



SLOVENSKI STANDARD
SIST EN 16870:2017

01-junij-2017

Kakovost vode - Navodilo za določevanje stopnje spremenjenosti hidromorfoloških značilnosti jezer

Water quality - Guidance standard on determining the degree of modification of lake hydromorphology

Wasserbeschaffenheit - Anleitung zur Bestimmung der hydromorphologischen Eigenschaften von Seen

Qualité de l'eau - Préconisations pour la détermination du degré de modification des caractéristiques hydromorphologiques des lacs

<https://standards.iteh.ai/catalog/standards/sist/e32ada1e-a0bd-41d1-b6ee-48f8207f0127/sist-en-16870-2017>

Ta slovenski standard je istoveten z: EN 16870:2017

ICS:

07.060	Geologija. Meteorologija. Hidrologija	Geology. Meteorology. Hydrology
13.060.10	Voda iz naravnih virov	Water of natural resources

SIST EN 16870:2017

en,fr,de

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN 16870:2017](#)

<https://standards.iteh.ai/catalog/standards/sist/e32ada1e-a0bd-41d1-b6ee-48f8207f0127/sist-en-16870-2017>

EUROPEAN STANDARD

EN 16870

NORME EUROPÉENNE

EUROPÄISCHE NORM

February 2017

ICS 07.060; 13.060.45

English Version

Water quality - Guidance standard on determining the degree of modification of lake hydromorphology

Qualité de l'eau - Guide pour la détermination des conditions hydromorphologiques des lacs

Wasserbeschaffenheit - Anleitung zur Bestimmung der hydromorphologischen Eigenschaften von Seen

This European Standard was approved by CEN on 4 December 2016.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

<https://standards.iteh.ai/catalog/standards/sist/e32ada1e-a0bd-41d1-b6ee-48f8207f0127/sist-en-16870-2017>



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents	Page
European foreword.....	4
Introduction	5
1 Scope.....	6
2 Normative references.....	6
3 Terms and definitions	6
4 Principle	10
5 Determining the hydromorphological modifications of lakes	10
5.1 Feature categories	10
Table 1 — Features to be assessed when determining the hydromorphological modifications of lakes.....	11
5.2 Procedure for scoring.....	11
Table 2 — Conversion table.....	12
6 Interpreting and reporting hydromorphological modifications.....	12
6.1 Modification scores	12
Table 3 — Options, applications and procedures for reporting hydromorphological modification scores	13
6.2 Assigning classification terms.....	13
Table 4 — Classification terms for 5 classes (Score band A).....	14
Table 5 — Classification terms for 3 classes (Score band B).....	14
Annex A (normative) Characterization of lake modification based on hydromorphological features.....	15
Table A.1 — Characterization of lake modification based on hydromorphological features	16
Annex B (normative) Alterations to mean annual water level range.....	29
Table B.1 — Alterations to mean annual water level range	29
Annex C (normative) Land cover in the lake catchment.....	31
Table C.1 — Land cover in the lake catchment.....	31
Annex D (informative) Case study examples.....	32
D.1 Lago Maggiore (Italy).....	32
D.1.1 Summary description	32
Figure D.1 — Location of Lago Maggiore.....	32
D.1.2 Morphometric characteristics.....	33
Table D.1 — Morphometric characteristics of Lago Maggiore.....	33
D.1.3 Degree of modification using Annex A.....	33
Table D.2 — Modification scores for Lago Maggiore, using reporting option 1	33
Table D.3 — Modification scores for Lago Maggiore using reporting options 2, 3 and 4.....	34

D.1.4	Conclusions	34
D.2	Lago Bidighinzu (Italy)	35
D.2.1	Summary description	35
Figure D.2	— Location of Lago Bidighinzu	35
D.2.2	Morphometric characteristics	36
Table D.4	— Morphometric characteristics of Lago Bidighinzu	36
D.2.3	Degree of modification using Annex A	36
Table D.5	— Modification scores for Lago Bidighinzu, using reporting option 1	36
Table D.6	— Modification scores for Lago Bidighinzu using reporting options 2, 3 and 4	37
D.2.4	Conclusions	37
D.3	Lake Lidzbarskie (Poland)	38
D.3.1	Summary description	38
Figure D.3	— Location of Lake Lidzbarskie and a map of its bathymetry	38
D.3.2	Morphometric characteristics	38
Table D.7	— Morphometric characteristics of Lake Lidzbarskie	39
D.3.3	Degree of modification using Annex A	39
Table D.8	— Modification scores for Lake Lidzbarskie, using reporting option 1	39
Table D.9	— Modification scores for Lake Lidzbarskie using reporting options 2, 3 and 4	41
D.3.4	Conclusions	41
D.4	Lake Velenje (Slovenia)	41
D.4.1	Summary description	41
Figure D.4	— Location of Lake Velenje	42
D.4.2	Morphometric characteristics	42
Table D.10	— Morphometric characteristics of Lake Velenje	42
D.4.3	Degree of modification using Annex A	43
Table D.11	— Modification scores for Lake Velenje, using reporting option 1	43
Table D.12	— Modification scores for Lake Velenje using reporting options 2, 3 and 4	44
D.4.4	Conclusions	44
D.5	Arkanj Lake (Serbia)	44
D.5.1	Summary description	44
D.5.2	Morphometric characteristics	44
Table D.13	— Morphometric characteristics of Arkanj Lake	45
D.5.3	Degree of modification using Annex A	45
Table D.14	— Modification scores for Arkanj Lake, using reporting option 1	46
Table D.15	— Modification scores for Arkanj Lake, using reporting options 2, 3 and 4	47
D.5.4	Conclusions	47

