Title	**Eldred2 database operating and maintaining**
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Date	25 January 2008
Subject	
Status	**Release** V 2.08
Publisher	
Type	Working paper, on-going
Description	
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Format	MS Word 2003
Source	
Rights	
Identifier	Z:\PROJECTS\ELDRED2\Databases\Documentation\Eldred2 DB operating and maintening_2-08_2.doc
Langage	EN
Relation	Dam positioning Web tool Fragmentation issues Small rivers project
Coverage	Pan-Europe

Document History

Version	Date	Author(s)	Remarks
0	February 2006		Draft for urgent proxy coordinating the dams
2-	March 2006	Philippe Crouzet	
2-01	31/05/2006	Philippe Crouzet	Adding export facilities
2-02	3/08/2006	Philippe Crouzet	Processing comments and correcting text
2-03			Skipped
2-04	15/09/2006	Philippe Crouzet	Final text of Eldred2 V2
2.05	15/02/2007	Philippe Crouzet	Corrections related to small dams introduction and fish passing facilities
2.06	11/05/2007	Philippe Crouzet	Complements
2.07	1/06/2007	Philippe Crouzet	Fish characteristics handling, correction of bugs
2.08	24/01/08	Philippe Crouzet	Corrections for dissemination

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1 Executive summary

The EEA has updated the previous Eldred (European Lakes and Reservoirs database) created in 1997 to:

- Update and revise the structure of the database from a stand-alone application to a new database constituting a step in the current development of the spatial platform SPAICE[1]. This requires, among other, the accurate location of dams, attaching them to their associated lake and make the couple dams + lake becoming a part of the hydrographic system in WISE/SoE to allow all assessments where dams and lakes are important players.
- Update its content, to cover the whole pan-European area, with the view to document the ad hoc section of the Belgrade report,
- Contribute to the GWSP[2] initiative to build a World database on dams and lakes.
- Build fragmentation indicators, with high priority on SEBI2010 indicator " *Status and trends in the fragmentation of river systems due to artificial structures that may affect the passage of migratory fish and so restrict their range and/or abundance*".

The new database is named Eldred2, to mention the continuity of conceptual model between Eldred2 and Eldred and the first stage of its development is now ready.

Information on dams and lakes come from different, incomplete and non-harmonised sources that has to be merged with hydrographical system, themselves under development. Hence, the development of Eldred2 is a stepwise process that is forecast in three stages:

1. Collecting information on dams and associated lakes, organise the information, make it possible to quality assure it and get the accurate coordinates of dams, hence making Eldred2 a database with data and coordinates,
2. Co-register dams and their associated lake as lakes and upgrade Eldred2 into a geodatabase (data and associated geographic objects),
3. Merge Eldred2 geodatabase to the hydrographical system and insert it into SPAICE to make it possible to use dam and lake related information for fragmentation calculation, water accounts, etc.

Stage one construction is now finished and the collection of coordinates is progressing quickly thanks to close cooperation with a participant to the GWSP, the Greifswald University, and the DamPos tool developed in the EEA and support by Icold[3]. Stage two is starting, taking stock of currently available and validated coordinates collected in stage 1. Stage three is as well developing: on the hydrographical system based on different source, of which CCM2, ERC and Erica river data sets. The operational river system delivery was significantly delayed because the numerous gaps found during the development of a "fragmentation calculation module" developed by Pöyry Consultants. The module encompasses biological, sedimentological and hydrological faces of river fragmentation.

This report describes the structure of Eldred2 and its dam location tool DamPos, the source of data and the tools developed to insert, validate, check, update and exploit the information collected during stage 1 of the implementation of Eldred2.

[1] SPAICE: Spatial Platform for Assimilating and Integrating the Characteristics of the Environment
[2] http://www.gwsp.org/ Global Water System Project
[3] Icold = CIGB International Commission on Large Dams / Commission Internationale des Grands Barrages, http://www.icold-cigb.org/index.html

2 Purpose

Dams are major features of rivers. Dam and the associated lake have beneficial outcomes that justified their commissioning: water storage and water provision, hydro-power production, flood mitigation, regulation of the hydrologic regime, etc.

However, the dam proper constitutes an obstacle to fish migration and to aquatic fauna movement; it constitutes as well an obstacle to the movements of terrestrial fauna. The lake resulting from the dam is a factor of change in the river hydrology and constitutes a settlement tank for the suspended solids that accumulate in the lake. The relationships between dam size and effects (beneficial and adverse) are not direct: large dams constitute major water impoundments and potential sediment traps, by contrast they do not necessarily constitute the major obstacles to fish and contributors to the turning of river flowing ("lotic") to still ("lentic") water bodies.

Some of the dam and lake effects are not restricted to man-made lakes: natural lakes are also settlement tanks and operate a change in the hydrologic regime; cascades are natural obstacles to fish journeying. Hence, the equipment of natural lakes has not changed the situations on all aspects.

The EEA had considered the issues related to dams, lakes and reservoirs 10 years ago (**Leonard and Crouzet, 1998**). A first database, called "Eldred" (European lakes, dams and reservoirs database) was developed to harmonise the needed data. Eldred has been built from core information taken from the 1988 paper release of the Icold World Register on Dams, completed by data collected thanks to questionnaires processed by the ETC/water. The main lack in Eldred was the difficulty to get accurate coordinates of dams and the correlative absence of Rivers & Catchments database to place the dams and analyse their effect in a spatial perspective: succession of dams along a river, catchment issues, history of impact on fish migration, etc. Besides, Eldred was developed in Paradox® for Windows, which is nowadays obsolete database software.

The Eurosion project outcomes suggested that river damming might have been the major factor of cutting at least 100 million tons y^{-1} sediment input to the sea, for the Mediterranean part of EU15 (**Eurosion, 2004**). The Eldred database was used to achieve this result, but the difficulties in producing the estimate and its poor accuracy suggested that a) Eldred database should be deeply revisited and b) that it should be integrated into a spatial approach and no longer constitute a stand-alone system.

At the end of 2004, the EEA started revisiting the concept of Eldred and its integration to the spatial platform. The new database is called Eldred2 to mark the strong heritage from Eldred, despite substantial changes.

This report presents:

- The rationales and methodology
- The structuring of the information and the issues related to the heterogeneity of sources
- The database user manual, detailed at the administrator's level.

3 Methodology

3.1 Operational Definitions of Dams, Lakes and Reservoirs

Eldred2 is the new release of the Eldred database (**Leonard and Crouzet, 1998**) that deals with dams and lakes.

The purpose of the database is organising the information on dams and lakes (natural and artificial) that impact the continental hydrosystems in their historical development. By contrast with the major source of large dams and reservoirs information, Icold, dams that have disappeared are potentially present in Eldred2.

However, all "dams" in a wide acceptation of the term cannot be coded and documented: they are far too numerous, many are placed on river sites that are not part of the European GIS and no source can provide comparable information. The way to code, handle and store statistical information on damming within a certain catchment is not part of Eldred2 that is designed for handling information on individual objects.

In this database, the following definitions are used:

1. **Dam**: "a barrier constructed to contain the flow of water or to keep out the sea". In Eldred2, this definition is completed by "main dam" which is the dam that creates the lake and that is designated as such by dam managers and by "secondary dam" understood as those dams that contribute to create a lake(see "dyke").
2. **Dyke**: may have the same definition, but is often used in a restricted acceptation, especially when it constitutes a secondary dam filling a pass. In Eldred2, dykes that contribute to the making of a lake are designated as "secondary dam". In general acceptation a dyke is parallel to the river or makes barrier to sea intrusion.
3. **Lake**: "a body of (usually fresh) water surrounded by land". This definition can be quite imprecise: hydrologists consider as "lake" all still water body which is not in bilateral relationship with the world ocean disregarding its chemical composition. Under this acceptation, the Caspian sea is a lake (**Pourriot and Meybeck, 1995**)
4. **Reservoir**: "lake used to store water for community use", is used as well as synonym of "artificial lake", even though the percentage of artificiality may range from 0 to 100%,
5. **Large dam**: dam recorded as such by Icold. It can be a dam or a dyke, provided height, width and contained volume criteria set by Icold are met. Icold records large dams, with a wider acceptation of the term "dams" than mentioned in bullet 1. Icold considers all artificial barriers including those used to confine sediments and not only water because it has a civil engineering point of view, and therefore is committed to record "walls" building along with lake purpose.

   According to Icold, a large dam is *"not less than 15m high reckoned from the lowest point of the main foundation"* and *"dams between 5 and 15, impounding more than 3hm3, … , should be reported to preparing statistics on reservoirs"*, but *"countries having more than 1000 dams may seek special arrangements from the Chairman of the Committee on the Register"* (**CIGB/ICOLD, 2003**).

   Hence the definition of large dam holds a certain share of uncertainty. The application of the definition by Icold national Committees add some heterogeneity and inaccuracies in the delivered data as well.

Since the Eldred2 database deals with dams as obstacles and lakes as still water bodies that have ecological, hydrological relevance and act as sediment trap, all dams meeting the above definition are suitable for consideration.

Lakes are distinguished by their purpose, disregarding their origin. A "natural lake" does no result from man-made dam but can be a reservoir if its water is used for any beneficial purpose. The new Eldred conceptual model hence considers lakes that can result from zero, one or several dams, including natural lakes which useful capacity has been enhanced or made manageable by damming. To avoid confusion, the term "lake" is used for natural lake, even though is has been equipped, "artificial lake" or "lake" for a lake created by a dam and "reservoir" to call the function fulfilled by a lake. The term “reservoir” is not used to call a water mass.

3.2 Questions to solve

When Eldred was developed in 1997, it was mainly based on the 1988 Icold register. Its main adding to it was the coding of dams and associated lake and partial location of dams and lakes along with supplementary information which collection has not been maintained since the publication of the report by the EEA. The structure of Eldred was done by exploding the simple Icold structure (one line per dam, making it possible to have duplicated information of lake volume for example when dealing with secondary dams) into a more adequate structure. A special feature of Eldred was to distinguish (and code differently) artificial lakes and natural lakes. This distinct codification that proved being both inaccurate and source of complication is now abandoned to cope with definitions in § 3.1 above and consider the historical development of lakes that may have been turned from a 100% natural state to partly artificial state.

There is no direct and unique relationship between a dam, a lake and a river:

- A dam may have no lake (the wall is permanently opened for flood control, the dam is built to store sediment: ore tailings for example). Small dams do not make lakes, they just change locally the water table slope and change hydraulic conditions (water velocity), the residence time of water in the dammed reach is seldom unchanged,
- A dam on a river is generally an obstacle to fauna journeying, but not systematically (damming a cascade for example does not change journeying possibilities for fish). Besides, dam location, equipment and operating rules are very important issues that widely mitigate its impact on the river system.
- An artificial lake can result from several dams; in this case Eldred considers a main dam and secondary dam(s). Secondary dams are often called "dyke" or "pass dyke", in different languages (for example "dique del collado" in Spanish) in the source information records, because they lock passes on valley sides (possibly creating capacity above ground level).
- A dam can be placed out of a river or having specific catchment (the dam can be built on a derivation canal, two lakes can be related by a special canal, the lake(s) can be filled by pumping, etc. The database must handle some of this this information because a dam on a canal is not an obstacle to fish movement in natural system.
- A dam (and the associated lake(s)) are dated: the dam can be commissioned one year, it can be destroyed after decommissioning or accidentally, it can be modified, thus changing the conditions of existence of the associated lake and its permeability to fish and sediment and discharge regime,
- A natural lake is generally a long-lasting feature (albeit it can disappear), but it can be turned into a semi-natural lake or it can be operated without damming, especially in mountainous areas,
- The impact of an individual dam depends both on the catchment and on its position on the catchment and on the presence of other dams upstream and downstream. Hence, the history

of dam placement is a key element of understanding the overall impacts of basin management.

Not all possibilities are listed above; the list however presents the major issues that should be reflected in the database along with obvious information: which height, what use(s), etc.

The new question to solve is the accurate location of dams with sufficient precision so that further analysis could be carried out in a spatial approach. Positioning dam is a prerequisite to the next stages of Eldred development: identifying and co-registering lakes and attaching the dam to the correct river reach.

To this end, a three step methodology was defined and applied for carrying out the first stage:

1. Defining a new Eldred2 structure, compatible with the platform development and EEA database software. MS Access® was chosen because the volume of data is small and MS Access® makes it easy to develop prototype and operational database and geodatabase with little investment. It is fully compatible with ArcGis® handled geodatabase in which punctual, linear and polygon features are processed.
2. Collecting updated register of dams (new countries, new dams) from Icold and merge it with the former Eldred database,
3. Designing and developing a tool to locate the dams with good accuracy. After a deep analysis, the choice was made to develop a Web service, based on GoggleEarth®. This service is designed to involve as many experts as possible, with the clear target to include Icold experts as top priority everywhere these experts accept committing themselves in a cooperative process with the EEA.

The merging of Eldred and new Icold data was carried out with ad hoc temporary queries developed under MS Access®. This is a preparatory task that however provided interesting information that is summarized in this report when presenting the new database structure. At the end of the day, a linked system has been developed that both handles the data and fuels and harvest the Web positioning tool. This twin structure, capable of being related to the spatial platform is described in next sections.

A fourth step, under thinking is the integration of Eldred2 to the EEA GIS infrastructure. Its prerequisite is the full availability of the Rivers & Catchments database that is scheduled in the coming months.

3.3 Selecting the objects to consider

3.3.1 Dams

There is currently no publicly availabledatabase dealing with the same topics as Eldred. Different University initiatives have been developed (**NOAA, 2005; FAO, 2006; Hirano, Magome et al., on press**). At world scale, Lehner and Döll (Lehner and Döll, 2004a) developed a lakes and wetland database that calls for data on dams.

These initiatives are currently merging under the auspices of one of the actions of the GWSP project chaired by Prof. Charles Vörösmarty. Therefore the latest developments of Eldred2 have been done in the view of carrying similar concepts, if not identical databases.

During the previous development of Eldred, it was decided to start considering the "large dams", as defined by the International Commission on Large Dams (Icold, in French CIGB: “Commission Internationale des Grands Barrages”). Icold maintains a **world register of large dams**, which is a selection of dams based on inclusion criteria defined jointly by the national committees that are grouped under the Icold umbrella.

Icold national committees are lead by country's experts that are expected to apply accurately the commonly defined rules. Hence information on large dams is expected to be populated in a comparable way. This is unfortunately not the case and leads to devoting many resources to checking the information. This comparability is very important when considering the countries in the EEA area, that are not all bound to report under the Water Framework Directive (WFD), for pan-European reporting for example. Since criteria for including a dam in the Icold register on the one hand and reporting it as *"heavily modified water body"* (HMWB) under the WFD are different, it is expected that both sources do not yield the same list, even though the Icold experts from the EU countries are certainly aware of those dams reported under the WFD albeit they are not included in the Icold register.

In the May 2006 release of the database, there were 6462 records describing “large dams” in the primary dams table that covers the pan-European area (5811 in the EEA MS of which 4247 in the EU member states and 651 in other countries), This figure is not exactly the number of dams because there are errors and duplicates, dams under construction and dams decommissioned and different criteria for inclusion of dams in the Icold register in the former USSR countries[4]. Further updates will refine the accurate number of dams currently operating and decommissioned and those that just matter for environmental issues.

The order of magnitude is just provided to show the range of final size of the database. The total number of dams (disregarding the notion of "large dam") in the member states of the EU is unknown, and might reach several 10,000, according to Icold informal guesses and changes every year by inclusion and deletion.

For example, the recorded number of all Swedish dams in 1994-1995 (**Svensk Vattenarkiv, 1994; Svensk Vattenarkiv, 1995**) was 8753, to compare to 190 large dams in the 2003 update of Icold database. Most of the recorded Swedish "dams" are small weirs.

Similarly, in France, two recent databases populated respectively on the Seine-Normandie and Loire-Bretagne water agencies (that are as well river districts) present respectively 5370 and 10700 dams and works on rivers (several having limited elevation, some being destroyed, etc.), including the large dams.

Large dams and the associated lake represent major volumes of water, and consequently the major sediment traps. By contrast they do not represent the unique cause of river fragmentation vs. fish and aquatic fauna.

The “non-large” dams that are 10 to 100 times more numerous that the large ones may represent the major threat on fish populations: all those having a few decimetres in height are impassable obstacles for many species and their repetition end up with making a lock for species capable of jumping (mainly salmonids).However, these many small dams cannot be addressed in a comparable way for the time being, all the more because most of the very small dams are not in available or existing databases and because several are likely to placed on rivers that are not recorded in the medium-scale river GIS under construction at the EEA.

The number of HMWB in relation with damming is unknown for the time being.

The number of artificial lakes is directly depending on the selection of dams. The number of large artificial lakes is at most the number of large dams, they store the majority oft volumes. By contrast, the length of rivers turned from lotic (running) to lentic (still) segments is unknown until specific assessment have been carried out. By contrast, the number of natural lakes is depending on the definition of lake to include. For the time being, this point has not been explored. It should be reconsidered as soon as possible because a) it determines the representativeness of the assessments

[4] Former USSR, now Russia, People's Republic of China and the USA have requested larger thresholds to limit the number of dams they declare because otherwise it would make too many entries in the register. Any country having more than 1,000 dams may do so after permission of the Chairman of register Committee under Icold internal regulations.

carried out from the "lakes" priority dataflow under the Eionet/water and b) it determines the representativeness of the assessments carried out from the "lakes" waterbodies reporting under the WFD.

In practical terms, the lakes to be included should be first defined from the populating of the Rivers & Catchments database which conceptual model has been carried out in 2005 (**ETC/W, 2005**) and completed in 2006 and in early 2007. The main sources of lakes are:

- the water table layer extracted from the Image2000 dataset by the JRC,
- CORINE land cover,
- TeleAtlas® database
- Eurogeographics data purchased in 2006
- With time, the insertion of national data sets that become available to the public
- To some extend, the global lakes and wetlands database (Lehner and Döll, 2004b). This database poses problems of accuracy of coordinates and is used mainly as control source of comprehensiveness of objects.

Natural lakes would therefore come from subtracting from this layer all identified artificial lakes, themselves resulting from the updating and populating of Eldred2.

3.3.2 Lakes

All lakes attached to dams, as obtained from Icold or other data source should have a record in Eldred2.

Natural lakes, without dam will be entered from trustable data sources in a next stage.

Since the May 2006 release, the natural lakes have been set aside because the dataset has not been updated since 1998. Hence, only artificial lakes are entered.

The notion of starting and ending years applies to both natural lakes and artificial ones. An interesting example is Lake Sarez[5] in Tajikistan, created by the landslide resulting from an earthquake in 1911. The present area of the lake is 80 km^2, its length 60 km, and the volume of water is about 17 billion m^3. Many specialist fear a possible catastrophe because a new earthquake could break the natural dam making the lake.

3.3.3 Special problems to analyse

Complex situations

Dam data come from different sources that are equally trustable. However, the different sources happen to provide apparently incompatible data for the same dam. A major issue is related with commissioning and upgrading dam that requires keeping data in order to complement information. The same type of problems occurs as well for height, reservoir volume, area, etc.

Dam replaced, without being destroyed.

An extreme example is on the Puentas III dam (Spain), next to the city of Lorca, province of Murcia, on river Guadalentin, with height of 69 metres (latest data). This dam is recorded as commissioned in 1791 by Icold, and having been heightened in 1884. It is recorded as DSP00013 in the Eldred2 database.

A complementary information is provided by the Spanish “Inventorio de presas Españolas”, issued in 2006 (**Ministerio de Medio Ambiente, 2006**), that is both on paper and electronic support. Dam Puentes III is recorded under n° 1609, for same locations and characteristics as in the Icold

[5] http://www.tajik-gateway.org/index.phtml?lang=en&id=983

database. However, is it mentioned as being finished in 1905 in the summary list, has no printed descriptive sheet but is reported as finished in 1997 in the attached database (CD-rom). It seems that this final date, contradictory with the former, records the latest modification.

There is an apparent two centuries discrepancy between commissioning dates from two equally trustable sources! In fact, a first 52 Hm^3 dams was commissioned in 1791 in this place, dam that was destroyed in 1802[6] during a major flood event causing more than 600 human casualties. A new dam was built in the same place in 1884, getting the name of "III" (supposedly because it was the third version of the dam: version I started in 1685, but was destroyed during construction).

Now, Puentes IV dam is at short distance upstream Puentes III, which has been kept in place. Hence there is a dam without lake (Puentes III), that have had a lake until 1997 (guessed date), and a new Puentes IV, commissioned in 2000 that has a lake. Data provided by both providers is only partly accurate because not reflecting the discontinuities in data.

In this case, the issue can be solved by:

1. creating a Puentes I entry between 1685 and its destruction, possibly without lake,
2. creating a Puentes II entry, between 1791 and 1802, both dam and lake created 1792 and dead 1802.
3. modifying Puentes III entry between 1884 and 1997, with lake,
4. creating Puentes IV dams and attaching new lake record to PuentesIV with different lake features in 2000.

This reflects accurately the history of the equipment of the site and the succession of river damming.

Figure 1: Special case of Puentes III and Puentes IV dams in 2006 (GoogleEarth image capture)

[6] http://servicios.laverdad.es/murcia_agua/cap12.2.htm

This is quite important because in the Icold database, Puentes III is reported with a reservoir capacity of 13.870 Hm3 (value before transformation) and Puentes IV with a reservoir capacity of 29.500 Hm3. Both have not been simultaneously present, thus making a possible double accounting in water reservoir capacity.

The risk of introducing inaccuracies in the database is certain, because updates must be quite automated. In the current case, the discrepancy was detected because matching the Icold source and Spanish source to pair the ID from both sources displayed difference in commissioning dates, despite all other fields had the same content.

Dam sunken into a new lake

The Cholodogocagna dam (DFR00087, extreme South-West of France) commissioned in 1931 has been drowned by the lake make by Choldogocagna 2 (DFR00518), next to the former place. This results into a complex situation because lake has not ceased existing. The simplest coding is:comparable to Puentes case:

1. Creating dams and lake in 1931;
2. creating dam in 1991 and changing lakes attachment at this date. Former dam is kept, with no lake attached..

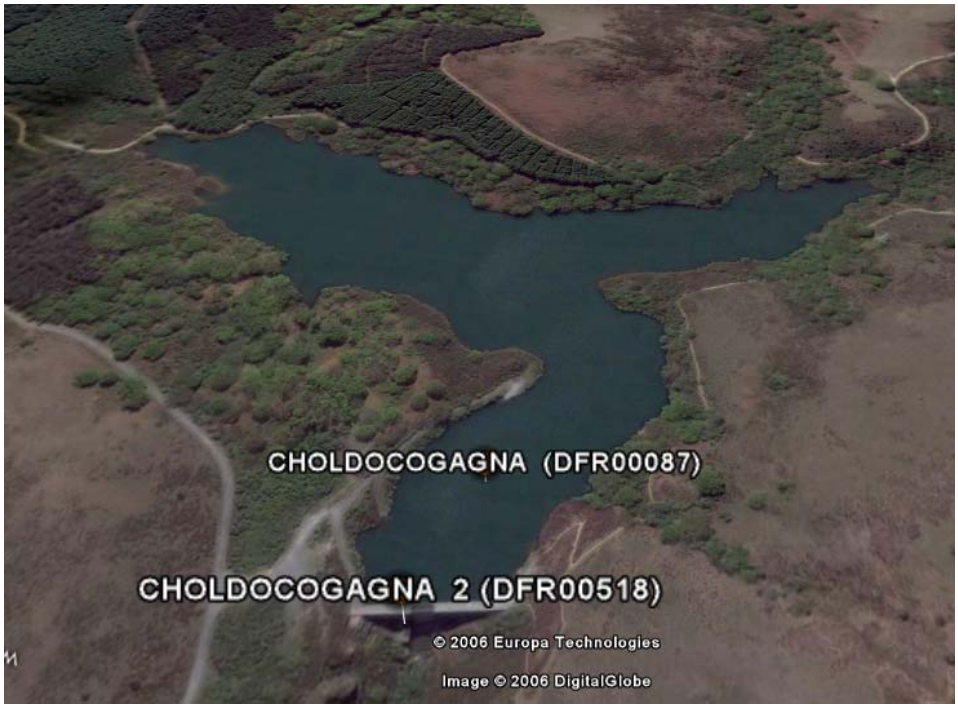

Figure 2: Cholodogocagna dam and lake (GoogleEarth image capture)

Special function of a dam inside a lake

Lake Naussac (DFR00427) has been created by a dam commissioned in 1981. A secondary dam, Mas d'Armand, has been built inside the main lake area to create a permanent capacity. This configuration is quite common, although not simply represented in database. Most secondary dams contribute to the capacity created by the main dam. This applies as well in this case, since secondary dam is a share of the total capacity and not a supplementary volume.

Figure 3: The Naussac lake with reference to the Mas d'Armand submersed dam

The analysis leads considering that:

1. Naussac is a main dam creating a lake,
2. Mas d'Armand is a secondary dam related to Naussac, which capacity share to the Naussac reservoir is its proper capacity, not to be added to Naussac lake capacity.

Settlement tank dam and lake

Montbel (DFR00466) is used to settle quarry sterile and wash-outs. It is not on a river. The same situation is observed for Berrien 7 (DFR01004) and Berrien 8 (DFR01005) that store kaolin quarry refuses.

Dam under sea level

Port-Miou (DFR00390) is a dam under sea level, used to prevent mixing between Mediterranean sea-water and fresh water inside a large karstic cave.

Dams as potential obstacles

Icold source data identifies 8 categories of dam and reservoir use but does not address dams and their depending lake as obstacles.

This issue has to be considered from a generic and from the individual structure points of view.

The generic point of view analyses the potential obstacle in the absence of other data, just analysing the characteristics. This information is just depends on dam main features and is always populated.

The structure related point of view details, where information is available, the actual possible impact of the structure, including the specific operating rules that allow mitigating the possible impacts. This information is populated only when it is available and which is are catchment and specie depending.

The potentials are simply coded from 0 to 7 from the 3 different targets because there is at the end 8 possible cases that have to be considered, as reported in Table 1. The selected code is additive and is worth 0 when the potential is missing, 1 for Fish, 2 for Sediment and 4 for Hydraulics. Considering the potential functions as obstacles of the different cases exemplified above, it comes. However, these case are time depending, since modified dams have changed their obstacle making potential with time.

Table 1: Potential functions of dams as obstacles

Dam case	Fish	Sediment	Hydraulics
Puentes III	Yes	No	No
Puentes IV	Yes	Yes	Yes
Choldocagagna	No	Yes	No
Choldocagagna 2	Yes	Yes	Yes
Naussac	Yes	Yes	Yes
Mas d'Armand	No	Yes	Yes
Montbel	No	Yes	No
Port-Miou	No	No	(no)

Decommissioned or destroyed dams

Dams happen to be decommissioned and voluntarily destroyed, or accidentally broken, the valley being reopened in both cases

Eldred2 handles the year the dam or the lake has ceased functioning as dam or existing a specific lake. For the time being, only few dams have this field populated. Management principle is that a decommissioned dam is erased; hence the lake disappears as well. This option should be checked and, if necessary the database adjusted in consequence. In fact, many decommissioned dams may continue existing and hence constitute obstacle.

The major problem in this case is twofold:

- The dam present in the source database is not considered as discontinued (sometimes this information appears at the validation phase, for example the Kernansquillec dam, DFR00059, destroyed in 1996), and no longer making obstacle of any kind
- the destroyed dam is not present in the source database, precisely because no longer existing at the time the database is updated (example the Malpasset[7] dam in France, which breaking made a terrible catastrophe in 1959, causing hundred of deaths) or because it was not a "large dam" despite posing problems (example Maisons-Rouges and St Etienne de Vigan[8] in France).

A decommissioned or destroyed dam may still constitute obstacle to some extend. The example of the Malpasset dam suggests that a destroyed dam may stillconstitute an obstacle to fish (this is not the case for the Reyran brook because this river is not habitat to fish being out of water 9 month per year), but indicates that the database structure must consider the case as possible. Figure 4 shows the current state of the ruins.

This is all the more that situation for smaller dams for which little documentation is available. When relevant, records are created in the database to ensure historical accuracy of the equipment and changes in river infrastructure.

[7] http://www.ecolo.org/documents/documents_in_french/malpasset/malpasset.htm (checked 10/08/2006)
[8] http://www.rivernet.org/general/dams/decommissioning/decom3_f.htm (checked 10/08/2006)

Source: image capture from "géoportail" http://www.geoportail.fr/

Figure 4: The site of the Malpasset dam showing the potential obstacle made by the ruins.

Important dams not recorded in major dam registers

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Figure 5: The lago di Garda and the Salionze dam, huge potential despite "non-large" dam

Considering the potential uses of the database, the issue of completeness (at least representativeness) of data source is a very important question It is assumed that the Icold register on large dams provides major impoundments and does not discard any. During the update of the coordinates of the Italian dams, and matching data from the Icold source on the one hand and "Registro Italiane Dighe[9]" on the other hand, the missing dam of Salionze (alt: Valsecca) on rio Mincio, in Lombardia was identified. This dam, 6.9 m height, commissioned in 1950, does not meet Icold criteria for inclusion in the register. However, this dam regulates the largest Italian Alpine lake "lago di Garda". Its size is 370 km^2 and it volume 50.35 billion m3.

The usable capacity created by damming ranges between 2027 and 400 hm^3. This suggests that the level change may range between 5.5 and 1.1 m (rounded figures) that are in the range of dam height. The larger volume mentioned above is more than twice the second larger volume mentioned in Italy as impounded resource, making this inclusion in the database very important.

In this case, the dam does not change the sediment trapping bit may act as fish barrier.

[9] Of which the list on the Web at http://www.infrastrutturetrasporti.it/page/standard/mop_all.php?p_id=04029&PHPSESSID=86740d9c4465888eb79504b1b5288a0b

Major lakes are more or less managed and the associated dam not recorded as “large dam”. The example of ”lago di Garda” strongly suggest that adequate investigation should be done to populate the database.

3.4 Definition of Dam coordinates

A dam is a large object, which is conventionally represented by a point at the operational scale of computation, which is in the range of 1:1M to 1:250,000.

The operational coordinates are those that define the point in the centre of the dam wall intersecting the river represented by a line. If no river exists, the river line is substituted by the outlet canal, the centre of the valley, etc. this is illustrated by the examples taken from the Web DamPos service.

Three sets of geographical coordinates with increasing confidence in their accuracy are managed. Each coordinate pair (X= longitude, Y latitude) is in decimal degrees; the used reference geode is WSG84. Longitude coordinates at the west of origin are marked as negative, coordinates south of the equator (dams in overseas possessions of European countries) are marked negative as well. When missing, they are replaced by the joker value of -32768, value chosen because clearly outside the ranges -180/180 and -90/90 of possible coordinates. The final accuracy that is aimed at is the nearest second[10]. Checks show that the distance between the river line and the dams point is often less than 100 m. Considering the size of the dam, the error in positioning and the fact the river width is considered as zero, the practical accuracy is very acceptable.

Coordinate accuracy is scored from 4 (worst) to 1 (best). Score 1 is reserved to validated coordinates, the validation being possible only thanks to DamPos application.

The three sets are the following in Eldred2:

1. Original dam information producer coordinates (e.g., Icold, Eldred, etc.) are named `X_0DD` and `Y_0DD` ('DD' states for decimal degree). If populated, gives score 3, otherwise 4 and coordinate pair is set to joker.
2. EEA obtained coordinates (e.g., collected from Web sources, assesses from nearest city coordinates, provided by external collaborators, etc.) are named _EEADD. If documented gives score 3 otherwise (or 3 if _ODD is documented)
3. Final coordinates, after validation or proposed as validated because supposedly accurate, are named FDD. Final coordinates after validation in DamPos are confirmed by the flag `is_Validated` in the database. Documented coordinates from external sources gives score 2 that turns to 1 confirmed with setting the `is_Validated` field to True. Score 2 is the standard value for official coordinates provided by any trustable provider (e.g. national dam office).

