whether caused by an act within or outside the authority's area. Section 82 provides for a Magistrate's Court to act on a complaint made by

any person on the ground that he is aggrieved by the existence of a statutory nuisance. It is hoped that the terms of this code will not only avoid the need for action under these sections of the Act but also provide a framework whereby the use of these powers is both consistent and effective.

7.0 Method of Rating Water Ski Noise

- 7.1 In order to determine the suitability of a site for water skiing activity, whether it is an existing or proposed facility, an assessment may be required to evaluate the rating noise level for comparison with the limits given in 6.2.7 above.
- 7.2 BS7445:1991 provides guidance on the method of rating and factors to be taken into account when carrying out an assessment for rating purposes.
- 7.3 For existing sites, or where demonstrations of proposed activities take place, the rating method could consist of either measurement, prediction or a combination of both.
- 7.4 For proposed sites, the expected noise climate should be determined using a suitable prediction method. Since universally agreed prediction methods do not exist, the method adopted should be carefully described. Further information on this subject is given in Appendix G.

8.0 Control and Monitoring

- 8.1 Assistance in this respect can be obtained from suitably qualified companies. A list of these can in turn be obtained via the Association of Noise Consultants and or the Institute of Acoustics. Should difficulty be experienced in organising a company to undertake monitoring then the Local Authority Environmental Health Department may well be able to offer assistance, on a chargeable basis. Where necessary, water ski demonstrations for sound level testing can be arranged by British Water Ski.
- 8.2 Noise monitoring for the purposes of checking compliance with the environmental noise limits specified in 6.2.7 should be carried out over an appropriate period(s) of time. It is not necessary and would not normally be appropriate to monitor for the full 16 hour period. The time period may comprise a number of short term intervals during which representative water skiing activities are carried out. Guidance parameters for noise monitoring are given in BS 7445:Part 2 1991. It is also necessary to determine by monitoring the source noise level of each boat used in the monitoring exercise as referred to in Appendix A.
- 8.3 An assessment to check compliance with environmental noise limits should be based upon a typical busy summer day's activities at a water ski site. The overall 16 hour noise exposure level ($L_{Aeq, 16h}$) at a point may be determined by considering the results of noise monitoring and the variations in activities, for example on an hourly basis throughout the day.

9.0 Water Ski Racing

- 9.1 Water ski racing differs fundamentally from Tournament, Recreational and Barefoot skiing. As its name suggests it is a race either between two points or for a period of time involving a number of boats all towing one or two skiers at relatively high speed.
- 9.2 All ski racing should take place under the auspices of British Water Ski at club, regional, national, international and world championship levels and is divided up into classes, one, as a combination of engine size and two, as a combination of age and sex, current classes are formula 1, formula 2, formula 3, formula 4/sports and Dauphin, Bambino and Juniors, (open to both sexes) then mens, ladies and veterans.

- 9.3 Typical speeds reached obviously vary on conditions but can be as high as 100 miles per hour for formula 1 down to 45+ miles per hour for formula 4.
- 9.4 In view of the speeds, water ski racing is restricted by British Water Ski to large expanses of water.
- 9.5 Duration of the races vary in length of time at club and regional level, are typically 50 minutes plus one lap at national and international level and one hour at world championship level.
- 9.6 Maximum engine capacity is currently 8.2 litres petrol and 16.4 litres diesel.
- 9.7 In view of the relatively high speeds involved in ski racing, skiers wear special life jackets, crash helmets and ski on an extended type of slalom ski in what is termed a wrapped position. Similarly the driver and observer (who always faces the skier) have to wear approved life jackets and crash helmets, all crash helmets being coloured day-glo orange/red.
- 9.8 Boat Engines are either inboard or outboard types. Inboard engines are generally 4 stroke petrol or diesel and quite often turbo or supercharged. Outboard engines are attached to the stern of the boat and are invariably 2 stroke, operating on a petrol/oil mix. The maximum boat length is 21 feet.
- 9.9 For Club, Regional and National competitions held in Great Britain the maximum noise emission from individual boats used for water ski racing will not be more than 98 dB(A) measured from the shore when the boat is travelling at a constant maximum design engine speed, 30 metres from the measurement instrument under the conditions described in Appendix B. At International and World Championship level this figure would be increased to 105 dB(A) in accordance with parameters set down by the International Water Ski Federation.⁽⁶⁾
- 9.10 Most water ski racing in the U.K. is held either in off shore or estuarial waters but there are a number of events held on inland waters. Examples of places where water ski racing take place off shore are Weymouth and Lyme Regis on the South coast, All-hallows in Kent and Dunoon in Scotland being examples of estuarial waters and Chase water and Loch Earnhead being examples of inland waters. Water ski racing again falls under the control of British Water Ski and races take place on a regular basis but normally at weekends between May-October with water ski racers training during the week.

