REPORT SNO 6535-2013

Lake Ohrid ENSIS database
Technical report

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– an institute in the Environmental Research Alliance of Norway

REPORT

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Title	Report No..	Date
Lake Ohrid ENSIS database Technical report	6535-2013	03/05/2013
	Project No. O-29248	Pages: 54 Price:
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	Geographical area Europe	Printed NIVA

Client(s)	Client ref.
Norwegian ministry of foreign affairs	

Abstract

Import of measurements to ENSIS. Examples of how ENSIS can be used. Detailed import instructions

4 keywords, Norwegian	4 keywords, English
1. ENSIS Import	1. ENSIS Import
2. Klassifiseringssystem	2. Classification system
3. Målinger	3. Measurements
4. Stasjoner	4. Stations

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ISBN 978-82-577-6270-4

Lake Ohrid ENSIS database

Technical report

Preface

Firstly this document is a detailed description of how to import stations, measurement position, dataseries and measurements to ENSIS. The document is intended to be a step by step description of the process.

Secondly this document describes how ENSIS database has been designed in Lake Ohrid. The database includes chemical, physical and biological data. This is the very first time that ENSIS has covered biological data.

Grimstad, 03/05/2013

Anne Bjørkenes Christiansen

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Summary

The first part of the report gives detailed information about how to import data to ENSIS. This deals with stations, measurement positions, dataseries definitions and data values. The second part describes how the database for Lake Ohrid has been made.

Sammendrag

Første del av rapporten inneholder en detaljert beskrivelse av hvordan man importerer data til ENSIS. Dette gjelder stasjoner, måleposisjon, dataseriedefinisjon og måledata. Neste del av rapporten inneholder en beskrivelse av hvordan denne databasen er bygget opp for Lake Ohrid.

1. ENSIS database

ENSIS is a state of the art management and decision support system used as a tool for environmental protection. The system consists of modules for handling different mediums. ENSIS Water can be applied for a holistic management and protection of the water resources. The basic part, ENSIS Kernel, contains functionality for data handling, presentation and tools for processing and analysis of data independent of the medium. The system can be used as a management tool for planners, an information tool for the public and an expert system for specialists.

The very first version of a simplified ENSIS was applied during the Winter Olympics at Lillehammer in Norway in 1994, where the focus was on data acquisition and presentation from on line monitoring instruments. ENSIS was developed as a joint co-operation between the Norwegian Institute for Water Research (NIVA), the Norwegian Institute for Air Research (NILU) and the IT-company Interconsult Norgit. The system has undergone extensive developments, both from a scientific and a technical point of view, and is now commercial available in the version 3.0.

The ENSIS database is prepared to receive and store a wide range of environmental information, such as monitoring data to assess the status of the environment, data about the pollution sources that causes pressure on the environment, and general information such as physical characteristics of water resources.

The database can in principle store all relevant environmental monitoring data of physical and chemical character. Examples of these types of data are meteorological and hydrological data (i. e. temperature, wind speed and direction, humidity, water level and flow,) and water chemistry (i. e. pH, total nitrogen, dissolved oxygen, Cu, Zn, POPs). The list of components are generic, so new components can easily be added as the measurements are registered in the database. The system can also store biological and biota chemistry data. This is an important feature for the system, and gives the possibility to cover all aspects in the ***EU Water Framework Directive.***

All the monitoring data are linked to a geographic location (monitoring station and measurement position) and can therefore easily be searched for through the map.

ENSIS database has previously been used for rivers and lakes, and it has stored physical and chemical data from both manual and automatic monitoring stations. This database for Lake Ohrid includes physical and chemical data in addition to biological data. This is the first time biological data has been incorporated into ENSIS.

To make ENSIS able to include biological data some definitions and restructuring had to be done. ENSIS is originally created to store physical and chemical data, but the system can be adjusted to store other kinds of data as well.

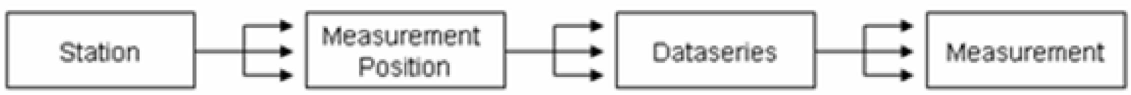

Figure 1 Organization of data in ENSIS

Figure 1 shows schematically how different type of data are stored in ENSIS and how they are linked to each other either in one → one relation, or one → many relation.

This report is a step by step explanation of how ENSIS is build and how import of manual monitoring data to ENSIS is done. We focus in this description on the import of text files since this better explains the details about how the import of data is performed than import of data in ENSIS format. Import of files in ENSIS format can be used when large amounts of data are taken from one database and imported into another database.

This report describes the general way of importing data, and then describes Lake Ohrid data in specific.

2. ENSIS import procedure

The import should be done in sequential steps according to the table below. If step one is already performed the user can go to the next step. The reason for keeping the import order rigid is that data in the next step might refer to information entered in the previous steps.

Table 1 Import routine

Step:	**Type of data:**
0	Control
1	Import all definitions
2	Station description
3	Measurement positions for Station
4	Dataseries physical
5	Data value physical

An important step before importing data into ENSIS is to check whether the data already exists in the database or not. When stations and dataseries already exist in the ENSIS database, the user should not import data already existing in ENSIS, since there is limited checking if data exist in the database or not (except for monitoring values – data class Data Value Physical). So, to avoid duplicated information, check if the data exist in the database before import is performed. Go through these 5 steps before starting:

1. Check if the **definitions** (measurement position type, medium, measurement type, component, component group etc) are imported. If some definitions are missing they must be imported first. Remember that some definitions must be imported before others. This is because of how the properties are referred to each other.
2. Check if the **station and the co-ordinates** of the station already exist in the database. The station name can be different from the name that is used for the station, but the co-ordinates can be equal (however, if the co-ordinates are equal, it should probably not created a new station at the same location!). If the stations do not exist, import (or enter it manually) the stations. If the station already exists, go to next step.
3. Check the **measurement positions** at the stations. Measurement positions can differ from station position. If they do not exist, import measurement position (step 3 in table 1). If they exist, go to next. If only a few measurement positions are missing in the database, they can be created manually.
4. Check if the **measurement data series** exist. If they do, the data series are already defined. Go to next step. If they do not exist, it is often easier to create dataseries manually within ENSIS, especially if only a few new dataseries are to be created. You can also import data series definitions (step 4 in table 1). When the dataseries are defined or imported, go to next step.
5. If all stations, measurement positions and data series exist (the latter, dataseries, will guarantee that also stations exist), check if the **data values** are already in the database. If not, start to import measurement values (step 5 in table 1). It is difficult to check all values, of course, but a check on the validity period (DateFrom and DateTo) of the dataseries gives a good feeling if the data are already present in the database or not.

2.1 Terms used in the import routine

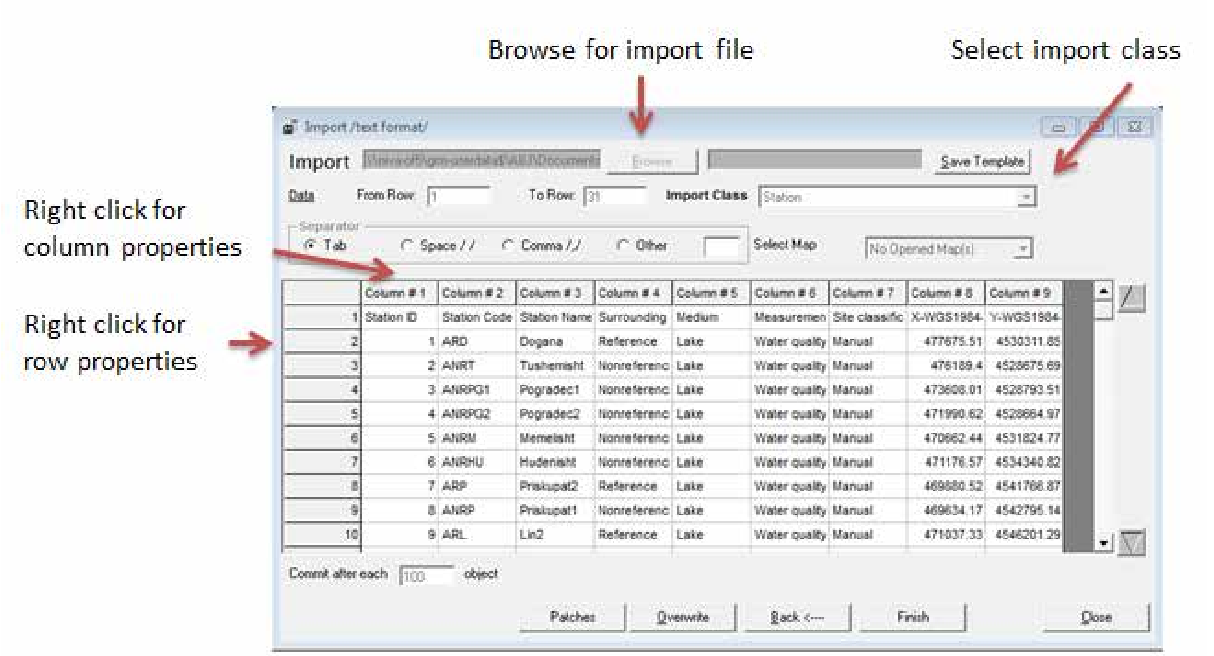

Figure 2 Import dialogue

<u>Import class</u>
Import class must be selected before the import can be performed. The import class can be seen as one of many tables in the database. As an example, one import class is called ‘Station’ holding Station information, while another is called ‘Components’ holding Component information.

<u>Property:</u>
Within each table it can be a set of columns/fields. Each column of data you want to import must refer to one specific field in the selected data class. Some fields or properties are required; meaning **must** be filled with data, while others are optional. Some properties can also be a reference to properties from other data classes. For instance, import of station definitions might refer to class Medium.   and Medium consist of and ID and a Name. When importing station definitions, medium must be given either as a number (ID) or a text (Name).

<u>References:</u>
Some properties are given as references. That means that these properties refer to some other data class. If this is the case, it must also be given which property in the referred class that is used. As an example, import of station can refer to class Medium (optional information about the station). The Medium is defined by ID (key) and Name (Text), and the user must select which of these properties that is used to uniquely refer to the correct Medium. Sometimes the user must even define two or more properties used for reference to ensure a unique reference to a given object in another data class. An example is when monitoring values are imported and the user must refer to a Dataseries Physical definition by both the Station name/ID/Code and measurement position code and component. More details about this are given in later sections.

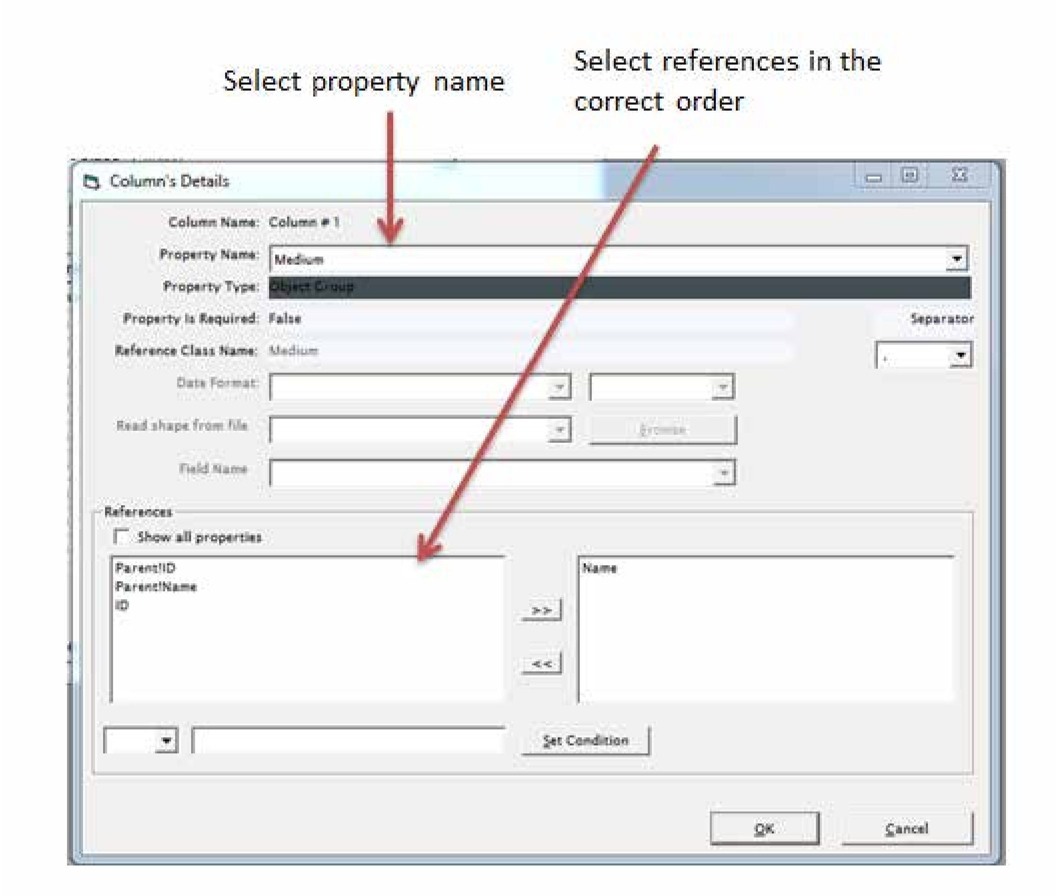

Figure 3 Column's details, properties and references

<u>Column and row functionality:</u>
Column properties are set in the import dialogue

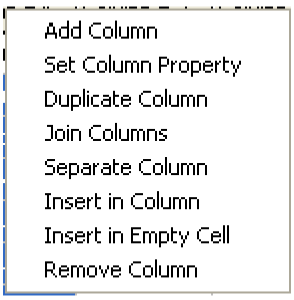

Figure 4 Edit functions for one column.

Figure 4 above shows the dialogue that appears when pressing the right mouse button while holding the cursor on top of the heading of one column. The following bullet points give the functionality of this dialogue:

- Add column: Used to add a new and empty column. This is useful when you manually want to enter new information to be imported. The cells can be written in.
- Set column property: Here you define the property (more details later).

- Duplicate column: This makes a copy of the selected column. This can be useful when From time and To time is equal, but must be set twice.
- Join column: This merges two columns into one. This is useful when you need to define 2 or more properties to refer to (one) another data class, for instance when referring to Dataseries physical definitions (by Station, measurement position, component...).
- Separate column: Can be used to split one column into 2.
- Insert in column: Fills the entire column with the number given in the first cell. The system fills all cells independent of there is already a value on one of the cells (in other words, it overwrites). Useful when you want to fill one entire column with the same data/information. Sometimes used after adding an empty column.
- Insert in empty cell: Enters a user-specified number into all empty cells of the selected column. Useful when you want to add something to cells that are empty. Mostly used when you want to fill empty cells with the number indicating missing value (-9900).
- Remove column. Removes the selected column.

Rows can also be removed, either by defining From- To rows to be imported, or by placing the mouse above the grey field to the very left of each row. The following dialogue appears:

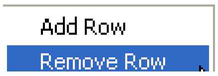

Figure 5 Edit functions for one row

Figure 5 above shows the dialogue that appears when pressing the right mouse button while holding the cursor on top of the grey row field to the very left. The following bullet points gives the functionality of this dialogue:

- Add Row: Simply adds a row by selecting where to insert. Can be very useful when manually entering data into the import wizard.
- Remove Row: Simply removes the selected/highlighted rows. This can be a time-consuming operation if very many (several thousands) rows in the import wizard.

2.2 Import stations

If only a few stations are to be defined, it is normally an easy task to define them one by one. The figure below shows what kind of data Station properties includes, and how it is shown in ENSIS.

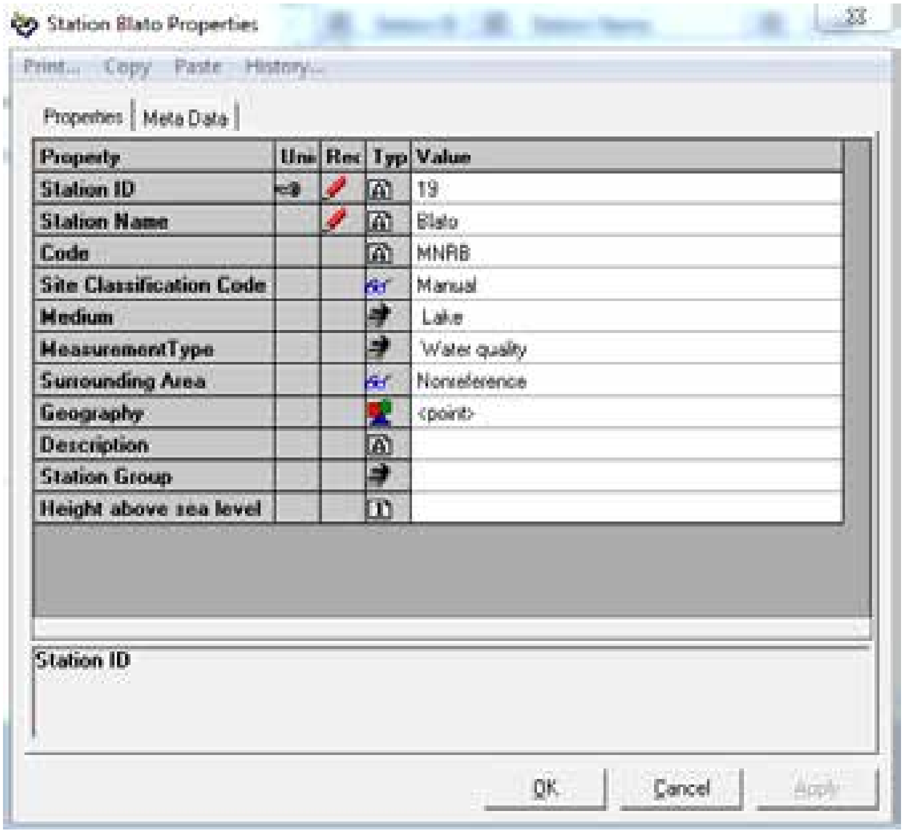

Figure 6 Description of monitoring station

To import monitoring stations, you need to organize the data as shown in Table 2. The columns can be in a different order. The important issue is that all information is defined. In the example below you can see that medium is given as text (Lake). Information about Medium could also be given as a number. This is because medium “lake” has ID “6”. Note that all rows must then be either as text or as number. It is not possible to have text and numbers mixed.