[10] 1 degree is 3600 seconds. Earth’s circumference is (average) 40040 km, 1 second is (40040*1000)/(360*3600) = 30.9m~31m

Figure 6: Examples of dam coordinates.

Left, with river (Villerest, DFR0460, on the Loire river, upstream the city of Roanne), right without river (Castrejon, DSP0462, on a canal close to Tajo river, North of the city of Toledo). In this later case, the dam is at the start of two canals and does not constitute (apparently) an obstacle.

A volatile default value centred on the country is used into DamPos to display dams having all its coordinate values to joker. Scoring allows sorting dams per rank of coordinates quality and quickly identifying where location efforts have to be done.

3.5 Purpose of obtaining dam coordinates

The major use of coordinates, from EEA point of view, is to place the dam on the river, attach it to the lake it makes and produce basic data for computing relevant information on dam incidence of the river system (e.g., computing fragmentation indices: catchment fragmentation, sediment transport changes) that are depending on transversal obstacle. A dam is generally perpendicular to flow direction, with exception of those dams that are dykes and are considered as secondary dams (as discussed in definitions). The coordinates are required:

- To make it possible to link the dam at the correct place on the river. To this end, main dams and secondary dams can be functionally represented by a single point.
- To identify, liaising with data provided in the data bases, dykes participating to damming (many examples exist on the Rhone river, in the Netherlands, in Spain and in Russia) but do not transversally fragment the river system and should not be considered as such.
- To correctly identify the river on which the dam is and discriminate artificial canals. For example, canals and diverting canals are not the targets of fragmentation indices. If the dam makes a lake, it is important to locate it anyway, but to flag the fact it does not contribute to fragmenting river systems.

A second use is displaying the dams on the map, for public information.

3.6 Scheduled improvements

The definition of “large dams” is not operational for assessing dams and lakes impacts. At the GWSP level, it was agreed during the last workshop held in 16-17 May 2007 that the notion of “dam that matters” should be substituted. Several criteria were analysed, albeit it is not yet possible to implement them.

Next exploitations of Eldred2 and of the attached fragmentation module will be carried out to populate criteria thresholds and end-up with a customisable approach to output “dams that matter” under certain goals and threats.

4 Structure and use of the Eldred2 application

The Eldred2 application consists in two databases. The database Eldred2 proper is a local database which elements can be publicly viewed and updated with the DamPos facility. DamPos handles a copy of the relevant tables of the Eldred2 database and Web services which outputs are used and required by the Eldred2 database.

4.1 The DamPos facility

DamPos (Dam Positioner) is a web-services based tool developed to **validate** dam position. It has been designed with the view that the final validation should be given by an expert. The envisaged experts are in principle Icold national correspondents, that are the best informed persons capable of adjusting, and possibly verifying, the information originally contained in Icold register.

However, different users are used the application; a large share of dam positioning have been carried out by Dr Röedel (Griefswald University) and by M le Delliou (French Icold focal point) along with the author.

To this end, a DamPos record is a temporary copy of a view from Eldred records. DamPos editing possibilities are restricted to:

- Final coordinates,
- Presence of dam on a canal (not in Icold register) or if dam is a dyke (parallel to the river or secondary)
- Comments, where any relevant information can be inserted.

Experience has shown that the original purpose of DamPos is too restricted: a validation tool understates that at least proxy coordinates are available. If otherwise, validation is virtually impossible. An adjustment allows DamPos to be used to guess proxy coordinates that would be harvested as seeds and further validated. Examples of major DamPos features are summarized in **Error! Reference source not found.**.

4.2 Relationships between DamPos and Eldred2 database

The main database is Eldred2 which structure is built to answer the main issue of spatial integration of dams and lakes in the assessment of river systems assessments.

DamPos and Eldred2 databases are related on demand only for security reasons: modules in Eldred2 allow harvesting DamPos and uploading DamPos and DamPos-demo. This second application is just for demonstration: modified locations of dams are not harvested. DamPos uses Web services: Google Earth®, CCM, TeleAtlas®, and where available, scanned maps.

The physical separation between Eldred2 and DamPos has the following consequences:

- Newly entered or updated dams / lake /river information into Eldred2 is unknown by the Web application until it has been uploaded from Eldred2.
- Newly validated coordinates are unknown to Eldred2 until the Web database has been harvested. For the time being, data related to dams cannot be edited with DamPos; only comments, coordinates and two flags are editable. Information inserted through comments must be analysed before updating the Web database from a previous updating of Eldred2.

Consequently, there may be some difference at a certain moment between the content of Eldred2 and DamPos databases.

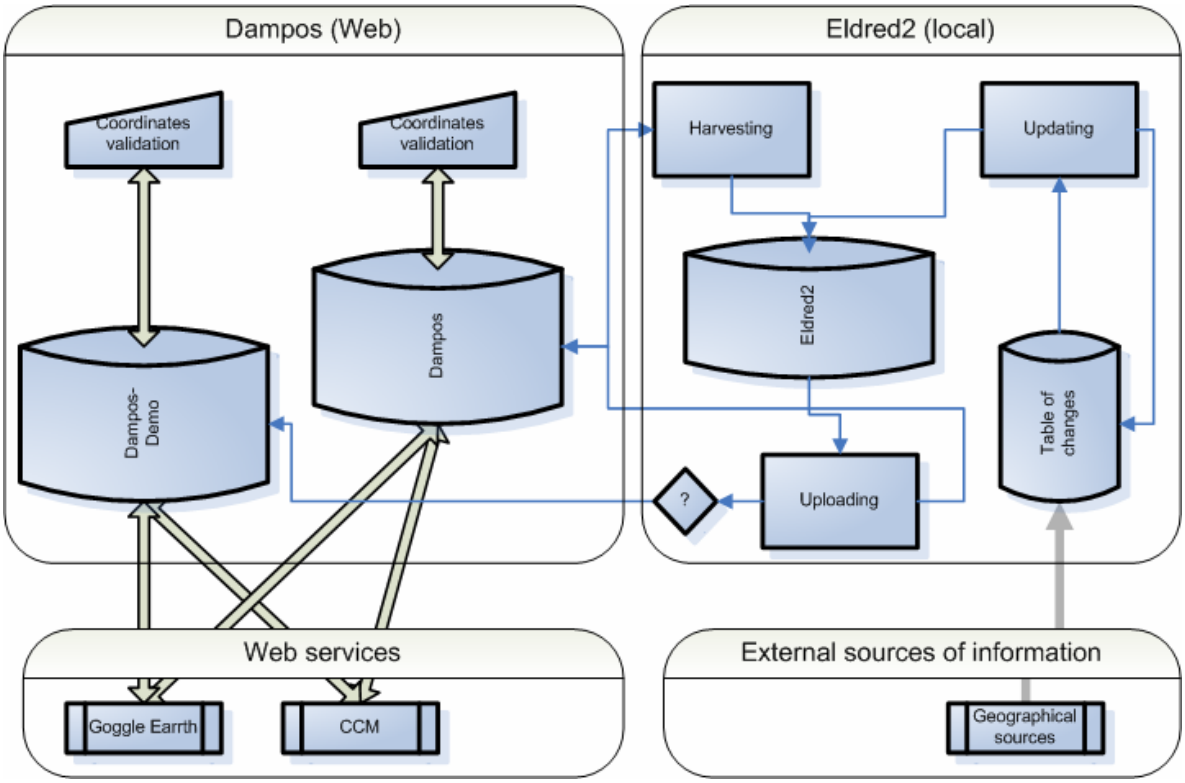


Figure 7: Relationships between Eldred2 and DamPos

4.3 Conceptual model

4.3.1 Eldred2 conceptual model

The Conceptual model described here refers only to Eldred2 database, that is the source of information. The conceptual model proper is very simple. It is reported as graphics in the next Figure 8. This Fig. reads as follows:

- A dam is a wall, hence only information related to this wall are stored in dams related tables[11].
- A dam has fix information (it is somewhere, has a name, etc.) and time variable information. Time variable information are considered at the conceptual stage because the artificial lake is as well time-variable and related to the different states of the dam.
- A dam can be main object or attached to a unique main dam. A main dam may have several secondary dams attached to it,
- A dam is a point structure that is potential obstacle. Potential is possibly time-depending because the dam structure may change and result in different potential.
- A dam is on a river (but may be off a river)
- Lake's existence results from a maximum of 1 dam at a certain date; a lake may have no dam attached and the **creating dam can change**. The physical data attached to the lake are unique for a certain date (for example, total volume and z/V relationships). A lake may successively be related to no dam, to a dam, to the same dam with changed characteristics,

[11] However, specific reservoir volume data related to the created lake can be attached to secondary dam to keep trace of the volume share that is attributed to the secondary dam (see data model section)

to another dam and again to no dam. A lake which creating dam changes is exemplified by Figure 1and Figure 2 above.

- A lake is related to no, one or several rivers
- Obstacles are loosely related to dam for several reasons that lay in the specific nature of obstacle and the fact that "obstacle" relates to the target impacted. The following rules should be considered:

  1. Any dam is in principle obstacle, the target may change with equipments, hence this is document in the variable part of dam information; a 'dead' dam is no longer obstacle to sediment and hydrology if the lake dies in parallel
  2. A "dead" dam can be obstacle, partial obstacle or no obstacle. Hence a 'dead" dam is considered obstacle unless otherwise indicated, a 'dead' dam which lake has died is obstacle to fish if not otherwise documented
  3. If special equipments are in place to mitigate the fragmentation of an operational or decommissioned dam, they should be documented especially. Since this is the exception, the data model sets a separate information may represent no obstacle if adequately equipped or managed

  Consequently dam existence and constituting obstacle are documented separately, which is addressed in the data model and described according to the available data.

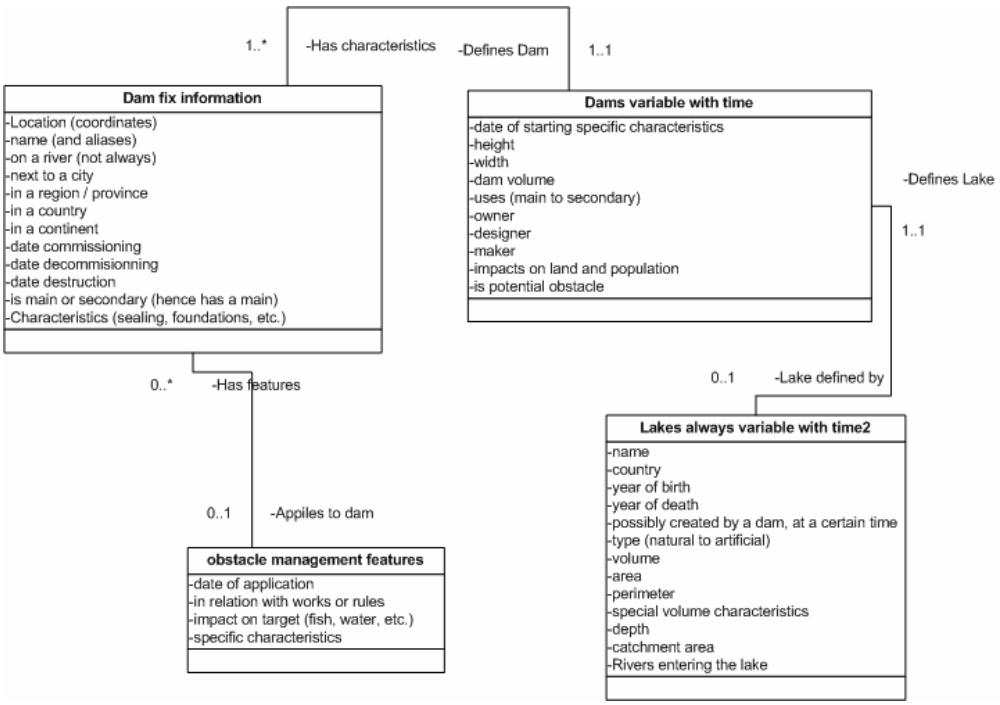


Figure 8: Eldred2 conceptual model

4.3.2 Relationships with Rivers & Catchments database conceptual model

Eldred2 conceptual model describes only the dams and attached lake information, as stand alone database. This status was imposed by the lack of relevant Rivers & Catchments database on the one hand and FWD "water bodies" on the other hand at the moment the Eldred2 database was started. The current Eldred2 structure is therefore the outcome of a partly interim design. However, much effort was devoted to make this structure compatible and "pluggable" the GIS infrastructure of the EEA.

The Rivers & Catchments database model is described in a separate report (ETC/TE and EEA, 2006). A specific feature of the data model had to be updated because the implementation makes it necessary. The original design considered that the elementary catchment area could be drained by a maximum of 1 river segment. In practice, this requirement would lead to a too large number of tiny catchment that could be neither *accurately populated* nor *practically processed*. Hence the elementary catchment definition allows several drains, provided that a unique outlet is kept for the newly defined elementary catchment.

Practical difficulties in building the data set and fragmentation module development led to changing the Rivers & Catchments database model and postpone the attachment to reaches since dynamic segmentation proved more effective when considering the large number of small dams that should be processed.

4.4 Data model

4.4.1 Data model principles

The Eldred2 data model comprises more tables that the ones sketched in the conceptual model to handle confidential data, log of updates and practical issues. The 2006 application derives from Eldred database which data model was very comprehensive (**European Topic Centre in Inland waters, 1997**). The Eldred2 data model has been simplified by suppressing all ancillary tables related to documentation, water quality, etc. that are no longer useful because they will be replaced by specific tables in the platform and in the spatial infrastructure.

In particular, were eliminated:

1. observation data, that are handled at the SPAICE[12] or WaterBase levels,
2. bibliographic data that has been abandoned,
3. catchment data that is handled by SPAICE.

By contrast, many new features have been added:

1. tables acting as entry and logs of updates,
2. tables handling the adding, update and management of main tables,
3. tables handling the fish, sediment and hydrologic functions of dams acting as obstacles

Reference to river is not accurate (see section related to rivers). This relationship is kept top host river name until a Rivers & Catchments database (ERC2[13]) becomes available.

It applies on two MS Access® files; E_Eldred2 that hosts the main tables and the application facilities and E_Eldred2_work that hosts temporary tables and the intermediate data to be loaded (E_ states for European level, to distinguish from possible country applications).

By contrast, the information related to dams, lakes and their history has been completed, namely to cope with the new Web positioning facilities. Whenever possible the table names have been kept from Eldred, adding '2' at the end.

4.4.2 Coding

All objects are coded with a semi-significant code derived from Eldred. The code is not perfect and is a compromise between effectiveness and practicality. It comprises three sub-units:

[12] SPAICE stands for Spatial Platform for Assimilating and Integrating the Characteristics of the Environment.

[13] A new design of the ERC (European Rivers and Catchments) inserting topology and routes is underway

- One character (uppercase) root 'D' / 'L' respectively for Dam or Lake. The special code R for "reservoir" has been discontinued in May 2006 since a lake may be natural and then artificial.
- Two characters (in uppercase), the ISO code of country of belonging. In case of international objects, a flag indicates the existence of other country(ies). The two characters ISO code has been considered because its use is free of duties to ISO. The 3 characters code, more explicit should be used only under licensing, which use would breach the open data dissemination policy of the EEA.
- Five numeric characters (from '00000' to '99999'[14], being the sequence number of the object, given in the order of coding. Codes are NOT reused. A decommissioned and destroyed dam remains in the database, its `year_dead` field being updated, an erroneous record is purged and the code not reused. Non-reusing is ensured by the `LogmaxCodes` table that is populated only when new records are being added. Codes may happen to be skipped, for reasons related to simplifying the procedure of adding new records, especially in the case of lakes attached to reservoirs.

4.4.3 Relationships

For different practical reasons, there is virtually no relationships set into the database, under MS Access® facilities. In particular, referential integrity **has not been enforced** between all tables. It exist only between Dams2 and its three depending tables. The reason is that the one to many relationships are not set automatically because the irregular obtaining of the required information to create and update record.

4.5 Main tables and data model

4.5.1 Simplified Data model

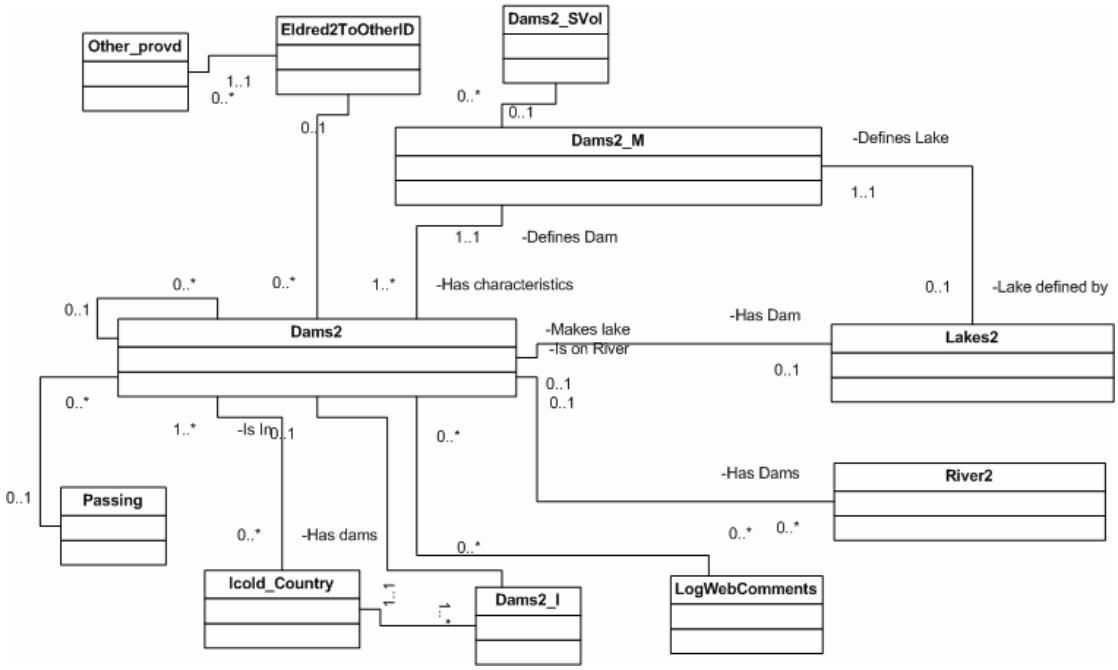


Figure 9: Relationships in the Eldred2 application (V 2.08)

[14] Recent data suggest that this might have to be raised to '000000' to '999999' especially to secure the non reuse of abandoned codes.

As displayed in the Figure 9, table Dams2 is the central database. Detail of fields in technical tables `Dams2_M` (for Main) and `Dams2_Svol` (for secondary dams share of capacity and Lakes2 is in Appendix 1. tables are only represented as block, attributes being detailed in the appendix.

The key to Lakes2 is `CD_Lake`; the relationship with Dams2 NOEEA ↔ NOEAA[15] is populated in the event the lake is made by a dam.

Field `is_historic` in `Dams2_M` makes the room for different stages of table (only `Dams2` is not historicized). In this, later case, field `year_first` indicated the first year of commissioning and if the first year is from Icold register. This is not systematically the case because some Icold member countries update the year of the dam at the last modification of the dam. This is in relation with the current Icold register structure that allows only one line per dam; the latest update crashes the previous data in many cases. This has been observed when updating the Eldred database with new data from the 2002 release of the Icold register.

Table `Eldred2ToOtherID` keeps track of objects ID from other providers that are coded in the `Other_provd` table. This allows as well exporting results to any recorded correspondent and providing him his ID with the Eldred2 ID. A single `NOEEA` coded object may have as many entries as correspondents process this object in their own databases.

The values of scoring and validation status are computed and copied from the Web database, according to rules defined in section 3.3.3.

Some efforts should be made to consider previous releases of the World Register of large dams to populate the dams having had significant changes along their life.

4.5.2 Standard joker values

The concept of "joker" values helps populating tables and processing data unambiguously when data is not available.

Numeric data may be ambiguous because empty fields are considered as zero (0) by MS Access®. The selected joker is -32768. In some cases, zero values may be joker, if they come from sources in which the zero means 'absence of data' but is not documented as such.

In alphabetic fields, the joker is the empty field, because this is not ambiguous.

4.5.3 Eldred2 main tables description

The Eldred2 database comprises the following main tables:

1. Table Dams2 that identifies a dam and it location. Data in Dams2 is partly coming from Icold and partly added by the EEA. It comprises only information understood as public. A set of Boolean fields indicate the different sources of the dam record. Key is Dam code only.
2. Table Dams2_M (for main) that comprises all the technical information on dams, with the possibility of historicising it, most of information comes from Icold register, with duplication of fields that may have alternate sources. Key is dam code + year . The flag (`is_historic`) points to historical records.
3. Table Dams2_SVol[16] that contains volume information attached to secondary dams. Volume information of the lake is in Lakes2, but the share of volume related to a secondary dam is stored in this table. Key is dam code + year.

[15] To simplify queries, dam code is NOEEA in dams database and NOEAA in Lakes database.
[16] The April release of Eldred2 had a `Dams2_S` table that has been suppressed because it contained only redundant / calculated information from Icold export table. `Dams2_SVol` is NOT related to the former `Dams2_S`.

4. Feature 'Passing' designates a set of tables in relation with fragmentation. There are tables `P_fish`, `P_sed` and `P_hydr` to deal with the main fragmentation issues. Three tables are considered to avoid inconsistent structures and the different time relationships that they may have. Key is `dam code + year + specie/target`
5. Table Dams2_I that stores information on the international dams. It comprises dam code, country code of first quoted country and one record per supplementary country. International dams are flagged by `is_International` into the Dams2 table
6. Table Lakes2 that comprises all the technical information on lakes and their function as reservoirs attached to dams, with the possibility of historicising it. Like dams2, only a part of fields come from Icold register. Lake information is identified by lake code + year. The latest year (closest to present) identifies the most recent update of data. The flag (`is_historic`) points to historical records.

   A major difference between table `Lakes2` and `Dams2_M` is that the latter is strictly bound to `Dams2`. By contrast, `Lakes2` is weakly bound: a lake may have no dam; a lake may change its dam relationship. For example, the complex following sequences is possible:

   > **Y0 no dam → Y1 dam1 → y2 dam2 → y3 no dam, indicating that lake, initially natural has been dammed by dam1 between Y1 and Y2, where dam1 was replaced by dam2, decommissioned in Y3, making lake returning to its natural state.**

The DamPos database main table is `public_dams` that mirrors the ad hoc fields from the four main tables and some ancillary tables, presented for the most recent year is several are available.

To preserve the traceability of data source, Icold fields are named `ic_[informative name / Icold register name, simplified`[17]`]`.

The main tables will be turned into an ArcGis® geodatabase, when version 3 has been developed, hence having GIS objects attached to the tables. These fields are not described in this current release. This will not change the structure of the application: only the geographical attributes will be added to the tables where appropriate.

4.5.4 Dates meaning

Date issues are extremely complex, because lack of common definitions and full encompassing of the different dates that matter in any dam's life. The following dates should be considered, but simplifications have to occur because the lack of data:

- Date of construction building. This date represents the starts of river fragmentation. It is generally not known.
- Date of commissioning, this is the date when the dam starts its operational life. The information is generally present and stored.
- Date of first full filling of the lake. This date is generally unknown, and can differ by several years from commissioning date. It is assumed to be equal to commissioning date.
- Date of major changes in structure, equipment, heightening, change in function. When available, the dates make secondary records.
- Date of decommissioning, this date often corresponds to destruction, but is more likely to be the end of official life of the dam, when operating ceases. It is assumed to equal to destruction date, but recent data suggested that decommissioned dams could still be present and constitute obstacles.

[17] Icold exports tables with column names that are captions and not variable names.

- Date of destruction, is would seem obvious that a destroyed dam is no longer obstacle of any kind. This is certainly the case only if the wall has been erased on this purpose. Accidentally destroyed dam by still represent obstacle as well.

As a conclusion, and considering the available (even existing) data, only the following dates (rounded to the year) are considered in the application:

1. date of commissioning, i.e. the year the dam started to exist. Two different values are processed in the main dam record: `ic_year` and `year_first`. `Ic_year` is the source field populated (from Icold source in most cases) and copied into `year_first` that is used to exploit the database. This later value is often modified and a flag is then set to TRUE. Unknown values are set to joker -32768. For example, external information present dams with no starting date and decommissioning dates. In this case a standard duration of existence of 50 years is assumed until better information.
2. date of decommissioning, this field is named `year_dead` because this even often relates to dam destruction. This field can be mirrored in table Lakes2, but the lake can be kept even if dam is decommissioned. In this case a lake may continue exisiting despite its creating dam has been set as "dead". The dating rule has been adjusted (because new data) during the development of Eldred2 and will be reformulated and checked in a further stage.
3. date of changes, that result in significant modifications of dam or lake, this is handled by supplementary records in Lakes2 and Dams2_M tables,
4. date of specific passing changes. Passing may be set free after the dam has been destroyed (as supposedly specified by setting `year_dead` to non-joker value). This is the default information. In the case the decommissioned or destroyed dam still makes obstacle, with different passing possibilities (including full passing) this is specified in the corresponding passing table. In principle, a **dead dam no longer making obstacle should have a record in this table to confirm the free passing**.

All dates are understood as from date included until next date excluded or present. For example, 1750 and -32768 means from 1750 included to present. If a record in the P_x table sets a value in 1980 this means that the dam was obstacle from 1750 included to 1979, and that new passing characteristics are applied from 1980 included to present.

4.5.5 Date and issues in relation with commissioning year uncertainty

When a new record is created, ic_year is populated and year_first copied from it. The depending records in `Dams2_M` and `Lakes2` are created accordingly. The value in `year_first` must match at least 1 corresponding record in `Dams2_M` and possibly in `Lakes2`.

The commissioning year is updated if information is provided in `DL_otherdata` update table (Icold data) or in the loading data set (other sources).

Two sources of update of this `year_first` field are processed in Eldred2:

1. when processing the comments, historical data is created and the first year of commissioning is set to the earliest year inserted. As many supplementary records are created in`Dams2_M` and `Lakes2`.
2. when external source of data provides correction

Problems of desynchronizing may occur at this opportunity. If a dam record is updated from external source before its historical data has been inserted, the records created in Dams2_M and Lakes2 may become orphans because their values in `c_year` point to `ic_year` (intitial value, by definition) and not on `year_first` that has been updated. This happens all the more because comments processing is a manual task that cannot be automated.

Year of commissioning is synchronised when entering new records. When updating from external data sources, the synchronisation may disappear. The problem is acute only if historical records currently exist, because there is a risk of having duplicate records and create a run-time error, otherwise updating the year is obvious.

The code has been written so that such problems should not occur, but errors in manipulating the tables (that are unprotected) could nevertheless result in desynchronising. Hence, a utility for listing the desynchronised data has been implemented and the update from external sources checks the possible desynchronising, but does not solve all possible cases.

4.5.6 Data ownership

Data ownership is a complex issue that cannot be both fully traced and be simple to trace. The reason is that some sources consider the information on dam X as confidential whereas another consider it as public. The principles that governed the development and data model are the following:

- Data provided by Icold is marked as Icold.
- Data provided by other sources is marked as from other source, disregarding the source because a same dam may have several sources.
- Data from the reporting under the Water Framework Directive is marked as such.
- Data is understood as publicly available (under the data ownership limitations) unless specified as restricted. This applies ONLY to "other" source" and provided no source provides public data[18] on the SAME dam.

Data sources may be multiple. A dam may be Icold and other and WFD. In these cases, the lesser restrictive data provision rule is applied.

The handling of sources is made at data entry and during the updating phases. To this end the list of data providers is marked by flags.

Ownership rules are defined by the "less demanding" criterion, expressing that a data that is public for one source and non-public for another is public.

Table 2: Ownership decision table

Icold (is partly public)	WFD (is public)	Other (is public, unless otherwise)	Restricted (defines other ownership rules	Ownership
yes	No	yes	no	public
Yes	No	No	No	Is Icold rules
Yes	Yes	yes	(yes)->no	Public: WFD AND Icold supersedes restriction
no	no	Yes	yes	restricted
no	Yes	yes	(yes)->no	Public because WFD supersedes restriction

Ownership rules are processed and updated at the moment the lines are added or updated.

4.6 Ancillary tables

The Eldred2 application comprises several ancillary tables that are part of different groups of functionalities. Ancillary tables comprise reference tables, tables used to trace movements and updates and web application tables.

[18] Public information is understood as such if any person can reach it by permitted means. For example, getting information on a public web site is understood as public an information published in any "non-grey" document.

4.6.1 Reference tables

Reference tables in the Eldred2 database are:

1. Table `Rivers2` that host river names and links with the river codes. This table is provisional until the final ERC2 database is available. This table may contain potential duplicates because the source of information is the Icold register. Some rivers have different spelling because a) national names differences (e.g. Oder / Odra), b) typing mistakes (e.g. Afon Syfnwy / Afon Synfnwy). This table is used to facilitate calculation of number of dams per river etc. Results are obviously questionable because the river system / catchment is not provided for the time being. It should be completely revised with the development of the Rivers & Catchments database.
2. Table `Icold_country` that lists country from where dams are archived in the Dams2table. Countries are presented according to the freely available 2-digits ISO codification and associated country name (in English). Countries are presented with different spellings when required by data maintenance and data adding. The non-ISO spelling is indicated by a flag. Countries with correct ISO spelling are marked as well as EU and EEA countries to ease the data processing.
3. Table `Other_provd` that lists the providers of external information that is stored in `DL_Otherdata` table). The providers are coded as `code_Other` and their references stored. This table allows as well identifying the source of alternate object codes.
4. Table `Eldred2ToOtherID` stores, when available, the relationships between an Eldred2 object code (Dam or lake) and code from other provider, with `code_Other` as link. This table is used to accompany data exchanges. This table is populated when updating Eldred2 from external data
5. Table `Contact2` that lists the contact persons allowed to edit dam data (mirrors the Web service table `public_users`)
6. Tables `RefDamType`, `RefPurpose` and `RefWatertight` refer respectively to the dam type (as described by Icold plus addings related to non-large dams), dam purpose (as described by Icold plus addings related to non-large dams) and water tight features (as described by Icold plus addings related to non-large dams).
7. Table `Ref_ThresholdsFSH`. It contains only 3 data of dam height respectively referring to fish, sediment and hydrology. When loading non-large dam information, the value of `obstcode` is set to the most likely value according to the height of the dam. Where the height is unknown, the dam is understood as impassable.
8. Table `C_Fish` contains calculable information about migratory and resident fish (European Environment Agency, 2007). Fish is considerd as specie and age stage as well as anadromous / catadromous and resident. This table is used to produce the medelled data for fish migration. See 5.4.8 for details.
9. Tables `maskImportIcold` and `maskImportNonIcold` respectively store temporarily all data to be imported from Icold type and non-Icold sources. They are stored in eldred2_work database. The populating of the second may be quite complex because the different sources have generally their own data structure and metadata implicit.

4.6.2 Obstacle codes

From the V5.0 onwards, obstacle codes are entered with the stepwise inserting of non-large dams (and further documenting of large ones) from fish surveys sources. The complexity of obstacle passing an the one hand and needs for generalisation of fragmentation procedures lead to consider a total of three levels of documentation.