EN 16870:2017 (E)**European foreword**

This document (EN 16870:2017) has been prepared by Technical Committee CEN/TC 230 "Water analysis", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2017, and conflicting national standards shall be withdrawn at the latest by August 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

**iTeh STANDARD PREVIEW
(standards.iteh.ai)**

[SIST EN 16870:2017](https://standards.iteh.ai/catalog/standards/sist/e32ada1e-a0bd-41d1-b6ee-48f8207f0127/sist-en-16870-2017)

<https://standards.iteh.ai/catalog/standards/sist/e32ada1e-a0bd-41d1-b6ee-48f8207f0127/sist-en-16870-2017>

Introduction

This European Standard will enable broad comparisons to be made of the hydromorphological condition of lakes throughout Europe (e.g. for reporting by the European Environment Agency). In this document, the word 'lake' is used as a generic term for standing waters including natural lakes, reservoirs, excavated pits and other artificial water bodies.

The Guidance standard for assessing the hydromorphological features of lakes (EN 16039) describes a protocol for survey (field and remote sensing methods) and feature recording, whereas this standard gives guidance on assessing the condition of those features, and focuses especially on human pressures that affect lakes. This standard has applications for nature conservation, environmental impact assessment, lake management, and guiding lake restoration work.

The assessment of lake 'quality' in Europe has evolved over the past decades from its focus on chemical conditions to a more comprehensive ecological approach. The EC Water Framework Directive (WFD) has reinforced the need for this broader view of lake 'quality' through its requirement for determining 'ecological status' based on phytoplankton, phytobenthos, macrophytes, invertebrates and fish. The Directive also requires hydromorphological and physico-chemical conditions to be suitable for supporting biological communities. This standard, therefore, may be helpful for implementing the WFD when indicating the extent to which pressures might have caused a departure from natural hydromorphological conditions. In doing so it complements methods that have been developed within particular countries for assessment and reporting under the WFD. However, this standard makes no links between hydromorphology and biology, nor does it set any hydromorphological condition targets that should be achieved. Whereas decisions on management for individual lakes require expert local knowledge and vary according to lake type, this standard provides a framework to help those decisions to be made consistently.

[SIST EN 16870:2017](https://standards.iteh.ai/catalog/standards/sist/e32ada1e-a0bd-41d1-b6ee-48f8207f0127/sist-en-16870-2017)

<https://standards.iteh.ai/catalog/standards/sist/e32ada1e-a0bd-41d1-b6ee-48f8207f0127/sist-en-16870-2017>

EN 16870:2017 (E)**1 Scope**

This European Standard provides guidance on determining the degree of modification of lake hydromorphological features described in EN 16039. It enables consistent comparisons of hydromorphology between lakes within a country and between different countries in Europe, providing a method for broad based characterization across a wide spectrum of hydromorphological modification. Its primary aim is to assess 'departure from naturalness' for a given type of lake as a result of human pressures, and it suggests suitable sources of information that may contribute to characterizing the degree of modification of hydromorphological features. For wholly artificial lakes or reservoirs formed by damming rivers the aim is to assess the extent to which processes approximate to those in comparable natural water bodies. However, this standard does not replace methods that have been developed within particular countries for local assessment and reporting. Decisions on management for individual lakes require expert local knowledge and vary according to lake type. The assessment of the hydromorphological conditions as needed for the WFD (supporting the biological quality elements) remains in the competence of the individual Member States.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 15843:2010, *Water quality - Guidance standard on determining the degree of modification of river hydromorphology*

EN 16039:2011, *Water quality - Guidance standard on assessing the hydromorphological features of lakes*

3 Terms and definitions

[SIST EN 16870:2017](https://standards.iteh.ai/catalog/standards/sist/e32ada1e-a0bd-41d1-b6ee-48f8207f0127/sist-en-16870-2017)

[https://standards.iteh.ai/catalog/standards/sist/e32ada1e-a0bd-41d1-b6ee-](https://standards.iteh.ai/catalog/standards/sist/e32ada1e-a0bd-41d1-b6ee-48f8207f0127/sist-en-16870-2017)

[48f8207f0127/sist-en-16870-2017](https://standards.iteh.ai/catalog/standards/sist/e32ada1e-a0bd-41d1-b6ee-48f8207f0127/sist-en-16870-2017)

For the purposes of this document, the following terms and definitions apply.