Table 2 Import text format for Stations

Station ID	Station Code	Station Name	Surrounding area	Medium	Measurement type	Site classification code	X-WGS1984-UTM34N	Y-WGS1984-UTM34N
1	ARD	Dogana	Reference	Lake	Water quality	Manual	477675.51	4530311.85
2	ANRT	Tushemisht	Nonreference	Lake	Water quality	Manual	476189.4	4528675.69
3	ANRPG1	Pogradec1	Nonreference	Lake	Water quality	Manual	473608.01	4528793.51
4	ANRPG2	Pogradec2	Nonreference	Lake	Water quality	Manual	471990.62	4528664.97
5	ANRM	Memelisht	Nonreference	Lake	Water quality	Manual	470662.44	4531824.77
6	ANRHU	Hudenisht	Nonreference	Lake	Water quality	Manual	471176.57	4534340.82
7	ARP	Priskupat2	Reference	Lake	Water quality	Manual	469880.52	4541766.87
8	ANRP	Priskupat1	Nonreference	Lake	Water quality	Manual	469634.17	4542795.14
9	ARL	Lin2	Reference	Lake	Water quality	Manual	471037.33	4546201.29
10	ANRL	Lin1	Nonreference	Lake	Water quality	Manual	470673.15	4546993.91
11	MRR	Radozda	Reference	Lake	Water quality	Manual	469468.58	4550595.83
12	MRK	Kalishta	Reference	Lake	Water quality	Manual	470892.5	4555533.61
13	MNRS	Struga	Nonreference	Lake	Water quality	Manual	472706.85	4556590.07
14	MNRA	Auto Camp As	Nonreference	Lake	Water quality	Manual	476450.38	4557462.79
19	MNRSR	Sateska River	Nonreference	Lake	Water quality	Manual	483455.15	4550159.46
15	MNRG	Grashnica River	Nonreference	Lake	Water quality	Manual	477552.77	4557118.29
16	MNRK	Koselska River	Nonreference	Lake	Water quality	Manual	482123.09	4551629.31
17	MNRZ	Ohrid bay	Nonreference	Lake	Water quality	Manual	480905.87	4552226.44
18	MNRB	Blato	Nonreference	Lake	Water quality	Manual	482812.09	4551169.99
20	MNRR	Rachanska River	Nonreference	Lake	Water quality	Manual	482926.92	4549240.8
21	MRP	Hotel Park	Reference	Lake	Water quality	Manual	483202.52	4549631.23
22	MNRM	Hotel Metropol	Nonreference	Lake	Water quality	Manual	483158.12	4544234.2
23	MNRP	Peshtani	Nonreference	Lake	Water quality	Manual	483687.43	4540440.8
24	MRV	Velidab	Reference	Lake	Water quality	Manual	482937.58	4537926.58
29	MRVL	Veljapes	Reference	Lake	Water quality	Manual	479479.09	4530675.69
25	MRT	Trpejca1	Reference	Lake	Water quality	Manual	481429.23	4534705.37
26	MNRT	Trpejca2	Nonreference	Lake	Water quality	Manual	480735.45	4533893.35
27	MRZ	St. Zaum	Reference	Lake	Water quality	Manual	480927.53	4534250.7
28	MNRCR	Cherava River	Nonreference	Lake	Water quality	Manual	480663.92	4533368.74
30	MNRSN	St. Naum	Nonreference	Lake	Water quality	Manual	478942.57	4530461.08

To import stations to ENSIS do the following steps:

Table 3 Import routine

Step 1	Import dialogue	Open ENSIS and find the Import dialogue
Step 2	Import file	Browse and find import file Select import class Station Press next
Step 3	Define properties	Define all properties Control that all properties are correct
Step 4	Remove	Remove rows and columns that are not to be imported
Step 5	Control	Manual control of the import file and properties
Step 6	Import	Press finish

Step 1: Import dialogue
Open ENSIS and select File/Import/Import text format and the dialogue in Figure 7 will appear.

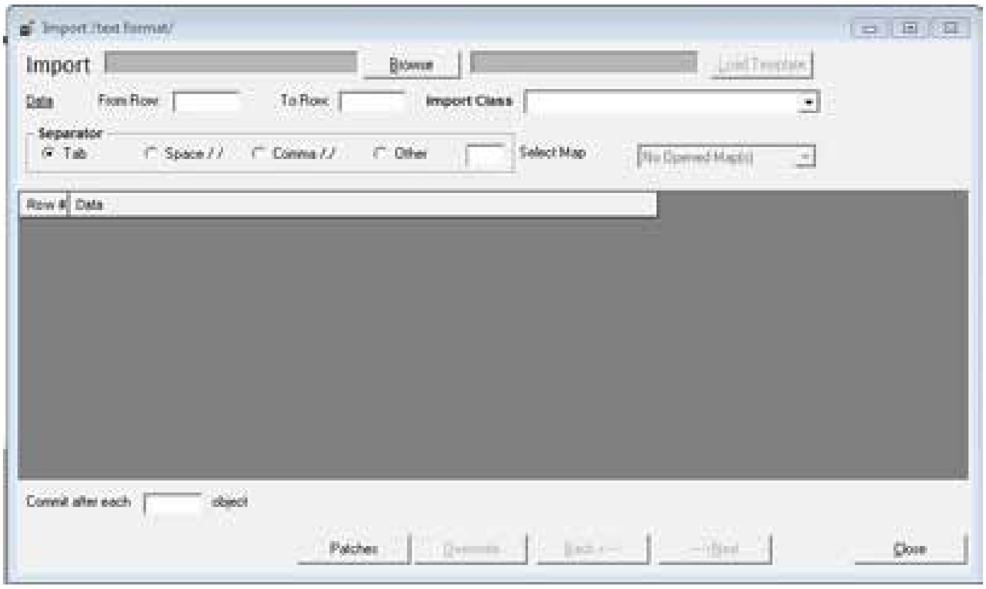

Figure 7 Import dialogue (ENSIS 3.0, File | Import | Import/ Text format)

Step 2: Brows and find import file.
Press the Browse-button and then find and select the file containing the stations that are prepared (the import file).

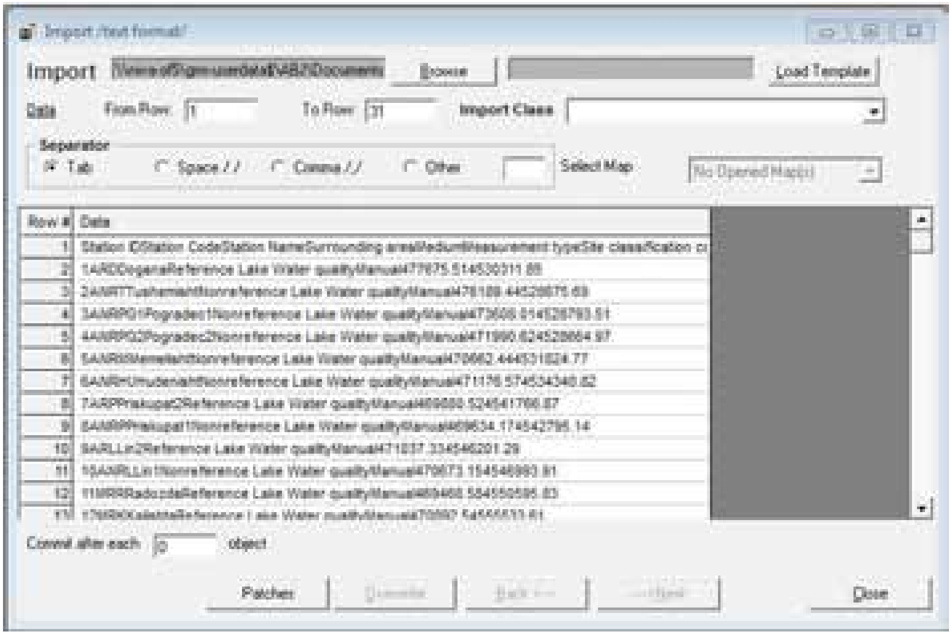

Figure 8 Import file is retrieved via the Browse-button

The import file is now read into the canvas of the dialogue. By default, tab separator is selected. The file could also have been stored in Excel with other separators. Select the import class Station and the rows that are to be imported. By default all rows are given. Press next and Figure 9 will appear.

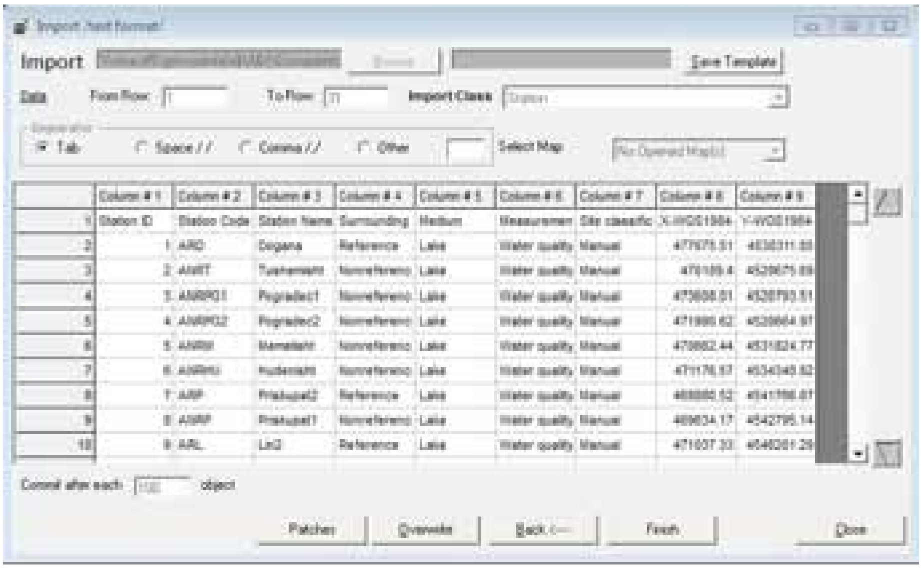

Figure 9 Import class Station

Step 3: Define properties

The system recognises the file as tab separated and splits it into columns. The first row gives the column properties.

Properties of each column must be set, meaning to define what information that should be stored where in the data class Station. This is done by locating the cursor on the heading of the column and then pressing the right mouse button. The dialogue in Figure 10 below appears. The “Set column property” should be selected.

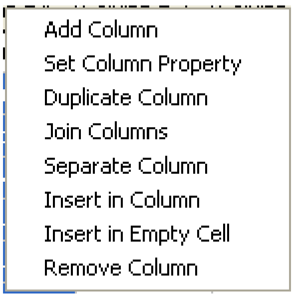

Figure 10 Edit functions for one column.

More information about all these options are given in chapter 2.1.

The following dialogue appears.

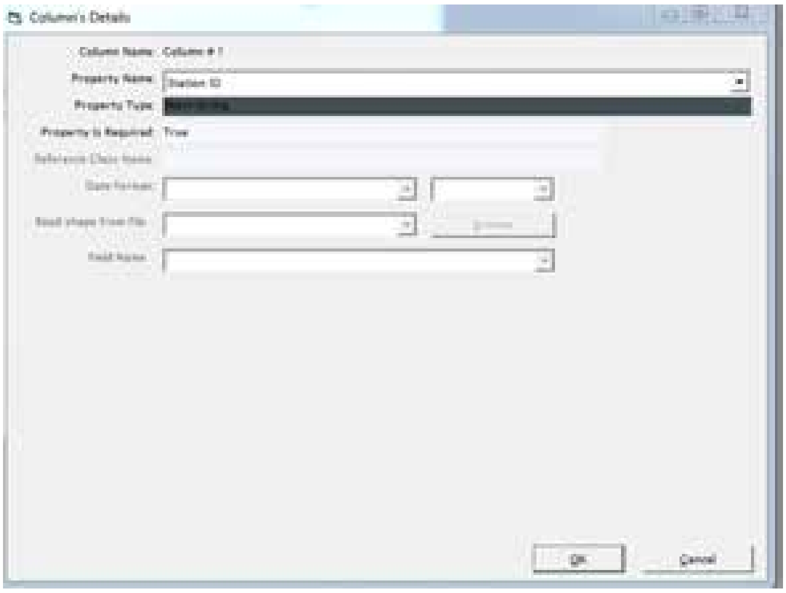

Figure 11 Properties dialogue for one column.

The property is defined from the Property name combo box. Select one item from the list.

- Case 1: The property **has no** reference to other classes: nothing more to be defined than selecting the right property in the Property name combo-box.
- Case 2: The property **has** reference to other class: This reference must be defined. For instance, refer to Medium by ID or by Name. (see
- Figure 12. Example reference to medium)

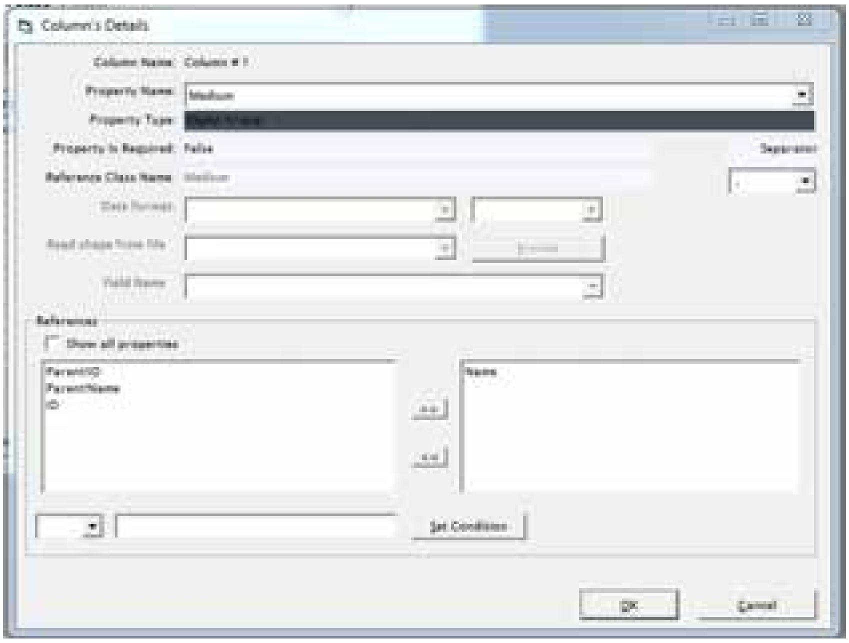

Figure 12. Example reference to medium

Property Medium is selected. This property (property type) is a reference to another data class (greyed in the upper part), but this property is not required (Property is required = false), in contrast to for instance Station name (=True). As soon as a reference type property is selected, the part of the dialogue inside the "References"-frame is enabled, and which property within the medium class to refer to must be selected to be used for reference. The references moved to the right box are selected. If several properties must be used to make the reference unique, several of them must be moved to the right. The order must also be the identical to what is given in the import file column (top of the list -> first property to use).

The example in Table 2**Feil! Fant ikke referansekilden.** should have the properties and references in Table 4.

Table 4 Station properties and references

	Property Name	**References**
Column 1, Station ID	Station ID	
Column 2, Station Code	Code	
Column 3, Station Name	Station Name	
Column 4, Surrounding area	Surrounding area	Name *
Column 5, Medium	Medium	Name *
Column 6, Measurement type	MeasurementType	Name *
Column 7, Site Classification Code	Site Classification Code	Name *
Column 8	dblX	
Column 9	dblY	

(*) If information about these properties is given as a number, reference should be set as ID. EX Medium Lake has ID=6.

Please pay attention to the "Show all properties"-check (see check-box in Figure 12). Checking this gives additional properties to use to refer to the correct objects. When you have defined the property of each of the columns to be imported, the wizard will look more or less like given in Figure 13.

Grey cells indicate that some references, that are not required, are not defined (no grey in the example, but this can happen). This will not cause any problems during the import; the stations will still be imported. References, or other properties, that are required and not set will reject these objects from import.

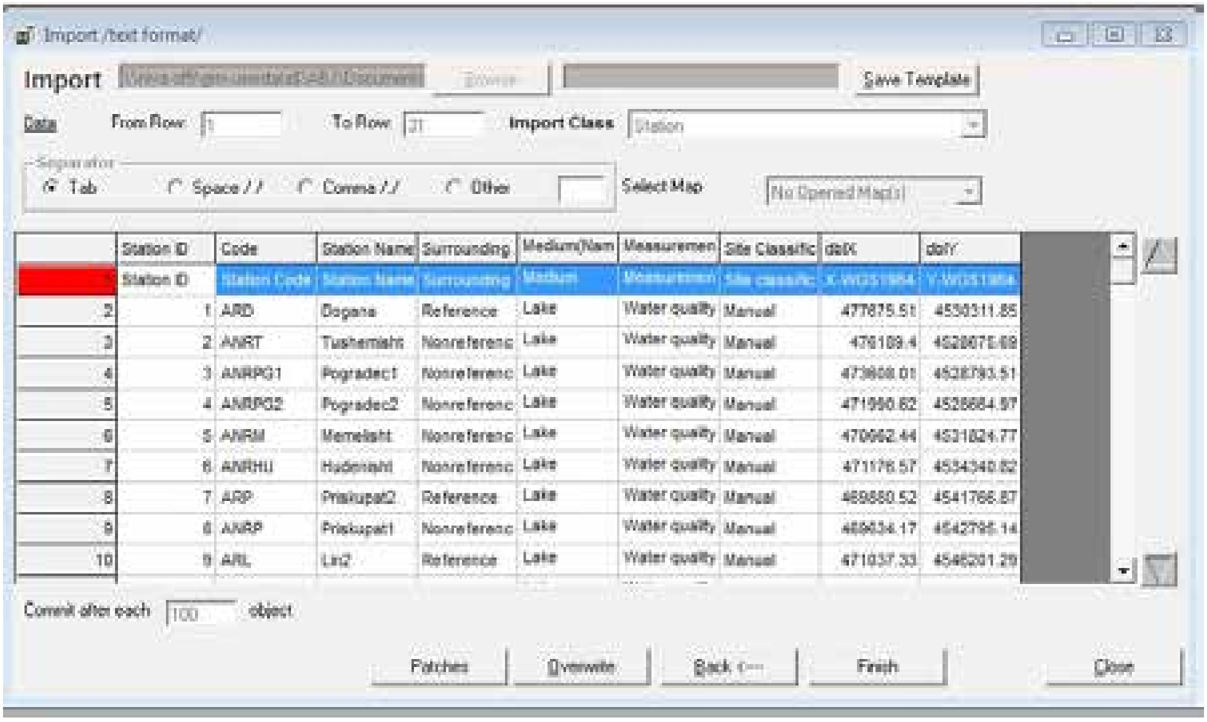

Figure 13 Properties are defined for each column.