1) First of all, the generic obstacle already presented pinpoints the dam as potential obstacle. This makes no judgment of its actual barrier function. This code serves to select or discard the dam from further examination in the fragmentation calculation procedure.

2) The passing code is a numeric code that states the difficulty (from 0= 100% transparent) to 5 (impassable). The grading and the meanings are reported in Table 3. the code grading comes from the French *Conseil Supérieur de la Pêche* (Conseil Supérieur de la Pêche, 2005b). The passing codes are part of a manual assessment of migrating conditions along a route. Their processing, according to CSP recommendations achieve in producing impact note, because the addition of passable obstacles is more or less equivalent to a lesser or impassable obstacle at the end.

3) The detailed passing parameters attempt capturing the cumulative characteristics and compute them for any time windows, which is not feasible with the manual method mentioned above. For more detailed calculations, three parameters that may have values in the downstream to upstream and upstream to downstream directions have been recognized by the ETC/BD and experts from the Muséum d'Histoire Naturelle (MNH):

   - ✓ "permeability", expressing the % of fish (or any passing item) that can pass through the obstacle. It is a multiplicative parameter
   - ✓ "delay" is the average time in weeks required to pass the obstacle (can be tuned by hydraulicity). It is an additivce parameter
   - ✓ "fatigue" expressing the quantity of non-renewable resource (or physiological status consumption) needed to pass the obstacle. This is a subtractive parameter

Table 3: Passing codes (as documented by CSP)

Code value and colour code	Definition	Basic criteria	Equivalence if passing facility installed
0	No obstacle	Dam ruined, erased or not impacting	
1	Obstacle that can be passed without apparent difficulty	Free passing of fish is reckon for any discharge under temperature conditions that allow migration	Effective passing device
2	Obstacle that can be passed with possibility of delay	The work has negative impact when hydraulic conditions are limiting or if temperature conditions are adverse	Effective passing device, nevertheless insufficient to avoid delays in migration
3	Obstacle that can be passed with difficulties	Marked impact of the work in average conditions (discharge and temperature are favourable)	Insufficient passing device
4	Obstacle that can seldom be passed	The impact of the work is so marked that fish passing is possible only during exceptional conditions (hydraulicity greater than 2 or 3 fold the average inter-annual module)	Very insufficient passing device
5	Impassable	The work is impassable for fish in any conditions, including flood	

The given definitions are quite fuzzy and are in principle populated thanks to the use of an estimation grid that requires visual inspection and metering of the work.

This approach allows minimizing the data collection effort because the simplest data are populated from standard assessments, and more and more detailed information is provided when available. Equivalence is assumed between the generic codes and passing variables on the one hand and

between passing codes and passing variables on the other hand. The equivalences are part of the fragmentation module export module. They are presented in the "utilities" part of this report.

4.6.3 Logbook of changes

The following sets of changes are stored in specific tables to trace the changes and their origin.

a) tables in relation with DamPos operating:

1. table `LogWebComments` stores all the comments harvested from the Web service application, with the date of harvesting and information on if processed or not. Pseudo-comments resulting from dam editing are added as well, to ensure complete logging of recorded changes.
2. table `LogWedDamsReloaded` contains the history of the different Web tables, before reloading. This is default option that can be suppressed (in this case the Web table is replaced without archiving it). It is dated with reference to the date of harvesting.
3. table `LogWebUsersDamsReloaded` is a temporary table of the relationships between a dam and a permitted editor. This table logs the possible lost relationships when the Web table is reloaded. Until now this table is not a logbook of DamPos rights, but it is envisaged to keep track of these relationships in parallel with the content of the database.

b) tables in relation with Eldred2 management:

4. table `DL_OtherData` stores and allows input from it of information attached to dam or lake. Its use is to input data into this table and a function updates the tables and the web service (see section on operating the application). It works both as input table and log of changes table.
   A specific procedure to populate table `DL_OtherData` from the comments has been added. Each time a record is created in `DL_OtherData`, a flag is switched in table `LogWebComments` to mark that the comment has been processed.
5. table `LogDatesCreation` holds the latest date set into records being inserted from Icold or non-Icold source. This table allows deleting the latest inputs from buttons 21: delete last inputs and 25: delete last inputs. It contains only two fields respectively for Icold and non-Icold importing and is managed automatically.

The processing of this table allows as well deleting a dam from the database and keeping track of the deletion, with exception of the two buttons mentioned above, which are operated immediately after insertion to delete the lastly inserted records. Depending records on related tables are deleted as well.

6. table `Hist_ChangesData` contains the different stages of dams when several dates are to be used. When the changes are set to the target tables, a Boolean field is switched and indicates that this record is logged.
7. table `LogErrorsHistory` stores all records that had been submitted for insertion and that were already present in the database. It contains code, year, target table and date of try.
8. table `LogMaxCodes` keeps the codes per object to ensure non reusing of destroyed codes. It is updated every time a table is edited to prevent form duplicating codes.
9. table

4.6.4 Web application tables

The `public_dams` table is regularly harvested and copied to an intermediate table for processing. The structure of processing is designed to allow harvesting of information attached to dam (and not

just the coordinates) if this option becomes requested by the persons checking the coordinates to the table.

This table, `maskOfWebTable` is stored in the E_Eldred2_Work database. On request, the log of changes mentioned above will be set at this time. This table has the same structure than `LogWedDamsReloaded`, but its function is temporary and not logging, hence it lacks the indexing fields.

The table `public_metadata`[19] has a single function to allow locking / unlocking DamPos. If the field value is set to TRUE then DamPos cannot be logged on. This is useful to lock DamPos prior operating on it to avoid record locking errors. It use is reserved to Eldred2 administrator.

Since version V 2.08, the linking to the PostgreSQL web data base is checked. If either the link is not present or the linked user not administrator, the web database management functions are inhibited

4.7 Special tables

Table `NopHelp` stores the help text attached to the functions. The content of help text can be edited from the help display by the administrator of Eldred2, when logged to it[20]. Table inherited its name and uses as help from the NOPOLU *Système 2* help management procedures.

Table `NopHelp` is also used to store the database version. Code 0 of help is reserved to the version number that is displayed on the main form. NopHelp is as well used to document accurately the application reports. This is because the length of argument that can be passed to a report through a call is limited, code 1 is used to this end.

By convention, codes between 2 and 99 are normally reserved for programming, 100 to 999 are free and help messages have indexes from 1000 onwards.

	index	Class	
	0	Version	Eldred2 version 2.02x (August 2006) on dev.
	1	Label1	Selection of dams operating between 0 and 2099. Dams under construction excluded. Only
	2	Label2	
▶	1009	Eldred2	export results
	1010	Eldred2	This action harvests the dampos (Web) database and updates the Eldred2 database and add
	1011	Eldred2	Comments processing makes addifitonal lines to the standard update file used to change Eldr

Figure 10: NopHelp table structure

To allow the insertion of dam photography in the future, the table `damsPhotos` can store the path of the image attached to the dam. It is not operated for the time being.

4.8 Current workspaces organisation

Since version 2.07, Data and facilities are split out into the next workspaces, which names are given as examples:

I. Forms, reference tables, queries and modules are in the main `Eldred2.mdb`

II. Key data, tables `Dams2, dams2_M, Dams2_I, Dams2_SVol, Lakes2, DL_OtherData, Eldred2ToOtherid and LogWedDamsReloaded` as well as `P_Fish, P_Sed and P_Hyd` are preferably placed into Eldred2_Data.mdb workspace. All tables in `Eldred2_Data` have their structure copied under the same name + '_Structure' in Eldred2 main workspace.

[19] Table name is not in relation with its content.
[20] In version 2.06, all users can edit comments, the logging in at the start of application being not yet developed.

III. Temporary data, especially transient imports are in `Eldred2_Work.mdb`,

IV. Export data to fragmentation module are in `NOP_2exp.mdb`

V. Export data for other uses are in `Eldred2_DataExport.mdb`. This latter database comprises the main data tables, which name is complets with E for export (e.g. `Dams2` becomes `Dams2E`).

This organisation can be modified but is recommended to simplify maintenance.

To ease operation and data sharing, table `LogTableLinks` has been added. It comprises 3 fields:

- `Group`, corresponding to the group of tables, respectively “data”, “work” and “export”
- `Tblname`, containing the name of tables susceptible to be in external linked databases,
- `Currentpath`, giving the last path of connexion.

A new facility been added. First of all, when the main form opens it checks if the tables which names are in the `LogTableLinks` table are present or connected. If not, a message is issued indicating how many tables are missing before the main form is opened to strongly warn the user. Since not all links are required for usual processing, a four-box status has been included in the lower right hand side of the window (see Figure 11). Linked sets are in green, in red otherwise.

The procedure is not blocked in all components; hence processing with incomplete links may cause unexpected errors and programme collapse.

Second, a button has been added to the service group. It has been placed to allow linking the database to other sources, if required.

The programme analyses the links. If one link (or more) is missing in a group, the group name is set to red and re-linking is recommended. Other group names are set to green and re-linking is possible.

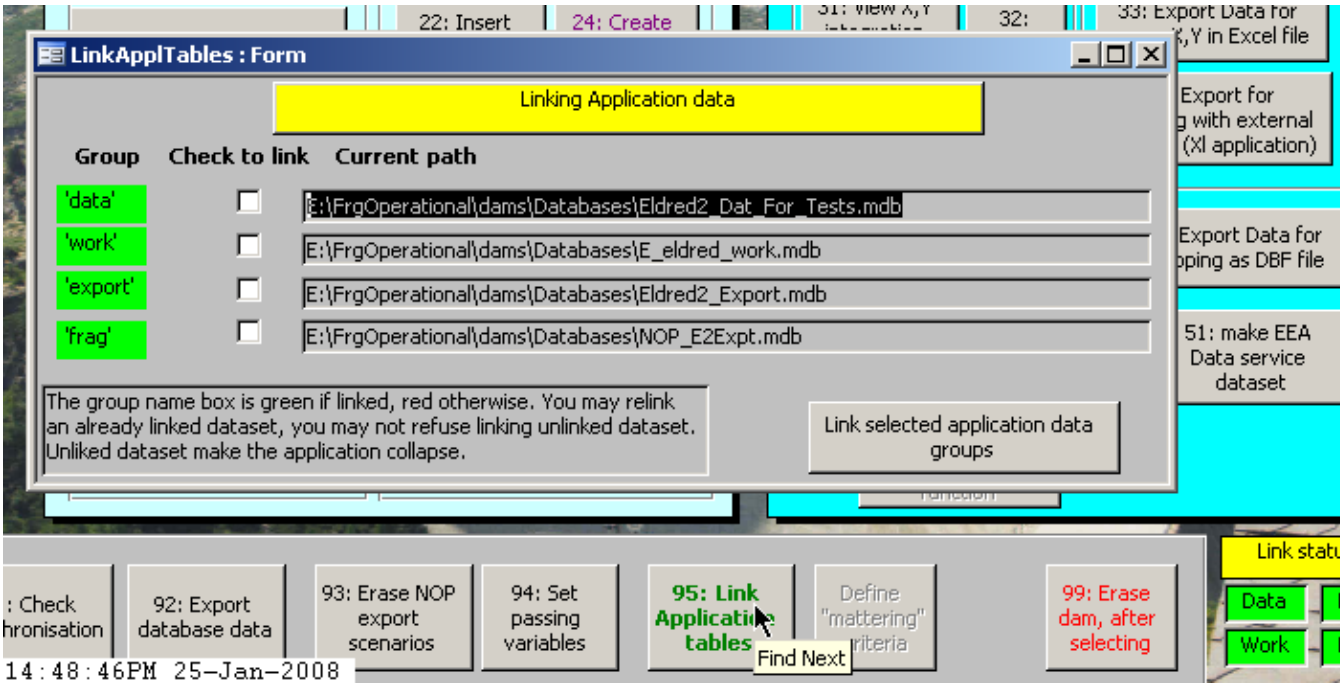


Figure 11: form to re-link the external sources

To link, for example, data group to another source, check the check box and press Link selected application data groups button.

As many selection forms open, one per selected group, to allow selecting the target database. Only MS Access® databases are permitted in this version. It is unlikely that the volume of data should require SQLserver facilities for example.

If linking fails, for at lat one file, an error message is displayed and a final message is popped-up.

Correcting the position of tables or their presence in the target databases is out the scope of this manual. In case of trouble, correct it with the application administrator.

4.9 Rules and facilities for updating the database tables

4.9.1 Recommended procedure

Since there is deliberately no active link between Eldred2 and DamPos, their respective contents are not synchronized.

To partly tackle the possible negative consequences of this totally effective security rule, it is recommended to proceed on the following order:

1. lock DamPos, (cancel possible updates during the operation time slot, that is a couple of minutes)
2. harvest DamPos,
3. update Eldred2,
4. reload DamPos
5. unlock DamPos (reopen to users).

The locking / unlocking of DamPos is incorporated in the processing code, it is recalled for making the steps more accurate. To minimise the time DamPos is not reachable, all updates of Eldred2 are made with prepared tables and programmed procedures.

However, if coordinates validation would happen during the time Eldred2 is updated, this would not harm: validated coordinates would just be incorporated to Eldred2 at the next harvest.

4.9.2 Updating rules

The update files can comprise data that is not the most up-to-date, because the sources of this information are random. Hence, some precautionary rules apply that are:

1. The provided coordinates never substitute to validated coordinates. Hence the provided coordinates can be placed in `_0DD` (if from proxy source) or `_EEADD` if from any other source, for example dam located on a map. The final coordinates plus validated flag set to TRUE can result only from DamPos harvesting (or from reloading the database by database administrator). Since DamPos allows substituting joker final coordinates by EEA coordinates, the original jokers in `_FDD` are not substituted.
   If the provided coordinates are from trusted / authorized source or fitted with quality data, the rule is that the least accurate are placed in `_ODD`, intermediate in `_EEADD` and the most accurate in `_FDD`. Only missing coordinates in one of the three sets are replaced. If coordinates are already validated, there is no reason to replace them by provisional coordinates: in this case, no action is taken.
   Validated coordinates are NOT inserted through the automated process; they are designed to be the result of DamPos operation exclusively[21].

[21] That means that no programmed procedure can force validation. However, it is always possible to force data by hand processed queries.

2. The non-Icold provided city name is kept as `alias_city`, and is updated only if the `is_goodCity` flag is false, indicating that the city name is not validated. This rule presents difficulties because quality of city name is not defined. This will be solved when city names and official codes become available.
3. Alias object values are filled if explicitly mentioned as such,
4. Proposed lake capacity values are inserted as true capacity if the field `CAP_TOTAL1000m3` is set to joker. Otherwise, the `Cap_Alias1000m3` field is populated. In the first case, the flag `updvol` is set to TRUE.
5. Proposed lake area values are inserted as true area if the field `SUPERF1000m2` is set to joker. Otherwise, the `Super_Alias1000m2` field is populated. In the first case, the flag `updarea` is set to TRUE.
6. The other fields are not as critical and are updated if previously set at joker values. If the provided values are considered as replacement values, this should be processed separately.

4.9.3 DamPos Key fields management

When validated by operator on the Web service, the database `public_dams` is updated: the fields `x_prop` and `y_prop` are set to the coordinates values obtained from the cursor position and the field `valid` is set to TRUE. By contrast, the `score` field is not updated in the Web application; it is reset when the web base is updated. Scores are set to the following values: 4 no data (all coordinates at joker), 3 proxy values from the next municipality, 2 adjust slightly (this is guessed scoring when data from external trusted sources are entered). When a dam is validated, its scoring is set to 1, and the valid field is left at True.

After harvesting the Web service, the validated coordinates becomes the EEA coordinates, leaving the original coordinates unchanged. When updated, the Web database then superimposes the EEA and validated coordinates and the validated dams are presented at the end of the list to ease the validation of the next not validated dams.

The `comments` memo field is possibly updated as well; for further use. Comments are kept in table `LogWebComments` that is designed for further update of Eldred2

Two Boolean fields, by default set to FALSE can be switched to TRUE: `is_oncanal` and `is_dyke` that mark the different possibilities of dam relationships with river system, respectively if the dam is on a canal (only artificial canal are considered, canalised rivers are rivers, not canals) instead of river and if the dam is a dyke (secondary dams can be marked that way; they act as dykes with respect to fragmentation). More complex situations should be commented or updated directly in the database.

5 Eldred2 procedures (as in V 2.08)

5.1 General

Eldred2 is an MS Access® database hosting all Eldred2 tables and processes that manages exchanges with DamPos through ODBC links.

For user, all procedures are managed from an application form represented below.

Since version V 2.08, password management has been added. The password is a security for processing and is not a limitation of the database. When logging in, the system detects if the user is administrator or user.

User name is given by administrator, as well as password. The administrator sets as well the administrator's rights, in the `ifen_users` table.

Button Quit App closes MS Access® .
Button OK validates login, and sets rights. If login fails after 3 tries, MS Access® is closed.
See administrator in case of trouble.

Login procedure is inserted to protect user from errors, not for hiding the procedures.

Figure 12: Password form

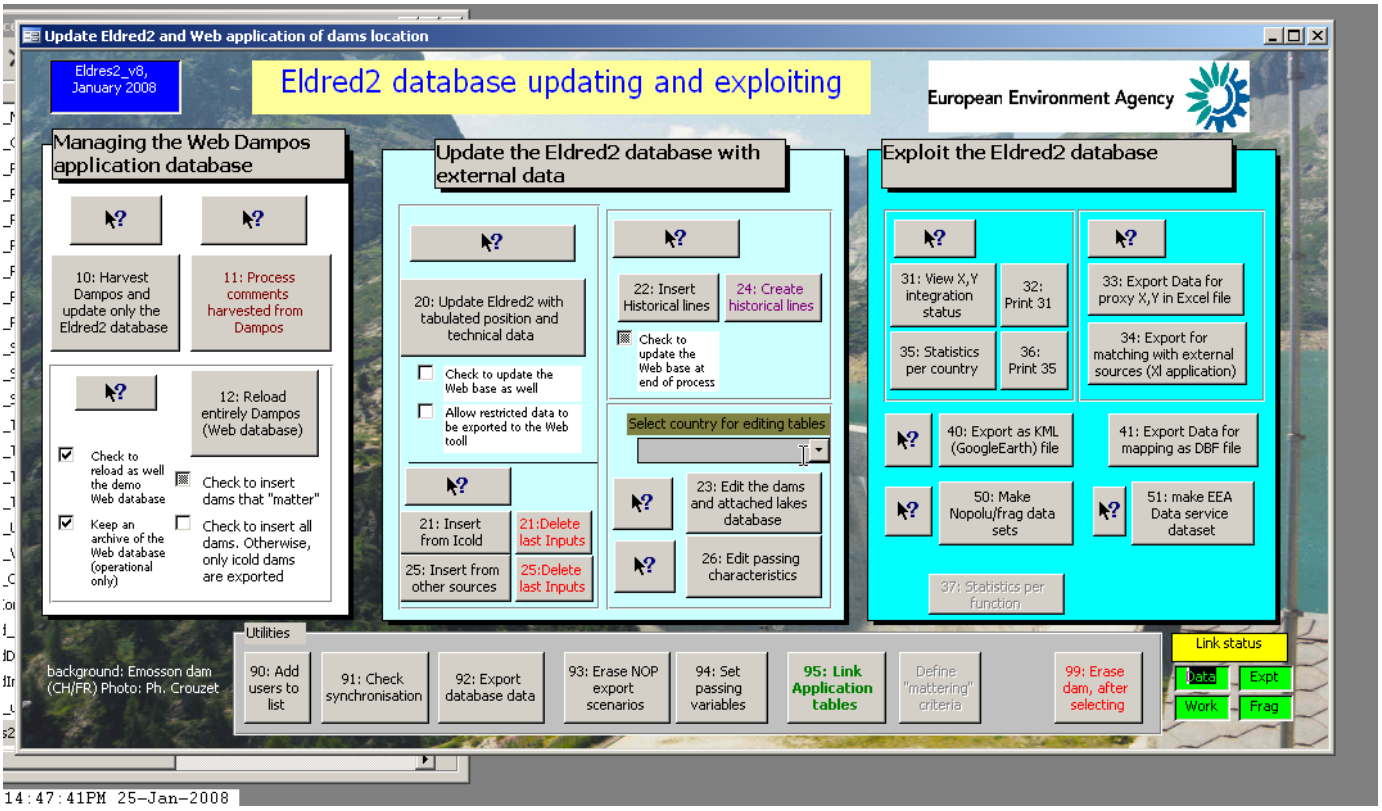


Figure 13: Main form of the Eldred2 application (V 2.08) as for administrator.

Buttons with greyed caption are not operational at this stage.

The form comprises three sets of facilities. From left to right: processing jointly with the Web application, processing primarily the Eldred2 database and exploiting it. The development is not finished yet. Buttons have numbers and, when relevant a help button with the same help code +1000 (button 10 refers to code 1010 in the `NopHelp` table) which content is editable on line by the database administrator.

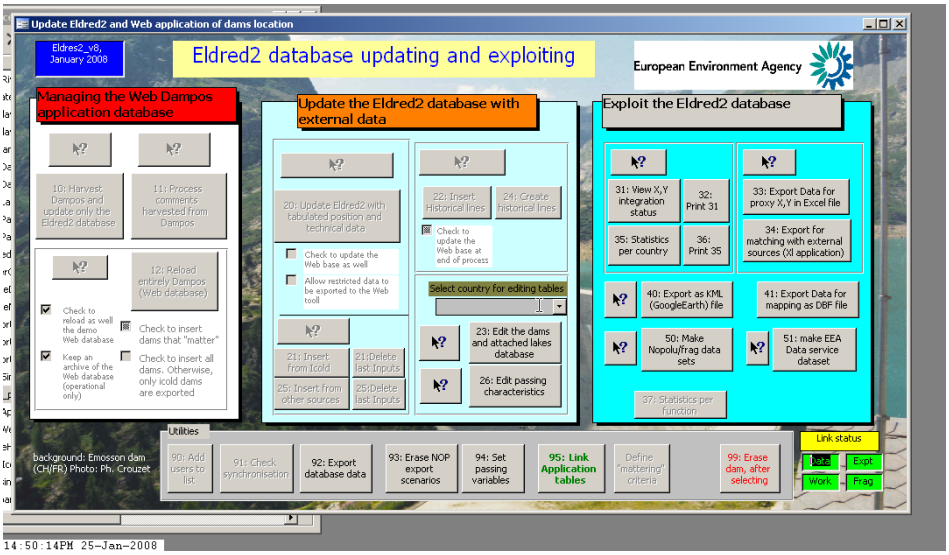


Figure 14: Eldred2 main form for user.

Some functions are not enabled in this case. The DamPos management is as well inhibited if no link is detected.

5.2 Adding and updating Eldred2

5.2.1 Actions launched during Eldred2 operation

The main form buttons launch different actions mocked-up in the next Figure 15 that manage processing between DamPos and Eldred2 tables. When required, secondary forms are opened and activated by the buttons.

The way of operating is described in the next sections.

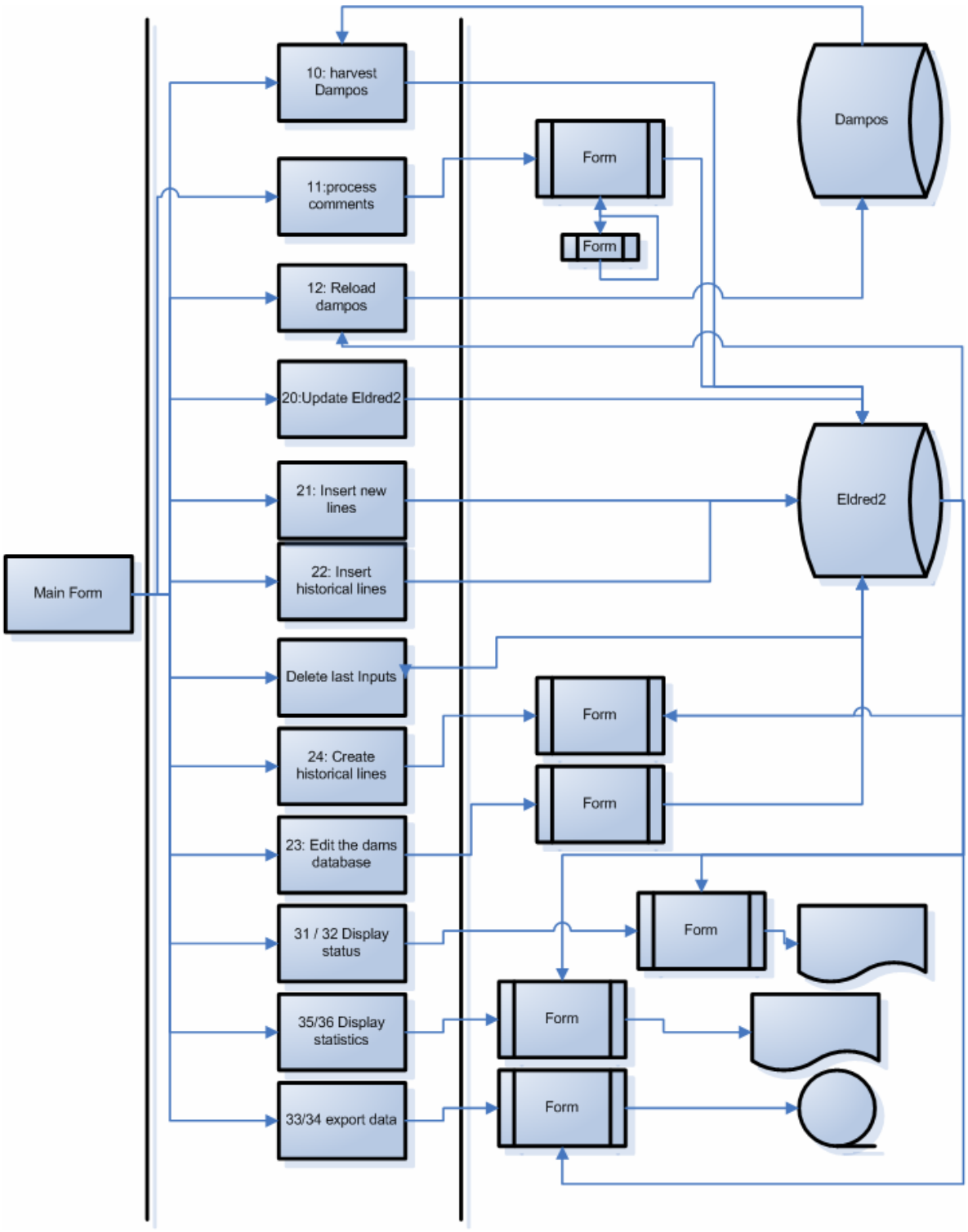


Figure 15: Schematic hierarchy of forms and tables

5.2.2 Inserting and updating data (dams, lakes, etc.) from external sources

Adding new objects requires assessing them a unique code and recreating the links. The normal source of information is Icold data provision, but other sources may provide dam data as well. Another possibility is duplicating sets thanks to the procedure set up in the editing form (c.f. 5.2.6)

Prerequisites

In all cases, the resetting the values of the table `LogMaxCodes` that stores the maximum present value in coded items is carried out. Using the maximum prevents possibility of reusing a code of an object that has been destroyed.

Inserting new lines from Icold sources

This procedure is not frequent; hence it is not fully automated. The flow of processing that is activated by button 21: Insert new lines from the Icold tables is sketched in next Figure 16.

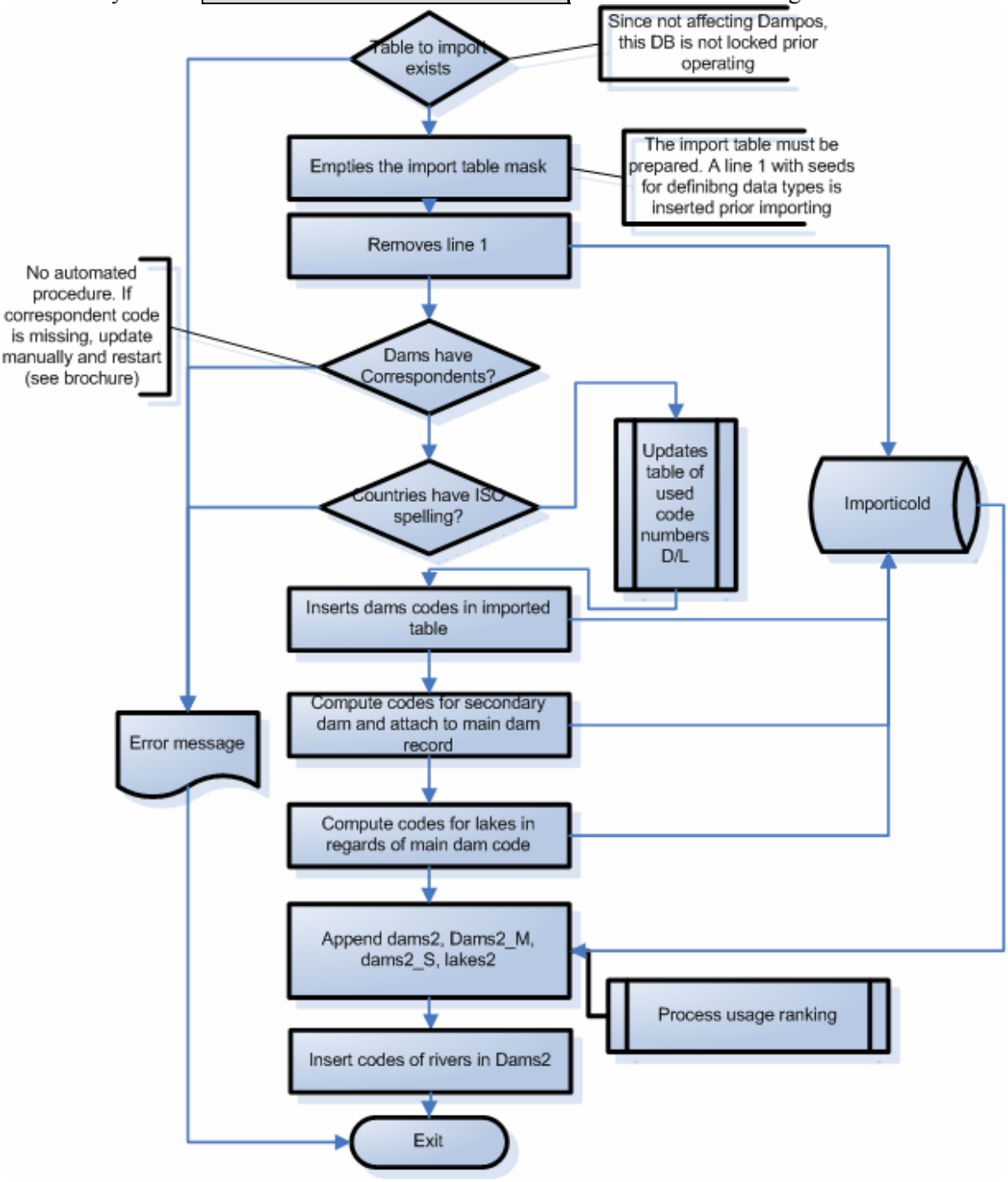


Figure 16: Flow diagram of actions when adding lines from Icold dataset.