3.1
bank
physical edge of the lake shore, or of the island(s) within, generally defined by a wave-cut break in slope at or near the water's edge of the lake, but can also be defined as the line along which riparian (terrestrial or land) conditions change to littoral in-lake conditions

[SOURCE: EN 16039:2011, definition 3.3]

3.2
bar
discrete, natural, depositional feature with shallow slope into water composed of unconsolidated material

3.3
bathymetry
systematic survey of size, shape and water depth distribution in a lake

Note 1 to entry: Bathymetry is the basis of deriving morphometric parameters and to predict thermal stratification, residence time and sediment redistribution processes.

[SOURCE: EN 16039:2011, definition 3.5]

3.4**catchment**

drainage basin contributing water and sediment into a lake (also recognized as drainage area)

[SOURCE: EN 16039:2011, definition 3.10]

3.5**connectivity****continuity**

uninterrupted movement of water, sediment and organisms into, out of and within a lake system

[SOURCE: EN 16039:2011, definition 3.11]

3.6**drawdown**

lowering of lake levels caused by deliberate water release

3.7**dune**

underwater ridge formed by wave or current action on the lake bed

3.8**ecological status**

expression of the quality of the structure and functioning of aquatic ecosystems, by comparing the prevailing conditions with reference conditions

ITeC STANDARD PREVIEW
(standards.iteh.ai)

Note 1 to entry: As classified in accordance with Annex V of the EC Water Framework Directive.

[SIST EN 16870:2017](https://standards.iteh.ai/catalog/standards/sist/e32ada1e-a0bd-41d1-b6ee-48f8207f0127/sist-en-16870-2017)

3.9**embeddedness**

extent to which fine sediment infiltrates littoral gravels

<https://standards.iteh.ai/catalog/standards/sist/e32ada1e-a0bd-41d1-b6ee-48f8207f0127/sist-en-16870-2017>

3.10**gauging board****staff gauge**

graduated scale, fixed to a lake outlet or inflow structure, or directly into the substrate, used to measure the water level in a lake

3.11**geotextile**

permeable fabric often used to reinforce or protect banks

3.12**groundwater table**

surface of a body of underground water below which the soil or rocks are permanently saturated with water

3.13**hard engineering**

stabilization of the shoreline using 'hard' materials including concrete walls, gabion baskets and sheet piling

EN 16870:2017 (E)**3.14****hydromorphology**

physical and hydrological characteristics of lakes including the underlying physical processes from which they result

[SOURCE: EN 16039:2011, definition 3.22]

3.15**island**

landform protruding from the surface of a lake

[SOURCE: EN 16039:2011, definition 3.26]

3.16**lake stratification**

variations in water column structure with respect to temperature and density

[SOURCE: EN 16039:2011, definition 3.30]

3.17**littoral zone**

habitat extending from the water's edge to the lakeward limit of rooted macrophytes or algae on the lake bed

[SOURCE: EN 16039:2011, definition 3.33]

iTeh STANDARD PREVIEW
(standards.iteh.ai)

3.18**pelagic zone**

open water zone extending from the littoral zone towards the centre of a lake

[SOURCE: EN 16039:2011, definition 3.41]

SIST EN 16870:2017

48820740127/sist-en-16870-2017

3.19**planform**

view of lake shape from above, e.g. elongate, circular, etc., and also relevant in relation to the shoreline development index which expresses the degree of irregularity of a lake compared with a circular form of the same area

[SOURCE: EN 16039:2011, definition 3.42]

3.20**profundal zone**

deeper parts of the lake where light does not penetrate and there is no photosynthetic activity

3.21**ramping rate**

rate of rise and fall of water levels often associated with hydropower generation

3.22**remote sensing**

group of techniques for acquiring data on land forms and land cover (e.g. aerial photographs, satellite imagery, radar, sonar)

3.23**residence time
retention time**

time for water in a lake to be replaced, which can be calculated in a range of ways (e.g. instantaneous, seasonal, annual) and may be applied to the entire lake, to individual lake basins or to strata within the lake

3.24**riparian zone**

area of land adjoining the lake capable of directly influencing the condition of the aquatic ecosystem (e.g. by shading and leaf litter input)

[SOURCE: EN 16039:2011, definition 3.45]