ENSIS 3.0 supports import of one-to-many relations. This is the case for mediums and measurement types on stations. In the import file these multiple references (medium, measurement type) should be given in the same cell, separated by for instance dot (.). The separator is selected from the combo-box as shown in Figure 14.

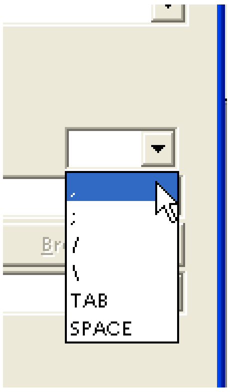

Figure 14 Separator

Step 4: Remove columns and rows that are not to be imported.
This is done by right click in the heading of the row or the column. Select either remove column or remove row.

Step 5: Control
You can now quickly check if all stations (all rows) are ready for import. This can be done by scrolling through the whole file, or pressing the arrows to the right. They will then automatically move to the nearest row where there is something wrong. The row where something wrong is present will be marked with red colour. Errors can be changed manually by typing in the correct data/information, or

by correcting in the import file. If the latter is done, the import must be started from the beginning. If manually correction is done you can select the correct information from a scroll-down list that appears when you click in the cell.

If errors are discovered in the import file, the rows that are OK can still be imported. Errors during the imported will be logged in a log file (*.log), stored where the program is installed, for instance on D:\Program Files\Ensis 3.X\Addins\Import. The log file is named after the date of the import (i.e. Ensis_Import_2012_08_18.log, log of import August 18, 2012).

Step 6: Import
To import the data press Finish. You will be prompted a message asking if you want to convert the co-ordinates during the import, but we strongly recommend to select “None”, and instead do all the geographical conversion ahead of importing the data. When the import is finished, a message telling the success (or lack of) will appear.

2.3 Import of measurement position

There can be many different measurement positions linked to each monitoring station. Measurements can be taken at different depths in the lakes (same horizontal position), or at different positions along transects in the river. For meteorological data, data can be measured at different heights, for instance 2 and 10 masl

Table 5 Import text format for Measurement positions

Station Name	Measurement position Code	Code	Z1 Value	Z2 Value	Measurement Position Type	x	y
Blato	Blato ST 15-20	ST 15-20	15	20	Deep (15-20)	482812.09	4551169.99
Blato	Blato ST 5-10	ST 5-10	5	10	Medium (5-10)	482812.09	4551169.99
Blato	Blato ST 0.5-2	ST 0.5-2	0.5	2	Shallow (0.5-2)	482812.09	4551169.99
Blato	Blato ST 0-20	ST 0-20	0	20	Total (0-20)	482812.09	4551169.99
Blato	Blato ST 0-2	ST 0-2	0	2	Transect	482812.09	4551169.99
Blato	Blato ST 2-4	ST 2-4	2	4	Transect	482812.09	4551169.99
Blato	Blato ST 4-10	ST 4-10	4	10	Transect	482812.09	4551169.99
Blato	Blato ST >10	ST >10	10		Transect	482812.09	4551169.99
Blato	Blato ST	ST				482812.09	4551169.99
Blato	Blato ST 2	ST 2	2	2		482812.09	4551169.99
Blato	Blato ST 5	ST 5	5	5		482812.09	4551169.99
Blato	Blato ST 10	ST 10	10	10		482812.09	4551169.99
Blato	Blato ST 15	ST 15	15	15		482812.09	4551169.99
Blato	Blato ST 20	ST 20	20	20		482812.09	4551169.99
Blato	Blato ST 0.5	ST 0.5	0.5	0.5		482812.09	4551169.99

Measurement position code is (in Lake Ohrid database) constructed by station name and code. This can be done directly in the import routine in ENSIS.

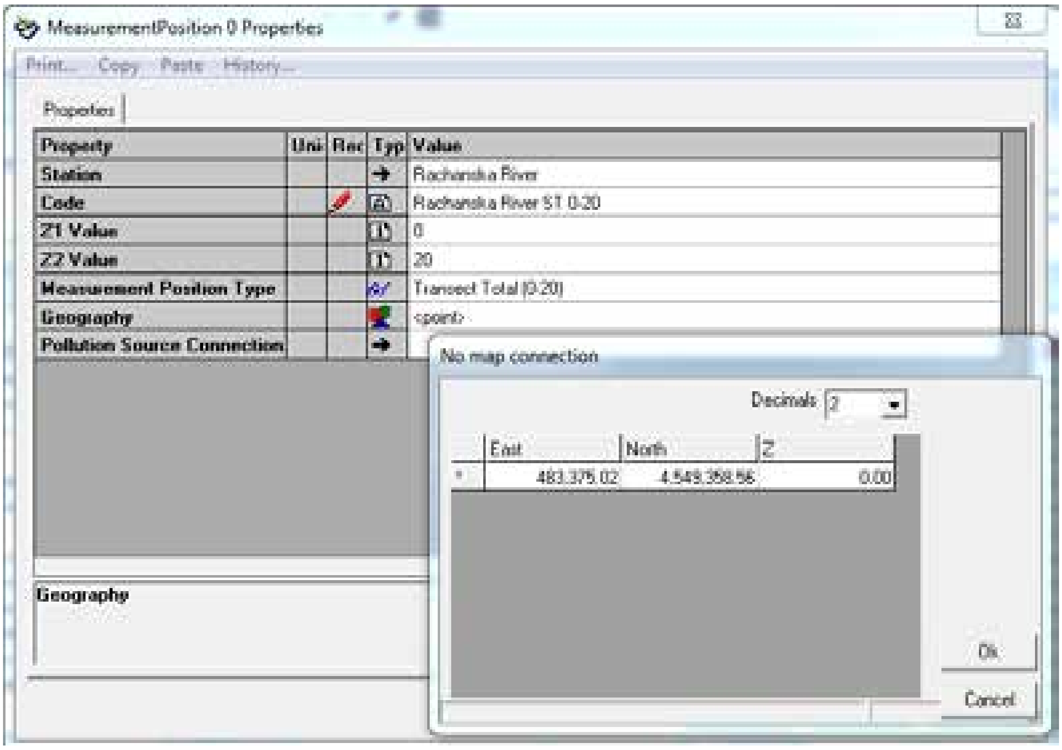

Figure 15 The figure shows the Measurement Position Definition for one station. Edit Geography opens the coordinates as shown.

Z1 and Z2 value are different when an integrated sample is performed, but in most cases identical. Note: Always enter the depth as a negative number. If the same horizontal position for all measurement positions (for instance lake samples with only different depth), we recommend using ST as the Code for all positions (but varying z1 and z2).

To import measurement position to ENSIS do the following steps:

Table 6 Import routine, Measurement position

Step 1	Import dialogue	Open ENSIS and find the Import dialogue
Step 2	Import file	Browse and find import file Select import class MeasurementPosition Press next
Step 3	Join columns and define properties	Join columns Define all properties Control that all properties are correct
Step 4	Remove	Remove rows and columns that are not to be imported
Step 5	Control	Manual control of the import file and properties
Step 6	Import	Press finish

Step 1: Import dialogue
Open ENSIS and select File/Import/Import text format and the dialogue in Figure 16 will appear.

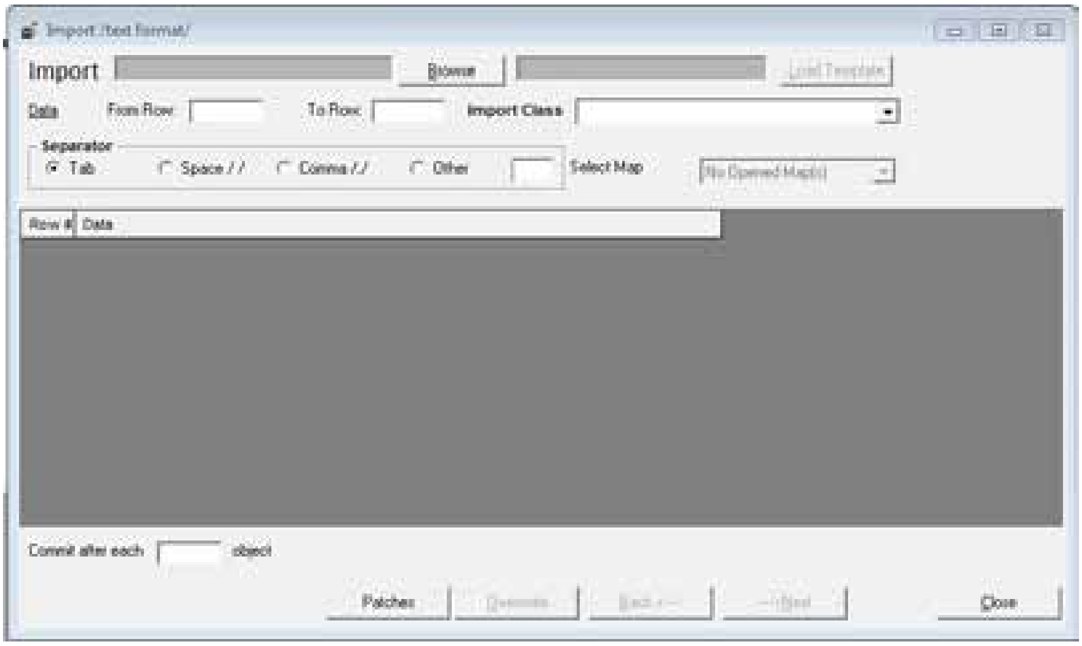

Figure 16 Import dialogue (ENSIS 3.0, File | Import | Import/ Text format)

Step 2: Brows and find import file.
Press the Browse-button and then find and select the file containing the measurement positions that are prepared (the import file).

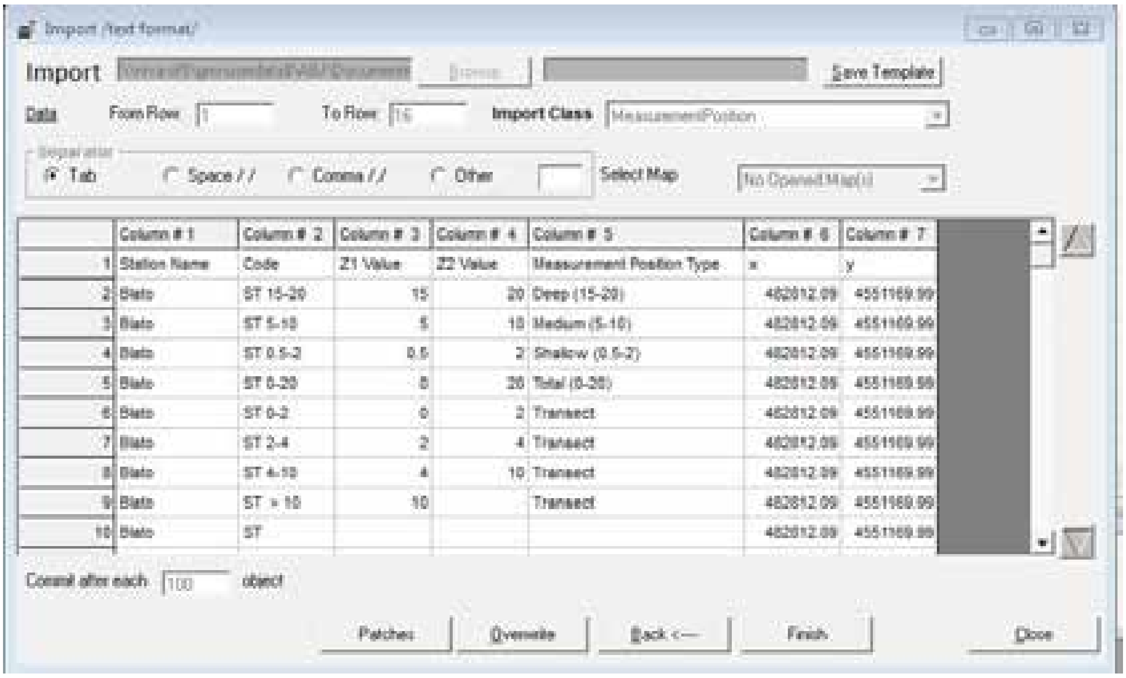

Figure 17 Import dialogue and measurement position import file

Step 3: Join columns and set properies

1. Select column 1, station name and press right mouse button. Select Duplicate column.
2. Select column 2, station name and press right mouse button. Select Join columns and write 3 (meaning the column that contain Code). Click OK

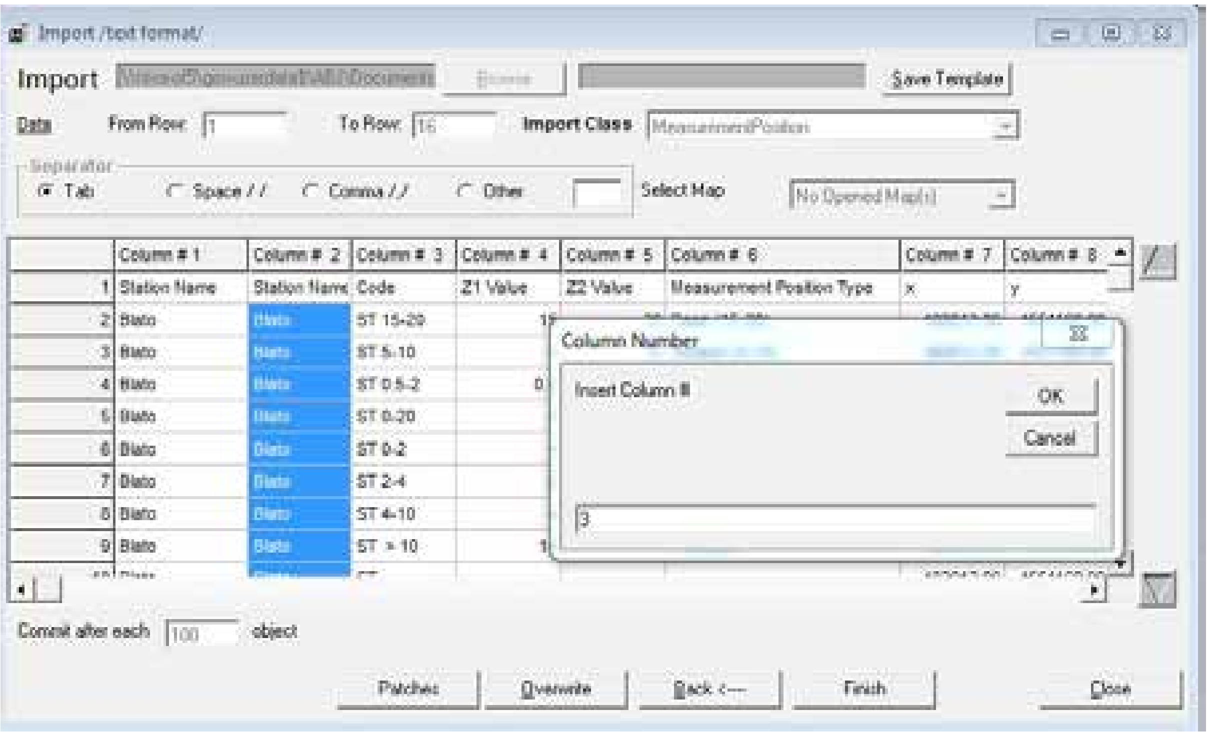

Figure 18 Join columns

3. Remove column 3, Code
4. Set properties and references according to the table below.

Table 7 Import properties for measurement position

	Property Name	References
Column 1, Station Name	Station	Station Name
Column 2, Station Name Code	Code	
Column 3, Z1 value	Z1 value	
Column 4, Z2 value	Z2 value	
Column 5, Measurement Position Type	Medium Position Type	Name
Column 6, X	dblX	
Column 7, Y	dblY	

Step 4: Remove
Remove columns and rows that are not to be imported. In this example row 1 must be removed.

Step 5: Control
Manually control the import file as described in the previous chapters.

Step 6: Import
Press Finish and import the file.