The MS Access® process must be carefully prepared, according to the following procedure:

1. Convert the Icold extracts under Works format into Excel workbooks from Icold deliveries. This requires installing a converter that has to be purchased, because the sheets are in Works format in the current release of the Icold extraction tools.
2. Check the countries spelling (English field). The correct spelling (`ISO` check is TRUE) are in `Icold_Country` table. If new spelling is present, the best way is to add a new entry and country code in the reference table having the `ISO` field unchecked. Hence, misspelled country names are correctly processed without having to correct the source table. If unknown country is met, inserting is cancelled.
3. Check the possible duplicates. The way the register is made makes it possible to have duplicates. Obvious duplicates have often close names and all, but one or two, fields that differ.
4. Check and, if necessary populate, the main dam name attached to secondary dams. Many countries do not populate correctly this filed, despite the 'S' is present in the secondary dams field.
5. Link the source MS Excel® file. Procedures are based on the use of the `Importicold` generic name for this table name Beware that MS Access® and MS Excel® try to be "intelligent", hence they analyse the type of field from the first lines and guess the type field from the content of these lines, which requires that these lines are not Null or Empty. Hence, erroneous field type may be selected by MS Access® if several blank lines are placed in the upper lines of the source file.

   To tackle this, the procedure that has been developed uses the `XLIcoldMask` MS Access® workbook to enter data. This workbook has a first line populated with ad hoc seeds so that the linking is systematically correct. The import procedure discards the first line from the linked MS Excel® table. Hence, populating this table must start at line 3 and if data is placed in line 2, it will NOT be processed.
6. Apply the ad hoc MS Access® programme, pressing the button from main menu form. This programme cannot check possible duplicates because it provides new codes starting from previous maximum +1.
7. Reservoir usage is coded as a string with a maximum of 6 possibilities, in decreasing order of usage priority. The filling of field in source data happens to be not consistent[22] with Icold recommendations. A function has been written to turn the codes into ranks that are placed in the 8 possible uses of dams. Source string is kept unchanged.

Inserting lines from non-Icold sources

The procedure is identical to Icold source inserting, the difference being in the source used that requires specific pre-processing. A good example is given by the inserting of UK dam data that were provided by BDS (British Dam Society23,) or French dams provided by the water agencies. Data provision comprises 2730 references of existing dams (plus 230 references of destroyed / decommissioned dams) for UK and ~20,000 for French dams over 3 water agencies.

Special precautions should be taken to keep trace of public and none-public information. In such cases, dams mentioned in different sources are understood submitted to the less demanding confidentiality level. In the UK case, dams already in Icold register are partly public, whereas non-Icold are submitted to UK BDS rules. By contrast, Spanish dams listed in the Spanish public

[22] This string should contain only letters C, I, H, F, N, R, S, X, without separators and in uppercase. String containing ', were found. Extension with letters G, L,M and P plus Z (confirming no data) has been implemented.

[23] http://www.britishdams.org/default.htm; Henry Hewlett, Hon Technical Secretary

database (Ministerio de Medio Ambiente, 2006) supersede Icold restrictions on these dams, because their information is more public than Icold.

The procedure is typical of any procedures consisting in obtaining data from other sources (e.g. the mentioned French, Spanish or Swedish datasets) because:

- The delivered data set comprises both large and non-large dams,
- The coded large dams should be first matched to the external source to identify the common dams,
- The remaining dams should be reformatted to enter in the database, under the Icold (or Icold compatible format).

UK case

The UK dataset comprises 5 tables under MS Excel® respectively England, Wales, Scotland, British Isles and decommissioned dams. The first four were merged and duplicates eliminated (9 in England, 2 in Scotland, 2 in British Isles and 2 in Wales, plus 3 in decommissioned dams).

The existing dams were matched using Dr Rödel's modified tool (see Appendix 5), secondary corrected by visual examination and 30 addings. At the end, 526 certain matches were found and can be processed to update Eldred2 databases. Non-matched dams are to some extend situated in Northern Ireland that is not covered by BDS data delivery.

In parallel, the position of dams provided by the BDS were converted from OS (Ordnance Survey) coordinate system into geographical coordinates under WSG84. To this end a special programme has been developed in-house, using the core converter found on the Web.

French case

French data position had as well to be converted. Dealing with huge number of small dams, not formatted as required, some processes were carried out as well. For example, fish pass installation year was documented whereas no construction date was reported. In all cases, a 50 years existence of dams was supposed and applied to any relevant date (if not true commissioning date reported in comments and not in the commissioning year field).

Generic procedure

The procedure for inserting non-Icold dams is rather complicated because it is dictated by the differences in formats and structure of original data sets. It is suggested to:

1. Try to match by adequate means the candidate dams that were not matched automatically, otherwise duplicates of large dams would exist. A good trick is to consider dams in the range 10 to more meters in height not matched and make visual inspection. Set the final ID correspondence in the `results` sheet of the matching application.
2. once all data is prepared in a specific database, export in a standard format. This format is stored in the Eldred database and is named `NONIcoldImport_FP`. This format is a simplified copy of the standard import format, with specific adjustments.
3. Further processing is carried out by the procedures under the button 25: Insert from other sources that first copies and populates a target intermediate table named `maskImportNonIcold` which is stored in Eldred2_work.

The most practical procedure, developed after having consideried pros and cons of different approaches is the following:

I. From the source database, populate the target format NONIcoldImport_FP, using the free fields for passing specific information.

II. Link the populated NONIcoldImport table in Eldred2, under the name of NONIcoldImport (drop the _FP in the connected table).

III. Carry out processing through he procedure under button 25: Insert from other sources.

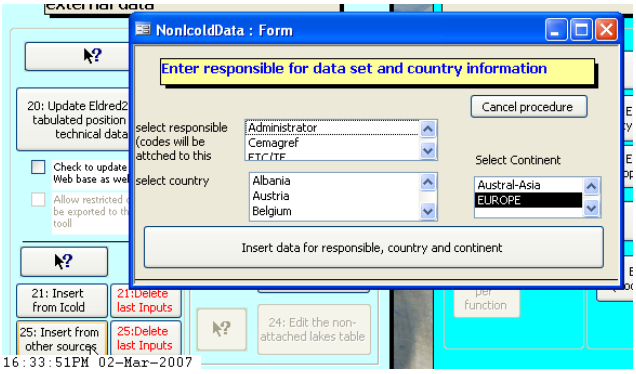


Figure 17: mask for documenting the Non-Icold sources importing

A form pops-up and queries for continent, responsible and country. All non-Icold records are attributed to a single country at this stage.

If the targets are not visible, cancel the procedure and update the tables. The Insert data… button sorts out the records to insert according to the fact they are or are not already explicitly documented as Icold. All records to insert are coded and inserted, without further check because there is no possibility of such checking considering the very variable naming of dams.

Codes from provider are stored and rivers coded automatically, if river names are not correctly spelled, then duplicated river entities may be stored.

If passing data is provided, it is updated included for those Icold dams already present.

The procedure expects finding (if necessary) specific data in certain fields of the original table NONIcoldImport. These filedshave the specific use:

- Comn°011 contains the passing down code at dam construction. It is mirrored by
- Comn°10 that contains the passing up code at dam construction.
- Comn°02 contains the passing down code after installing of passing facility (refers to date in field Ext_YDispo, that has the corresponding year.). This fields is mirrored by
- Comn°09 that contains the passing up code after installing the passing facility,
- Comn°03 is expected to contain ‘True’ if the passing codes are guessed or modelled (otherwise, codes are expected to be from record, including if not present because the joker value is from observation that no data is present),
- Comn°11 contains 1 character code which meaning is the following:
  - ‘2’, ‘G’, ‘J’ or ‘M’ tell about the type of river, respectively artificial waterway, navigation canal, input/output trench and pipe.
  - ‘#’ indicating that no impoundment is attached to the dam. In this case, a check is made on the volume and if both # and joker are found, then no lake record is created.
- Note/Note is considered a s comment to insert in the target comment field.

Specific information is then stored in fields from `maskImportNonIcold`, reported in Appendix 6.

Deleting the last inputs (applies to inserting lines from external sources)

If, for any reason, the last insertion is understood has having resulted in bad results, it is possible to remove the inserted lines. This is only feasible if the inserted data has not been changed or purged. A special button, with red letters 21: Delete the last Inputs restores database in the state prior inserting.

This action removes only the inserted dams, and makes therefore it possible to reinsert beaching the rule of no reuse of codes (this makes as if the codes had never been used).

Only trained operators should use this function.

Adding objects

The editing frame (Figure 23, p 51) has a button Create new empty dam record… The action after pressing the button creates a dam and attached lake almost empty records, with the first possible code. Dam and lake name are standard "AddedDamByAdministrator" and "AddedLakeByAdministrator". Year of commissioning, name, date and river name are set by the user thanks to input box.

This is the recommended way to create single new dam.

5.2.3 Inserting historical data

Rationales

Dams and by extension, lakes, are given a year of commissioning. This year value is not systematically given in the same way across countries. However, in many cases, `ic_comment` fields (there are many) contain this information. It is very important to address the history of changes because the possibility of pass-trough by fish and by sediment is depending on the changes in dam structure, height and storage volume of the associated lake.

Even though the information related to the change proper is poorly documented, the database structure has to make it possible the capturing of this information.

To handle it, it has been considered that the Dams2 table would have unique records per dam, a dam being considered as object with first and last year. By contrast, tables Dams2_M and Lakes2 have lines duplicated to store as many changes as they are recorded. Unique key to dams2 is NOEEA code, it is NOEEA + Year of current information in the other tables.

Each dam having been modified at some date has three years populated: the year of the current information, the year of first commissioning and the year of decommissioning.

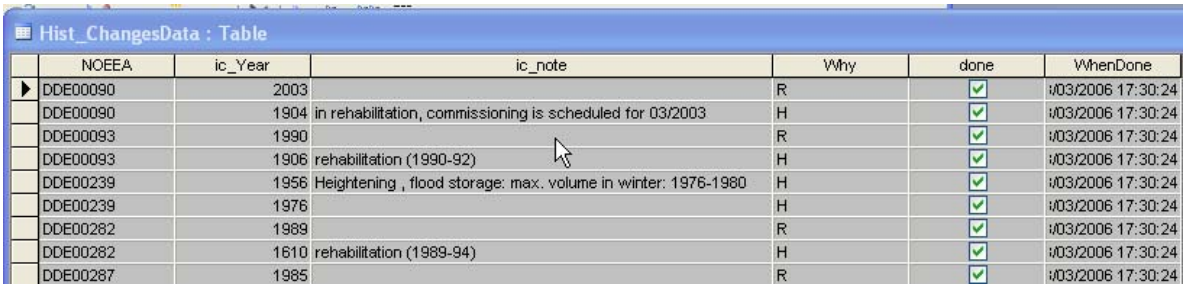
Updating problems

Historical data is contained in notes, remarks, etc. in source files: there is no automatable procedure to synchronise effectively the entering of new dam and the updating of its historical lines. To minimise the impact of possible non synchronised records, the following actions are taken:

- A special form is provided to scrutinize unprocessed comments and historical data to make it possible the preparing of historical records to insert,
- Queries in the statistical preparation procedure are made insensitive to non-synchronised data; this does not guarantee accuracy of results but avoids mismatched numbers of dams and main information. This cannot work as effectively for lakes because there is no certainty of having in `Lakes2` at least one record matching every selected record from `Dams2`.

Data structure

The processing consists in three steps: inserting the lines, populating the lines with information duplicated from the last line and updating the dates in the Dams2 table information. The update of the historical information is a process that is not automated because is has to be preceded by manual data collection.



Hist_ChangesData : Table

NOEEA	ic_Year	ic_note	Why	done	WhenDone
DDE00090	2003		R	☑	3/03/2006 17:30:24
DDE00090	1904	in rehabilitation, commissioning is scheduled for 03/2003	H	☑	3/03/2006 17:30:24
DDE00093	1990		R	☑	3/03/2006 17:30:24
DDE00093	1906	rehabilitation (1990-92)	H	☑	3/03/2006 17:30:24
DDE00239	1956	Heightening , flood storage: max. volume in winter: 1976-1980	H	☑	3/03/2006 17:30:24
DDE00239	1976		H	☑	3/03/2006 17:30:24
DDE00282	1989		R	☑	3/03/2006 17:30:24
DDE00282	1610	rehabilitation (1989-94)	H	☑	3/03/2006 17:30:24
DDE00287	1985		R	☑	3/03/2006 17:30:24

Figure 18: Image of structure and contents of table `HistoricalChangesData`

The table displayed in Figure 18 containing the information to insert is `Hist_ChangesData`. Since the usual way of populating it consists in copying the dam reference and the ad hoc comment, this is kept as log in the table. The lines to insert are added by hand and the comment let blank. The file comprises unique records keyed by noeea + ic_year, otherwise errors will occur in processing.

Since the table acts as log table, a Boolean field named '`done`' and a date field named '`WhenDone`' are updated after the process of inserting is completed. The filed '`Why`' documents the nature of change applied to the dam.

Populating table with special form

Table is populated either by hand (procedure to avoid…) or using the special facility started by button 24: Create historical lines that opens a special form displayed in Figure 19.

The form displays all prepared information for those dams that are understood as having historical changes and which changes are not documented in the database.

- Dams having a note, and no historical lines or no entry in the log file on historical insertions,
- Dams which difference in years between Icold year and corrected years is >= 5.

The system prepares two records (one on Icold year and one on first year). Records for other years can be added in the displayed list.

The process is not as straightforward as it should ideally be. The form is fuelled from comments contained in field `ic_note`. Unfortunately many dams have no data in this note filed related to their first commissioning year. The update procedure is therefore indirect and uncertain.

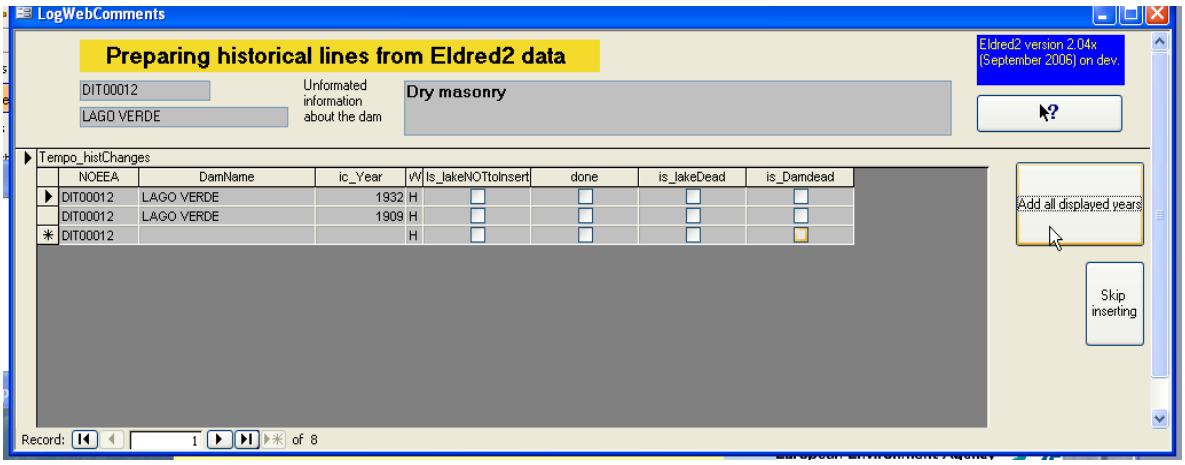


Figure 19: Form to prepare inserting historical lines

In the example displayed in Figure 19, differences in dates strongly suggest historical change despite the comment does not mention such event.

Action started by button Add displayed years results in adding records to the log table, and removing dam entry from display. Button Skip inserting removes dam from display.

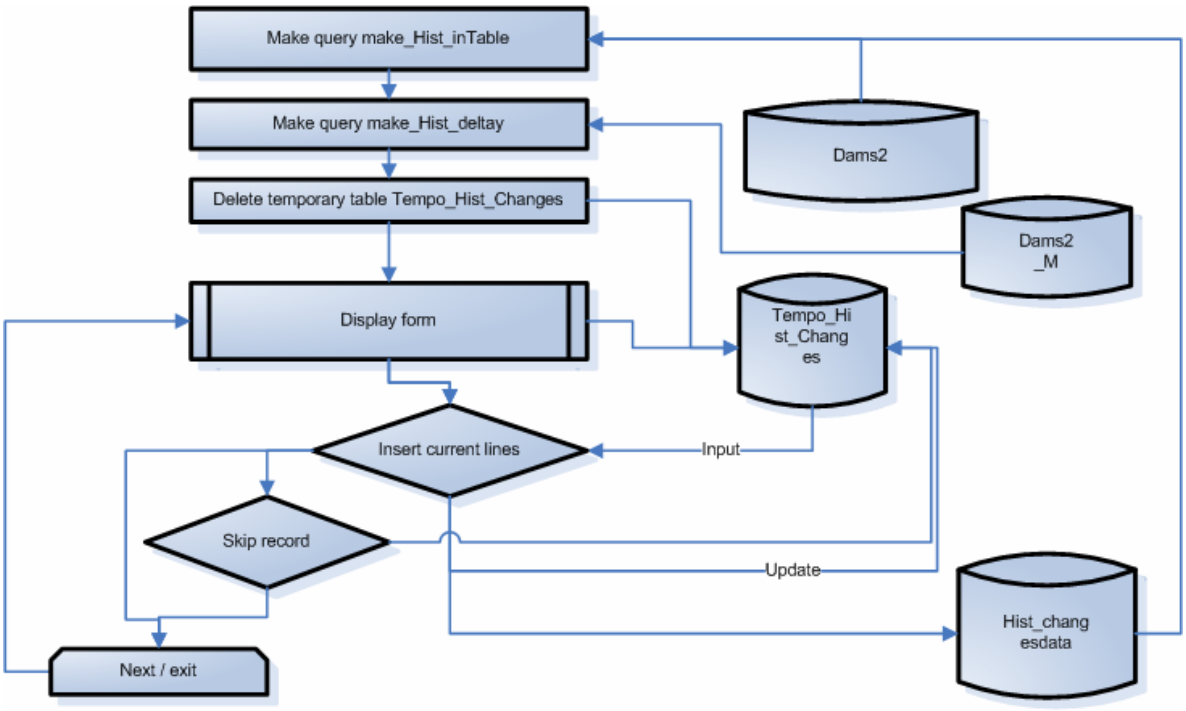


Figure 20: Procedures behind the form making historical lines

The final process is carried out by the button 21: Insert Historical lines. When process is started, the programme checks if the lines to insert are not already present. If this is the case, an error message, indicating which lines are redundant is issued and the process stopped. Hand correcting the `Hist_ChangesData` table has to be done before restarting.

When update about the year become available, they may trigger a desynchronisation of on the table or b) a possible warning that are handled by the synchronisation form. In this case, the added note allows re-entering the current form and creating historical lines.

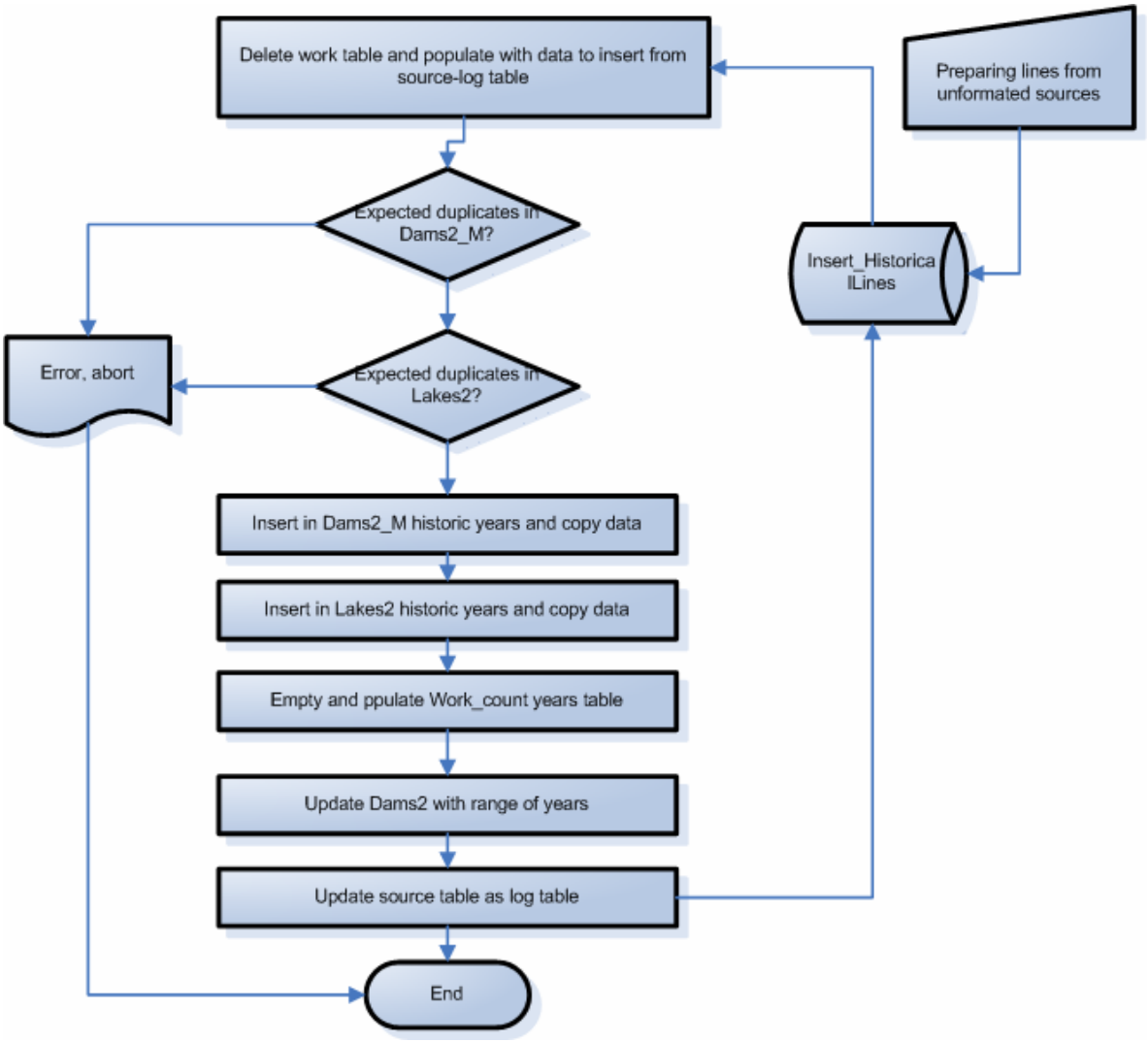


Figure 21: Flow chart of procedures of inserting historical lines

The major risk of error in this process that requires manual preparation of data is inserting lines already processed. This is the reason why possible duplicates are checked prior to inserting lines. In the event this would happen, the process is cancelled and error message issued.

5.2.4 Updating with position and technical data

Procedure

Dam position and important public complementary information can be collected from many different sources, true positions or proxy positions. Similarly, some other main data can be collected from sources out of Icold, from Web databases for example or from local providers.

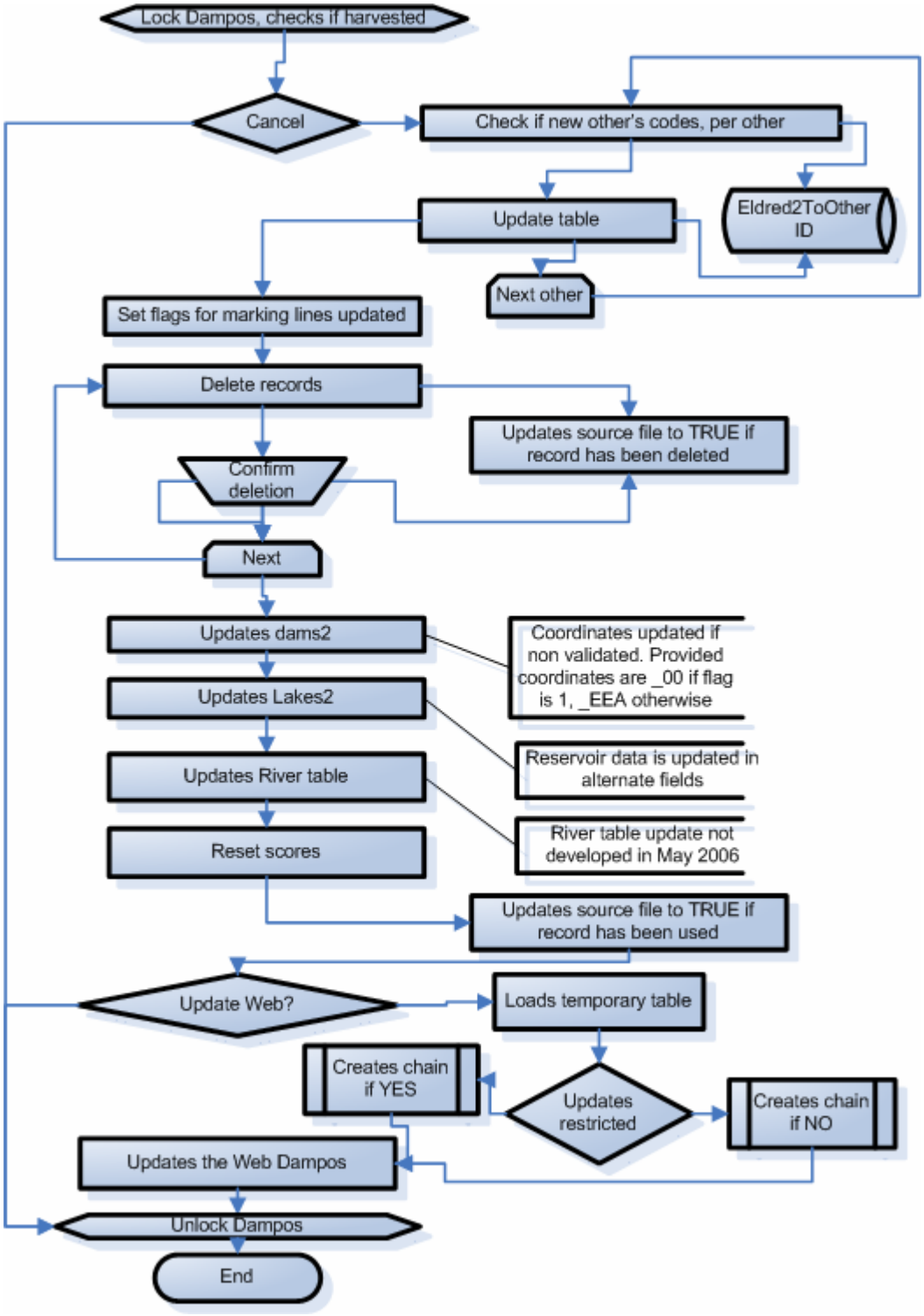


Figure 22: Flowchart of updating steps in Eldred2 updating (tabular data)

To insert this data, a procedure has been set up, based on a table that acts as log book as well. To trace data source, data in table `DL_OtherData` must have a link with the reference table `Other_provd`, where the information about the provider is stored.

The different steps are processed according to the content of fields in the `DL_OtherData` table and settings of the checkboxes update Web and include restricted data on the main management form.

- Records flagged TRUE in the field `RecordToDelete` are first cascade erased. This allows keeping trace of duplicates further erased. Fields `DL_OtherData`, `HasUpdatedDams2` and `DateUpd2Dams` are updated. **Record deletion being non reversible, it is done record by record, and asks confirmation to the operator for each record to delete**.
- Table Dams2 is updated with Fields `X`, `Y` and `XY1I2E3F` provide coordinates, with type (1 Icold, 2 EEA, 3 final / considered as very accurate). Other fields have names self explanatory. The best quality data (code 3) makes score 2. The difference in codes of data quality and scoring is deliberate to avoid automatic confusion with final scoring.
- A second step of updates in Dams2 relates to the ownership codes. This is done in three different steps to insert only the TRUE settings. The ownership code is managed at the external input correspondent level (hence all records for which information is provided by correspondent X are updated accordingly). The three possible ownership flags are Icold, WFD (for Water Framework Directive) and other which points to any other source. The "other" case comprises for example national non-Icold correspondents, Universities, etc. EEA's ETC work is included in this last category as well. The original setting is kept and can be only completed by values set to TRUE. Ownership can therefore only be completed, not depleted. In case of error, correction should be applied by hand queries by the Eldred2 administrator.

The NOEEA code must be in the form 'dams' (D…). Information is diverted to the ad hoc table. At the end of the update, fields `HasUpdatedDams2` and `DateUpd2Dams` are updated as well to keep trace of the changes.

Preparing data in the source / log file for permanent source

It is not possible to process adequately data at the update step and tackle all possible problems, as described in §3.3.3, p 11. On the contrary, it is preferable to prepare consequently the data table to avoid further problem. Using the `DL_otherdata` table facilities ensures logging the different steps. Details related to the table structure are reported in.

The questions to solve are:

1. Matching external information with Eldred2 information, with other words, pairing unique IDs,
2. Accepting reasonable changes in the target database, for example adjustments in dates, etc.

The first case requires as many solutions as they are external providers. In the case exemplified in Appendix 5, the frequency of exchanges with the Greifswald University justified setting a type of procedure thanks to which the pairing of IDs progresses along with the improvement of data.

Preparing data in the source / log file for exceptional source

Experience from matching exceptionally information from two reliable data sources provide interesting suggestions on the way to proceed. The Spanish Ministry of the Environment has released a comprehensive list of Spanish dams (**Ministerio de Medio Ambiente, 2006**). This volume is accompanied with a CD-Rom from which data can be extracted as MS Excel® file.

The following problems had to be solved:

- MS Excel® interprets dates with its own data range. Hence, all dates prior 1/1/1900 as ill extracted and must be reset as text strings to be processed with MS Access® (that starts its internal date processing range in 1/1/0100)[24].

[24] Internal inconsistencies in Microsoft® products are quite expectable, not this one, the export function inside the provided CD-ROM does not force the extracted date as string

- Most of dam names and commissioning dates match between Eldred2 database and the Spanish database, but not all dams present in both sides. Eldred2 has 1267 dams in Spain; the Spanish file contains 1226 entries on which 1016 match immediately. Visual comparison between lists of dams present in Eldred2, without corresponding entry and reciprocally provides 96 certain matches, making 1112 possible updates. One certain duplicate has been identified in Eldred2, making the final uncertain count of dams reaching 114 new dams to insert (includes projects) and 154 dams currently in the Eldred2 which existence is questionable, albeit they initially come from Icold database.

The update procedure is the following:

1. create the DL_otherdata records from the first match
2. add Dl_other data records from the second match
3. insert dam deletion request in Dl_otherdata for the duplicated dam,
4. insert special correction in Dl_Otherdata (the special case of Puentes III dam). In this case, the current Puentes III should become Puentes II and be corrected, Puentes III should be created in a next step
5. *apply corrections*
6. create historical data for the special case,
7. *apply corrections*
8. make pseudo_Icold data entry set for the 114 new dams.
9. *insert new dams*
10. the case of the uncertain 154 dams should be solved by exchange with the Spanish authorities / Icold correspondents and preferably through DamPos comments manager.

Processing

Processing is launched by the Update Eldred2 with tabulated position and technical data button.

The `public_dams` table of the DamPos application is then updated if the checkbox is checked; if sensible data is updated, it may be restricted to internal use by checking the corresponding checkbox.

Possible problem

The case when *validated* coordinates in Eldred2 *must be* replaced by new coordinates is not possible by procedures. Two possibilities are open:

1. Reset coordinates with DamPos and harvest data; this is the most seamless procedure.
2. The administrator makes an ad hoc query and updates data.

5.2.5 Harvesting

Definition

Harvesting collects information from the Web and updates Eldred2 database. It processes the administration tables to maintain log of permissions and relationships between dams and users in DamPos.

In the current version, and to cope with informal agreements with Icold, which is the main provider of the source data, harvesting is limited to few data, namely final coordinates, switch `is_dyke` and `is_oncanal` and comments which are the main dialog path to update of the information.

Since the information collected from the Web application is supposedly populated by experts that have only a restricted set of dams at their disposal, the information from the Web application supersedes the previous information contained in Eldred2.