Appendix A - British Water Ski Approved Pass-by Test

Recreational, Tournament & Barefoot Skiing Test for measuring maximum noise emissions from boats used for water skiing (excluding water ski racing).

The maximum noise level emitted by a towing boat shall not exceed 75 dB L_{Amax} where:

- (1) The L_{Amax} level is the arithmetic average of the L_{Amax} readings from at least four straight passes, two in each direction, past the microphone at a distance of 25 metres.
- (2) The boat under test is travelling at a constant speed of 10 metres per second (+/- 1 m/s) 35kph +/- 3 kph (22 miles per hour +/- 2 mph) measured by timing the boat with a stopwatch over a known distance.
- (3) The microphone is sited at a fixed location (for example on a solid jetty or the bank) where the sound is transmitted directly to the microphone over water with no intervening objects, and is at a height of 1.2 metres vertically above the water level. There should be no reflective or absorbent surfaces near the microphone position.
- (4) Measurements should be made using a sound level meter conforming to BS 5969:1981 or BS 6698:1986 and set on "A" weighting and "S" time weighting, under conditions of wind speed below 3 metres per second. The equipment shall be calibrated and used as given in the manufacturer's recommendations.

Appendix B

British Water Ski Federation Approved Pass-by Test - Water Ski Racing

Tests for measuring maximum noise emissions from boats used for water racing

The maximum noise level emitted by a water ski racing boat shall not exceed 98 dB L_{Amax} , where:

- (1) The L_{Amax} level is the arithmetic average of the L_{Amax} readings from at least four straight passes, two in each direction, past the microphone at a distance of 30 metres.
- (2) The boat under test is travelling at a **constant maximum design engine speed**.
- (3) The microphone is sited at a fixed location (for example on a solid jetty or the bank) where the sound is transmitted directly to the microphone over water with no intervening objects, and is at a height of 1.2 metres vertically above the water level. There should be no reflective or absorbent surfaces near the microphone position.
- (4) Measurements should be made using a sound level meter conforming to BS 5969:1981 or BS 6698:1986 and set on "A" weighting and "S" time weighting, under conditions of wind speed below 3 metres per second. The equipment shall be calibrated and used as given in the manufacturer's recommendations.
- (5) The figure of 98 dB L_{Amax} would be increased to 105 dB L_{Amax} on occasions when International or World Championship sanctioned water ski racing events are held.

N.B. The distance used in the above appendix of 30 metres rather than 25 metres brings the pass-by test for water ski racing directly in line with the Belgian Water Ski Federation guidelines ⁽⁶⁾ on noise for water ski racing and also the additional distance affords a greater margin of safety between the boat and the shore in view of the high speeds undertaken by Ski Racing Boats.

Appendix C - Summary of Criteria

In Great Britain there are no agreed criteria for establishing the impact of water skiing noise.

Guidance is available however in the form of current codes of practice and other documents on methods of mitigating noise from water sports.

Listed below are documents that have been used in the past to rate or consider water ski noise.

BS 4142

In the past, in the absence of other guidance, assessment methods using BS 4142 have on occasion been used to rate water skiing noise although this is specifically intended as a method of rating industrial noise affecting mixed and residential areas. This method allows for a comparison of the specific noise against the background noise level L_{A90} .