2.4 Import of Dataseries physical (required)

If only a few dataseries are to be defined, it is normally an easy task to define them one by one. Dataseries physical definition is shown in the figure below

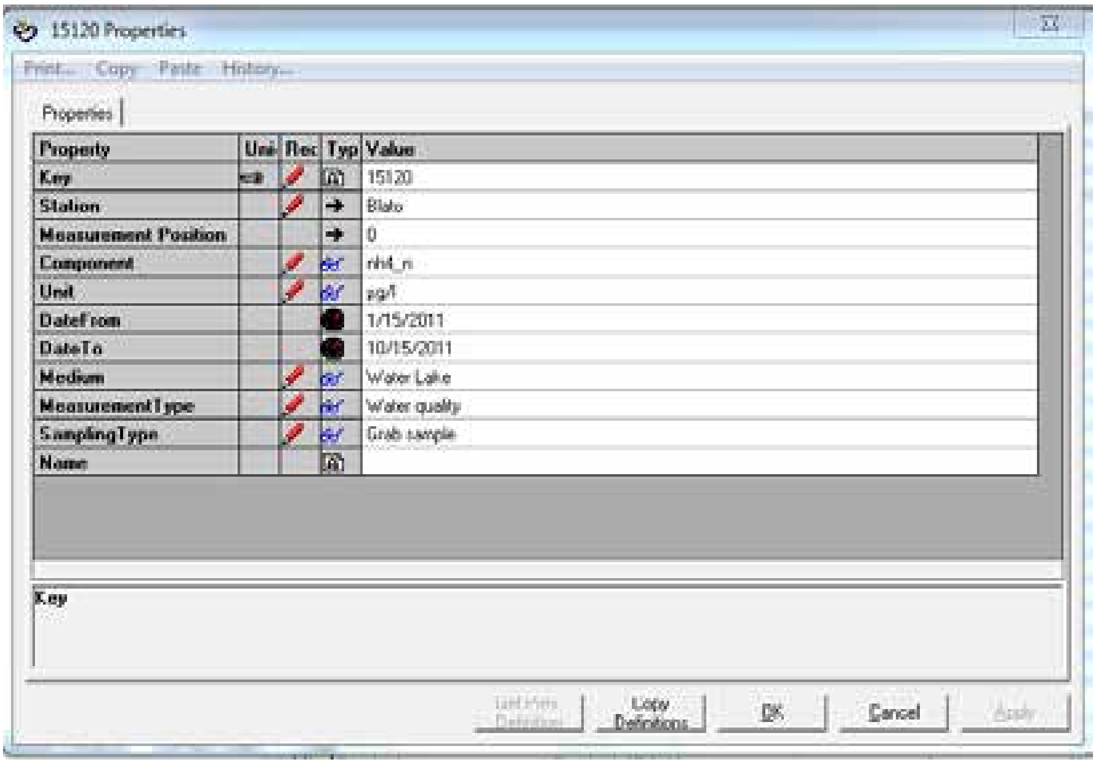

Figure 19 Example of a dataseries physical definition

The screendump above shows which information is important/necessary when data series definitions are given for a new dataserie or imported. References to station, measurement position for selected station, sampling type (use sampling method = 2 Grab sample, or sampling type = 1 Mixed samples for mixed samples), medium (river, lake) and the measurement type (usually water quality, hydrology for wd and wq), component that is measured, and unit.

Table 8 Import text format for dataseries

Key	Station	Measurement Position Code	Component	Unit	DateFrom	DateTo	Medium	MeasurementType	SamplingType
4635	Blato	Blato ST 0.5	Chilopyrgula sturanyi	ind/m2	5/30/2011	10/31/2011	Lake	Biology	Grab sample
7482	Blato	Blato ST 0.5	no2_n	µg/l	1/15/2011	10/15/2011	Lake	Water quality	Grab sample
7512	Blato	Blato ST 0.5	no3_n	µg/l	1/15/2011	10/15/2011	Lake	Water quality	Grab sample
7542	Blato	Blato ST 0.5	p_total	µg/l	1/15/2011	10/15/2011	Lake	Water quality	Grab sample
7572	Blato	Blato ST 0.5	w_cond	µS/cm	1/15/2011	10/15/2011	Lake	Water quality	Grab sample
7602	Blato	Blato ST 0.5	pH	pH	1/15/2011	10/15/2011	Lake	Water quality	Grab sample
7632	Blato	Blato ST 0.5	p_alk	MEq	1/15/2011	10/15/2011	Lake	Water quality	Grab sample
7662	Blato	Blato ST 0.5	m_alk	MEq	1/15/2011	10/15/2011	Lake	Water quality	Grab sample
7692	Blato	Blato ST 0.5	Tot_alk	MEq	1/15/2011	10/15/2011	Lake	Water quality	Grab sample
7722	Blato	Blato ST 0.5	Tot_alk_CaCO3	mg/l	1/15/2011	10/15/2011	Lake	Water quality	Grab sample
7752	Blato	Blato ST 0.5	do	mg/l	1/15/2011	10/15/2011	Lake	Water quality	Grab sample
7782	Blato	Blato ST 0.5	O_2	%	1/15/2011	10/15/2011	Lake	Water quality	Grab sample
7812	Blato	Blato ST 0.5	bod5	mg/l	1/15/2011	10/15/2011	Lake	Water quality	Grab sample
7842	Blato	Blato ST 0.5	COD	mg/l	1/15/2011	10/15/2011	Lake	Water quality	Grab sample
7872	Blato	Blato ST 0.5	TNKjeldahl	mg/l	1/15/2011	10/15/2011	Lake	Water quality	Grab sample
7913	Blato	Blato ST 0.5	w_temp	deg._C	1/15/2011	10/15/2011	Lake	Water quality	Grab sample
15139	Blato	Blato ST 0.5	nh4_n	µg/l	1/15/2011	10/15/2011	Lake	Water quality	Grab sample
7982	Blato	Blato ST 0.5-2	Number of Taxa	Metric value	5/21/2011	10/31/2011	Lake	Biology	Grab sample
8102	Blato	Blato ST 0.5-2	Saprobic Index Zelinka Marva	Metric value	5/21/2011	10/31/2011	Lake	Biology	Grab sample
8222	Blato	Blato ST 0.5-2	German Saprobic index old	Metric value	5/21/2011	10/31/2011	Lake	Biology	Grab sample
8342	Blato	Blato ST 0.5-2	German Saprobic index new	Metric value	5/21/2011	10/31/2011	Lake	Biology	Grab sample

To import measurement position to ENSIS do the following steps:

Table 9 Import routine, Dataseries Physical

Step 1	Import dialogue	Open ENSIS and find the Import dialogue
Step 2	Import file	Browse and find import file Select import class Dataseries Physical Press next
Step 3	Join columns and define properties	Join columns Define all properties Control that all properties are correct
Step 4	Remove	Remove rows and columns that are not to be imported
Step 5	Control	Manual control of the import file and properties
Step 6	Import	Press finish

Step 1: Import dialogue
Open ENSIS and select File/Import/Import text format and the dialogue in Figure 20 will appear.

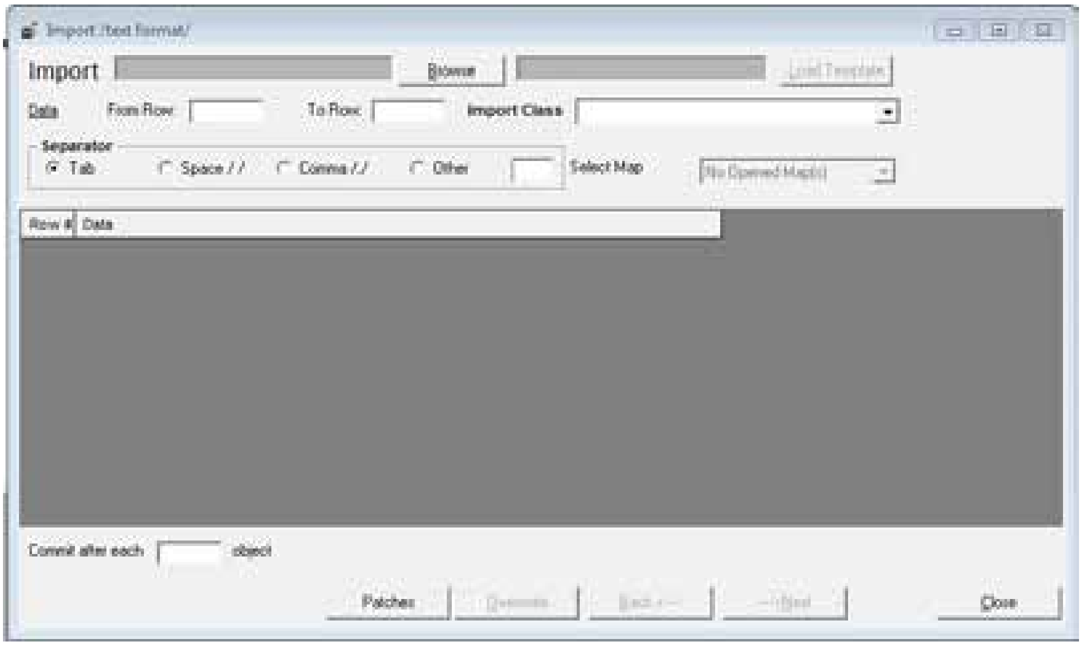

Figure 20 Import dialogue (ENSIS 3.0, File | Import | Import/ Text format)

Step 2: Brows and find import file.
Press the Browse-button and then find and select the file containing the dataseries physical that are prepared (the import file).

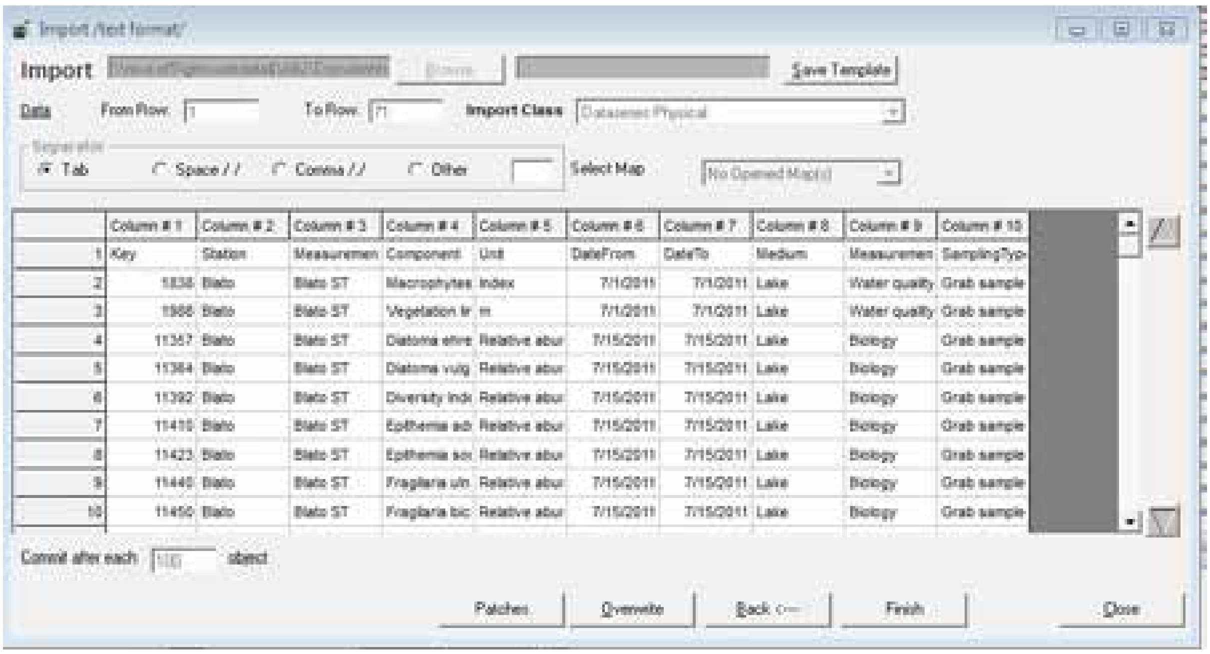

Figure 21 Import dialogue and import class Dataseries Physical

Step 3: Join columns and set properties

Duplicate column 2 Station, since the station reference is also needed to uniquely refer to measurement position. This inserts a new column after column 2 that holds the same information as column 2, see
Figure 22.

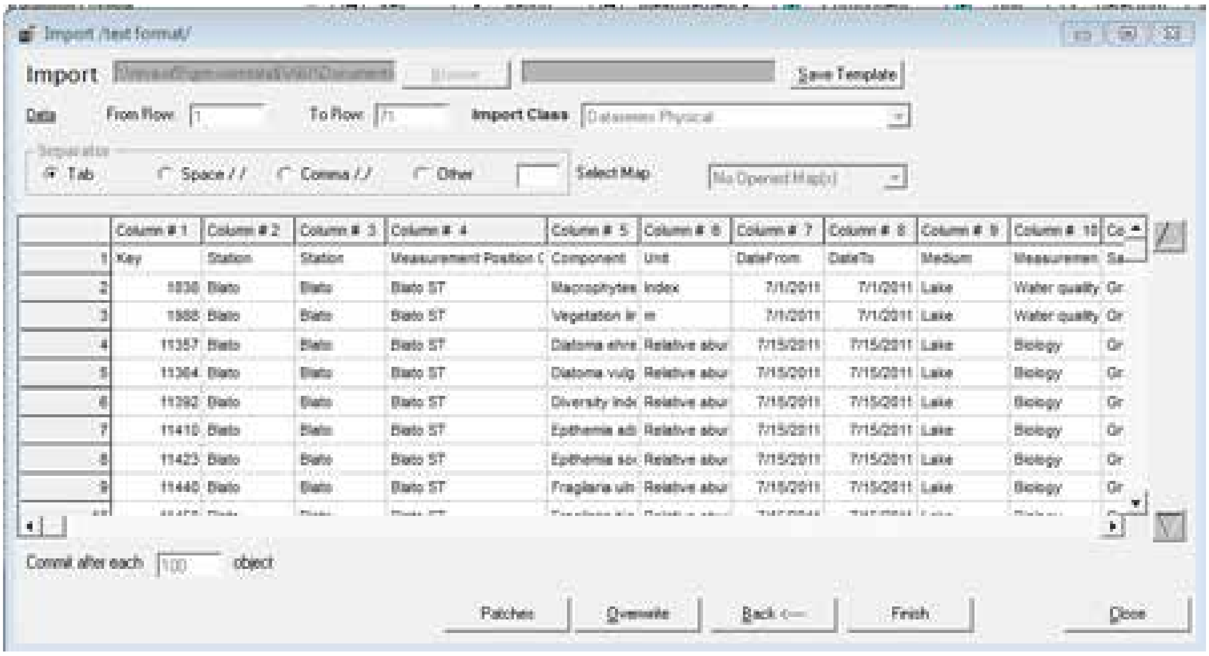

Figure 22 Duplicate column

1. Join column 3 (station) and 4 (measurement position). The combination of the two properties gives a unique identification of measurement position.
2. Remove column 4 (measurement position), 7 (date from) and 8 (date to). See result in
3. Figure 23.

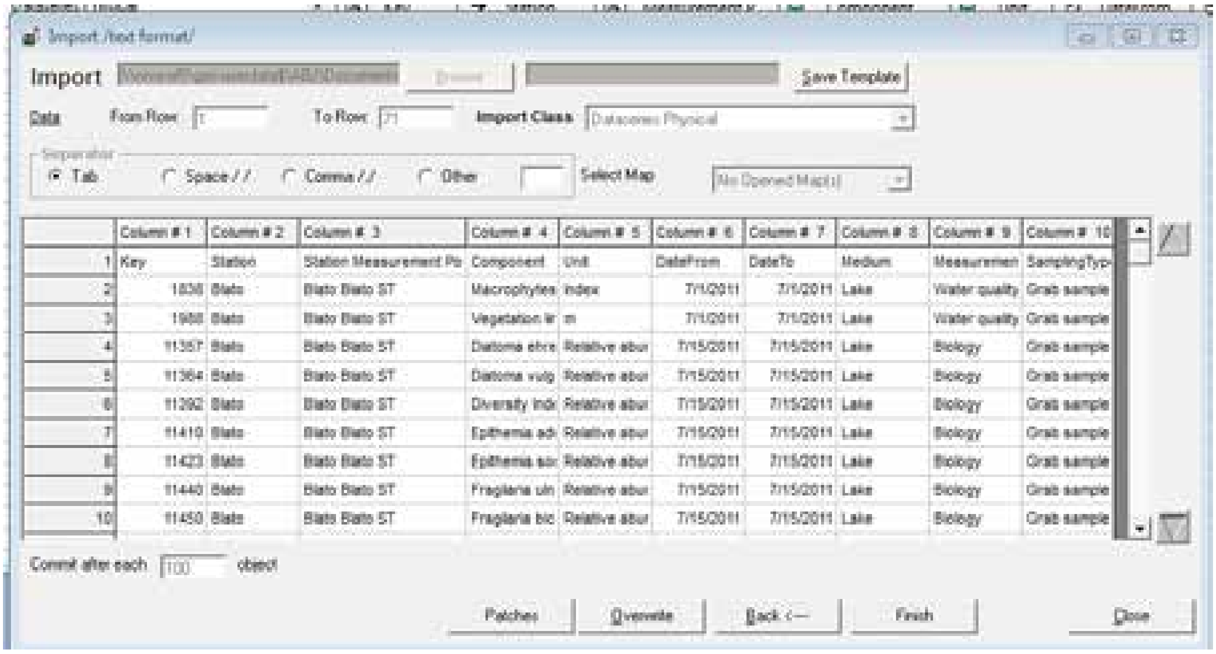

Figure 23 Remove column

4. Set properties according to Table 10.

Table 10 Import properties for Dataseries Physical

	Property Name	References
Column 1, Key	Key	
Column 2, Station	Station	Station Name
Column 3, Station Measurement position Code	Measurement position	Station Name Code
Column 4, Component	Component	Name
Column 5, Unit	Unit	Name
Column 6, Medium	Medium	Name
Column 7, Measurement type	Measurement type	Name
Column 8, Sampling type	Sampling type	Name

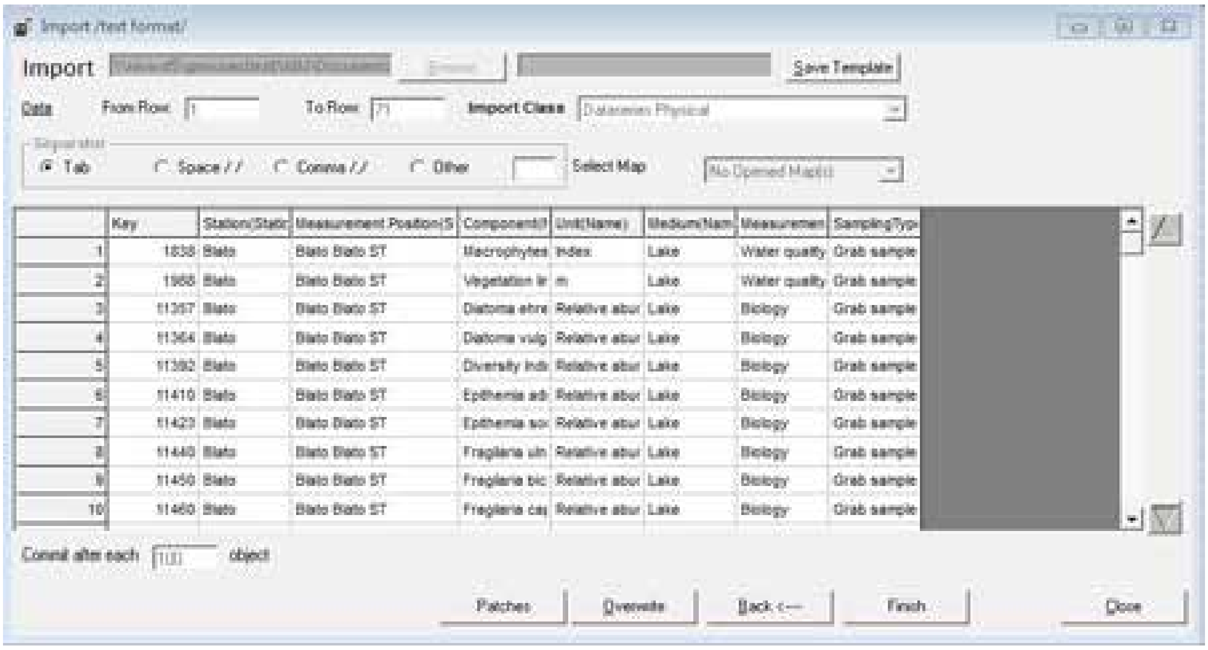

Figure 24 Import dialogue and properties defined

Step 4: Remove
Remove columns and rows that are not to be imported. In this example row 1 must be removed.