Processing

Harvesting is processed by the button Harvest DamPos and update only the Eldred2 database in the main application form.

Harvesting carries out the following operations:

- Copies the entire Web `public_dams` table into a temporary table,
- Analyses the changes in comments and content of the critical fields, and logs the changes in comments as old comments / new comments and date of harvesting. The table `LogWebComments` comprises a switch to mark if the comment has been eventually being processed.

5.2.6 Editing Eldred2 (V 2.08)

Eldred2 tables may require editing to insert modifications that could not be managed elsewhere. This procedure does not allow tracking of all changes and has to be used by persons well acquainted with Eldred2 structure.

The editing is made dam by dam, after selecting a country of attachment. The selection of the attachment country is made from the main form from button 23: Edit the dams database.

The functions of the editing form are the following:

- Edit dam data, attached lake data and change / complete values. This is especially the case of historical information that is seldom addressed by the other service components of Eldred2.Change dam status from main to secondary and specify dam of attachment. In this case, the **attached lake records are destroyed,**Modify or add countries in the case the dam in international (or set it as international). Changing country is warned by a message, and has no incidence on dam code.Modify of update lake's attachments. It has been mentioned previously that a lake may have several attachments. For example a natural lake becoming dammed has two historical records related to its natural state and its dammed state. If the dam changes, lake's attachment has to reflect it, independently of dam persistency or not. The Puentes III example is clear case of change in dam attachment.

It is possible to add or delete attached records. By contrast, dam cannot be deleted from the editor. To delete a dam, refer to procedure in §5.2.4.

Form presentation

The form comprises 4 blocks, which functions are:

1. Surrounded by black shadowed rectangle, the identification and dam attachment data. This part allows selecting the dam to be edited from its name or its code. Code and name dropdown are linked together. Selection of either displays all information attached to the selected dam in the next block.
2. Surrounded by yellow shadowed rectangle, the kernel data attached to dam.
3. Surrounded by green shadowed rectangle, the time depending information related to dam. Score as potential obstacle just indicate that dam can or cannot be considered under these aspects. Secondary dams have scores set to 0 by default, although this can be changed in very specific cases.
4. Surrounded by blue shadowed rectangle, the time depending information attached to the lake depending on dams.

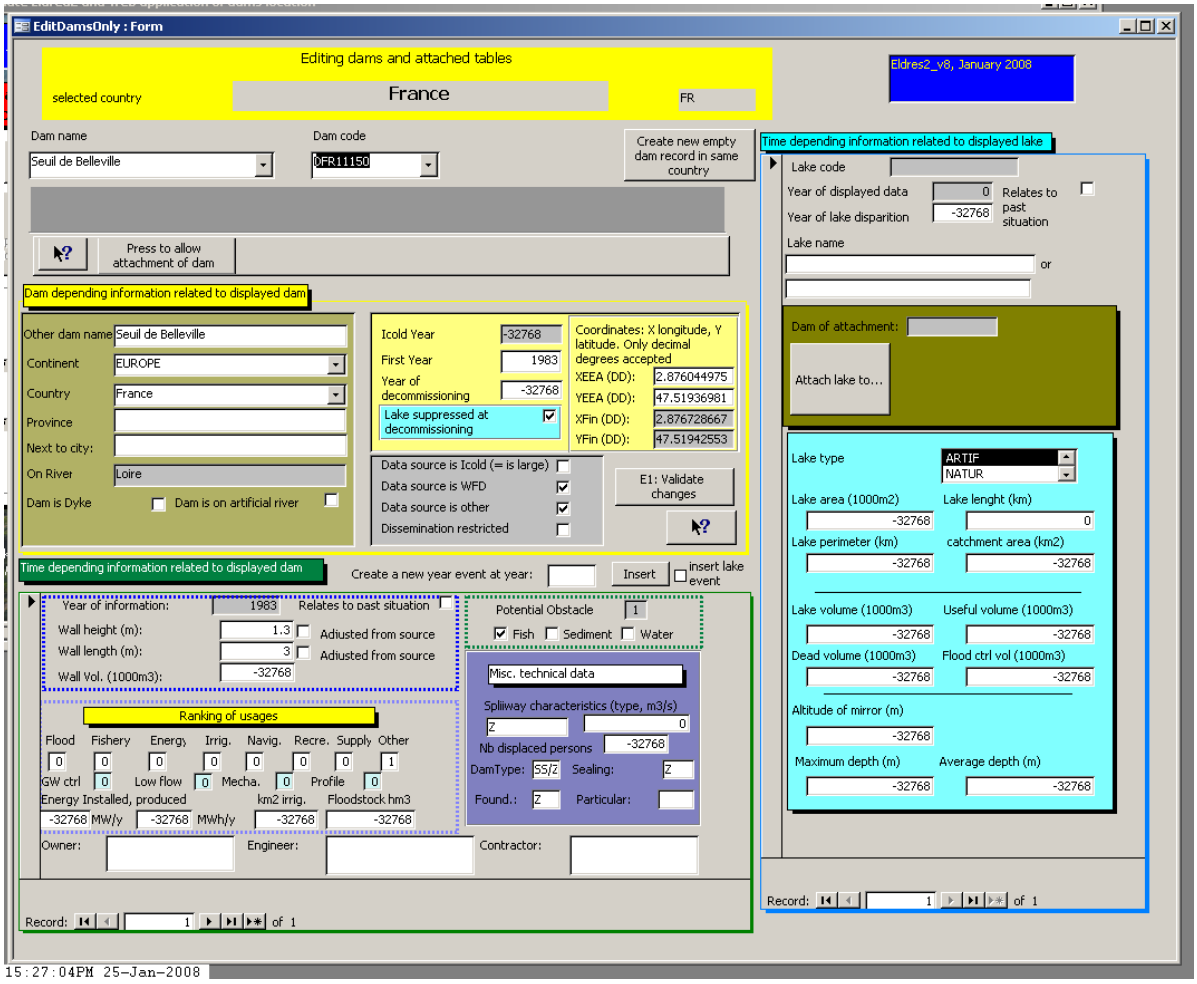


Figure 23: Dams and lakes editing form (dams and attached lakes only)

Importance of order in updating

It is very important to analyse the order in which the changes should be applied that reflect the hierarchy of records within the application.

For example, if the dam has to be attributed to another country, then attached to main and it lake attached to another dam and dam shared between countries, the correct order is:

1. if dam of attachment is in current country, attach dam to it
2. attach the lake to another dam to preserve records,
3. attach dam to another country,
4. exit procedure
5. select the other country, if dam of attachment is in this country make the attachment,
6. restart editing, being aware that attaching to another country will change dam code!

Block 1 has different displays, according to context. If dam is secondary, its attachment is mentioned in the upper right corner.

Button Attach dam to main dam, once pressed, displays two drop down boxes that allow selecting a dam

Selecting dam entry

When the form opens, it presents the first dam in the selected country. The order is the dam code NOEEA. Any other dam can be selected either from the alphabetical list of dams names or dam codes. Type the first characters to hurry the selection of the correct dam. Once selected, all other blocks are updated.

Changing dam status (move from main to secondary)

By default, dams are set as main when created. A lake is created inconsequence. It may happen that a dam is secondary, and has therefore to be changed.

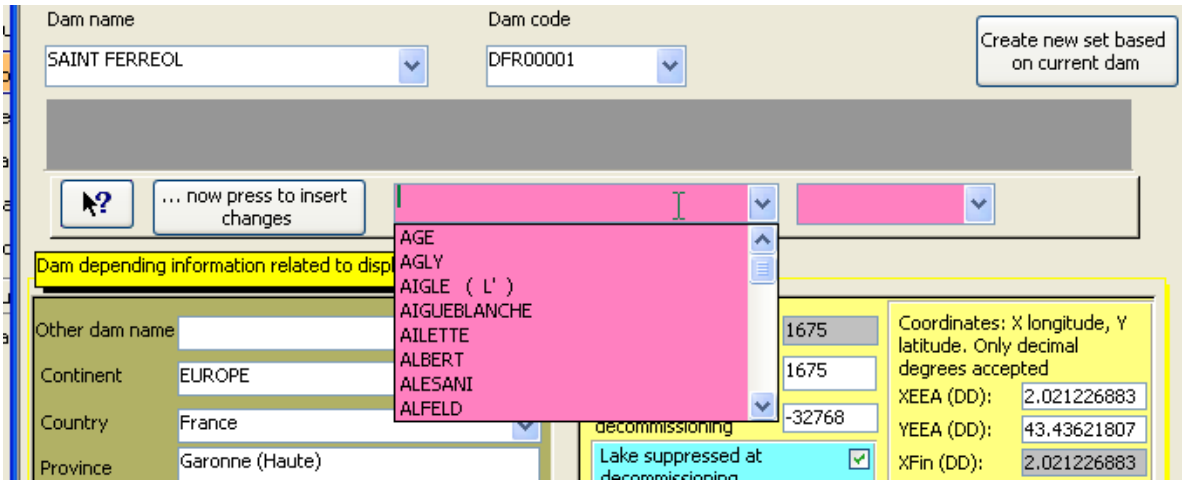


Figure 24: Changing main dam to secondary

When pressing button marked Press to allow attachment of dam..., the caption turns to ...now press to insert changes and two drop down on pink background pop-up. Select the dam that will become the new main of the current dam either from its code or name, the press again the button. The action processes dams already secondary (re-attachment) or primary (attachment)

A confirmation message is displayed with cancel as primary choice.

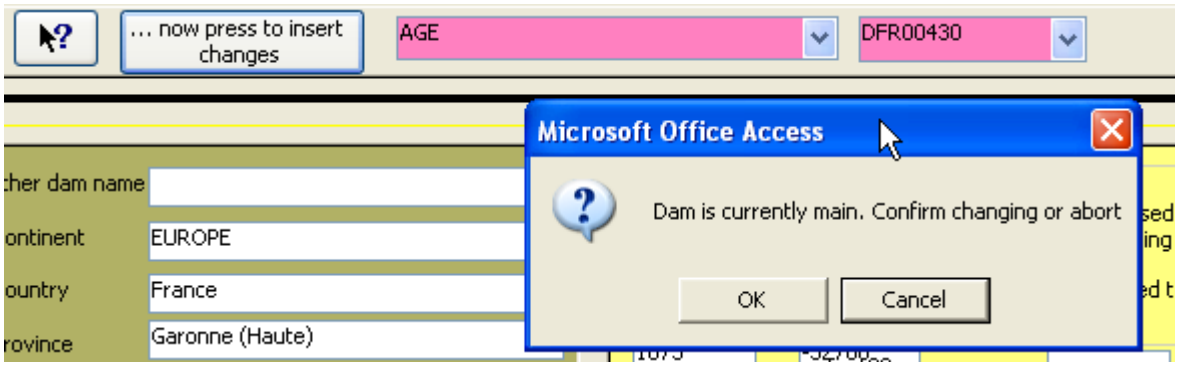


Figure 25: Changing dam status confirmation message

If OK is pressed, the records are set and lake records destroyed. Volume related to dam (if any) is placed in the `Dams2_SVOL` table. In parallel, log tables or fields are populated:

- `LogWebComments` table receives a standard message, either “Main dam DCCXXXXX attached to DCCYYYYYr” or “Dam DCCXXXXX reattached to DCCYYYY”, date set to now() and processing flag set to true (the comment should not be reprocessed)

- The `Comment` field of Dams2 is populated with standard message above message + "by Administrator" + previous comment if any.
- `DL_otherdata` receives a record of lake deletion, with processing flag set to true (deletion has already occurred).

Editing Dams2

Dams2 data are edited in two stages: entering modifications on the screen, then inserting modifications in the table and depending tables. This is why a button is devoted to this task because key-making information, e.g. year of commissioning must be updated in cascade through the depending table before these tables are edited. **No modification is considered until the button is pressed.** The inserted modifications are processed in the following way:

- Change of country impacts only the CT field; the dam code is not changed. Should dam code be changed as well, it is wiser to destroy dam records and recreate it. This change should apply only to dams *belonging to a country* and *situated in another one*.
- Change in first year / decommissioning year applies as well to Dams2_M and Lake2. The corresponding dates are updated. The Icold year cannot be changed.
- The check button indicates which special behaviour the updates have vs. lake related information. If lake is NOT suppressed at decommissioning, a record with no dam attachment is created.
- Two sets of coordinates are presented, this allows proposing EEA seed coordinates, in the event these coordinates are available. Final coordinates are protected: they can be updated thank to DamPos procedure only. Coordinates are checked at the entry. If either non numeric or out of -180/180 or -90/90, the entry is rejected and previous value restored.
- Since V 2.08 , a facility has been added to insert a new record for dam (historical record in Dams2_M) and the possibility to add with the new dam record, or with existing record, a lake record for the currently inserted year.

No change in river is allowed because managing river codes and infinite spelling variants would be useless in the view of attaching dams to rivers through the Rivers & Catchments database.

When button E1: validate changes is pressed, the following actions are carried out:

1. Dams2_M year is updated. The record having initial first year is updated to the new first year. Three possibilities are processed:
   - No such record exists, because synchronisation is wrong. Process is aborted.
   - A single record exist, it may be keyed on initial year (normal expectation), then it is updated. On the contrary, it is keyed on the updated year (ill synchronisation that will become corrected!); in this case no action has to be taken.
   - Two records exist, the initial and the updated. Record keyed on the initial value is deleted.
2. Lakes2 is updated. The process is close to the one described above, with some differences: first, the presence of lake records is checked, otherwise no action is taken. If lake records exist, then:
   - No such record exists, because no lake is attached synchronisation is wrong. Process is aborted.
   - A single record exist, it may be keyed on initial year (normal expectation), then it is updated. On the contrary, it is keyed on the updated year (ill synchronisation that will become corrected!); in this case no action has to be taken.

- Two records exist, the initial and the updated. Record keyed on the initial value is deleted.

3. Dams2 dates are updated and Lake2 is updated if needed.
   - According to value of the checkbox "lake suppressed at decommissioning", either field `year_lake_dead` is set to year of decommissioning or anew record is inserted at year of decommissioning (or year of decommissioning +1 if needed) with current information on lake..
4. Dams2 data is updated, disregarding if the rest of data has been modified or not.

Dams characteristics should be set to appropriate codes. Since this is generally provided from source, no specific validation has been coded. Double-clicking on the boxes opens the attached reference file, as show on next image.

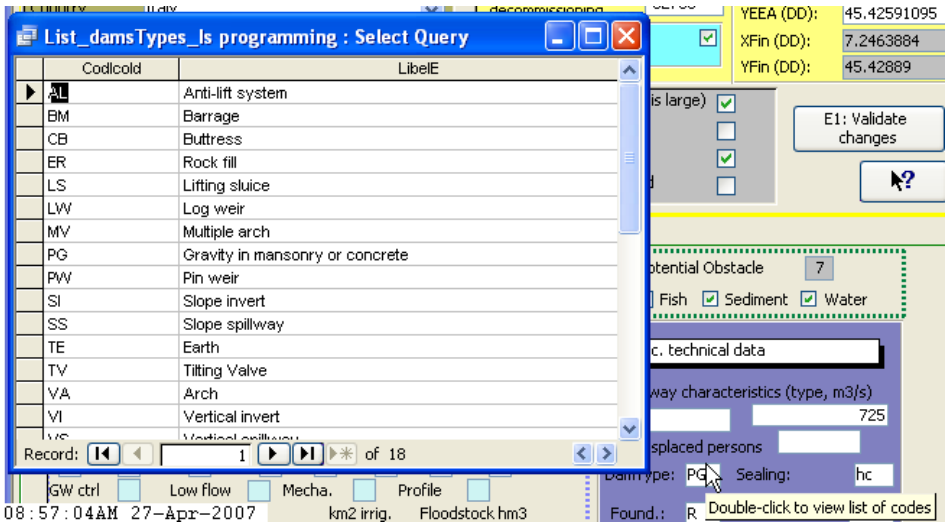


Figure 26: simple reference lists attached to dams characteristic boxes

Editing Lakes2

Lakes editing is somehow different to editing dam historical data. In most cases, there is mirroring between historical states of dam and the associated lake. To cover special cases of lake attachment, especially change in dam attachment, a facility, similar to the one described for changing dam attachment to main dam has been installed.

After pressing button Attach lake to..., its caption turns to ...now press to insert changes and three pink boxes pop-up. The two leftmost allow selecting an existing dam in the country, the third one is primarily populated with the initial date (the one in the protected grey are above, '1675' in the example shown). This date can be changed.

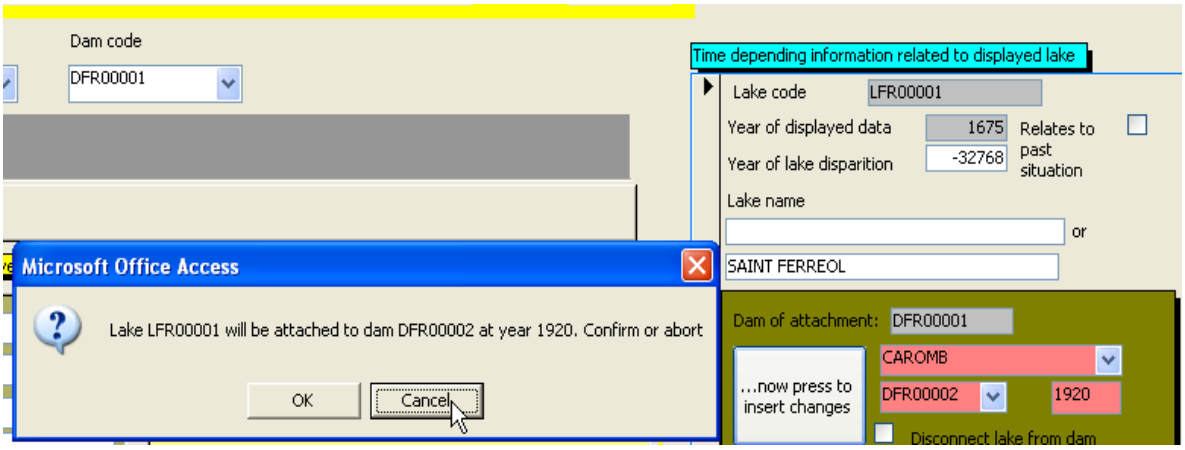


Figure 27: Lake attachment facility working example

After pressing again the button, a confirmation message pops-up. If OK is pressed, then two possible actions are taken, if no error occurs:

1. the proposed date corresponds to a lake record, then the record is updated with the new dam code,
2. the proposed year does not exist, then a new record is added at this date, with the new dam code.
3. if the checkbox “disconnect lake from dam” is checked, then the message is “Lake LCCxxxxx will be disconnected at year: yyyy. Confirm or abort.”. Process is identical, with the difference that the attachment dam code is set to Null.

Inserting appendix records

It may happen that a dam has no lake or that a dam has no secondary record. If information is collected about a change on this dam or on the existence of a lake, it must be inserted. Facility has been added since V 2.08

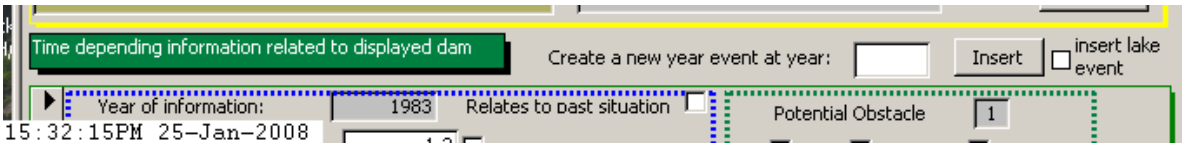


Figure 28: Inserting records facility

The box titled “create a new year event at year:” allows inserting a new event at the given year. The checkbox on the right indicates if a lake event (record) has to be inserted as well. The following cases are processed:

1. no lake is existing for this dam, hence the check box is unchecked and enabled if the dam is main. Secondary dams are not permitted to have a lake event added; the check box is hence disabled.
2. when year is given and button Insert pressed, the actions are the following:
   - if year already exist in `Dams2_M`, message is issued and no record is added, if lake was NOT existing, a message is prompted task for confirmation of insertion (default is cancel action), otherwise empty lake record is added,
   - if year is not existing in `Dams2_M`, the non-historical (=most recent) record is copied and inserted in Dams2_m with new date, lake is copied in the same conditions if check

box is checked, otherwise a message is prompted to confirm the n on inserting of a lake event (default is insertion).

- After processing, if required, historicity of records is recomputed and display updated.

Creating new set of records

As mentioned in §5.2.2, a set of records comprising dams, dams data and lake information. Inserting a new dam is different to inserting an historical event for an existing dam.

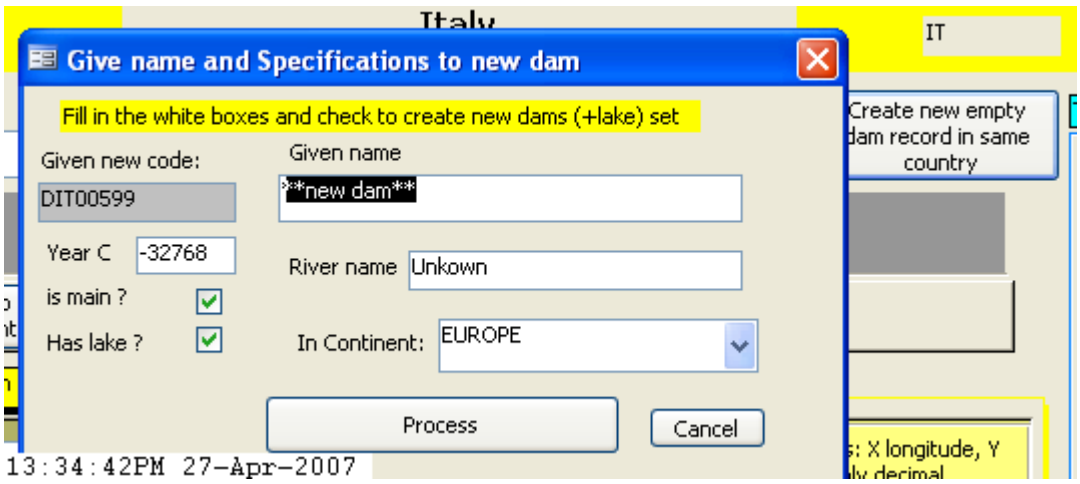


Figure 29: pop-up input box for creating new dams

The function creates a new dam with the given code (automatic attribute. If name is not entered, the process is cancelled. The year of creating is better entered here, although it can be updated afterwards. The request can be cancelled at this stage by pressing cancel.

If the checkbox `Is_main` is set to false, no lake is created (checkbox turns to false) and the dam is attributed as secondary dam to the currently displayed dam or to its attachment dam, in the case the currently displayed dam is itself a secondary dam.

The created records are set to blank or default values: the created records are in Dam2 (new entry) a current record in dams2_M, if relevant a Lakes2 record and if dam is secondary a record in Dams2_SVol.

The year of commissioning is input by the user. If the year is non numeric, a message is issued until either a valid year is entered or the process cancelled.

Once created, the record is presented for editing It is highly recommended to fill-in all fields available.

A recommended procedure in such cases (that should be exceptional is using a hand filled table (example of commonly found data on the Web in Appendix 8).

5.2.7 Adjusting helps

Most processes are featured with a help button that opens a help window.

The content of the help can be adjusted if the message on green background is as displayed on Figure 30. The window closes by pressing either the cross or the door button.

Updating helps is permitted only to administrator since V 2.08 The banner is in red and caption is “You may not update the content” if the logged user has not the rights, otherwise the display is as on Figure 30.

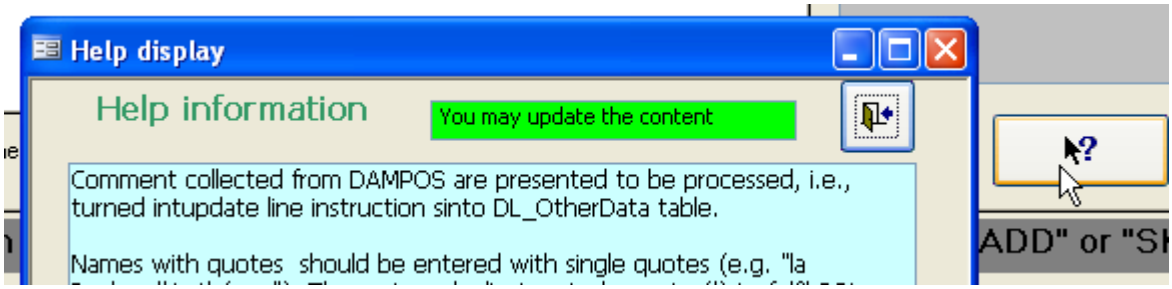


Figure 30: Help window and help button

To skip a line inside the comment area, use Ctrl+Enter. Message length is virtually unlimited because the help is stored in a memo field.

5.3 Uploading DamPos database

5.3.1 Uploading new database that replaces the old one

The process is sketched in the next Figure 31.

Definition

Uploading a new database from Eldred2 comprises:

1. Optionally (default) safe keeping a copy of the replaced Web database, with date of replacement,
2. Replacing the content of the relationships between dams and users by a new one and replacing the content of the old database by a new one,
3. Replacing the contents of the demo database and the relationships between users and dams by new ones, optionally. The Demo data base is never archived.

Processing

This is done by action on the button Reload entirely DamPos (Web database), with the possibility to reload as well the demo database and archiving the former DamPos data base.

For the time being, locking the Web database is not fully operational because ill understood ODBC manager errors; hence errors can occur, because the database is being processed and its contents cannot be purged.

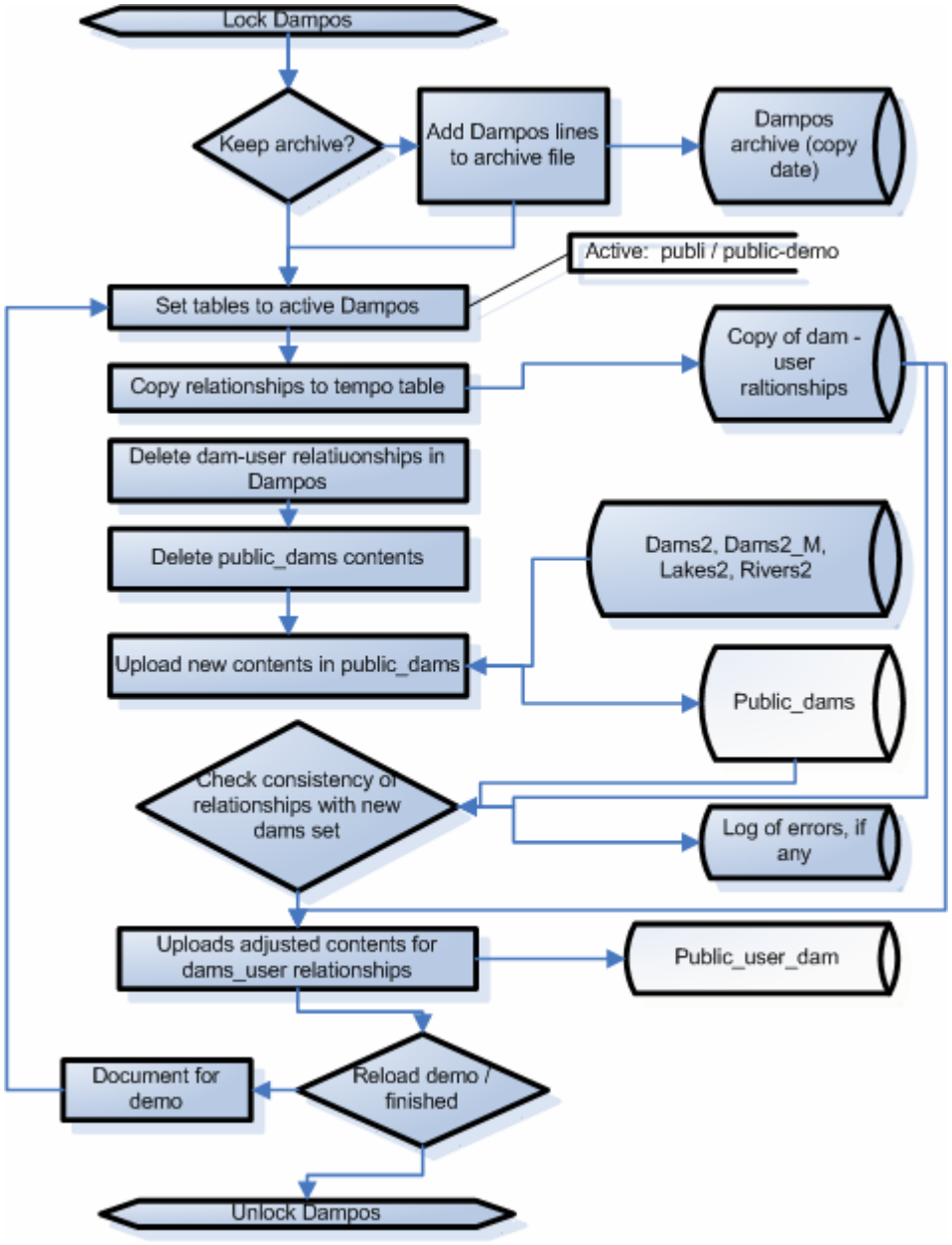


Figure 31: Process flow for uploading a new web database

5.3.2 Purging safe copies of previous DamPos versions

This is not available as procedure in the current V 2.08 database release. To purge version, create a hand processed query based on copy date.

5.3.3 Updating Eldred2 from information collected through DamPos use

Principles

Different sources of information are intended to add corrections to records:

- Comments harvested from DamPos,
- Exploiting notes inside the records,
- Getting data from Web sites or literature

- Obtaining complementary information from GIS processing.

In all cases, the principle of logging the information and changes must be preserved. To this end, records editing will be limited and traced through the existing files.

1. Comments harvested from DamPos are processed to insert new records in the `DL_Otherdata` table. Processed comment is flagged TRUE after the record is inserted, and `HasUpdatedDams2` is flagged FALSE to make its processing possible by the update procedure (see §5.2.4).
2. Exploiting internal comments, especially the different stages of dam development is ensured by a specific function that creates lines in the table `Hist_ChangesData`.
3. Exploiting notes or information from Web sites and literature results either in preparing records in `Dl_other` data or direct editing. In this second option this results in record creating in `Dl_other` data, to track the change. In this case, the inserted record is flagged TRUE because processing has taken place.
4. GIS processing will be handled through specific log table, not yet designed.

Processing DamPos comments

Comments processing is implemented since version V2.04 of September 2006.

Comments cannot be processed automatically; hence a half automated procedure has been set. Comments are presented to the database administrator, who creates, with a special form, records inserted in the standard updating file `DL_OtherData`.

The latest and previous versions of comment are displayed on the upper part of the form.