Planning Policy Guidance: Planning and Noise (PPG 24)

This document is the replacement for Circular 10/73. It builds on the basic principles established in Circular 10/73 and suggests new mechanisms and guidelines for local planning authorities to adopt.

In particular, it provides guidance in the form of noise exposure categories on planning matters for various noise sources, including mixed sources where road traffic for example and another source(s) affects a location. This method of rating noise according to the category into which it falls is principally aimed at planning for the introduction of new dwellings into an existing noise affected environment.

In applying these noise exposure categories, it states:

“Traditionally, different indices have been used to describe noise from different sources, and limits have been set over different time periods. This has caused confusion, and a move towards consistency has been made here by expressing all noises of $L_{Aeq,T}$ over the periods 07.00-23.00 or 23.00-07.00.”

This document gives guidance about acceptable limits at the nearest dwelling of:

< 45 $L_{Aeq,16h}$ at night time (23.00 - 07.00)
and < 55 $L_{Aeq,16h}$ during the day (07.00 - 23.00)

It states that for recreational and sporting activities, the local planning authority will have to take account of how frequently the noise will be generated and how disturbing it will be and balance the enjoyment of the participants against the nuisance to other people.

The document states that the Sports Council has published a report Providing for Motorised Water Sport (1990). It also states governing bodies of sport have produced codes of conduct which are used when organising events, and these should be consulted when new sites are being selected. This advice is repeated in PPG 17: Sport and Recreation which gives additional guidance on noise.

Planning Policy Guidance: Sport and Recreation (PPG 17)

This document suggests that suitable sites for water sports which give rise to noise could include former mineral sites adjacent to an existing noise generator such as a main road.

Code of Practice for Water Skiing in Noise Sensitive Areas (dated April 1989)

This document, prepared by the British Water Ski Federation, the national Governing Body for the sport, sets out rules which are intended to ensure that serious disturbance is avoided in most circumstances.

It states that where the use of a new site is contemplated, the code may be used to determine what constraints may be necessary to avoid serious disturbance. In this case and that of any existing site which has caused complaints, it recommends that the water skiers, the local authority and the near neighbours of the site should discuss, in the light of the Code, any limits which might be necessary to prevent serious disturbance.

The Code recommends that the maximum peak noise emission from individual boats used for towing water skiers should not be more than 75 dB(A), measured at 25 metres, under test conditions given in the Code.

As regards noise limits in countryside areas, the Code includes an optional clause suggesting that the equivalent continuous sound level (Leq) for a 12 hour period from water skiing as a whole at the boundary of the zone of activity, should not be more than 7 dB(A) over the ambient Leq.

It should be noted that the above Code of Practice was produced to primarily include Tournament, Recreational and Barefoot skiing and did not specifically include Ski Racing.

Appendix D - Typical Activities at British Water Ski Clubs

Water ski clubs in Great Britain operate in a variety of ways on widely differing waters including both inland and coastal sites. British Water Ski promotes a policy of water skiing through clubs on all sites that are important to water skiing. An indication of how skiing takes place is given below.

(1) Inland Waters

Inland clubs may be situated on rivers, natural lakes, active and disused mineral workings, such as gravel pits and on water supply regulating and canal feeder reservoirs. At some clubs the boats are privately owned whilst at others they are owned and operated by the club. The utilisation of boats varies greatly between clubs which teach tournament and barefoot skiing as indicated in paragraph 1.5 above, and other clubs which tend to cater for recreational skiing.

Clubs which specialise in tournament and barefoot skiing may be active throughout the year with a single boat. A stand-by boat will normally be in attendance as well. During training and tournament sessions it is only possible for one boat to operate and use the jump or slalom course facilities.

Most clubs operate throughout the year with peak activity between May and October, mainly in the evening and at weekends. At some of these clubs there may be privately owned boats but the safety factors and the amount of water required by a skier and boat limits the number of boats that may be used at any one time.

(2) Coastal Waters

Possibly the greatest amount of recreational skiing takes place along our extensive coastline. Rough seas and tides severely affect many launching sites and restrict the amount of water skiing which can actually take place. Noise attenuation with distance is such that boats operating beyond one hundred metres from the shoreline are seldom heard above the background noise of beach surf.