Step 5: Control
Manually control the import file as described in the previous chapters.

Step 6: Import
Press Finish and import the file.

2.4.1 Import of Data value physical (required)

This is the final step of importing monitoring data (data values physical). The measurement values are shown in a table format below.

Table 11 Import text format for monitoring values (Data values Physical)

	A	B	C	D	E	F	G
1	DataSerie Physical Meas	DataSerie Physical N	DateFrom	DateTo	DataSerie Physical Component	Value	DataSerie Physical Unit
2	Blato	Blato ST 10	5/15/2011	5/15/2011	TNKjeldahl	173.91	mg/l
3	Blato	Blato ST 10	1/15/2011	1/15/2011	TNKjeldahl	192.67	mg/l
4	Blato	Blato ST 10	10/15/2011	10/15/2011	TNKjeldahl	295.95	mg/l
5	Blato	Blato ST 10	7/15/2011	7/15/2011	TNKjeldahl	260.65	mg/l
6	Blato	Blato ST 0.5	10/15/2011	10/15/2011	O_2	124.62	%
7	Blato	Blato ST 0.5	1/15/2011	1/15/2011	O_2	103.08	%
8	Blato	Blato ST 0.5	5/15/2011	5/15/2011	O_2	119.36	%
9	Blato	Blato ST 0.5	7/15/2011	7/15/2011	O_2	122.59	%
10	Blato	Blato ST 10	7/15/2011	7/15/2011	do	8.737	mg/l
11	Blato	Blato ST 10	1/15/2011	1/15/2011	do	10.644	mg/l
12	Blato	Blato ST 10	5/15/2011	5/15/2011	do	11.594	mg/l
13	Blato	Blato ST 10	10/15/2011	10/15/2011	do	9.549	mg/l
14	Blato	Blato ST 20	10/15/2011	10/15/2011	w_temp	13.8	deg._C
15	Blato	Blato ST 20	1/15/2011	1/15/2011	w_temp	6.8	deg._C
16	Blato	Blato ST 20	5/15/2011	5/15/2011	w_temp	10.4	deg._C
17	Blato	Blato ST 20	7/15/2011	7/15/2011	w_temp	13.5	deg._C
18	Blato	Blato ST 10	1/15/2011	1/15/2011	w_temp	6.8	deg._C
19	Blato	Blato ST 10	5/15/2011	5/15/2011	w_temp	12.4	deg._C
20	Blato	Blato ST 10	7/15/2011	7/15/2011	w_temp	23	deg._C
21	Blato	Blato ST 10	10/15/2011	10/15/2011	w_temp	13.6	deg._C
22	Blato	Blato ST 0.5	1/15/2011	1/15/2011	w_temp	7.4	deg._C
23	Blato	Blato ST 0.5	10/15/2011	10/15/2011	w_temp	14.2	deg._C
24	Blato	Blato ST 0.5	5/15/2011	5/15/2011	w_temp	14.5	deg._C
25	Blato	Blato ST 0.5	7/15/2011	7/15/2011	w_temp	25.5	deg._C
26	Blato	Blato ST 0.5	10/15/2011	10/15/2011	TNKjeldahl	185.9	mg/l

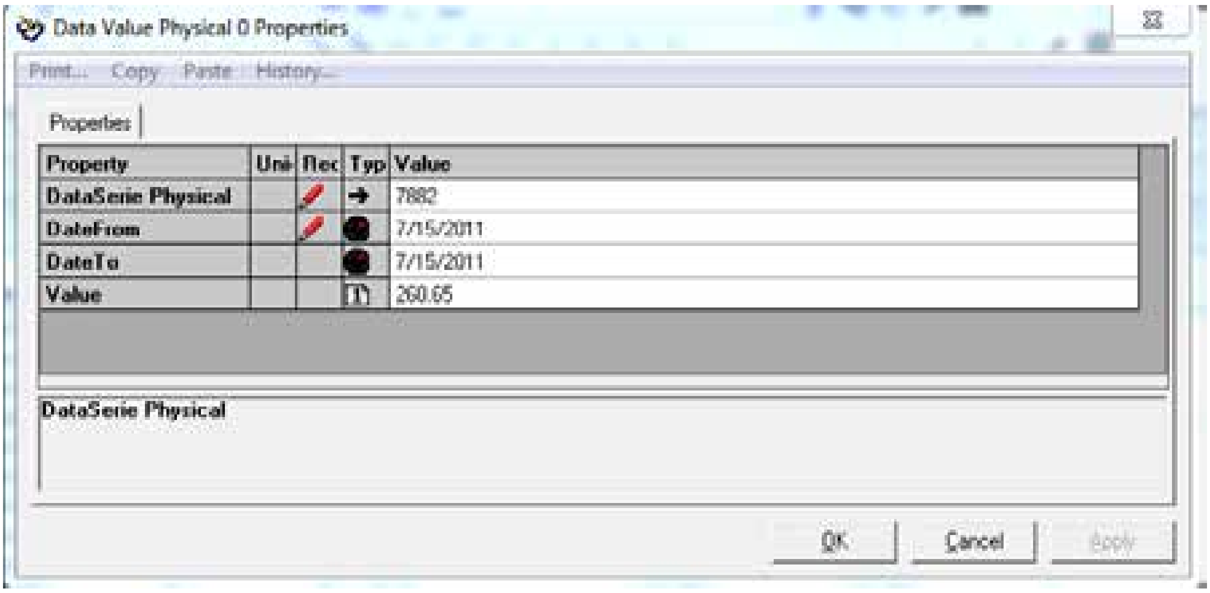

Figure 25 Data value properies

To import data value to ENSIS do the following steps:

Table 12 Import routine, Data value Physical

Step 1	Import dialogue	Open ENSIS and find the Import dialogue
Step 2	Import file	Browse and find import file Select import class Data value Physical Press next
Step 3	Join columns and define properties	Join columns Define all properties Control that all properties are correct
Step 4	Remove	Remove rows and columns that are not to be imported
Step 5	Control	Manual control of the import file and properties
Step 6	Import	Press finish

Step 1: Import dialogue
Open ENSIS and select File/Import/Import text format and the dialogue in Figure 26 will appear.

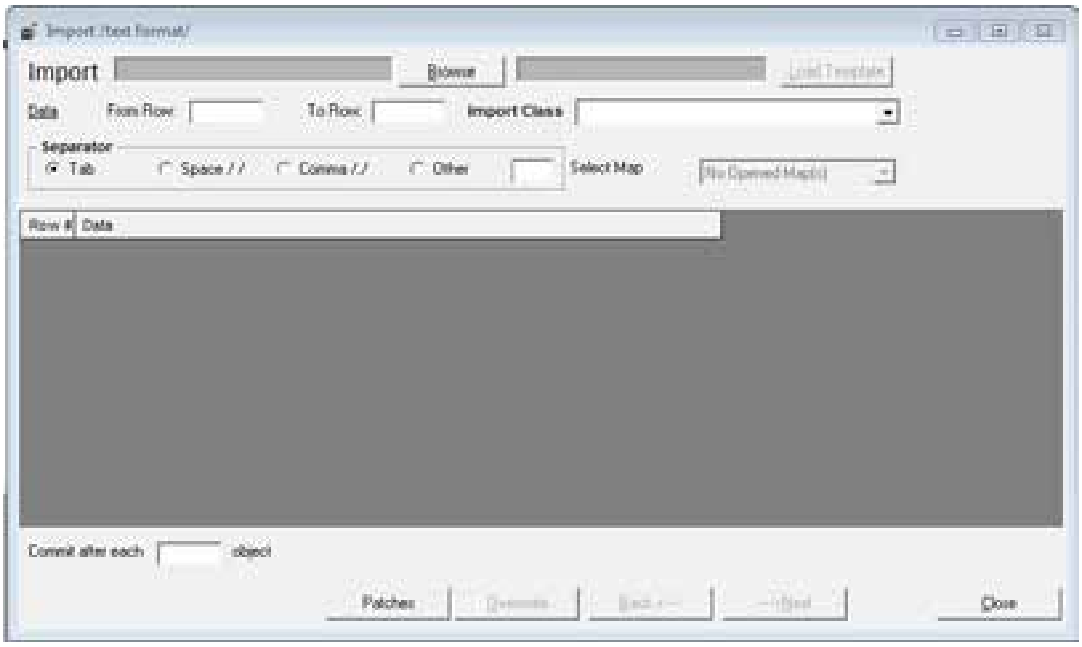

Figure 26 Import dialogue (ENSIS 3.0, File | Import | Import/ Text format)

Step 2: Brows and find import file.
Press the Browse-button and then find and select the file containing the data values physical that are prepared (the import file).
Import class: Data Value Physical

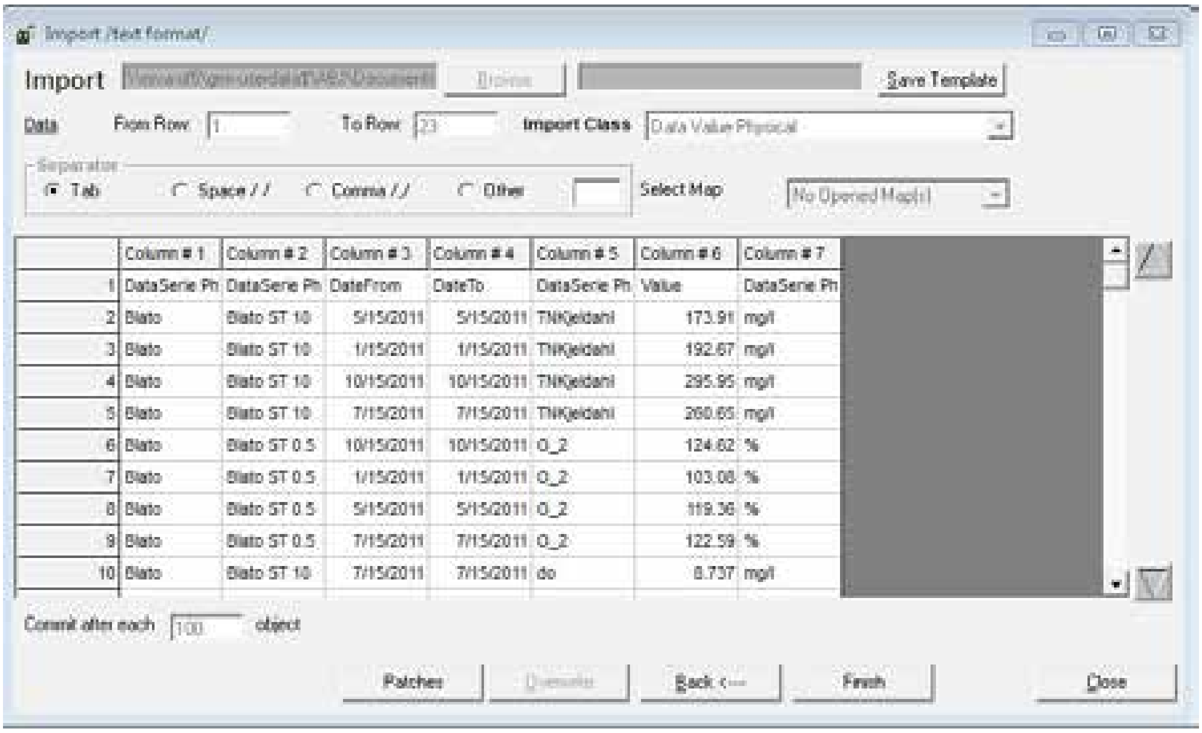

Figure 27 import dialogue with data value physical

Step 3: Join columns and define properties

1. Join column 1 and 2. This is the first step to create a reference to which dataseries the data value belong to. Both station, measurement position and component are needed.
2. Remove column 2. See how the result looks like in figure below.

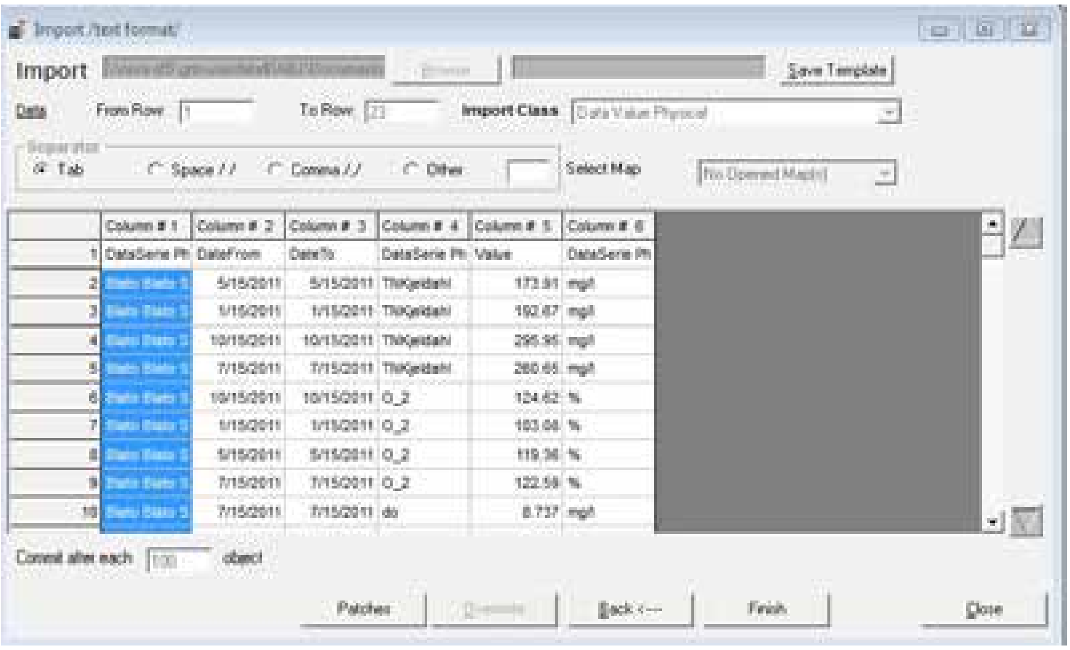

Figure 28 Import dialogue (join and remove)

3. Join column 1 and 4 (component). Column 1 will now include Station name, Measurement position code and component name. These three elements make the reference to dataseries unique.