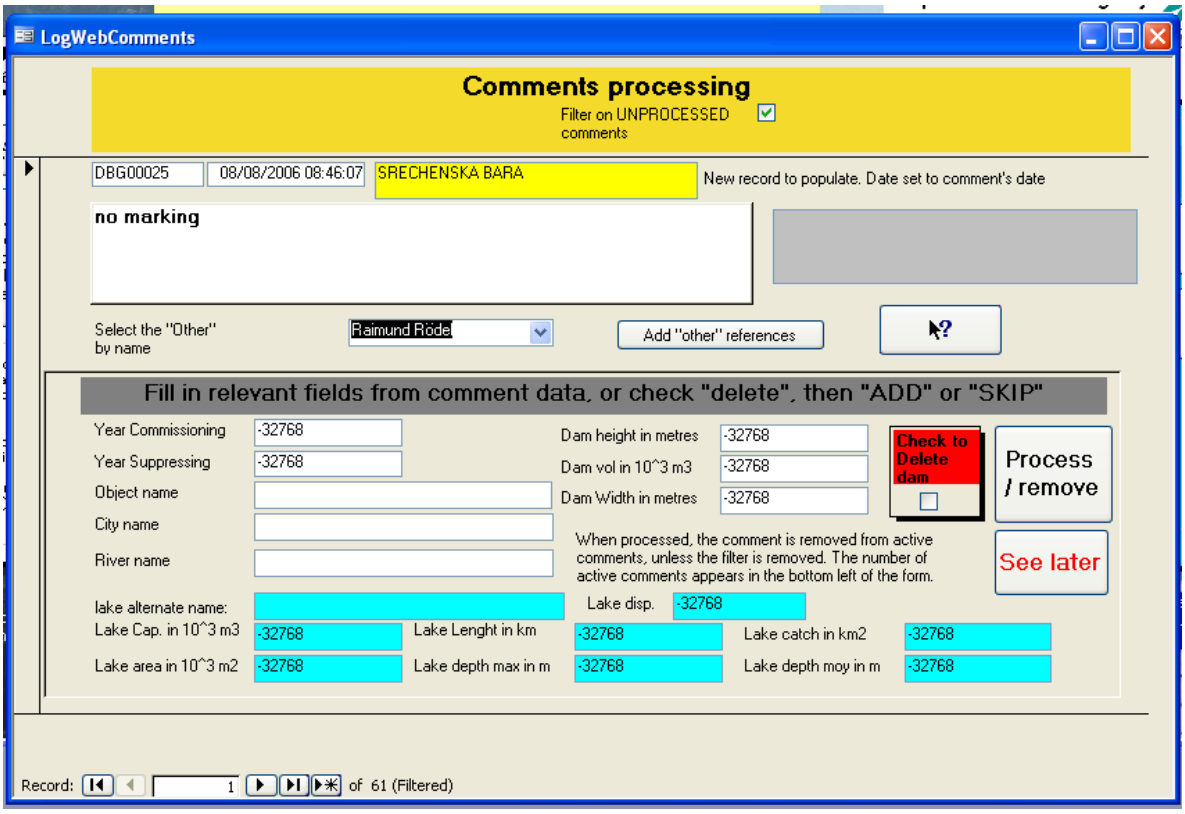


Figure 32: Form to handle comments

Comments are not attached to a specific contact person. This is because collecting the precise author is not possible during the DamPos operation. The author must therefore be guessed and set with the drop-down. If not yet entered, use the Add "other" references button. By default, the "other" field is blank. If field is left blank, an error message pops-up, and demands for inserting value (as shown on Figure 32).

Comments can be filtered (only unprocessed comments are presented) or unfiltered (to reprocess former comments). In the first case the date attached to the modification record is the comment's date, in the other case it is the processing date. Otherwise there would be a duplicate record.

Possible actions are:

- Inserting a delete record, by checking the check-box with red caption and pressing Process / remove. A double security is installed. If any field is not at joker values (-32768 or blank) an error message is issued. This is to prevent deleting inadvertently a dam. Second, if deletion is requested, a confirmation message with default on cancelling deletion is issue. On accepting, a deletion record is inserted in `DL_OtherData`.
- Modifying the information attached to dam / lake. Dams data are on white background and lake fields on blue background. Dam data are inserted as dam update records, lake data are inserted as lake updating records only if lake exists. Only main dam codes can create lake updating records. Comments requiring no action are withdrawn by pressing Process / remove without populating any field in the form.
- See later skips current record. Use it in the event no action seems to be taken. Skipping sets the `flagtempo` field to true and records are no longer presented in the current session. By contrast with the remove action they are presented again on the next opening of the form.

WARNING: Many names must have quotes (’). Enter these names in their natural spelling, for example **La Roche d’Anthéron**. The system will manage quotes and update accurately the tables. DO NOT attempt double quoting, etc. Avoid use of double quotes (“) or anticipate on SQL programming. The application is designed for handling special cases. However, GoogleEarth® does not parse correctly strings with several quotes. They are replaced by ‘°’ in the KML exported files.

5.4 Exploiting Eldred2 data

5.4.1 Status of coordinates achievement

The status of coordinates availability is produces as printed sheet or view respectively by pressing buttons 32: Print X,Y Integration status or 31: View X,Y Integration status. In case 1 the printing starts immediately, in the second case, the view form can be exported as MS Excel® workbook by selecting Export… after having right-clicked on the view.

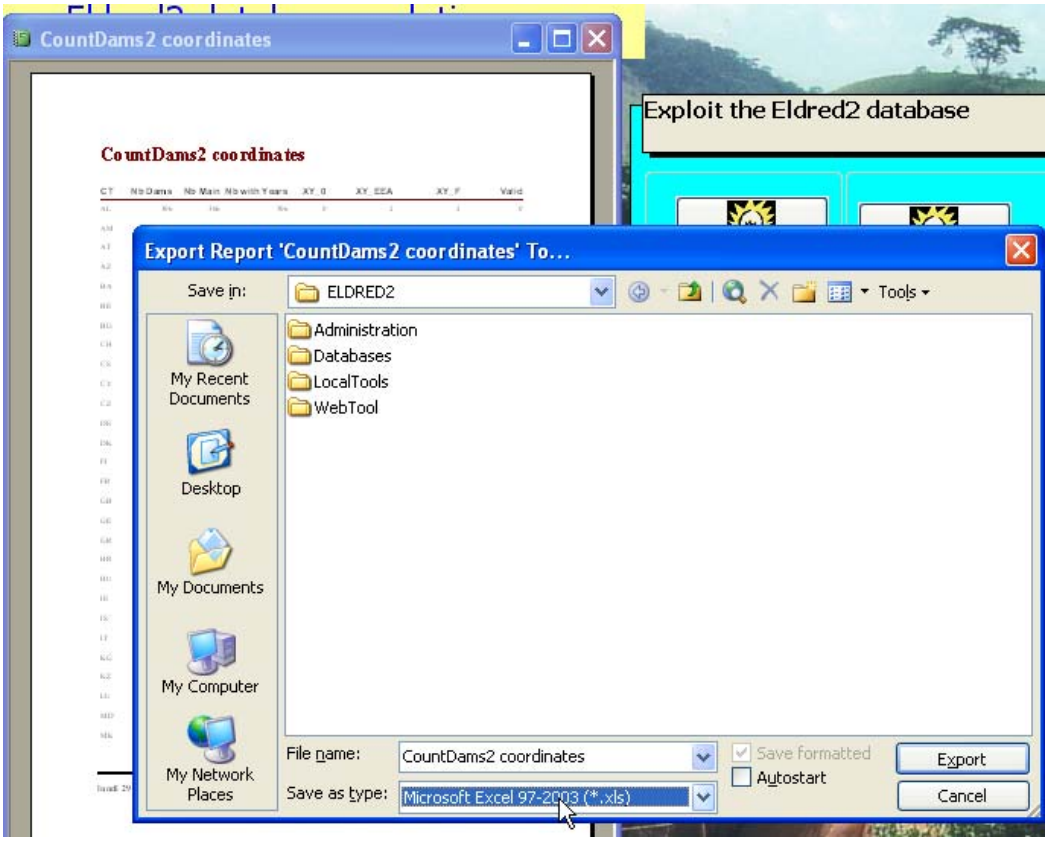


Figure 33: Exporting view as MS Excel® workbook

5.4.2 Dams and lakes statistics

Function similar to coordinate status displays and prints overall statistics on dams and reservoirs. To export as MS Excel®, see method on Figure 33.

When Eldred2 has been turned into a geodatabase, more statistics will become available and the function operation shall be arranged in consequence.

Making statistics is quite complex ands requires good understanding of the result of choices in the control panel. When pressing buttons 35 or 36 (Figure 13, p 36) a special forms pops-up, and proposed choices before exporting statistics.

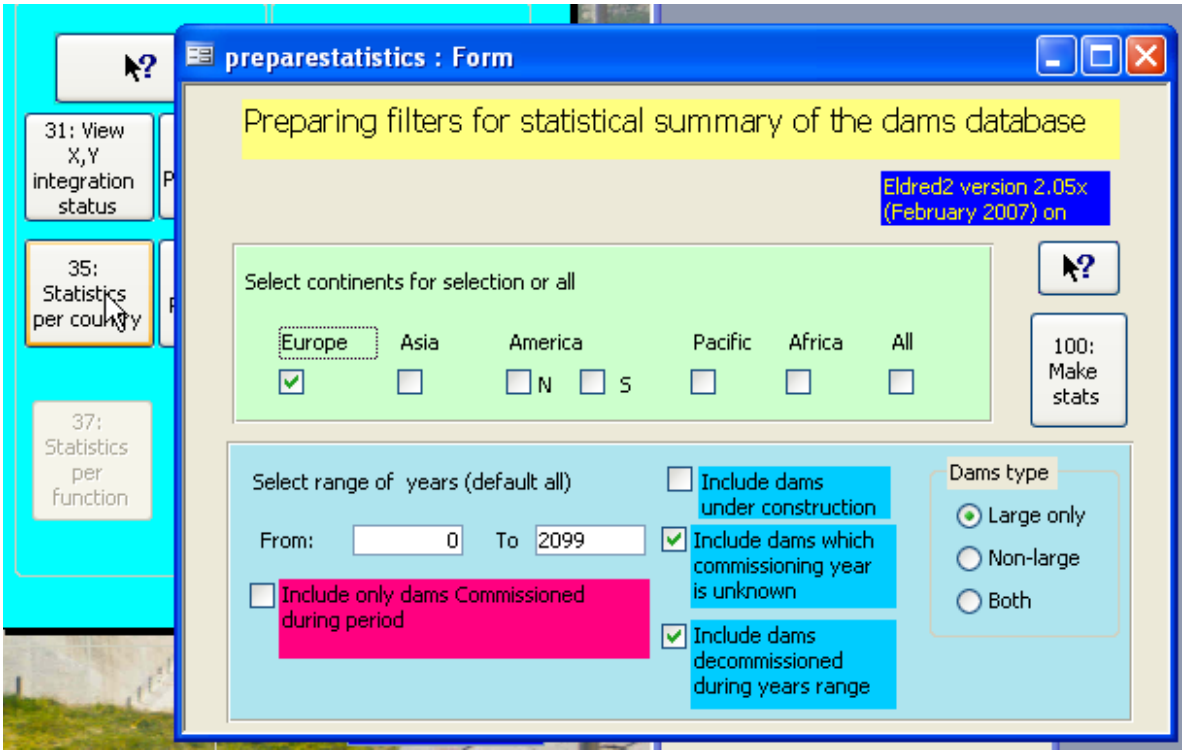


Figure 34: Form for preparing dams and reservoirs statistics

The top green set of buttons allows selecting in which continent the dams are. Checkbox All cancels previous choices; conversely, any selection on other buttons reverts All to unchecked. All continents are covered in the European database because at least France has dams in territories under its jurisdiction in all continents.

The second set of choices is more complicated.

- The range of years (default 0 to 2099 takes all dams) selects dams having existed at least ONE year during the selected period. If the checkbox with red label is selected, only dams commissioned during the period are presented: this is a subset of existing dams, because dams commissioned before the first year are NOT selected in this case.
- Dams under construction (`first_year` set to 2100 by default) are not included in default choice; they can be included by checking the box.
- Dams which commissioning year is unknown (`first_year` set to -32768) are included by default. This obviously makes double accounting if several selections are made and further aggregated. Summing the results of two selections, for example 1700-1900 and 1901-1950 will output different figures than 1700-1950, if dams with unknown `first_year` will be included in both first selections and once only in the later one.
- Dams decommissioned during the range of years are included if they have existed at least ONE year (see first bullet above). Unchecking removes these dams from the selection.
- Data from dams with historical changes are included for the last year documented during the period. For example, a dam built in 1894 and modified in 1902, 1930 and 1990 will be included with its 1902 data for a selection 1800-1915.

After pressing button 100, the statistics are displayed (if button 35 had been pressed in the main form) or sent to printer (if button 36 had been pressed from main form).

5.4.3 *Exporting extract of Eldred2 for coordinates assessment*

Selected extracts of Eldred2 can be exported as MS Excel® workbook by pressing button 33: Export data for proxy X,Y in Excel file. This opens a secondary form from where complementary information can be entered.

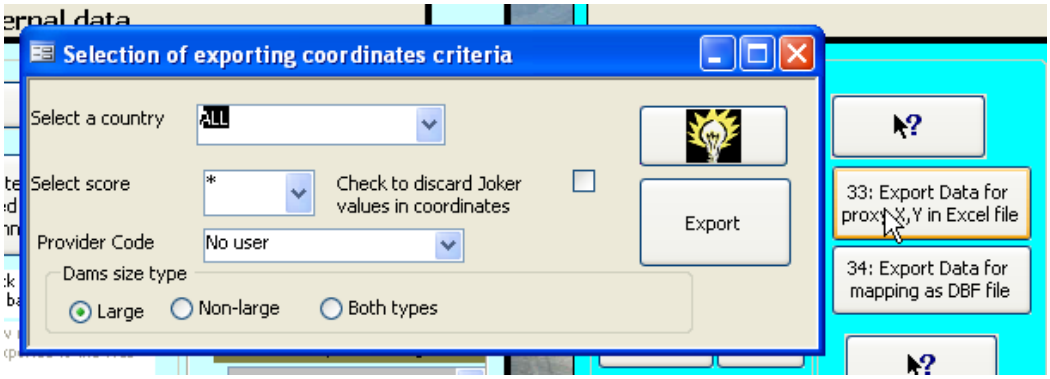


Figure 35: Form for exporting data and coordinates for checking

All coordinates are exported, including the missing ones because the aim of the export is precisely to complement the data, unless the checkbox "Check to discard…" is checked.

Three selections are possible:

1. "Select a country": only selected country (one choice) or ALL (all database) can be exported;
2. "Select score": * selects all scores, otherwise records are exported according to the quality of the current coordinates,
3. "Provider code": 'no user' takes all providers. Otherwise all dams meeting criteria 1 and 2 are exported and populated with provider's own code if any. Dams having no correspondence with 'other' have the corresponding field set to Null.

Clicking the Export button opens a dialog box in which the file name destination can be entered (no need to add the extension) or select a previous one (extension will be adjusted).

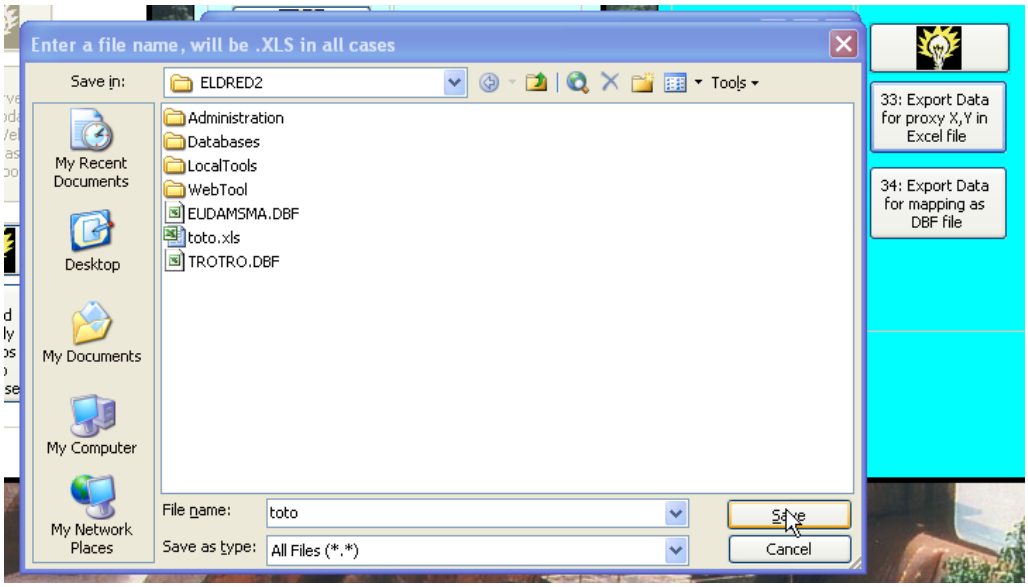


Figure 36: Dialog box for selecting the export file name and path

5.4.4 Exporting extracts for making ArcGis® layers

Tries with converting extracts from procedure in §5.4.2 suggested that the export format, that is suitable for assessing coordinates quality was not optimum for importing into ArcGis®. The following adjustments revealed necessary and were inserted as a new facility in Eldred2 main form (Figure 13, p 36):

- Export format is dBase that is directly imported as such by ArcGis®, whereas MS Excel® sheets require prior formatting of numeric columns.
- Merging all coordinates in a single coordinate pair and merging scores as unique score,
- Adding relevant information to allow direct mapping of volumes, dam heights and labelling.

The next rules are applied:

- Coordinates are selected in the decreasing order of final (_FDD), EEA (_EEADD) and initial (_ODD). Only valid (non joker) coordinates are exported.
- Score is set to 0 (initial score is 1 and `is_validated` is TRUE), then score value up to 3 are exported. Scores 4 (coordinates to joker) is not exported. This allows presenting differently the map output.
- Heights and volumes are compressed into a single value, merging first the non-joker values and presenting joker values only if no non-joker value is available.

The form is a simplified from the other export form, and allows only selecting one country or all.

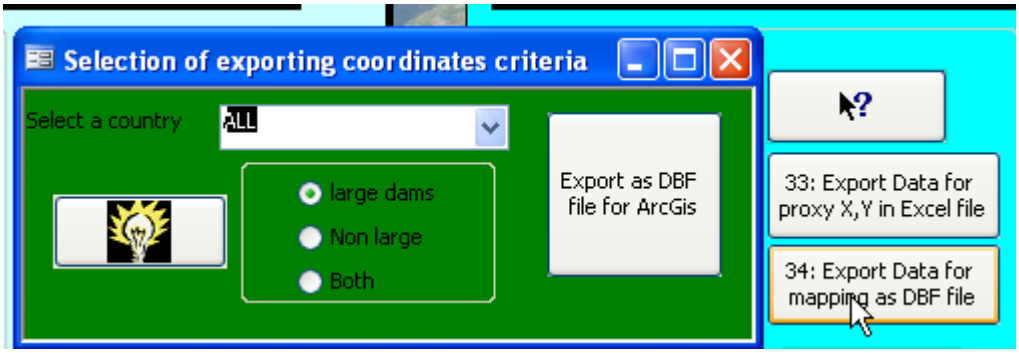


Figure 37: Form for exporting data as file for ArcGis®

When transforming the coordinates into layer, tell ArcGis® on the reference geoids that is reported on the next Figure 38.

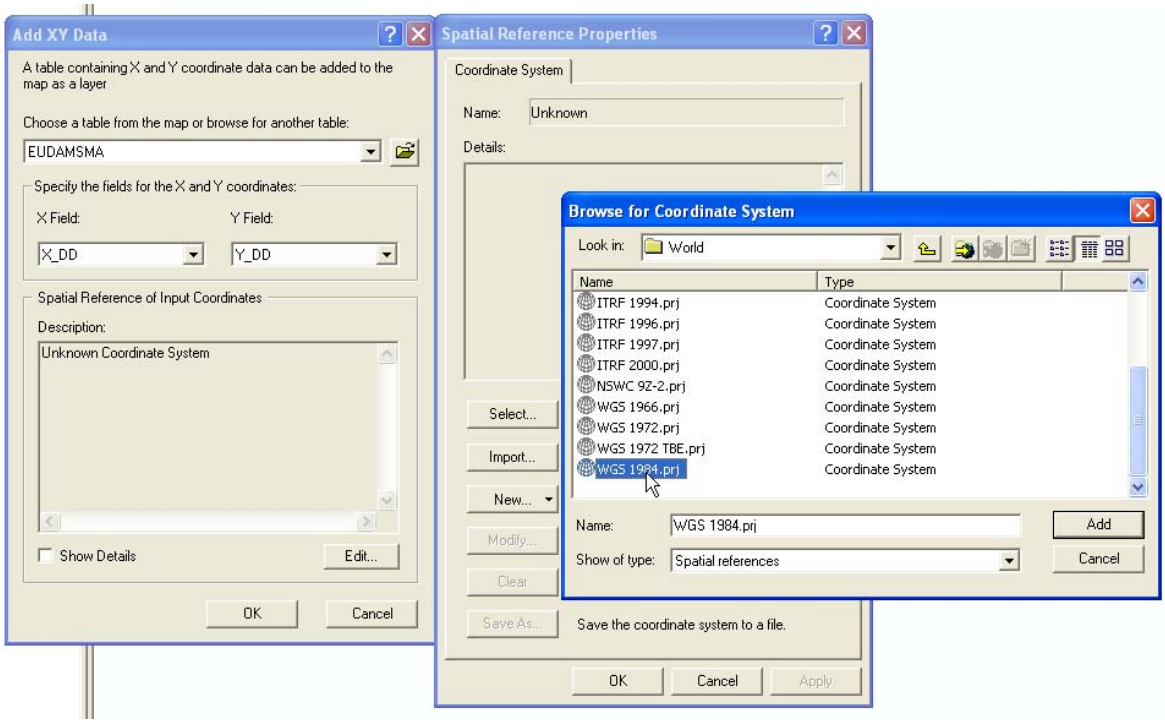


Figure 38: geographical coordinates reference to use with Eldred2 export

5.4.5 Exporting as KML files (Goggle Erath®)

GoggleEarth® has became a very practical visualisation tool. A new facility has been implemented to export selections as GoggleEarth® KML files (compatible with release 4).

The export procedure is designed from the statistical provision, allowing exporting selection of dams. The form used is the one presented in Figure 34, slightly adapted to restrict export to country(ies).

The form displayed in Figure 39 presents the results after calculation. Several or no country can be selected, and continents can be selected as well. For example, selecting France and Europe presents only metropolitan dams in France, whereas South America and France present dam in French Guyana.

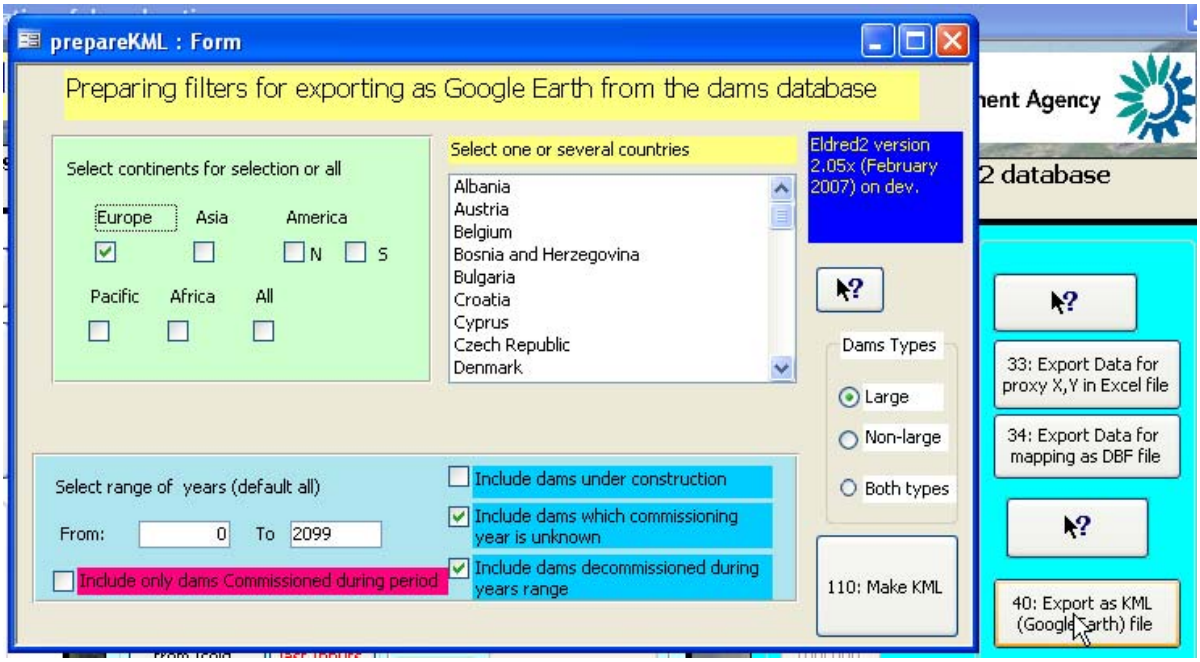


Figure 39: Export files as KML form

The rest of the form is directly derived from the statistics form. After file is created, the number of source dams and exported dams is displayed: only dams having relevant coordinates are exported, those having joker coordinates are not.

5.4.6 *Exporting data for the EEA data service*

The EEA data service provides data to the general public. Dams are part of this information, and the data service implements dissemination of dam data that must meet the requirements given by data providers. These requirements are:

- Not all data related to dam may be proposed,
- Dam location must not be too accurate.

The data service implemented by the EEA takes into consideration these requirements, taking into account the fact that the newly available technologies allow getting individually the blurred information from free accessible web sites. First of all, a limited set of data, as agreed with Icold .is provided as attribute to dam data and second, the dam coordinates are rounded to the nearest minute (instead of the nearest second in the current data base).

There is no filtering on the dams, with exception of dam size: only “large dams” (marked as `is_icold=true`) are exported. This is because the current heterogeneity of small dam data.

Pressing the button 51: Make EEA data service dataset exports under xxxxxxxxxx format the table, with the export date.

5.4.7 *Exporting data for fragmentation module*

A fragmentation module has been developed as both a stand-alone process (not recommended) and as part of the NOPOLU *Système 2*[25] used by the EEA as main component of the Spatial platform for environmental assessment.

In the current version (V 2.08 only fish fragmentation related exports are implemented

[25] Product by Jakko Pöyry http://www.infra-environment.poyry.com/contacts/contacts_6.html?CountryId=FR, 78180 Montigny le Bretonneux, France

5.4.8 Exporting a copy of the data

5.4.9 Defining "dams that matter"

Large and non-large dams are data source depending definitions. A large dams is a dam referenced in the Icold register. Criteria for inclusion are based on dam size and not applied in the same way across the countries.

By contrast, dams "that matter" refer to specific targets that may be biology, sediment retention or water cycle changes. It is important to note that in the above mentioned groups, there is no judgement. Mattering criteria have been sketched in the 3rd GWSP workshop and have to be checked.

For the time being, it is envisaged to implement a simplified query builder that will update a new Boolean field `is_matter` in dams2 table. To make selection easier, it is envisaged to add 3 supplementary Booleans `is_MFish`, `is_MSed` and `is_MHyd` that could be managed in a OR or AND condition when exported or displayed.

A button has been reserved in the utilities box to manage the "mattering" criteria.

Figure 40: Form to specify mattering criteria (TBD)

5.5 Fish fragmentation export data

5.5.1 Principles

Export data is placed in a set of 3 tables named `NOP_Fish`, containing all fish passing data per dam and year and fish species, `NOP_CFish` containing the fish characteristics used for the export, `NOP_Dams`, containing and extract of the dam data base relevant for all export related to fragmentation. The structure of the tables is reported in Appendix 7.

The export table contains as many records as the number of dams * dated events per dam AND per passing capacity * number of fish events (species * age status) that are required by the export scenario.

For example if 2 species are to be exported, one being migratory and the juvenile / adult differences specified, 3 replicates of the dam set are exported, with passing characteristics.

Besides dam event are documented in two different tables that do not require being synchronized:

1. dams2_M that displays the dam event proper (change in size, etc.
2. P_fish that contains all fish passing characteristics for those dams having such information.

Since fish passing may be totally independent of dam structure (e.g. transport by truck), this is informed in P_fish and not in Dams2_M.

5.5.2 *Populating and editing dam passing characteristics*

Table `P_Fish` contains all data related to specific passing characteristics per dam, year of starting validity and specie. It structure is reported in Appendix 7. In the general case, it is expected that `P_fish` table is being populated from external files.

When specific data is to be inserted, or modifications applied, a specific form has been developed and can be opened by pressing button 26: Edit passing characteristics. The management of fish passing characteristics is doubled filtered to ease manipulations. Selection of a country is required, as for editing dams and attached lakes (button 23:…).

Since it is expected as well that available documentation could be provided on a river route basis, a second facility is offered inside the special form to filter on a river. The rivers presented for selection are the rivers provided with dam. When river has been selected (only one river at a time) only dams present on this river are presented in the drop-down allowing selection on dam name / dam code.

The form is displayed in Figure 41. it presents three parts. The upper left part is devoted to dam selection. Once a dam is selected, all related and relevant information is displayed in the bottom part.

On the bottom left part, the different time changes on dam height are displayed. Since the fields are greyed, they are locked and cannot be modified. Changing dam height at a certain time is possible by using form to edit dams, as opened by button 23:…

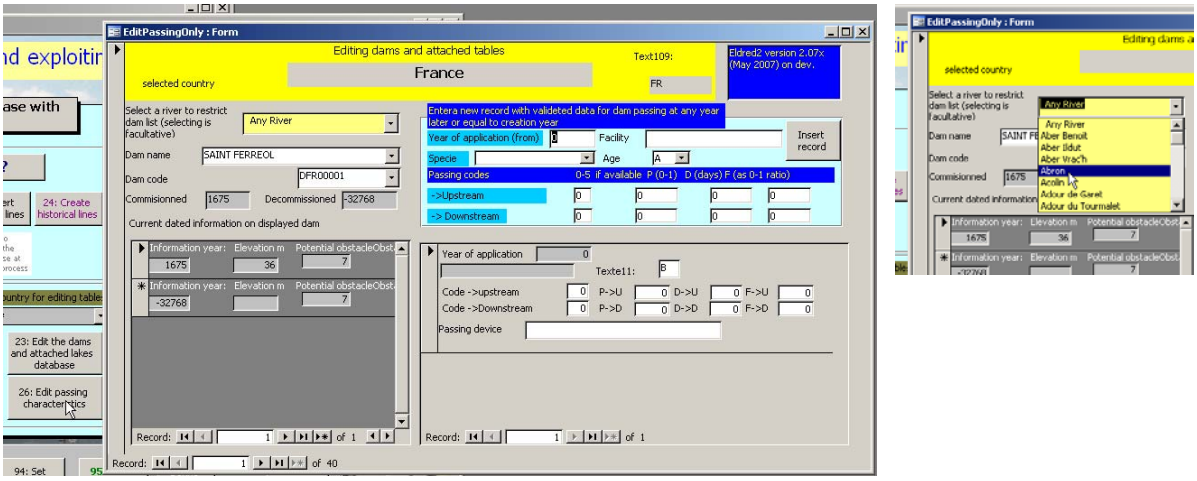


Figure 41: Form for populating / editing fish passing characteristics

Right: detail on river selection

The right part of the form is used to populate / modify fish passing characteristics. There are two possibilities:

1. dam has already fish passing data for a certain year and a certain specie, and the related data is presented in the bottom right part. In the displayed form above, no data is present, hence the display is empty.
   The existing data can be modified, with exception of year and specie. Record deletion is not permitted at this stage.
2. dam has no passing characteristics for this year and this specie. A new record has to be created by using the upper right part, with blue colours. To this end, enter any year of validity (greater or equal to dam starting year), relevant characteristics and press button Insert record.

The newly inserted record appears in the bottom right part and data can be adjusted as in the previous case.

Deleting a record has had to be programmed as a sub-function en creating a record. To delete a record, attempt creating a record with existing year, specie and age. When pressing button Insert record, a pop-up message appears.