Appendix E - Characteristic Usage of Water Ski Tow Boats

Appendix D gives a general guide to where skiing may be expected to take place. Determination of equivalent sound levels requires a more precise indication of how long peak noise levels may be generated, so a more detailed explanation of water skiing is necessary.

A boat uses idle power whilst the skier is in the water preparing to be pulled out. Once the skier is pulled to a skiing position an average figure for his speed might be 35 kilometres per hour (22 miles per hour) and the boat's engine might typically be at 70% of the maximum engine speed. The boat then travels at a constant speed and in as straight a direction as the shape of the water area allows. Owing to the sustained muscular tension a typical run will last for only ten minutes when the boat will return to the dock to pick up another skier.

Breaks in continuous skiing occur when falls take place and the boat returns the tow rope to the skier at idle power. All skiers from beginners to the most proficient tournament competitor fall when they are attempting to improve their proficiency. A boat returning to a fallen skier and starting again, might take an average of two minutes, and considering all the differing types of instructions and casual skiing that take place this might be considered to happen at least once every ten minutes. Changing skiers would also take an average of two minutes. Therefore at a busy time in a well organised club one would expect a ski boat to be operating at normal speed for approximately 40 minutes in every hour.

Appendix F - Possible Boat Concentrations for Water Skiing

Because so many variable factors are involved, each area of water needs individual consideration but an appreciation of the various limitations may help relevant authorities in deciding upon the maximum number of boats that might be used at one time.

First, to prevent collisions when more than one boat is in use there must be sufficient room to manoeuvre bearing in mind that towing a skier limits the radius of turn.

Second, it must be appreciated that water skiers prefer calm water and that for certain competitive skiing practice and instructing beginners, it is essential. Most disturbance to the water is caused by wind driven waves and the position of wind shielding barriers such as trees and banks is of importance in selecting the best sites for water skiing. Thus the amount of usable water may be less than the whole body of water and impose a restriction on the number of boats that can be used at one time.

It can be seen that with so many factors each body of water must be separately assessed but some examples can be quoted. The Thorpe Water Park ski area is purpose made for major ski tournaments. The arena measures approximately 650 metres by 75 metres and is suitable for use by only one boat at a time. Conversely Stewartby Water Ski Club in Bedfordshire consists of approximately 100 acres of water where 10 boats can operate in a satisfactory manner although this maximum number is rarely reached. Two further examples are South Yorkshire Boat and Ski Club near Sheffield, a lake of some 45 acres which can accommodate 5 boats at any one time and Church Wilne Water Ski Club south of Derby which has two lakes, one a recreational lake where 4 boats are allowed and a tournament arena measuring approximately 650 metres x 80 metres where only 1 boat is allowed at any one time.

The recommended standards set by the British Water Ski for water ski sites are as follows:

A. Tournament Sites

1. NATIONAL STANDARD SITE
Preferably not less than 650 metres long (750 metres preferred) by 80 metres wide.
2. REGIONAL STANDARD SITE
Preferably 500-650 metres long by 80 metres wide with larger areas for turning.
3. SUB-REGIONAL SITE
400-500 metres long and not less than 80 metres wide to accommodate trick, jump and four or eight buoy slalom courses, but larger areas are required for turning.

B. Recreational Skiing Sites

Recreational skiing can take place on sites 300 metres long and along the skiing area a width of 50 metres is safe. Larger areas are, however, preferable and large lakes with central islands and several long thin areas of water are better than one large open lake of the same water area. Maximum usage of small lakes would only occur on summer weekends because many skiers prefer to wait until only one boat will be in use. Obviously coastal sites are not normally limited in available water but weather and tide conditions as well as launching facilities may restrict usage.

British Water Ski is pleased to offer technical guidance on the maximum number of ski boats that may be operated in specific bodies of water.

Appendix G - Guidance on Method of Calculation of Water Ski Noise

There is no universally agreed prediction method for water ski noise. The method adopted for this purpose should therefore be carefully described.