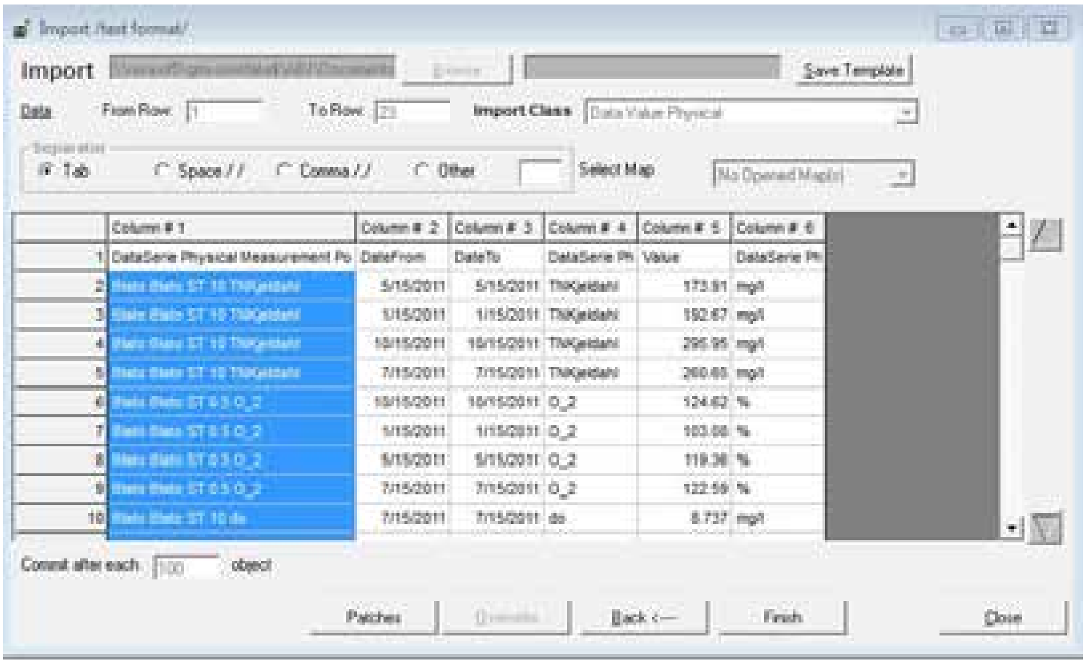

Figure 29 Unique reference to dataseries

4. Remove column 4 and 6

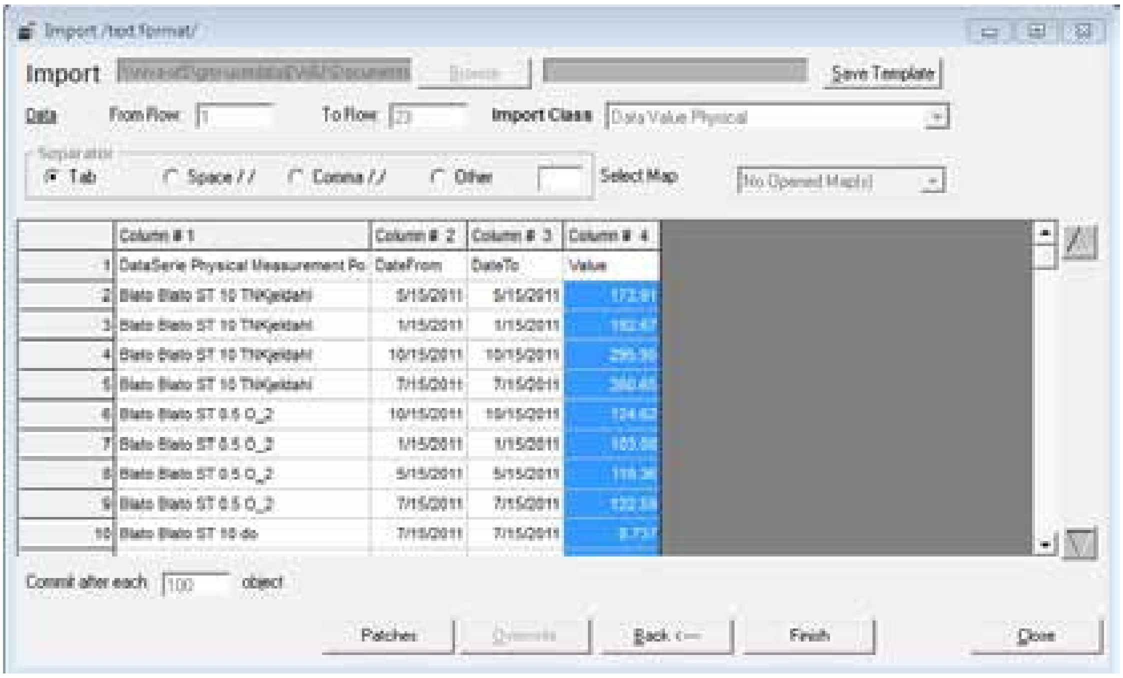

Figure 30 Columns to be imported to data value physical

5. Set properties and references according to table below.

Table 13 Import properties for Data value physical

	Property Name	References
Column 1, Dataseries reference	Dataseres Pysical	Station Name Measurement position code Component name
Column 2, Date from	Date from	Select correct date format(**)
Column 3, Date to	Date to	Select correct date format(**)
Column 4, Value	Value	

(**)We recommend using the format DD.MM.YYYY as date format (example 24.11.2004)

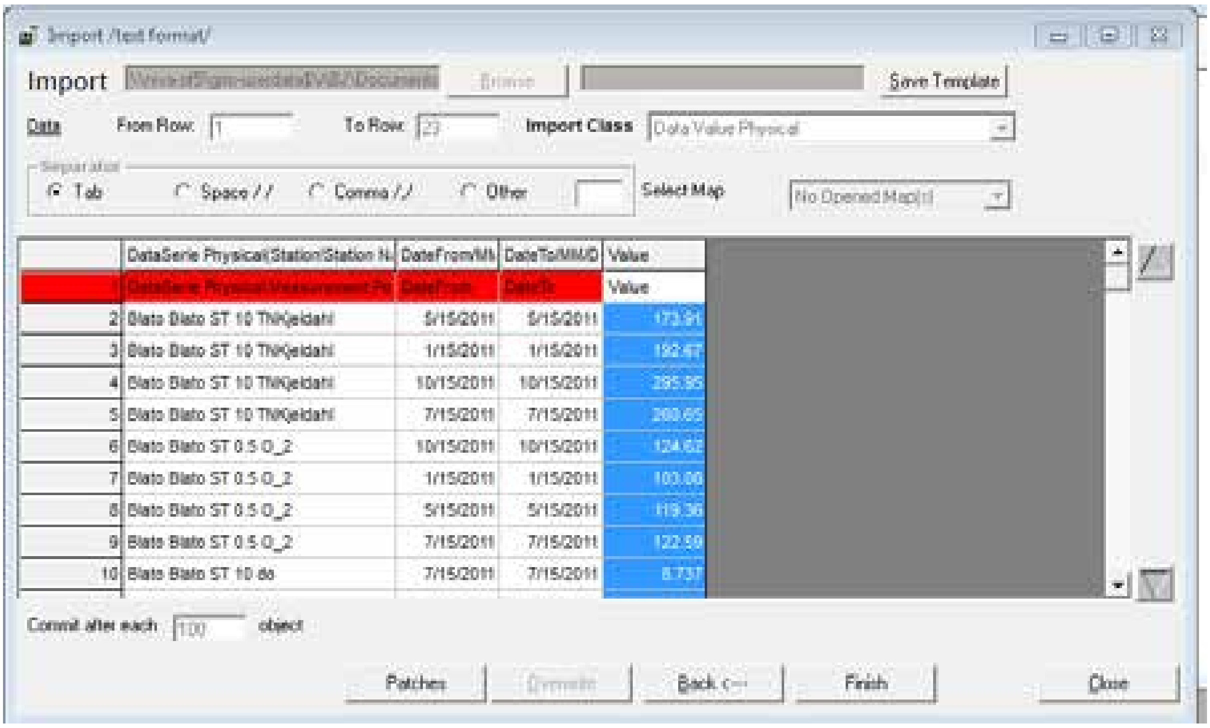

Figure 31 Data value physical properties

Step 4: Remove
Remove columns and rows that are not to be imported. In this example row 1 must be removed.

Step 5: Control
Manually control the import file as described in the previous chapters.

Step 6: Import
Press Finish and import the file.

2.5 Import dialogue and error messages

How to check if all rows are ready for import?
You can now quickly check if all rows are ready for import. This can be done by scrolling through the whole file, or pressing the arrows to the right. They will then automatically move to the nearest row where there is something wrong. The row where something wrong is present will be marked with red colour. Errors can be changed manually by typing in the correct data/information, or by correcting in the import file. If the latter is done, the import must be started from the beginning.

If errors are discovered in the import file, the rows that are OK can still be imported. Errors during the imported will be logged in a log file (*.log), stored where the program is installed, for instance on D:\Program Files\Ensis 3.X\Addins\Import. The log file is named after the date of the import (i.e. Ensis_Import_2003_08_18.log, log of import August 18, 2003).

Import
To import the data press Finish. You will be prompted a message asking if you want to convert the co-ordinates during the import, but we strongly recommend to select "None", and instead do all the geographical conversion ahead of importing the data. When the import is finished, a message telling the success (or lack of) will appear.

Very important !
NB NB !! If some properties like quality status flag, quality level flag and/or Admin project etc is used for some samples and not for all in the same import file, please import these ones with properties values separately from those ones without any of these properties (admin project, quality level, quality status).

Pressing the "Finish"-button will take the user to the next dialogue, and usually the last, of the import wizard. Before the import is started a standard checking of the data is performed, and a checking if the monitoring data to be imported already exist in the database. This is done by checking the reference to the Dataseries Physical together with the time stamp of each sample. Be aware of the fact that this way of checking for existing samples in the database is only implemented during the import of monitoring values (class Data Value Physical). The message given in
Figure 32 is prompted about how to handle the new data in the import file in relation to the existing data in the database.

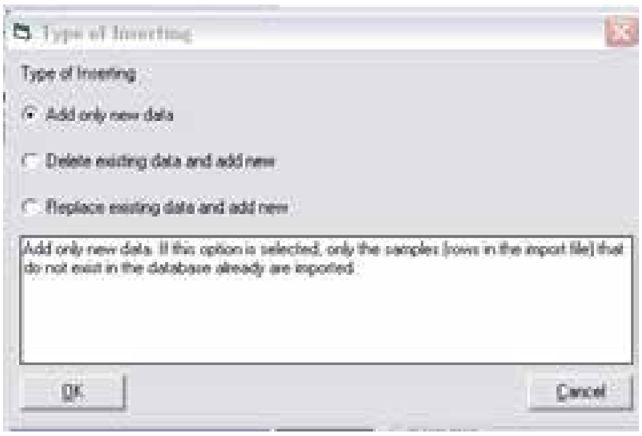

Figure 32 Type of inserting

The user is given the following options:

- **Add only new data.** If this option is selected, only the samples (rows in the import file) that do not exist in the database already is imported.
- **Delete existing data and add new.** If this option is selected the system will first delete all values linked those Dataseries Physical (Dataseries definitions) referred to in the import file (reference to Dataseries Physical), then import all samples (rows) in the import file. NBNB, use this option with great care!!
- **Replace existing data and add new.** If this option is selected, the data values/samples/rows that already exist in the database will be replaced with the new values given in the import file. New values in the import file will be appended to the existing dataseries. No delete/removal of samples will be done in the database, only replacement.

When the import is finished a message telling how many samples/rows that are imported and how many skipped during the operation, see
Figure 33. A log file is created during the import, stored where the program is installed, for instance on D:\Program Files\Ensis 3.X\Addins\Import. The log file is named after the date of the import (i.e. Ensis_Import_2003_08_18.log, log of import August 18, 2003)

Figure 33 Import message

ENSIS 3.0 does not support handling of duplicate samples. If duplicate rows of data (duplicate samples) are discovered in the import file (meaning values referring to the same Dataseries Physical/dataseries definition and taken at exactly the same date and time), only the first row of data will be imported. This means that only one value of the duplicates, triplicates value, etc will be imported. The other ones will be skipped. Skipped values due to duplicates will be logged in the log file.

Decimal symbol: During import, please pay attention to the Regional Settings of the computer (in the Control panel). It is recommended using English (United States). The decimal symbol in English (US) is period (dot (.)) and the decimal symbol used in the import files shall then be dot too.

Co-ordinate system: All locations (co-ordinates) related to stations (and other geographical objects) must be in co-ordinate system/project/datum. If conversion is needed for the co-ordinates, use ArcView (projector utility).

3. Lake Ohrid ENSIS database

3.1 Definitions

Lake Ohrid ENSIS database has been adjusted for Biological data. This has been done mainly through some definitions in ENSIS:

Component group:
A database with chemical, physical and biological measurements needs a way to filter the different kinds of measurements. Component group is a way to sort all the components into groups. We have added 3 new component groups; Macrophytes, Benthic fauna and Diatoms. This is to be able to filter out only one of the types of Biological data during search for dataseries.

Measurement type:
Measurement type includes in this database also Biology.

Table 14 Measurement type

ID	Name
1	Water quality
2	Biology
3	Hydrology
4	Meteorology

Components:
There are about 455 component definitions stored in ENSIS. To be able to sort/filter out the different components and the dataseries we had to add component group and measurement type to the definition. The table below shows 4 examples of the components stored. This is for all component groups measured in Lake Ohrid.

Table 15 Component properties

ID	Name	Component group	Medium	Measurement type
713	Surirella robusta (Ehr)	Diatoms	Lake	Biology
560	Tubifex tubifex	Benthic fauna	Lake	Biology
135	Tot_alk_CaCO3	Chemical, Nutrient	Lake, river,	Water Quality
443	Vallisneria spiralis	Macrophytes	Lake	Biology, water quality

In addition some components are included in two or more components groups and some components are not linked to a component group at all.

Measurement position type

Table 16 Measurement position type properties

ID	Name	Parent
Transect	Transect	
Deep	Deep (15-20)	Transect
Medium	Medium (5-10)	Transect
Shallow	Shallow (0.5-2)	Transect
Total	Total (0-20)	Transect

In Lake Ohrid there are 30 new measurement locations (or stations). Each station includes multiple measurement positions. This is either different measurement depths or depth interval/transects. The figure below shows all measuring positions at station Tushemisht. This station includes both transects/intervals and single depths. The location without any depths indicates surface location.

Table 17 Measurement positions in Ohrid

Code	Station	Z1 Value	Z2 Value	Measurement Position Type
Tushemisht ST 0-2	Tushemisht	0	2	Transect
Tushemisht ST 2-4	Tushemisht	2	4	Transect
Tushemisht ST 4-10	Tushemisht	4	10	Transect
Tushemisht ST > 10	Tushemisht	10		Transect
Tushemisht ST	Tushemisht			
Tushemisht ST 0.5	Tushemisht	0.5	0.5	
Tushemisht ST 10	Tushemisht	10	10	
Tushemisht ST 20	Tushemisht	20	20	
Tushemisht ST 2	Tushemisht	2	2	
Tushemisht ST 5	Tushemisht	5	5	
Tushemisht ST 15	Tushemisht	15	15	
Tushemisht ST 0-20	Tushemisht	0	20	Total (0-20)
Tushemisht ST 0.5-2	Tushemisht	0.5	2	Shallow (0.5-2)
Tushemisht ST 5-10	Tushemisht	5	10	Medium (5-10)
Tushemisht ST 15-20	Tushemisht	15	20	Deep (15-20)

3.2 Stations

There are 30 new measurement locations (Monitoring Stations) in the Lake Ohrid project. 10 stations are in Albania and 20 stations are located in Macedonia. The table below shows how the stations have been uniquely identified in ENSIS by ID, code, name and coordinates.

All locations have been measured by GPS as close to the shore as possible. Coordinates have been given as Decimal degree, and then converted to WGS1984-UTM34N. All coordinates in ENSIS have been given as WGS1984-UTM34N. Transformation of coordinates are done outside ENSIS.

Table 18 Measurement stations in Lake Ohrid

			COORDINATES 2012 WGS1984-UTM34N		COORDINATES 2012 Decimal degree	
ID	CODE	Name	X	Y	East	North
1	ARD	Dogana	477369,97	4528867,64	20,731283	40,9106
2	ANRT	Tushemisht	476412,39	4528038,86	20,719944	40,903107
3	ANRPG1	Pogradec1	473160,77	4527807,43	20,681348	40,900922
4	ANRPG2	Pogradec2	471106,85	4528151,22	20,656947	40,903949
5	ANRM	Memelisht	469794,57	4530891,1	20,641233	40,928583
6	ANRHU	Hudenisht	470209,87	4534334,07	20,646	40,959613
7	ARP	Priskupat2	469234,07	4542783,3	20,633984	41,035688
8	ANRP	Priskupat1	469412,95	4541291,1	20,636186	41,022253
9	ARL	Lin2	470673,8	4545489,32	20,650983	41,060117
10	ANRL	Lin1	470116,13	4546276,66	20,644308	41,067189
11	MRR	Radozda	469247,45	4550692,26	20,633748	41,106932
12	MRK	Kalishta	470722,31	4555486,9	20,651084	41,150176
13	MNRS	Struga	473081,85	4557928,8	20,679096	41,172254
14	MNRA	Auto Camp As	476107,57	4557558,81	20,715181	41,169016
15	MNRSR	Sateska River	477128,22	4557368,93	20,727355	41,167335
16	MNRG	Grashnica River	482197,24	4551727,78	20,787944	41,116647
17	MNRK	Koselska River	480786,05	4552300,18	20,771117	41,121771
18	MNRZ	Ohrid bay	483114,16	4551208,18	20,79888	41,111986
19	MNRB	Blato	483767,07	4550207,26	20,806683	41,102983
20	MNRR	Rachanska River	483375,02	4549358,56	20,802037	41,09533
21	MRP	Hotel Park	483188,08	4549032,28	20,79982	41,092387
22	MNRM	Hotel Metropol	483284,2	4545039,09	20,801073	41,056418
23	MNRP	Peshtani	483981,18	4540547,14	20,809484	41,015968
24	MRV	Velidab	483051,26	4537277,87	20,798514	40,986499
25	MRVL	Veljapes	482045,15	4535124,23	20,786616	40,967077
26	MRT	Trpejca1	481294,32	4534259,78	20,777719	40,959273
27	MNRT	Trpejca2	481642,58	4534508,9	20,78185	40,961525
28	MRZ	St. Zaum	481022,02	4533095,1	20,774519	40,948775
29	MNRCR	Cherava River	479493,02	4530398,79	20,756442	40,924449