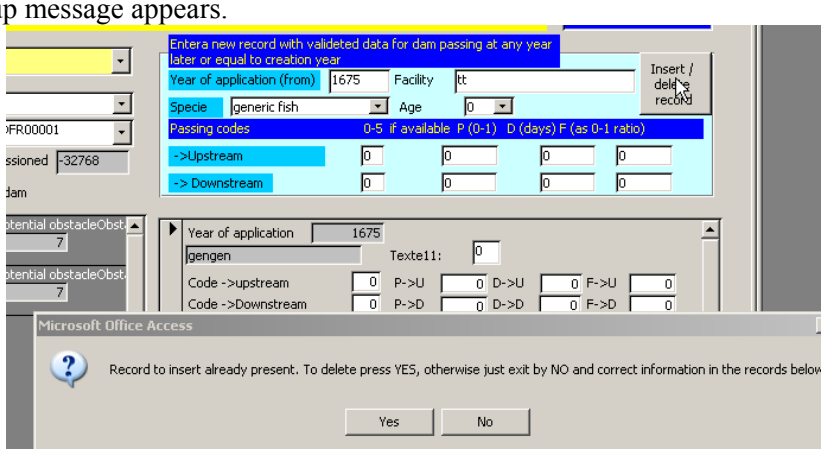


Figure 42: message permitting deletion of fish passing characteristics

Selecting NO (default option) does nothing, selecting YES deletes the record from the table.

5.5.3 Method for populating NOP_Fish

The fragmentation module works in such a way that long and infrequent processes are carried out in batch and that scenarisation is carried out over a comprehensive data.

Hence, all dams, disregarding their dates of existence are processed and snapped on the river system, and then the assessment is carried on those dams present / active during the time frame of the assessment.

To avoid parasitic process in the module, all information is prepared inside Eldred2. Since most dams are not populated with passing information, the processing way is based on:

1. systematic modelling of dams characteristics, disregarding if accurate data is available,
2. further updating of the export table where and when accurate data is available.

Moreover, passing data related to dams has two different steps: the simplest is a passing code (0-5), understood as a generic information not focusing on a certain specie. This information is available for a certain number of dams. The most accurate is the PDF values per species in both journeying directions.

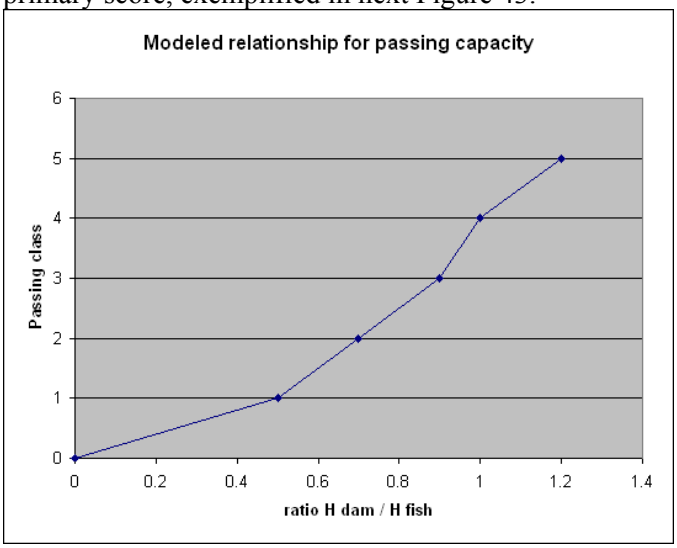
The processing comprises the following steps:

1. preparing dam characteristics for the subset of dams to be processed (making NOP_dams export table)
2. preparing temporary table W_Fish comprising all relevant dates for the set of dams, by incorporating the union of commissioning, decommissioning, changes and fish passing dates. This data set is not fish specific, it contains however both modelled passing codes and observed passing codes (that obviously supersede modelled codes)
3. making NOP_Fish by modelling PDF data per fish even
4. updating NOP_Fish form true PDF data is existing.

5.5.4 *Model bases*

It can be assumed that an obstacle, qualified by its height is all the more impassable that i) its height is closer to the fish physical capacities and ii) that the dam type is more difficult to pass. For example, a slope on which water overflows is passed easier that a vertical wall. This is exemplified by Figure 72 in Appendix 7. The values of changes are stored in Table 6 Appendix 2.

Calculation of the passing score is the result of the ratio dam height / fish capacities making a primary score, exemplified in next Figure 43.



C_FishH2code : Table

Field Name	Data Type
CodeScen	Number
rank	Number
RatioHFonHD	Number
Class0_5	Number
comment	Text
ScenTitle	Text

10:16:07AM 12-Apr-2007

Data can be scenarized under CodeScen, making as many functions as required. CodeScen is part of the final scenario of passing model

Figure 43: Example of height ratio to passing score relationship.

Data is in table C_FishH2code

Similarly, PDF and passing scores can be modelled by simple functions which values are scenarized in table C_C1-5ToPDF, which basic data are reported in the

Table 4: basic values for modelling PDF data from passing codes

CodeScen	codePS	P_DU	D_DU	F_DU	P_UD	D_UD	F_UD	ScenTitle
1	0	1	0	0	1	0	0	Baseline codes
1	1	0.99	0.1	0.01	0.99	0.1	0.01	Baseline codes
1	2	0.95	1	0.05	0.95	1	0.05	Baseline codes
1	3	0.8	3	0.1	0.8	3	0.1	Baseline codes
1	4	0.5	5	0.4	0.5	5	0.4	Baseline codes
1	5	0	99	1	0	99	1	Baseline codes

Du and UD respectively refer to downstream to upstream and reciprocally. Both scenari can be populated from adequate facilities launched by service button (see)

5.5.5 *Computing export*

Export tables are launched by pressing the 50: Make Nopolu/frag data sets button. This buttons opens (V 2.08) a single form devoted to fish issues.

This form (Figure 44) comprises:

- Selection facilities for the continent (country to add later),
- Selection facility for the dam type large only, non-large only or both. The selection is that a large dam has its field Is_Icold set to true.

- Multiple selection facility for fish specie, proposed as scientific name (English name between brackets)
- The bottom part proposes the two scenarios of ration (left) and passing codes to PDF (right). By default the baseline scenario is used.

Pressing the button processes and produces three data sets mentioned above. During the process, messages in the bottom part of the MS Access® window inform on the stage of the process. In case of any problem making the programme stop, the step to be processed is kept. Users not familiar with MS Access® should call their ADM in this case.

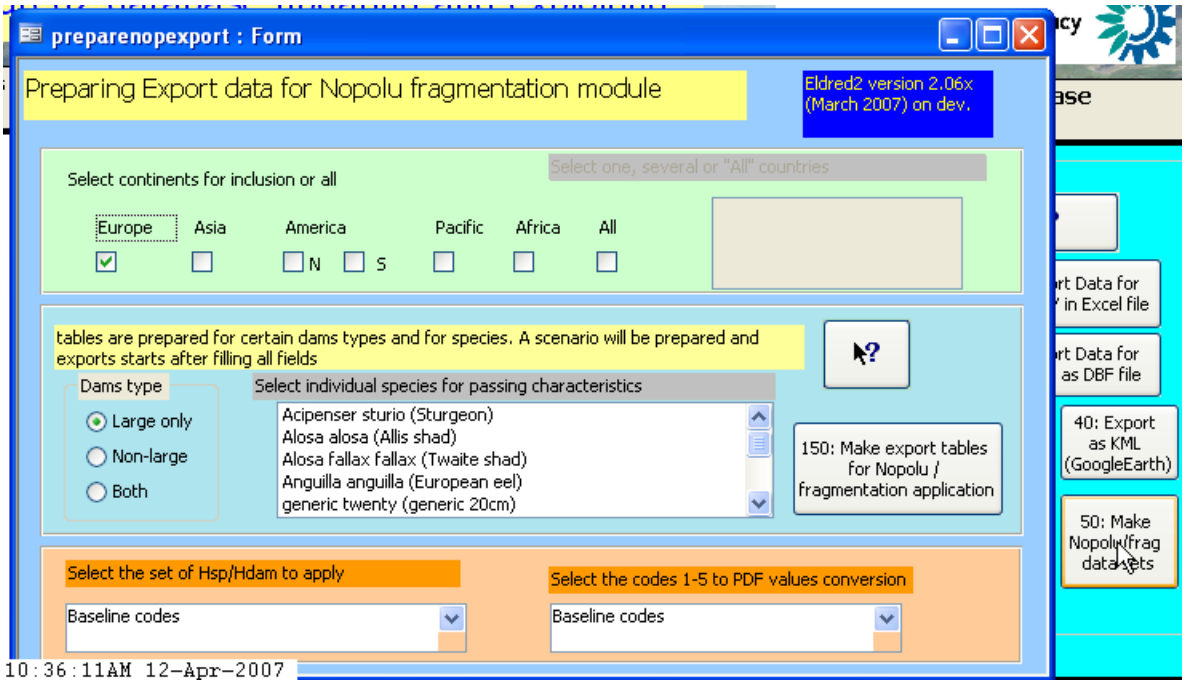


Figure 44: Form for processing fish passing export tables (provisional)

Final data produced are identified with a scenario code that is reported in all exported tables and handled in table LogNOPScen. Scenario codes are NOT reused unless the ADM resets the table.

Table 5: Content of the Fish export scenario table

CodNOPScen	FishCode	R1	DateCreated	NMaxScen
0	xxxxxx			15
15	acistu	Selection of dams on: (Europe) (Large and non-large dams) | Dam H to code: 1 | Code to PDF: 1	11/04/2007 17:26:56	15

The R1 field contains full description of the selection, and calculation data sets as numbers, along with calculation date. NMaxScen keeps track of the calculated scenarios.

5.6 Sediment fragmentation export data

tbd

5.7 Hydraulic fragmentation export data

tbd

5.8 Utilities

Utilities are launched by a set of buttons avaible in the bottom part of the main menu.

Figure 45: Set of utilities buttons

"Add users to lists"

The list of correspondents is opened by the button 90: Add users to list in the lower box of the main form (Figure 52) or by the button next to the drop-down in the comments management table (Figure 32).

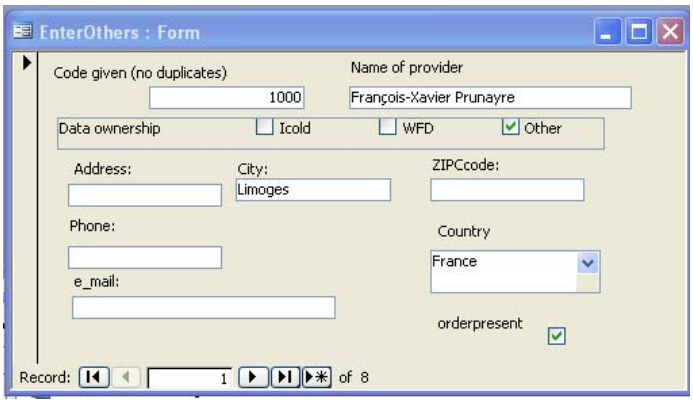


Figure 46: Form to manage the list of correspondents "Others"

Data ownership is exclusive: a correspondent cannot have several ownerships. This is automatically managed. The `orderpresent` field is for internal uses and is preferably set to TRUE. This field makes the record be presented in sorted order.

Checking de-synchronized records

Dams are entered and manipulated from different sources. If procedures are correctly used, all records should be in good agreement. It has been nevertheless observed that hand manipulations have resulted in loosing the year correspondence, thus resulting in unwillingly desynchronizing `Dams2` from `Dams2_M` and `Lakes2`. Desynchronizing results in having not matching dates between the main database `Dams2` and attached tables.

Matching means that dam code is equal (Dams2 and Dams2_M) or that Dams2 NOEEA matches Lakes2 NOEAA[26], synchronisation is on dates only.

The relationship between `Dams2` and `Dams2_M` is 1 to 1| many. The check is that at least one synchronised record exist, this record is not necessarily the one having the most recent date. By contrast, the relationship between `Dams2` and `Lakes2` is more subtle, and is 1 to 0|many because:

- Only main dams can have corresponding record in `Lakes2`,
- Not all main dams have a lake,
- A dam may have had a lake and no longer have it (see example in §3.3.3, p 11).

Consequently, the rules adopted to flag a mismatch are the following:

[26] This is not an error, is helps avoiding ambiguities on table source.

1. `Dams2` field `year_first` is considered as the reference date, any `Dams2_M` record not matching this date is considered desynchronised,
2. `Dams2` field `year_first` is compared to C_year from Lakes2 and should match. If year_dead in Dams2 is not set to joker, hence year_dead in Lakes 2 should match as well.

The form opened by pressing Check synchronization in main form allows partial synchronisation of dams. Dams with complementary note are suggested not to be synchronized, because (as displayed in example in Figure 47), desynchronizing obviously results from lack of insertion of historical lines.

Erasing scenarios has been presented with the export processing;

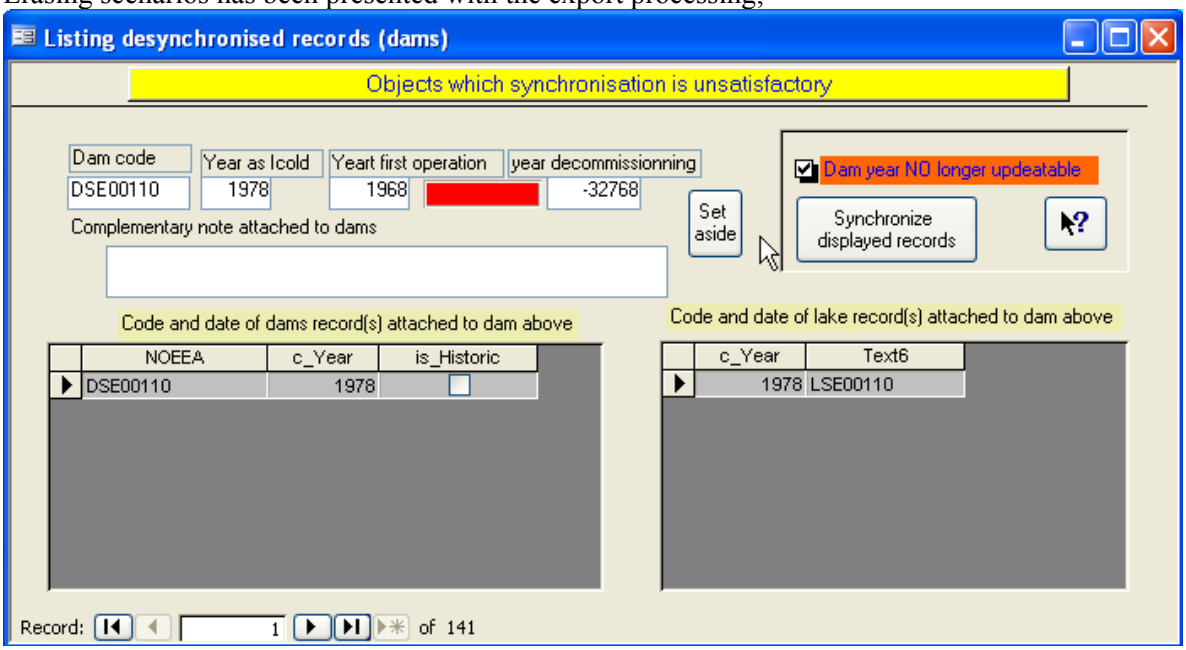


Figure 47: Synchronization form

The form computes the difference in dates between Icold and update, stored into `year_first` field. By convention less or equal than 5 years gives a green signal and more a red one. In all cases, the operator may decide to Synchronize displayed records or to Mark and set aside.

In this later case, a standard message is inserted at the beginning in the `ic_note` field of dams2, allowing automatic retrieval in the procedure of inserting historical lines. Many dams are not clearly indicated with correct year of first commissioning and do not have information of their history in the comments.

The standard message format is:

/* Eldred2 historicize: cccc : yyyyy */ + previously existing note.

Place cccc is ic_year and yyyy is for year_first. If and Eldred2 message already exist, no Eldred2 message is added. This addition is to force record to be presented to the form making historical lines. If the operator decides to **synchronize, record will NOT be presented**, because it is considered as closed case.

The records set aside are kept as non-synchronised and placed at the end of the subset. They are accessible from the last records. Synchronised records are n longer presented.

Synchronisation sets new date in all depending tables and checks note to set or replace by special note with the following format:

/* Eldred2 synchronized: cccc : yyyyy */ + previously existing note.

If historical lines are present, synchronisation is cancelled, with warning message. Request your administrator to fix the issue. In all other case, that result from updating problem, current dates are set to year of first operation. When dam records are synchronized, the further update of date is locked (if the check next to label on orange banner has not been unchecked). In this case, the year is untouched in further updates with `DL_otherdata` inputs.

Copying the database for external provision

A special button 92: Export database data is programmed to copy the database. This procedure ensures the possibility to copy only public contents. All records flagged as "restricted" are removed, if not having a secondary public source. According to choice, records from only Icold are partly hidden as well, if not having a secondary public source.

The procedure copies the source data to a mirror database which files are in the 'export' external database. The mirrored table names are supplemented with a 'E', for example dams2 becomes and so on. Pressing button Populate database carries out the following actions:

1. checks if mirror database is linked, otherwise abandon the process after warning,
2. purge content of the mirror files,
3. export data after removing / hiding the preserved contents.

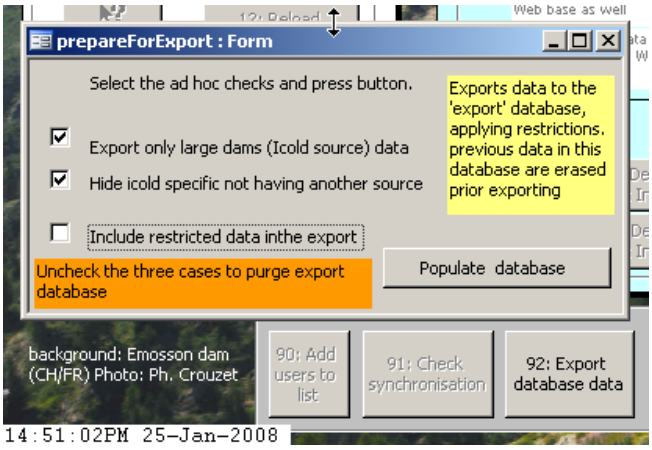


Figure 48: Preparing the database for external provision

Erasing obsolete export passing scenarios

Useless or obsolete scenarios take a lot of space in tables. To discard scenarios, use the utility button Erase NOP scenarios. This button opens a form from which the scenario to discard can be selected. Deleting scenario required a confirmation which default value results in keeping the data. Discarded data are totally lost. All data tables are purged from scenario related data. Scenario 0 cannot be purged.

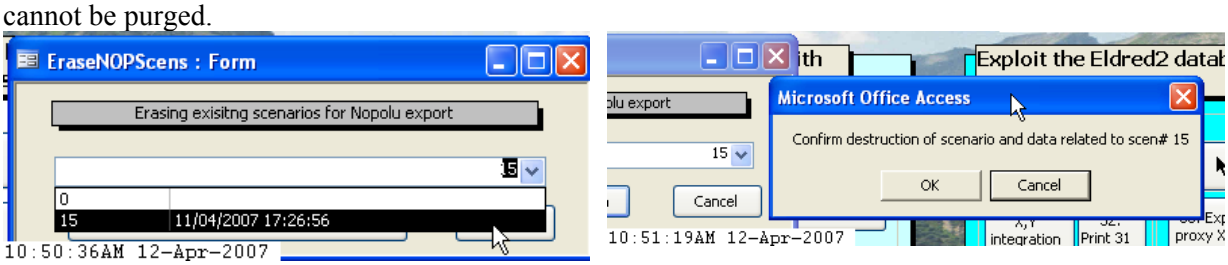


Figure 49: Erasing NOP export scenarios

Scenarios can be purged only one by one to prevent unwanted erasing.

Setting fish passing model variables

Model variables used for exporting dam characteristics are better managed thanks to facilities opened by pressing button 94: Set passing variables.

A form with two pages (until sediment and hydraulics are modelled) opens. The principles of functioning are identical:

a/ select which current scenario should be presented. To this end, select it in the drop-down on the left hand side of the form. Let it blank to create a blank new scenario. A selected scenario is the seed for a new scenario.

b/ create a new one by giving a new name in the right hand-side text box. If existing scenario name is already present , an error message is issued and scenario entry creation denied. To create a new scenario, just type a name and ENTER[27]. The new scenario becomes the active scenario, blank if no exisiting was selected before, copied from the former active otherwise.

The first page is used to set the ratios values between fish capacity and obstacle height. The values make the curve presented in Figure 43 which is dynamically set when changing any data.

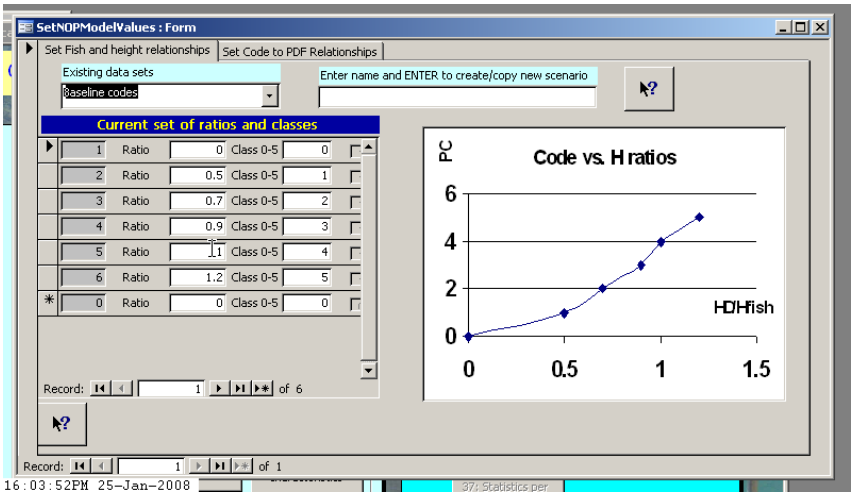


Figure 50: Fish passing modelling facility. Height to height ratios setting

Intermediate values can be added. It is however not recommended to be too precise, because used data is quite uncertain.

To this end, you can insert lines; inserted lines are always inserted BEFORE the current line. Inserting is carried out by double clicking on the rank, the greyed cells on the left-hand side. To insert line before line 1, double–click on the value 1, to insert before 4, double-click on the value 4. To insert line after the last, double-click on the 0, which is the first line after the end of the file. The application adds rank number and sorts the new data.

Newly inserted lines have spurious ratio (set to 10) and class (set to 5). Correct data accordingly to the needs.

The second page is used to set the relationships between passing codes (values 0-5) and PDF values.

For detail, refer to the developments in section 5.4.8.

The form presents as displayed in the next figure. By contrast with the previous page, inserting lines has been made impossible.

[27] Getting out of the cell by any means has the same effect however.

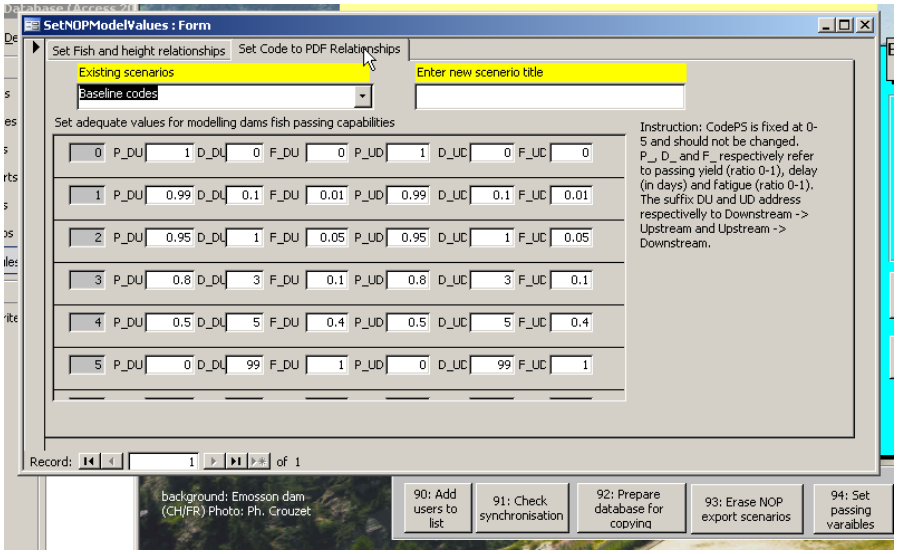


Figure 51: Fish passing modelling variables: code to PDF relationships

Creating scenario is carried out the same way: either select an existing scenario to copy its content or select blank line to create blank scenario both by giving a new name and pressing ENTER.

Suppressing dams

It happens that dam record have to be suppressed. This is **not to be done by accessing directly the tables** in any circumstance. A special procedure has been set to facilitate the use of the updating facilities. A button on the Utilities set opens a form that allows selecting a dam by its name or code and set the instruction sin the DL_otherData table. Confirmation is asked, default is abort.

Suppression is effective only when the 20: Update... button is activated, in this case confirmation is asked before physically destroying dam related records. Only the log of dam destruction and date is kept I DL_Otherdata.

Hence, destroying a dam record should be done wisely.

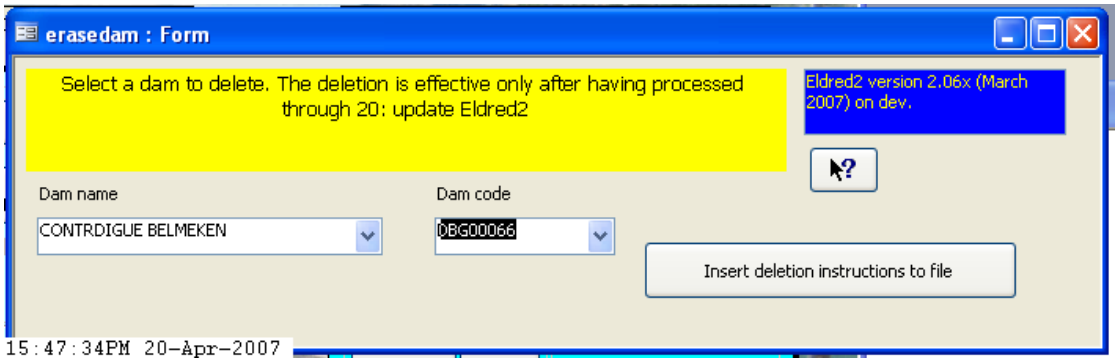


Figure 52: Form to insert instructions for deleting dam.

5.8.1 MS Access® settings for using the application

The code behind the forms is VBA that requires MS Access® settings. To make the ad hoc settings, open any module (double click on the module name), click on Tools on the menu bar and select References… The next dialog box appears where the following add-ins should be selected.

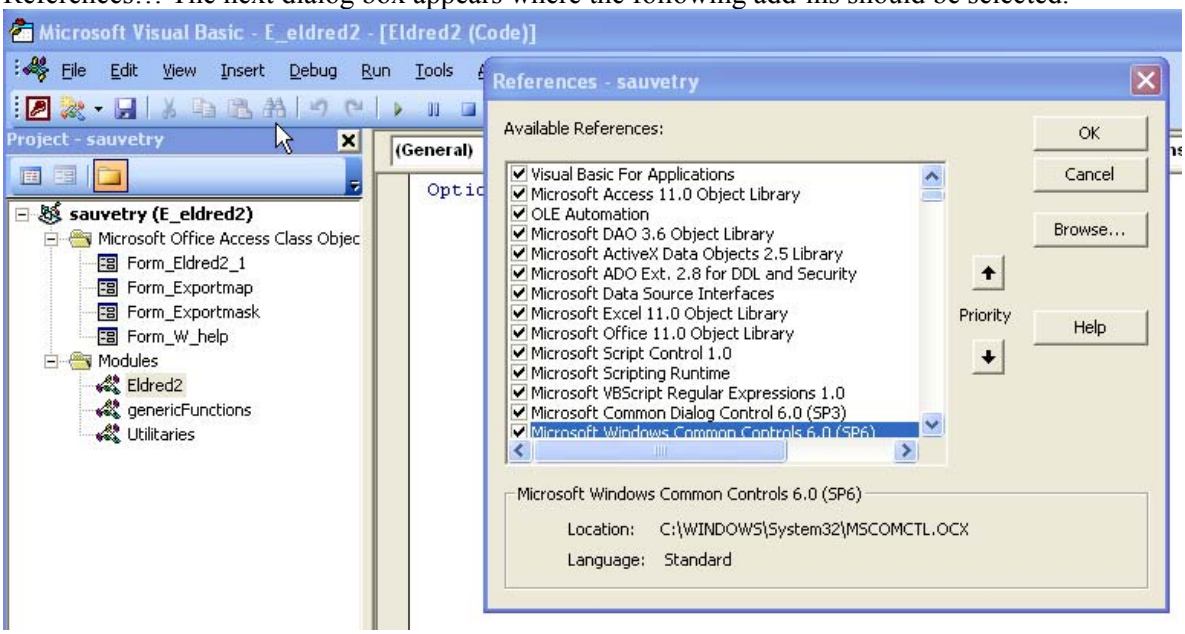


Figure 53: Required MS Access® references for Eldred2 operating

All the references are standard although generally not installed in the basic MS Access® customisation. If references are missing, compile / running errors may occur. When the references are set, control by compiling the application. Open any module and click Debug /Compile. If the application has already been compiled, the Compile entry is disabled.

6 Procedure for facilitating the finding of coordinates

End of March 2006, c.a. 2,000 dams were more or less accurately placed, with scoring 2 or better. These dams could be scored 1 within a short while, after checking their coordinated thanks to the use of the Web DamPos tool.

Conversely, around 4,000 do not have proxy coordinates, which severely jeopardises the possibility of using the Web DamPos tool; providing proxy coordinates becomes the major priority in the next weeks.

The following procedure is suggested:

- Starting with he exported MS Excel® file, select all dams that have city or region name attached and find out the coordinates (WSG84, decimal degrees) related to the commune. These coordinates replace the jokers in the MS Excel® file, and code '2' is set in the XY1I2E3F field, indicating that these coordinates come from EEA processing.
- This job is carried out country by country, considering those where coordinates could be found elsewhere (see previous report
- Extract of file with these coordinates is inserted into the Eldred2 and Web DamPos database by the EEA administrator.
- Where no city is reported with the dam, replace the city name by the dam name, country by country, considering excluding first the irrelevant words ('dams', 'dyke', in the relevant national language),
- Extract a second set of records for inclusion,
- The remaining dams should be considered individually, if too many have not passed successfully the first steps.

Value of `Code_other` for ETC/TE is 1003, which is populated in advance in the MS Excel® file of dams without proxy coordinates.