For guidance purposes, the principles of a suitable method of prediction to rate water ski noise with respect to noise limits given in this Code of Practice is given below. A glossary of acoustical terms is given at the rear of this appendix.

This method is based on the procedure give in BS 7445:Part 1:1991 for determination of the L_{Aeq} value on the assumption that the noise environment is the result of a number of identifiable noise events. Under these circumstances, the L_{Aeq} value may be calculated from the sound exposure levels (SEL) of the individual events occurring within a time period T.

Information on the following is required for the purposes of noise prediction:

- Water ski circuit layout
- Location of noise sensitive buildings and areas
- Types of boat in use at facility
- Number of circuits made by each boat type per day
- Reference noise data (and if provided in terms of L_{Amax} speed data) for each boat type
- Land topography between water ski lake and reception points
- Meteorological date (where relevant)

For each boat type, carry out the following (Stages 1-4):

Stage 1 Divide the water ski circuit used by the boat type into a number of segments such that the variation in noise (as determined at the reception point) between points within the segment is small (i.e. less than 2dB(A)).

For each segment, determine the following for each boat type (Stages 2-4):

Stage 2 A reference noise level at a specified reference distance commensurate with typical boat operations. This could be derived from measurement or other data. It may be in terms of an L_{Amax} . If this unit is used, the speed at which the boat traverses the segment should be used to record the duration, hence allowing the SEL to be derived.

NB. It may be appropriate to provide more than one reference noise level for each boat type since there will be some variation in SEL between that arising when a skier is being towed and when a skier falls off and requires the boat to stop and re-start. The SEL arising from the former activity is normally slightly higher.

Stage 3 Adjust the reference noise level to determine the SEL at the reception point taking account of the following factors:

- distance from centre point of segment to receiver
- soft ground attenuation and air absorption
- the effect of screening by barriers
- the angle of view (where relevant)
- meteorological conditions (where relevant)

NB. It may be appropriate in some circumstances to take account of the prevailing winds. Further guidance on this is given in MPG 11 (See Page 9 of this Code Reference 4).

Stage 4 Convert the SEL values at the reception point to values of L_{Aeq} taking into account the 16 hour daytime period and the number of movements by the particular type of boat in use during this period.

After completion of Stages 1-4 for each boat type, carry out the following:

Stage 5 Combine the total contributions from each boat type to obtain the total day $L_{Aeq,16h}$ value at the reception point.

References Used In This Code

- (1) Planning Policy Guidance: Planning and Noise, (PPG 24), Department of the Environment, Welsh Office, 1994.
- (2) Environmental Health Criteria, 12, Noise, Published under the joint sponsorship of the United Nations Environment Programme and the WHO, Geneva, 1980.
- (3) BRE Information Paper IP 21/93, Building Research Establishment, December 1993.
- (4) Minerals Planning Guidance: The Control of Noise at Surface Mineral Workings, MPG11, Department of the Environment, Welsh Office: April 1993.
- (5) House of Commons Environment Committee Fourth Report The Environmental Impact of Leisure Activities Volume 1 Session 1994 - 1995, July 1995 H.M.S.O.
- (6) Belgian Water Ski Federation's adopted guide lines on noise for water ski racing, used at the 1995 World Ski Racing Championships hosted by Belgium.

Glossary of Accoustical Terms

dB - Decibel

Logarithmic ratio used to relate a sound pressure level to a standard reference level.

dB(A) - A-weighted decibel

Internationally accepted unit for most noise measurement and represents the sound pressure level weighted to correspond to the frequency response of the human ear. A difference of 3dB(A) may just be noticeable and a difference of 10dB(A) represents a doubling or halving of subjective loudness for a steady state continuous noise.

LAeq,T - A-weighted equivalent continuous sound level

The equivalent continuous sound level is a notional steady sound level which would cause the same A-weighted sound energy to be received as that due to the actual and possibly fluctuating sound over a period of time, T.

SEL - Sound exposure level

The sound exposure level is a measure of noise from a single event which takes account of the duration as well as the intensity. It is the level which if maintained constant for a period of one second, would deliver the same A-weighted sound energy as a given noise event.

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