30	MNRSN	St. Naum	478261,41	4529302,56	20,741853	40,914542

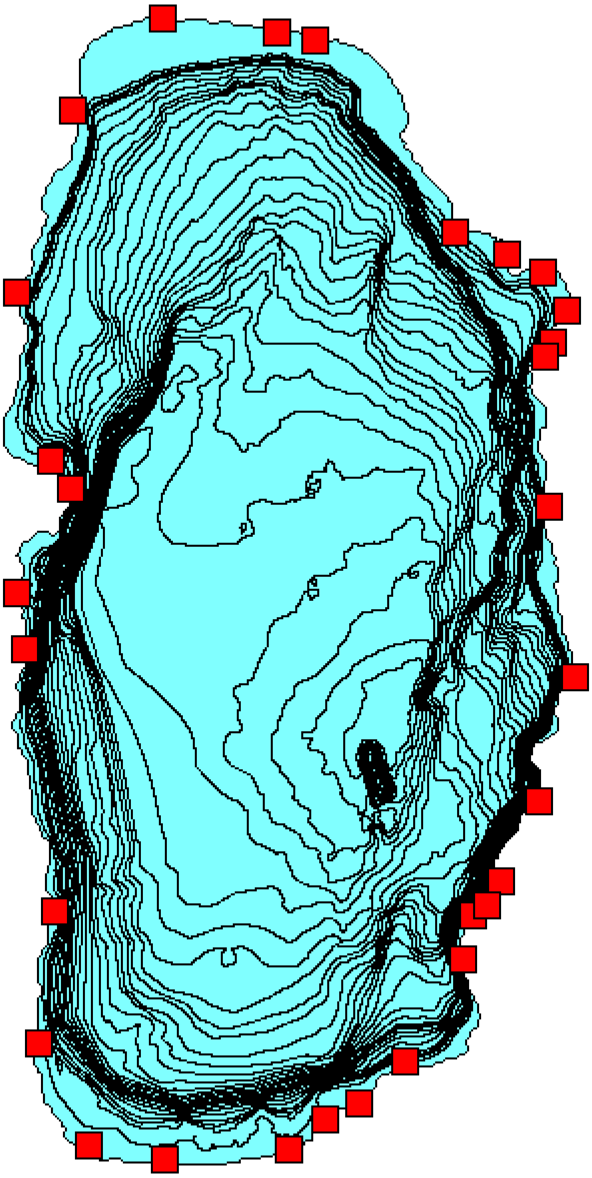

Figure 34 Lake Ohrid and monitoring stations

Table 19 Measurement stations in Lake Ohrid

Stat...	Station Name	Surrounding A...	Code	Des...	Site Classificatio...	Medi...	Measurement
1	Dogana	Reference	ARD		Manual	Lake	Water quality
2	Tushemisht	Nonreference	ANRT		Manual	Lake	Water quality
3	Pogradec1	Nonreference	ANRPG1		Manual	Lake	Water quality
4	Pogradec2	Nonreference	ANRPG2		Manual	Lake	Water quality
5	Memelisht	Nonreference	ANRM		Manual	Lake	Water quality
6	Hudenisht	Nonreference	ANRHU		Manual	Lake	Water quality
7	Piskupat2	Reference	ARP		Manual	Lake	Water quality
8	Piskupat1	Nonreference	ANRP		Manual	Lake	Water quality
9	Lin2	Reference	ARL		Manual	Lake	Water quality
10	Lin1	Nonreference	ANRL		Manual	Lake	Water quality
11	Radozda	Reference	MRR		Manual	Lake	Water quality
12	Kalishta	Reference	MRK		Manual	Lake	Water quality
13	Struga	Nonreference	MNRS		Manual	Lake	Water quality
14	Auto Camp As	Nonreference	MNRA		Manual	Lake	Water quality
15	Sateska River	Nonreference	MNRSR		Manual	Lake	Water quality
16	Grashnica River	Nonreference	MNRG		Manual	Lake	Water quality
17	Koselska River	Nonreference	MNRK		Manual	Lake	Water quality
18	Ohrid bay	Nonreference	MNRZ		Manual	Lake	Water quality
19	Blato	Nonreference	MNRB		Manual	Lake	Water quality
20	Rachanska River	Nonreference	MNRR		Manual	Lake	Water quality
21	Hotel Park	Reference	MRP		Manual	Lake	Water quality
22	Hotel Metropol	Nonreference	MNRM		Manual	Lake	Water quality
23	Peshtani	Nonreference	MNRP		Manual	Lake	Water quality
24	Velidab	Reference	MRV		Manual	Lake	Water quality
25	Veljapes	Reference	MRVL		Manual	Lake	Water quality
26	Trpejca1	Reference	MRT		Manual	Lake	Water quality
27	Trpejca2	Nonreference	MNRT		Manual	Lake	Water quality
28	St. Zaum	Reference	MRZ		Manual	Lake	Water quality
29	Cherava River	Nonreference	MNRCR		Manual	Lake	Water quality
30	St. Naum	Nonreference	MNRSN		Manual	Lake	Water quality

3.3 Measurement positions

Most stations have measurement positions in the following locations: depth 0.5m, depth 0.8m, depth 1m, depth 2m, depth 5m, depth 10m, depth 15m and depth 20m. Stations that are used for Macrophytes have transects as measurement positions: depth 0-2m, depth 2-4m, depth 4-10m and depth >10m.

Measurement positions are given in the same locations (meaning coordinates) as the mother station. For most of the positions the coordinates have been imported. In case this has not been done, ST indicated that the coordinates of measurement position are equal to the coordinates of the station. The numbers given behind ST indicates the depth of the location. If it is transect, the number behind is given as interval. Measurement position code is a combination of Station Name and the ST code.

Table 20 Measurement positions, examples

Code	Station	Z1 Value	Z2 Value	Measurement Position Type
Memelisht ST 2-4	Memelisht	2	4	Transect
Memelisht ST 4-10	Memelisht	4	10	Transect
Memelisht ST 5	Memelisht	5	5	
Memelisht ST 5-10	Memelisht	5	10	Medium (5-10)
Ohrid bay ST	Ohrid bay			
Ohrid bay ST > 10	Ohrid bay	10		Transect
Ohrid bay ST 0.5	Ohrid bay	0.5	0.5	
Ohrid bay ST 0.5-2	Ohrid bay	0.5	2	Shallow (0.5-2)
Ohrid bay ST 0-2	Ohrid bay	0	2	Transect
Ohrid bay ST 0-20	Ohrid bay	0	20	Total (0-20)
Ohrid bay ST 1	Ohrid bay	1	1	
Ohrid bay ST 10	Ohrid bay	10	10	
Ohrid bay ST 15	Ohrid bay	15	15	
Ohrid bay ST 15-20	Ohrid bay	15	20	Deep (15-20)
Ohrid bay ST 2	Ohrid bay	2	2	
Ohrid bay ST 20	Ohrid bay	20	20	
Ohrid bay ST 2-4	Ohrid bay	2	4	Transect
Ohrid bay ST 4-10	Ohrid bay	4	10	Transect
Ohrid bay ST 5	Ohrid bay	5	5	
Ohrid bay ST 5-10	Ohrid bay	5	10	Medium (5-10)
Peshtani ST	Peshtani			
Peshtani ST > 10	Peshtani	10		Transect
Peshtani ST 0.5	Peshtani	0.5	0.5	
Peshtani ST 0.5-2	Peshtani	0.5	2	Shallow (0.5-2)
Peshtani ST 0-2	Peshtani	0	2	Transect
Peshtani ST 0-20	Peshtani	0	20	Total (0-20)
Peshtani ST 10	Peshtani	10	10	
Peshtani ST 15	Peshtani	15	15	
Peshtani ST 15-20	Peshtani	15	20	Deep (15-20)

3.4 Dataseries and datavalues

During the Lake Ohrid project 4 categories of data have been measured; chemistry, benthic fauna, diatoms and macrophytes.

Dataseries are identified by a Key (unique number). They are linked to stations and measurement positions.

Table 21 Dataseries, examples

Key	Station	Measurement Positi...	Component	Unit	DateFrom	DateTo	Medium	MeasurementType	SamplingTy...
7326	Dogana	Dogana ST 20	w_cond	µS/cm	5/15/2010	12/15/2010	Lake	Water quality	Grab sample
7327	Dogana	Dogana ST 20	w_temp	deg_C	5/15/2010	12/15/2010	Lake	Water quality	Grab sample
7328	Dogana	Dogana ST 5	bod5	mg/l	5/15/2010	7/15/2010	Lake	Water quality	Grab sample
7329	Dogana	Dogana ST 5	COD	mg/l	5/15/2010	7/15/2010	Lake	Water quality	Grab sample
7330	Dogana	Dogana ST 5	do	mg/l	5/15/2010	7/15/2010	Lake	Water quality	Grab sample
7331	Dogana	Dogana ST 5	nh4_n	µg/l	5/15/2010	7/15/2010	Lake	Water quality	Grab sample
7332	Dogana	Dogana ST 5	no2_n	µg/l	5/15/2010	7/15/2010	Lake	Water quality	Grab sample
7333	Dogana	Dogana ST 5	no3_n	µg/l	5/15/2010	7/15/2010	Lake	Water quality	Grab sample
7334	Dogana	Dogana ST 5	p_total	µg/l	5/15/2010	7/15/2010	Lake	Water quality	Grab sample
7335	Dogana	Dogana ST 5	pH	pH	5/15/2010	7/15/2010	Lake	Water quality	Grab sample
7336	Dogana	Dogana ST 5	SO	%	5/15/2010	7/15/2010	Lake	Water quality	Grab sample
7337	Dogana	Dogana ST 5	w_cond	µS/cm	5/15/2010	7/15/2010	Lake	Water quality	Grab sample
7338	Dogana	Dogana ST 5	w_temp	deg_C	5/15/2010	7/15/2010	Lake	Water quality	Grab sample
7965	Dogana	Dogana ST 0-20	Number of Taxa	Metric val...	5/6/2010	10/19/2010	Lake	Biology	Grab sample
7966	Dogana	Dogana ST 0.5-2	Number of Taxa	Metric val...	5/6/2010	10/19/2010	Lake	Biology	Grab sample
7967	Dogana	Dogana ST 5-10	Number of Taxa	Metric val...	5/6/2010	10/19/2010	Lake	Biology	Grab sample
7968	Dogana	Dogana ST 15-20	Number of Taxa	Metric val...	5/6/2010	10/19/2010	Lake	Biology	Grab sample
8085	Dogana	Dogana ST 0-20	Saprobic Index Zel...	Metric val...	5/6/2010	10/19/2010	Lake	Biology	Grab sample
8086	Dogana	Dogana ST 0.5-2	Saprobic Index Zel...	Metric val...	5/6/2010	10/19/2010	Lake	Biology	Grab sample
8087	Dogana	Dogana ST 5-10	Saprobic Index Zel...	Metric val...	5/6/2010	10/19/2010	Lake	Biology	Grab sample
8088	Dogana	Dogana ST 15-20	Saprobic Index Zel...	Metric val...	5/6/2010	10/19/2010	Lake	Biology	Grab sample
8205	Dogana	Dogana ST 0-20	German Saprobic in...	Metric val...	5/6/2010	10/19/2010	Lake	Biology	Grab sample
8206	Dogana	Dogana ST 0.5-2	German Saprobic in...	Metric val...	5/6/2010	10/19/2010	Lake	Biology	Grab sample
8207	Dogana	Dogana ST 5-10	German Saprobic in...	Metric val...	5/6/2010	10/19/2010	Lake	Biology	Grab sample

3.4.1 Chemistry

- All chemistry data has been analysed and results have been imported to ENSIS.
- Albania 2010 and 2011
- Macedonia 2010 and 2011

Import of chemistry data started in 2011. In 2012 new data arrived and the data already imported had to be reimported due to some corrections. Updating ENSIS was very time consuming. Most of the corrections were due to wrong units. Ex: The following components; NO2_n, NO3_n, NH4_n, nH3_n and p_total had been imported with unit mg/l instead of µg/l

During the two years all 30 stations have been measured. There are registered 5186 chemical measurements in ENSIS for these stations and 4603 of them have been measured during this project. The components are; temperature, bod5, COD, DO, NH4_n, NO2_n, NO3_n, P-total, pH, conductivity, SO, TNKjeldahl, O_2, Tot_alk_CaCO3, Tot_alk, m_alk, p_alk.

3.4.2 Macrophytes

Macrophytes are measured at the monitoring station and for transects in depth. The components that are stored in ENSIS are Macrophytes index and vegetation limit. Macrophytes index has been calculated based on species found in the transect. During sampling the species found at the station are identified and called source composition. For each location the species found have been given and the abundance is given as a number from 1 to 5.

The dominante species are given as well. We are not able to import these to ENSIS due to the fact that measurement value only handles number and not text.

3.4.3 Benthic fauna

Benthic fauna has been registered in 2010 and 2011 in different depths. All benthic fauna has been imported according to correspondence with Tor Erik and Susi. Benthic fauna is given as flat structure, all in all 122 stk.

In addition, lots of additional information is stored as dataseries. The table below gives the components. As can be seen from the list, calculated indexes are given. The corresponding classification systems have been/can be added. These calculated indexes are given for each transect. They are also calculated for seasons or year.

Table 22 Benthic fauna, components

ID	Component name	Component group	Medium	Measurement position
569	Number.of.Taxa	Benthic fauna	Lake	Biology
570	Saprobic.Index..Zelinka...Marvan.	Benthic fauna	Lake	Biology
571	German.Saprobic.index.old	Benthic fauna	Lake	Biology
572	German.Saprobic.index.new	Benthic fauna	Lake	Biology
573	Dutch.Saprobic.Index	Benthic fauna	Lake	Biology
574	Czech.Saprobic.Index	Benthic fauna	Lake	Biology
575	Romania.Saprobic.Index	Benthic fauna	Lake	Biology
576	Slovakian.Saprobic.Index	Benthic fauna	Lake	Biology
577	Average.score.per.Taxon	Benthic fauna	Lake	Biology
578	BBI	Benthic fauna	Lake	Biology
579	IBE	Benthic fauna	Lake	Biology
580	Diversity..Shannon.Wiener.Index.	Benthic fauna	Lake	Biology
581	Diversity.Shannon.Wiener.expX	Benthic fauna	Lake	Biology
582	Feeding.types.Shredders	Benthic fauna	Lake	Biology
583	Feeding.types.Gatherers.Collectors	Benthic fauna	Lake	Biology
584	Feeding.types.Active.filter.feeders	Benthic fauna	Lake	Biology
585	Feeding.types.Predators	Benthic fauna	Lake	Biology
586	Relative.abundance.Gastropoda..pros.	Benthic fauna	Lake	Biology
587	Relative.abundance.Bivalvia..pros.	Benthic fauna	Lake	Biology
588	Relative.abundance.Oligochaeta..pros.	Benthic fauna	Lake	Biology
589	Relative.abundance.Hirudinea..pros.	Benthic fauna	Lake	Biology
590	Relative.abundance.Crustacea..pros.	Benthic fauna	Lake	Biology
591	Relative.abundance.Diptera..pros.	Benthic fauna	Lake	Biology
592	Croatia.Saprobic.Index.HRIS.System	Benthic fauna	Lake	Biology
593	Croatia.Saprobic.Index.WEGL.System	Benthic fauna	Lake	Biology
594	Lake.ICMi	Benthic fauna	Lake	Biology

Unit for benthic fauna is individes/m2.

3.4.4 Diatoms

Albania is responsible for the diatom part of this project, but there might be some mismatch between the Albanian and Macedonian data. They are not automatically done in the same way. We need to group the data in two according to who analysed the data. In ENSIS the person that analysed the data should be mentioned in Analyse method. Albanian data has not been marked as described – but the Macedonian data are marked.

Macedonia data have been imported and they are marked "diatoms analysed in Macedonia".

3.5 Classification system

Classification systems can be entered into ENSIS and the systems are user defined.

The classification system for macrophytes index ranges from 1 to 5 where 1 indicates that the macrophytes are very seldom and 7 indicates very high amount. The system has been imported to ENSIS and can be used to classify the macrophyte index in Lake Ohrid. The results can be viewed either in tables or in a map.

Table 23 Classification systems, Macrophytes

ID	Name	Medium	Author	Start	End
1	**Macrophytes index**	**Lake**	**Susi**	**01.01.2000**	**01.01.2020**

Cl.ord	Code	Description	Syst. ID	Component	Unit	Value from	Value to
1	Very low	Oligotrophic	1	Macrophytes index	index	1	2,39
2	Low	Oligo-mesotrophic	1	Macrophytes index	Index	2,4	2,69
3	Moderate	Mesotrophic 1	1	Macrophytes index	Index	2,7	2,949
4	Moderate-Considerable	Mesotrophic 2	1	Macrophytes index	Index	2,95	3,29
5	Considerable	Eutrophic 1	1	Macrophytes index	Index	3,3	3,549
6	High	Eutrophic 2	1	Macrophytes index	Index	3,55	3,89
7	Very high	Eutrophic 3	1	Macrophytes index	index	3,9	5

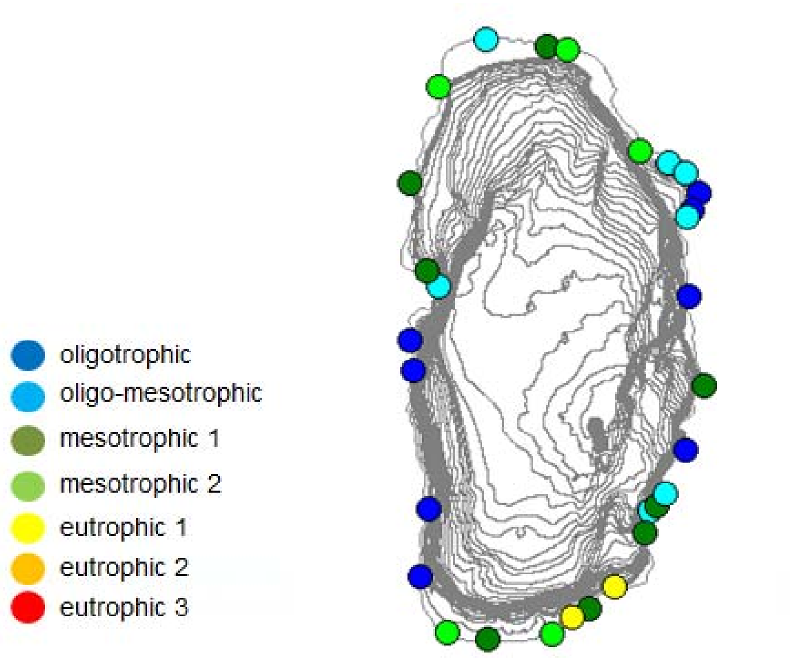

Figure 35 Macrophytes index in Lake Ohrid

In addition a classification system for Abundance is given. In ENSIS this must be imported for each component (meaning each species) – but the value range is identical for all macrophytes with unit abundance. (see the examples in Table 12 and Figure 44)

Table 24 Classification system, macrophytes abundance

ID	Name	Medium	Author	Start	End
2	**Abundance**	**Lake**	**Susi**	**01.01.2000**	**01.01.2020**

Cl.ord	Code	Description	System	Color	Component	Unit	Value from	Value to
1	Abundance 1	Very rare	2		Chara aspera	Abundance	0,9	1,89
2	Abundance 2	Rare	2		Chara aspera	Abundance	1,9	2,89
3	Abundance 3	Common	2		Chara aspera	Abundance	2,9	3,89
4	Abundance 4	Frequent	2		Chara aspera	Abundance	3,9	4,89
5	Abundance 5	Abundant	2		Chara aspera	Abundance	4,9	5,1

Cl.ord	Code	Description	System	Color	Component	Unit	Value from	Value to
1	Abundance 1	Very rare	2		Chara tomentosa	Abundance	0,9	1,89
2	Abundance 2	Rare	2		Chara tomentosa	Abundance	1,9	2,89
3	Abundance 3	Common	2		Chara tomentosa	Abundance	2,9	3,89
4	Abundance 4	Frequent	2		Chara tomentosa	Abundance	3,9	4,89
5	Abundance 5	Abundant	2		Chara tomentosa	Abundance	4,9	5,1

The example below is given for Cladophora glomerata in two depth intervals/transects.