3.25**scour hole**

depression in the lake bed created by wave or current action

3.26**shore zone**

comprises riparian, eulittoral and littoral zones around the perimeter of a lake

[SOURCE: EN 16039:2011, definition 3.48]

iTeh STANDARD PREVIEW

(standards.iteh.ai)

3.27**sidescan sonar**

sonar scanning obliquely onto the lake bed used to characterize lake-bottom features

[SIST EN 16870:2017](https://standards.iteh.ai/catalog/standards/sist/e32ada1e-a0bd-41d1-b6ee-48f8207f0127/sist-en-16870-2017)

3.28**soft engineering**

stabilization of the shoreline using 'soft' materials including basket-work, planted saplings and live willow, dumped natural debris (to re-nourish sediment supply) and degradable synthetic materials

<https://standards.iteh.ai/catalog/standards/sist/e32ada1e-a0bd-41d1-b6ee-48f8207f0127/sist-en-16870-2017>

Note 1 to entry: Also includes earth-moving where re-sectioning and re-profiling takes place

3.29**step**

feature of erosion where a lake bank or an old depositional bar has been eroded to create distinct edges (steps) into water

Note 1 to entry: Several steps can develop down the shore to reflect different periods of erosion at times of different water level

3.30**substrate (substratum)**

natural sediment or engineered surfaces comprising the shore and bed of a lake

Note 1 to entry: Natural sediments are generally characterized by texture and organic matter content, while artificial substrates are described by their construction materials

[SOURCE: EN 16039:2011, definition 3.49]

EN 16870:2017 (E)**3.31****tracer experiment**

one of a group of hydrogeological field techniques used to quantify groundwater flow

3.32**water balance**

flow of water into and out of a lake (e.g. groundwater, rain water, evaporation)

3.33**wetland**

transitional zone between permanently inundated, and generally dry, environments, e.g. marshes (wet ground without peat), fens (groundwater fed peats) and bogs (rain-fed peat systems)

[SOURCE: EN 16039:2011, definition 3.52]

3.34**willow spiling**

method of soft engineering used to strengthen lake shores using retaining walls constructed of woven willow stems from which trees will sprout

4 Principle

A standard protocol is described for assessing the degree of modification of the hydromorphological features of different lake zones. Both this European Standard and EN 16039 focus attention on lake features as surrogates for lake processes. Those making assessments, therefore, do not need to be trained geomorphologists although some geomorphological input may be useful. To ensure consistency in approach, the main feature categories are in general the same as those in EN 16039. However, some minor adjustments have been made to the details to help facilitate scoring.

[https://standards.iteh.ai/catalog/standards/sist/e32ada1e-a0bd-41d1-b6ee-](https://standards.iteh.ai/catalog/standards/sist/e32ada1e-a0bd-41d1-b6ee-48820740137/sist-en-16870-2017)

5 Determining the hydromorphological modifications of lakes**5.1 Feature categories**

Assessments are made for the feature categories listed in EN 16039, with subdivisions into specific features where appropriate (Table 1).

Table 1 — Features to be assessed when determining the hydromorphological modifications of lakes

Feature category	Feature
1. Hydraulics	Water level variability Lake volume
2. Morphometry	Slope profile of shore zone Planform Depth distribution
3. Bedforms/Landforms and Substrate	Landform and substrate characteristics Bank structure and modifications Littoral substrate Lake bottom bedforms Extent of artificial material/imported natural substrate
4. Connectivity and Continuity	Natural exchange with groundwater Connectivity of lake with adjacent riparian wetlands Natural erosion/deposition patterns Natural exchange between groundwater and surface water Migratory movement Sediment transport
5. Aquatic Vegetation	Human disturbance or active management of aquatic vegetation (shore zone) Human disturbance or active management of aquatic vegetation (open water zone)
6. Land Cover	Land cover in riparian zone

5.2 Procedure for scoring

5.2.1 Users should note whether the lake being assessed is natural (N), heavily modified (H) or artificial (Ar). Annex A sets out guidance on how to allocate scores for each feature category. It contains two separate procedures for scoring – using score band A with quantitative data, or score band B with qualitative data. Score band A is a 5-point scale (1 = lowest degree of modification, 5 = highest degree of modification). Score band B is a 3-point scale (1, 3, 5; following the same general approach as for score band A). Quantitative data should always be used where available; where there are quantitative data for some of the features but not for all, a mix of quantitative and qualitative data may be used. Users should state which scores have been assigned based on quantitative data and which on qualitative descriptions, as this determines the degree of confidence in the assessment. This note should also be added to any maps produced that show the results of lake hydromorphological assessment.

5.2.2 Where the majority of scores have been derived from 5-band scales users may wish to retain the five bands. Where the majority have been derived from 3-band scales users may wish to change the 5-band scores to 3-band scores as follows, making clear in the results which scores have been changed in the way given in Table 2.