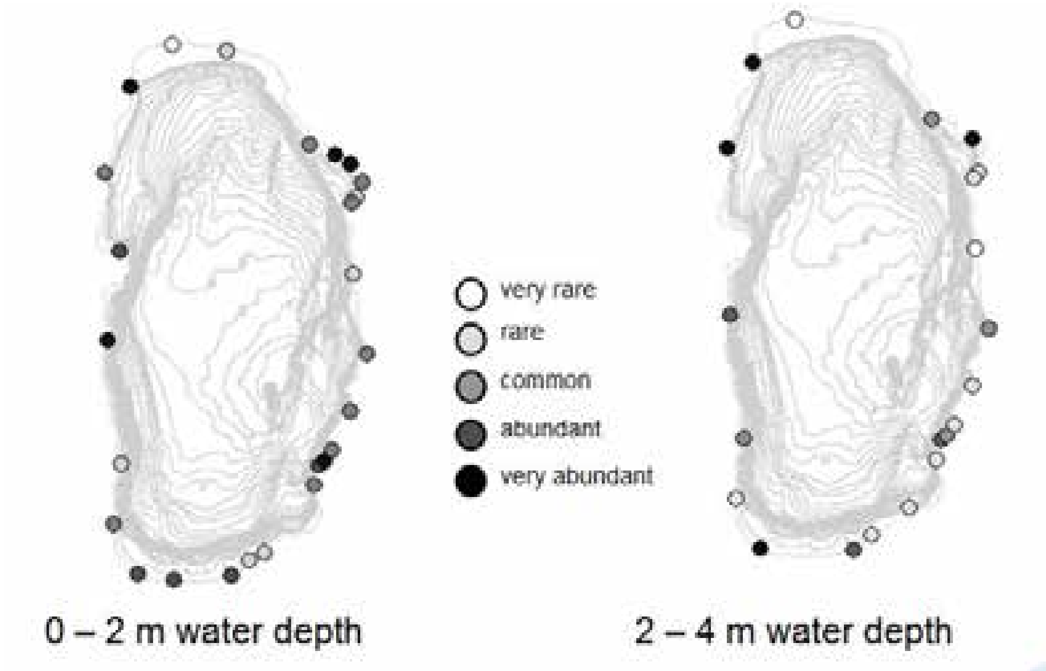

Figure 36 Cladophora glomerata abundance in two depth intervals/transects in Lake Ohrid

For diatoms two classification systems have been imported, Trophic index and Saprobic index.

Table 25 Trophic and Saprobic index diatoms

Class order	Quality system	Min value	Max value	Class	Component	Unit
1	Trophic index diatoms	0,00	1,00	*ultraoligotroph*	Trophic Diatom Index, TIDIA	Relative abundance
2	Trophic index diatoms	1,00	1,40	*oligotroph*	Trophic Diatom Index, TIDIA	Relative abundance
3	Trophic index diatoms	1,40	1,60	*oligo-mesotroph*	Trophic Diatom Index, TIDIA	Relative abundance
4	Trophic index diatoms	1,60	1,90	*mesotroph*	Trophic Diatom Index, TIDIA	Relative abundance
5	Trophic index diatoms	1,90	2,30	*meso-eutroph*	Trophic Diatom Index, TIDIA	Relative abundance
6	Trophic index diatoms	2,30	2,70	*eutroph*	Trophic Diatom Index, TIDIA	Relative abundance
7	Trophic index diatoms	2,70	3,20	*eu-polytroph*	Trophic Diatom Index, TIDIA	Relative abundance
8	Trophic index diatoms	3,20	3,40	*polytroph*	Trophic Diatom Index, TIDIA	Relative abundance
9	Trophic index diatoms	3,40		*poly-hypertroph*	Trophic Diatom Index, TIDIA	Relative abundance
1	Saprobic index diatoms	1,00	1,50	oligosaprob	Saprobic Index, SI	Relative abundance
2	Saprobic index diatoms	1,50	1,80	Oligosaprob deri β-mesosaprob	Saprobic Index, SI	Relative abundance
3	Saprobic index diatoms	1,80	2,30	β-mesosaprob	Saprobic Index, SI	Relative abundance
4	Saprobic index diatoms	2,30	2,70	β-mesosaprob deri β-mesosaprob	Saprobic Index, SI	Relative abundance
5	Saprobic index diatoms	2,70	3,20	a-mesosaprob	Saprobic Index, SI	Relative abundance
6	Saprobic index diatoms	3,20	3,50	a-mesosaprob deri polisaprob	Saprobic Index, SI	Relative abundance
7	Saprobic index diatoms	3,50	4,00	polisaprob	Saprobic Index, SI	Relative abundance

3.6 Examples

3.6.1 Total phosphorus

Total phosphorus is measured in different depths in Lake Ohrid for each station. Here is an example of how this can be displayed in ENSIS by use of GIS functions. Colour codes are according to classification systems.

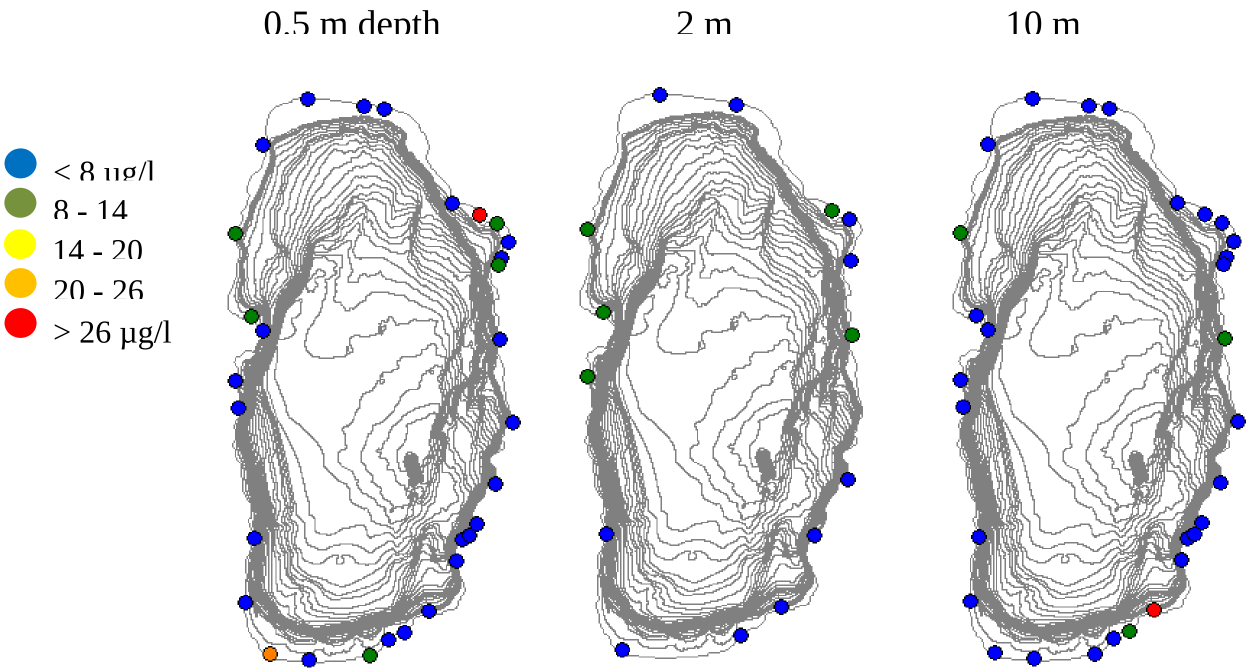

Figure 37 Total phosphorus at different depths in Lake Ohrid

3.6.2 Diatom index TIDIA

Diatom index TIDIA can be presented as in the figure below. Dataseries have been run through classification systems and are displayed in colour codes.

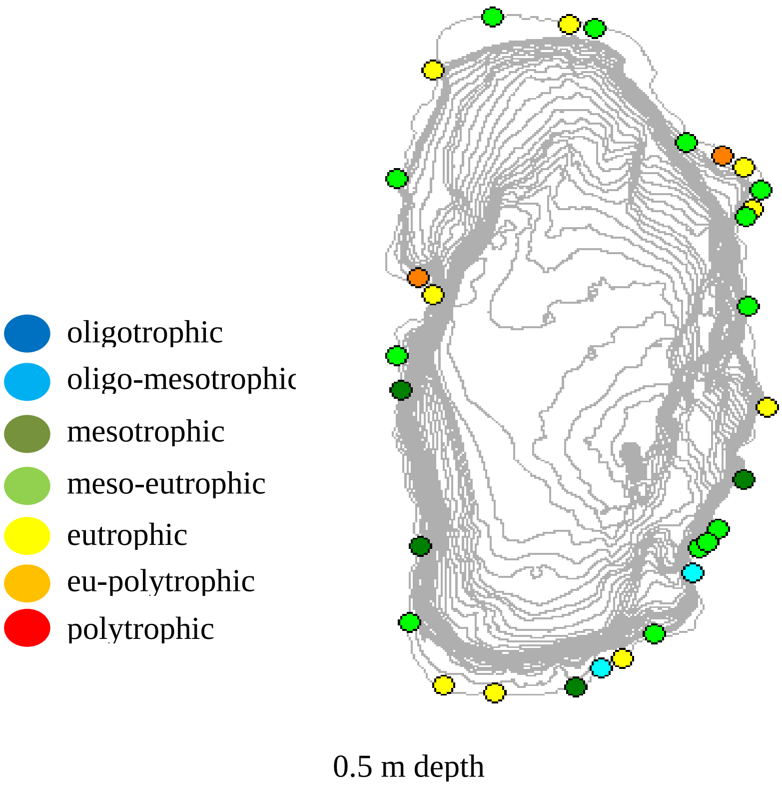

Figure 38 Diatom index TIDIA at 0,5 m depth

3.6.3 Macrophytes index

The figure below shows macrophytes index for different depth intervals and one figure for average index for all depth zones. These maps are calculated in ENSIS and displayed in GIS functions in ENSIS.

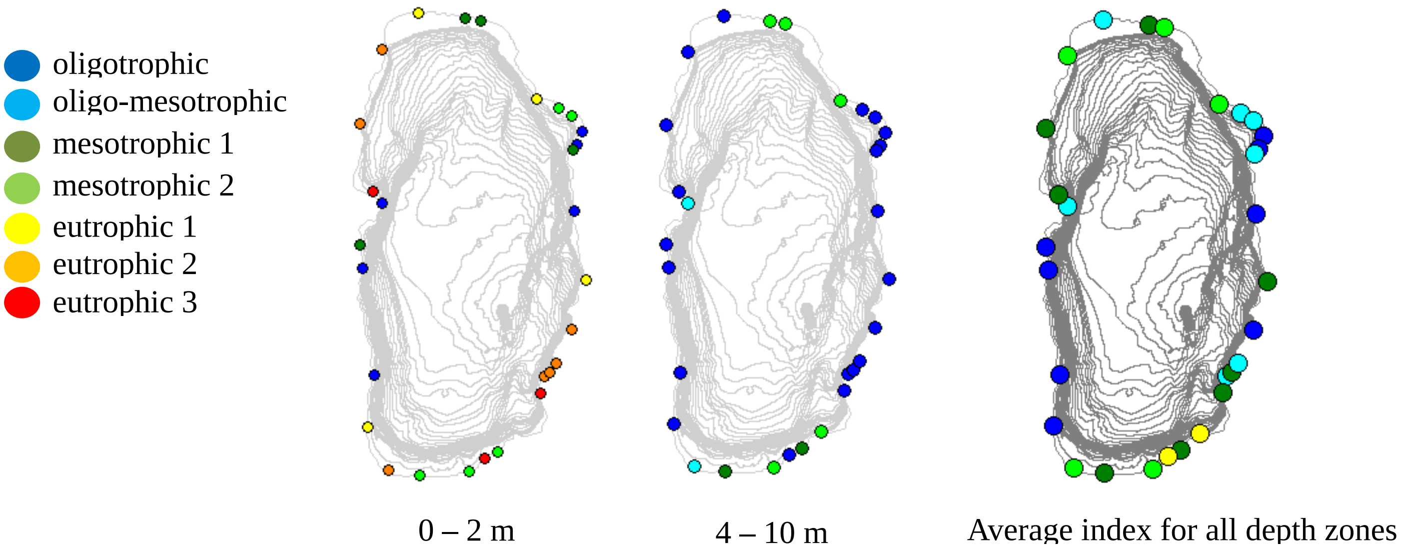

Figure 39 Macrophytes index for depth zones in Lake Ohrid

3.6.4 Lake ICMi macroinvertebrates

The figure shows Lake ICMi macroinvertebrates for depth 0.5m.

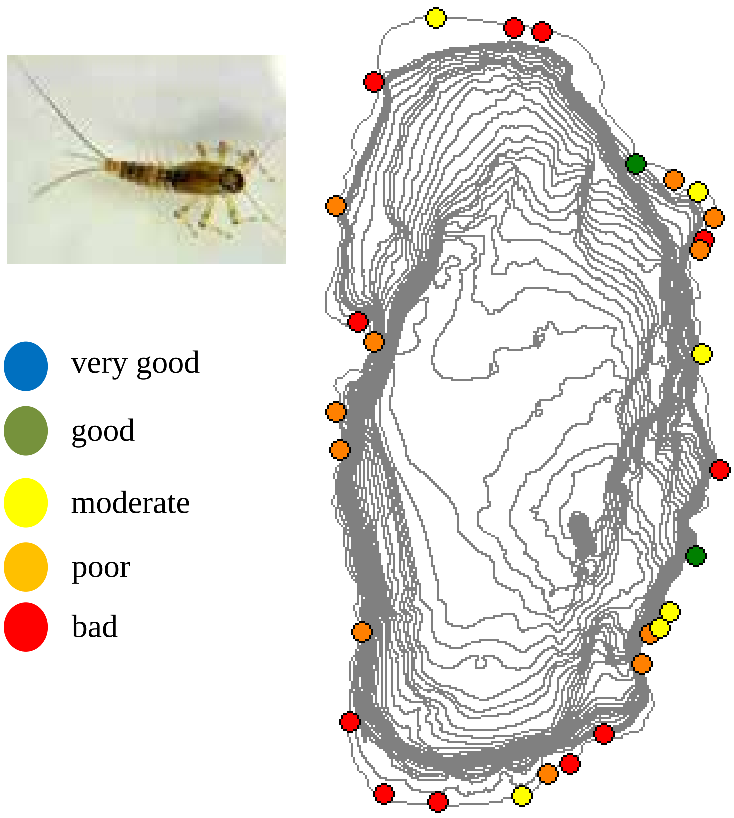

Figure 40 Lake ICMi macroinvertebrates for depth 0.5m in Lake Ohrid

4. Original files stored at NIVA

Stations and coordinates:
Original file: Localities&GPS coordinatesDevelopingBTfMoLO.doc

Chemistry:
Original data files:
Makedonia 2010: MACEDONIA_HYDROCHEMISTRY_in ENSIS_2010.xls
Makedonia 2011: TEMPLATE_MACEDONIA_HYDROCHEMISTRY_2011.xls
Albania 2010: _FINAL_MAGDA_ Hydrochemistry_May_July_2010_corrected_MAY_2012.xls
Albania 2011: HYDROCHEMISTRY_ALBANIA_2011_FINAL_May_2012.xls
All data have been edited and systemized in the file: Oppsummering kjemidata_09052012.xlsx

Macrophytes:
Macrophytes data are given in the following file *macrophytes_Ohrid_2010_and_2011.xls and edited in file: Macrophytes_ohrid_2010_and_2011_redigert.xls*
macrophytes_Ohrid_Dataseries.xls

Benthic fauna
The import file with benthic fauna are given in: Copy of Bunndyrdata_redigering2.xls. Calculated data and indexes are given in file: Indekser_import_ENSIS14052012.xlsx

Original data: Diatoms_Ohri_10-11.xls (Albania data)
Diatoms_Mak-Alb 2010_kun Macedonia OK.xls
Diatoms_Mak-Alb 2011_kun Macedonia OK.xls
The two last files consists of correct Macedonia data and INCORRECT Albania data. For Albania use the Diatoms_Ohri_10-11.xls file.

Classification system
Classification system for macrophytesindex: 20120112141720342.pdf

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