7 References

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8 Appendixes

Appendix 1: Structure of Eldred2 main tables

Dams2 : Table

Field Name	Data Type	Description
ID	AutoNumber	
NOEEA	Text	EEA-NOEEA is dam identifyer
ic_CONTINENT	Text	CONTINENT (for dams in overseas possessions)
CT	Text	CT is country ISO (first 2 chars of NOEEA)
Is_main	Yes/No	TRUE if is main dam (NOEEA_M is blank)
NOEEA_M	Text	NOEEA_M is Identifier of main dam
ic_Dam_Name	Text	ic_Name is of Dams2
Alias_dam_name	Text	EEA-other name for dam, if existing
is_Icold	Yes/No	TRUE if dams comes from Icold Register
is_WFD	Yes/No	TRUE if dams comes from WFD reporting
is_restricted	Yes/No	TRUE if dams is WFD AND restricted
is_other	Yes/No	TRUE if other source involved
is_International	Yes/No	if TRUE should point to Dams2_I table
ic_Year	Number	Year of last data, is current year
is_icy2yfirst	Yes/No	TRUE if year first is copy from ic_year
year_first	Number	year of first commissionning (is year in general case)
year_dead	Number	year of decommissionning or blank
Reach_ID	Text	River reach ID. Not populated for the time being. Index when avaiable
River_ID	Number	River_ID is pointer to river name and characteristics
is_GoodCity	Yes/No	Set to TRUE if the city name should not be replaced by city from DL_Others data
ic_City	Text	City name
Alias_City	Text	Alias City name
ic_State	Text	
X_ODD	Number	original-X is source longitude in decimal degrees of wall centre
Y_ODD	Number	original-Y is source latitude in decimal degrees of wall centre
X_FDD	Number	Validated-X_F is corrected longitude in decimal degrees of wall centre
Y_FDD	Number	validated-Y_F is corrected latitude in decimal degrees of wall centre
X_EEADD	Number	EEA-X_E is proxy longitude in decimal degrees of wall centre
Y_EEADD	Number	EEA-Y_ is proxy latitude in decimal degrees of wall centre
Score	Number	Indicates level of confidence on coordinates. Values are : fully OK (valid is TRUE), 2 to adjust (default if trusted coordinates), 3 proxy, 4 no gues
is_validated	Yes/No	is validated
Contact_ID	Text	Contact_ID is pointer to list and addresses of contacts related to data
FlgTempo	Yes/No	Work-marks the lines that are updated in any process. Value is volatile
is_oncanal	Yes/No	TRUE if dams is on a canal instead of river
is_dyke	Yes/No	TRUE if the dam is a dyke
ic_note	Text	original notes related to dam
Comment	Memo	is the exchange with the Web location system

Figure 54: Structure of main table Dams2

Dams2 is the main table containing permanent information on dam from commissioning to its disparition, if any. Ic_ fields are taken from Icold register; this is to mark the origin of the data.

P_Fish : Table

Field Name	Data Type	
NOEEA	Text	
year_V	Number	
SpCode	Text	Fish species code
c_PassUpp	Number	Code 0-5 /joker for upstream movement
c_Pass_Down	Number	Code 0-5 /joker for downstream movement
is_guessed	Yes/No	tells if data is computed or set from direct inserting
Is_Mig	Yes/No	True if fish is migratory
CodAgeSp	Text	"A" Or "J" Or "0" Or "B" Adult Both Juvenile or joker
D2U_yield	Number	P in Downstream to Upstream
D2U_delay	Number	D in Downstream to Upstream
D2U_ftg	Number	F in Downstream to Upstream
U2D_yield	Number	P in Upstream to Downstream
U2D_delay	Number	D in Upstream to Downstream
U2D_ftg	Number	F in Upstream to Downstream
TypApparatus	Text	Type of passing device
Comment	Memo	Free comment (source comment if any)
IDSource	Text	Code of data source (points to CodOther)
dateInserted	Date/Time	

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Figure 55: Structure of Fish passing table P_Fish (new input since V2.06)

P_Fish is the table containing the documented fish passing information. Modelled fish passing information are in NOP_Fish (see

Appendix 7). Homologous tables are P_Sed and P_Hyd. P_Fish is dated, every change is assigned to the nearest year.

Dams2_M : Table

Field Name	Data Type	Description
ID	AutoNumber	
NOEEA	Text	Eldred2 object codification
c_Year	Number	Yera of validity, in case of multiple changes in the dam history
is_Historic	Yes/No	TRUE if the dam is not the latest avatar of dam
ic_High_ m	Number	dam wall height in metres, as provided by Icold or other source (see is_guessed)
is_GuessedH	Yes/No	TRUE if the dam height is not from Icold
ic_length_m	Number	Lenght of dam= widht of the dam in the cvalley / lenght of dyke
is_GuessedL	Yes/No	TRUE if lenght is from other source that Icold
ic_Vol_1000m3	Number	dam wall volume in 1000m3
ic_damType	Text	Dam tuyp according to icold coding
ic_Purpose	Text	Code of dam purpose. Can be multiple, from ICOLD
Flood_CR	Number	rank of Flood use / joker (was 'C')
Fish_FR	Number	rank of Fish farming use / joker (was 'F')
HydroPw_HR	Number	rank ofHydropower use / joker (was 'H')
Irrig_IR	Number	rank of irrigation use / joker (was 'I')
Navig_NR	Number	rank of navigation use / joker (was 'N')
Recre_RR	Number	rank of Recreation use / joker (was 'R')
WSupp_SR	Number	rank of Water Supply use / joker (was 'S')
Other_XR	Number	rank of other uses / unlisted uses / joker (was 'X')
ic_Owner	Text	name of dam owner
Change	Text	Indicates if changes have occured (from notes) XXX is joket, otherwise reports change H for heightened
ic_P_MW	Number	Electric capacity installed in MW
ic_E_WhpYear	Number	Electric energy produced in GWh/year
ic_Irrigation_km2	Number	Area of irrigated land served in km2
ic_Floodstock_hm3	Number	Volume for flood protection in million m3 (hm3)
ic_Particular	Text	A abandoned; H heihtened; L Lowered; U Unchanged; R Rebuilt; C under construction
ic_International	Text	Is I if the dam abutments lie on different countries
ic_Sealing	Text	Position and type of watertight member. See reference table icSealingCodes
ic_foundation	Text	Foundation R; R/S or S rock ; rock/soil; soil
ic_Spill_m3ps	Number	Spliway capacity in m3/s
ic_Type Spill	Text	Spilway type, L freee; I/V gated free oiverspill; V gated; X other
ic_Engineer	Text	Consultant name / company
ic_Contractor	Text	Contractor / did the work
Dams2_tech_ic_Note	Text	Special information
ic_C01	Text	
ic_C02	Text	
ic_C03	Text	
ic_Resettlement	Number	Number of persons affected by resettlement
date_IN	Date/Time	date of entry in Eldred2

Figure 56: Structure of table Dams2_M

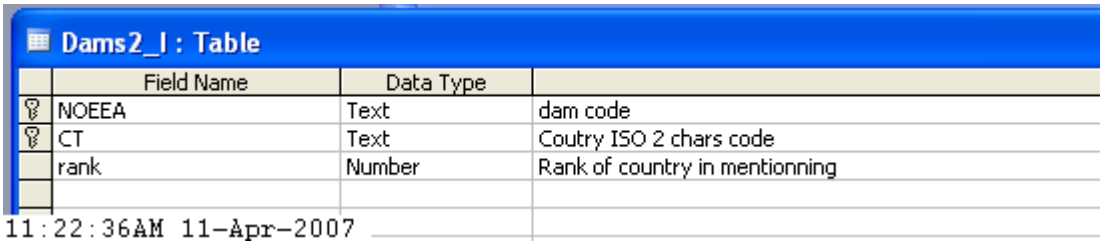
Dams2_M contains main information on dam, either susceptible of being dated (changes) or not immediately related to dam itself.

Lakes2 : Table

Field Name	Data Type	Description
ID	AutoNumber	
CDE_LAKE	Text	Lake ID, as Eldred coded 'L'+cc+xxxxx
c_Year	Number	Year of lake's creation, joker (unknown) is -32768
Year_Lake_Dead	Number	Year of lake's disappeareance, joker (unknown) is -32768? Is year_dead if disappeareance results from dam decommissionning
CT	Text	Country ISO 2 code
is_Historic	Yes/No	TRUE if record is not the most recent year
ic_NOM_LAKE	Text	lakes name as Icold Register
Alias_nom	Text	other lake's name
NOEAA	Text	Dam code (main dam) that creates lake, is NULL otherwise
Is_CLC	Yes/No	TRUE if present in CLC layer
Is_Wetlands	Yes/No	TRUE if in Wetlands layer
Is_Image2000	Yes/No	TRUE is in Image2000 water bodies layer
Is_other	Yes/No	TRUE if found in any geographical layer
VALID_LAKE	Text	Unused for the time being
Y_LATDD	Number	lake centre Y
X_LONGDD	Number	lake centre X
TY_LAKE	Text	is ARTIFICIAL if created by dam (field from Eldred1)
upd_area	Yes/No	TRUE if area value has been updated vs. Icold data
SUPERF1000m2	Number	Current and final lake mirror area
Super_Alias1000m3	Number	alternate lake mirror area
ic_area1000m2	Number	icold lake mirror area
upd_vol	Yes/No	TRUE if lake vol has been updated vs. Icold data
CAP_TOTAL1000m3	Number	Lake capacity current and final
Cap_alias1000m3	Number	Other lake capacity, if any
ic_volume1000m3	Number	Icold provided lake capacity
ic_length_reservoirkm	Number	length of lake mirror (axis), as icold
CAP_USEFUL	Number	useful volume (that can be exploited)
CAP_CRU1000m3	Number	Volume dedicated to flood control
CAP_DEAD1000m3	Number	Dead volume (should be control as total=dead+useful)
PERIMkm	Number	lake lirror perimeter
catchAreakm2	Number	lake catchment area
MirrorZm	Number	Elevation of lake mirror at CAP_TOTAL
Zmaxm	Number	Maximum depth
Zmoym	Number	mean depth
Flgtempo	Yes/No	For update purposes
WISE_ID	Text	ID in WISE / Waterbodies WFD
date_in	Date/Time	of insertion

Figure 57: Structure of table Lakes2

Lakes2 contains all data related to lakes made by dam (only main dams may control a lake) or natural lakes.



Dams2_I : Table

Field Name	Data Type	
NOEEA	Text	dam code
CT	Text	Coutry ISO 2 chars code
rank	Number	Rank of country in mentionning

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Figure 58: Structure of table dams2_I (dams belonging to several countries)

Dams2_I reports the different countries a dam can be attached to. The primary country of the dam is in Dams2, and is not repeated in Dams2_I

Appendix 2: Eldred reference and nomenclature tables

Dam structure is checked and used in modelling from table RefDamType, which content is displayed

Table 6: Content of table of dam types

CodIcold	Is_trueIcold	delFP	Cod	LibelF	LibelE	Text complement
AL	No	0.50	9	Système anti-refoulement	Anti-lift system	
BM	Yes	-0.50	-32768	Barrage Mobile	Barrage	vanne levante
CB	No	1.00	20	Contreforts	Buttress	
ER	Yes	0.00	10	Enrochements	Rock fill	
LS	No	-0.50	4	Vanne levante	Lifting sluice	
LW	No	1.00	3	Barrage à madrier	Log weir	Log Weirs (Not icold)
MV	Yes	1.00	20	Voûtes multiples	Multiple arch	
PG	Yes	1.00	20	Poids maçonnerie ou béton	Gravity in mansonry or concrete	
PW	No	-0.50	2	Barrage à aiguilles	Pin weir	Pin Weirs (Not icold)
SI	No	-0.50	8	Radier à paroi inclinée	Slope invert	
SS	No	-1.00	6	Déversoir à paroi inclinée	Slope spillway	
TE	Yes	0.00	20	Terre	Earth	
TV	No	1.00	1	Barrage à clapet basculant	Tilting Valve	Tilting Valve (not icold)
VA	Yes	1.00	20	Voûte	Arch	
VI	No	1.00	7	Radier à paroi verticale	Vertical invert	
VS	No	1.00	5	Déversoir à paroi verticale	Vertical spillway	
XX	Yes	0.00	99	Pas sur la liste	Unlisted	
ZZ	No	0.00	0	Non renseigné	No data	

Source table is `RefDamType`. The flag `is_trueicold` points those codes that are from the Icold nomenclature. French and English texts are either from Icold or adjusted and translated. Field `Cod` is related to French alternate sources and is a working field. The structure being simple is not displayed.

Dams uses are similarly processed in a specific table displayed below.

Table 7: Content of dams uses

CodIcold	is_TrueIcold	LibelF	LibelE	Comments
C	Yes	Contrôle des crues	Flood control	
F	Yes	Elevage de poissons	Fish farming	
G	No	Soutien de nappe alluviale	Groundwater recharge	

CodIcold	is_TrueIcold	LibelF	LibelE	Comments
H	Yes	Hydroélectrique	Hydroelectricity	
I	Yes	Irrigation	Irrigation	
L	No	Soutien d'étiage	Low water enhancement	
M	No	Energie mécanique	Mecanichal energy	
N	Yes	Navigation	Navigation	
P	No	Stabilité du profil en long	Stabilizing hydromorphological profile	
R	Yes	Buts récréatifs	Recreation	
S	Yes	Distribution d'eau	Water supply	
X	Yes	Autres usages	Other or unlisted	Other for Icold dams only
Z	No	Non documenté	Not reported	

Source table is `RefPurpose`. The flag `is_trueicold` points those codes that are from the Icold nomenclature. French and English texts are either from Icold or adjusted and translated.

Spillways are generally populated only in Icold source, the reference table is reported below.

Table 8: Spillway types reference

CodIcold	is_TrueIcold	LibelF	LibelE	Comments
L	Yes	Libre	Free overspill	
L/V	Yes	Libre et avec vannes	gated-free oversplii	
V	Yes	Avec vannes	gated overspill	
X	Yes	Autre	other overspill	
Z	No	Non renseigné	Not documented	

Source table is `RefSpill`.

Similarly, watertight references are referenced in soure table RefWaterTight, displayed below.

Table 9: reference of watertight features

CodIcold	is_TrueIcold	LibelF	LibelE	Comments
a	Yes	Béton bitumineux	Bituminous concrete	
c	Yes	Béton	Concrete	
e	Yes	Terre	Earth	
f	Yes	Masque amont	Upstream facing	

CodIcold	is_TrueIcold	LibelF	LibelE	Comments
h	Yes	Barrage homogène	Homogeneous dam	
i	Yes	Noyau interne	Core	
m	Yes	Métal	Metal	
p	Yes	Plastique	Plastic	
x	Yes	Pas sur la liste	Unlisted	
z	No	Inconnu	Unknown	added

Appendix 3: DamPos screens

The DamPos application provides access to the whole set of dams and offers two different facilities:

1. Validating dam position and documenting (through a free comment area) any information related to dam.
2. Viewing dams position per country.

DamPos recognises administrator and users. The administrator designates the users and allocates set of dams that can be edited by the user. Only these dams can be processed. Once dams are allocated (password protection), the user that logon is informed on the number of dams he has in charge, in the statistics box. The administrator is in charge of 0 dams, but can edit any of them.
Filters are provided to simplify access and management of large sets, namely by the administrator.
The administrator, and the user, can update the captions datasets, allowing the application to display all information in national language. By default, language is English.
Three sets of coordinates are possible:

- Proxy seed coordinates, displayed in red,
- EEA proxy coordinates, displayed in blue
- Final validated coordinates displayed in green.

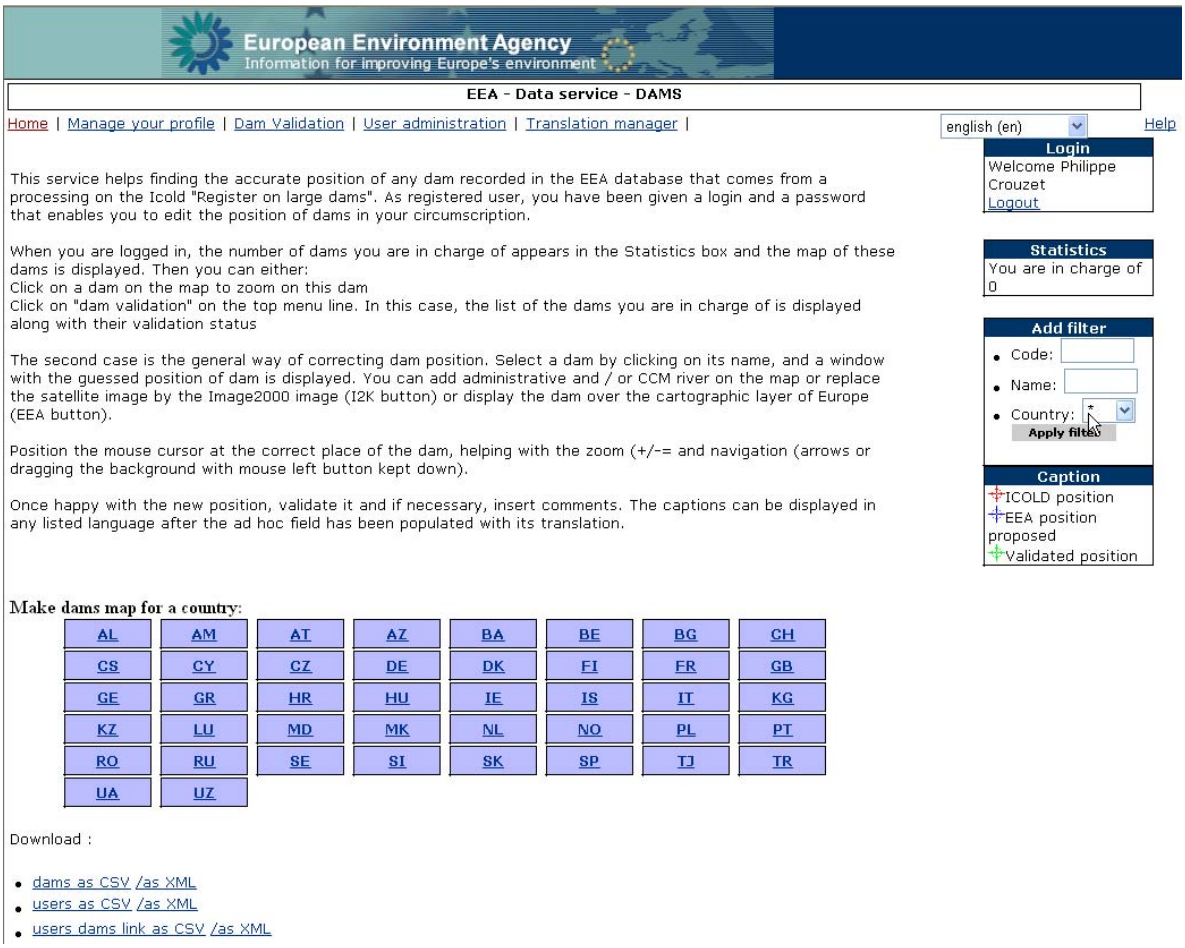


Figure 59: DamPos main screen

The translation manager is better populated directly into the Web database (under Posgresql) and should only be locally corrected from the manager.

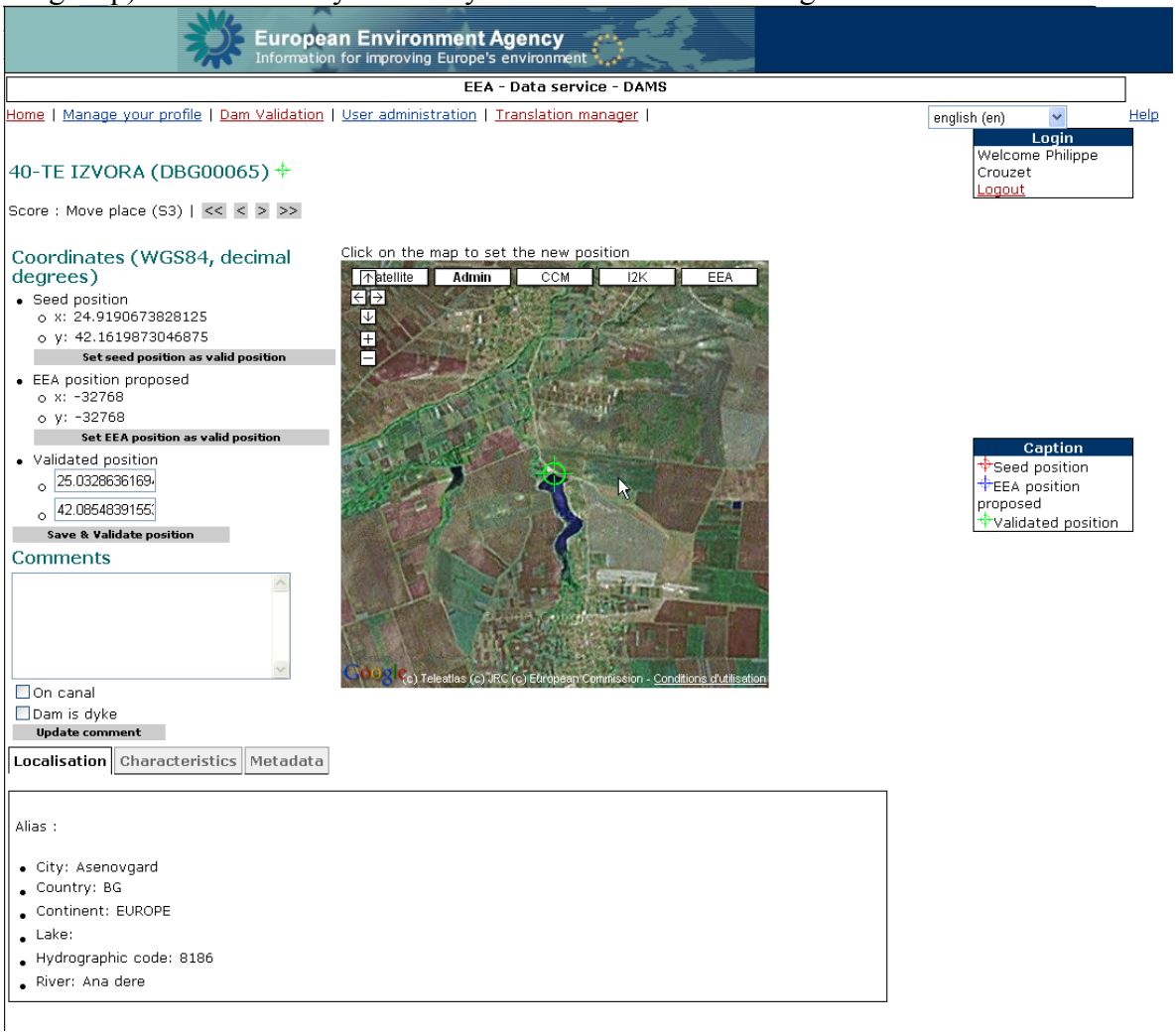


Figure 60: DamPos validation screen

The validation screen allows placing the cross by moving the cursor and dropping at the correct place. Validating can be done as many times as required. The values are recorded in Eldred2 only after harvesting the database.
Where available, other layers can replace to GoggleEarth®: Image2000®, geographical background. TeleAtlas® cities names and centroid, CCM2 rivers or any other compatible and Web served river system can be superimposed.

Appendix 4: Structure of updating table and associated procedures

DL_OtherData : Table

Field Name	Data Type	Description
NOEEA	Text	EEA dam given code
Code_other	Number	Code of the external provider
DateData	Date/Time	Date of data provision
Other_DamID	Text	Dam identification in other's database, if any
X	Number	Longitude in decimal degree as provided by Other
Y	Number	Latitude in decimal degree as provided by Other
XY1I2E3F	Number	lat/long source of data 1 is Icold, 2 if EEA, 3 is final (validated). 3 should be used exceptionnaly only
YearComm	Number	year of commissioning, as provided by Other
YearDead	Number	Year end of commmissionning as provided by Other
ObjNameAlt	Text	Alias object name, as provided by Other
CodCity	Text	EU code of the city next to the object (should be filled when codification is agreed)
NamCity	Text	Name of the city next to the object as provided by Other
River_cod	Text	EU code of the river passing through the object (should be filled when codification is agreed)
RiverName	Text	Name of the river passing through to the object as provided by Other
WB_height_m	Number	height of the Dam (if object is dam: NOEEA is Dccxxxxx) in metres as provided by Other
WB_damVol1000m3	Number	Volume of the Dam (if object is dam: NOEEA is Dccxxxxx) in 1000m3 as provided by Other
WB_DamWidthm	Number	Width of the Dam (if object is dam: NOEEA is Dccxxxxx) in metres as provided by Other
WB_VolOther	Number	Reservoir volume (if object is lake: NOEEA is Lccxxxxx) in Other unit as provided by Other. Shall end in 1000m3 in final DB
VTK	Number	Multiplies WB_VolotherUnit to make 1000m3 units. If Other provides hm3 worths 1000, if other provides m3 worths.001. Value 1 is assumed
WB_lakeAreaOther	Number	Reservoir area (if object is lake: NOEEA is Lccxxxxx) in Other unit as provided by Other. Shall end in 1000m2 in final DB
ATK	Number	Multiplies WB_LakeAreaother to make 1000m2 units. If Other provides ha worths 10, if other provides m2 worths.00001. Value 1 is assumed
WB_lenght_km	Number	Reservoir lenghtin km (if object is lake: NOEEA is Lccxxxxx) in km as provided by Other. is generally provided as km, check consistency before entering
WB_Zmax_m	Number	Reservoir maximum depth in m (if object is lake: NOEEA is Lccxxxxx) in m as provided by Other. is generally provided as m, check consistency before entering
WB_Zmoy_m	Number	Reservoir average depth in m (if object is lake: NOEEA is Lccxxxxx) in m as provided by Other. is generally provided as m, check consistency before entering
WB_catchkm2	Number	Reservoir catchment area in km2 (if object is lake: NOEEA is Lccxxxxx) in km2 as provided by Other. is generally provided as km2, check consistency before entering
HasUpdatedDams2	Yes/No	This value is checked TRUE when processing has sucessfully been achieved
DateUpd2Dams	Date/Time	This value is updated by the updating programme
RecordTodelete	Yes/No	is TRUE is the update deletes the record. This action is programme for asking double confirmation before deleting data, which is kept apart

Figure 61: Structure of table DL_OtherData

All numeric fields have default values set to 1 (XY1I2E3F and VTK and ATK that are scaling factors) or -32768, text fields are set to blank and Boolean to FALSE.

Therefore, only the populated fields are processed during the update phase.

The processing principles are that any value in DL_OtherData supersedes values in Eldred2 tables, with exception of validated coordinates that are NOT replaced.

The object ID provided by Other replaces the former object ID, this data being kept only for dialoguing purposes, there is no check. However, deleted records in Eldred2 having a correspondence are not cascade deleted in table Eldred2ToOtherID, to keep the history. A flag is set to inform that this record has been deleted.

Populating this table is exemplified with the frequent exchanges that occur between the Greifswald University and the EEA.

Dr R. Röedel (Greifswald University) has started positioning dams in Europe, under a research initiative aiming at modelling hydrological cycles under different climate change development. He uses different sources of information, including the Icold database, but not only. Location of dams is carried out in a progressive way involving data provided by the EEA, use of DamPos and searching for dams on different geographical sources, including maps; atlases and Web sites.

The cooperation procedure involves an extract on MS Excel®, for example extracted from Eldred2, populated by Dr Röedel, incorporated in Eldred2, followed by complements in DamPos, new extraction and so on.

Considering the number of exchanges, a procedure has been set-up in E_Eldred2_work database. A procedure launched by form `RR_inputdata` add records to `DL_OtherData` following the next steps::

1. Step 1 requires linking the external MS Excel® external data source as MS Access® linked table. The **compulsory name for this table is `RR_lastImport`**. A warning is issued to recall the operator about this linking.
2. Step 2 runs a series of queries, imposing date as time of start running as date in records key. This value is displayed as shown on Figure 62 (the '#' are not in the key proper). The processes are the following:

- Erasing all records from same provider not processed,
- Copying MS Excel® records to temporary table because possible errors in le linking process[28].
- Add records on dams to DL_OtherData,
- Create specific records on lake name, secondarily populated with lake code as entry.

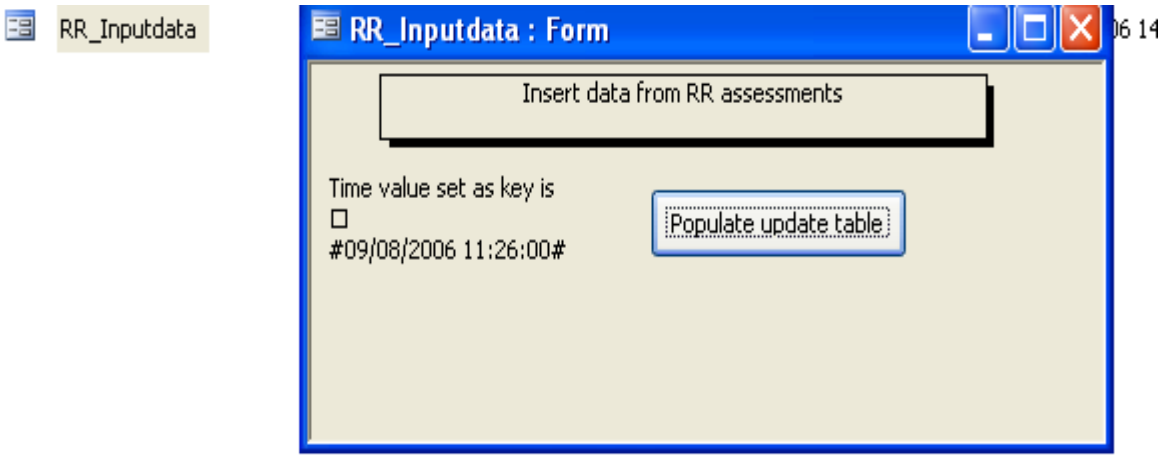


Figure 62: Display of form to include systematic data from Greifswald University

The rest of the process is to be carried out under normal procedures of Eldred2.

Operating DamPos requires adequately setting MS Access® ODBC links, with special regards to the management of Boolean fields, that are considered as text in standard postgreSQL driver.

When making the link, set the following steps, that can be started either from menu or from linked tables manager

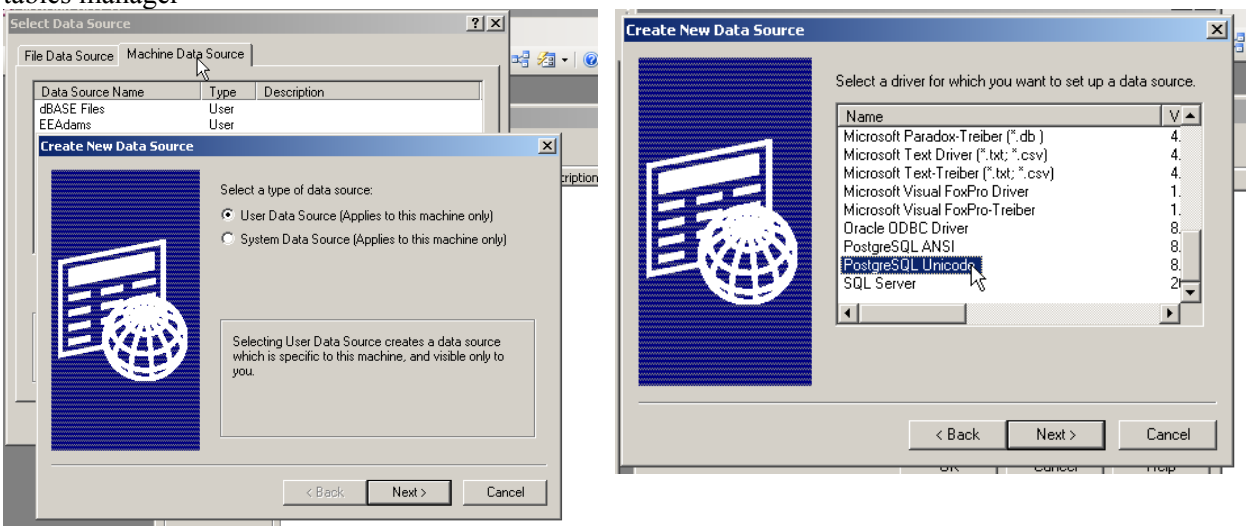


Figure 63: Setting ODBC link from MS Access® (left stage 1, right stage 2)

Then, after pressing Next on stage 2,

[28] Several « numeric overflow » errors have occurred in processing data from linked MS Excel® files. The error is tackled by first copying the data into a temporary MS Access® table. It seems that if a selection query containing sigma functions on a linked table is used as entry to another append query errors may occur.

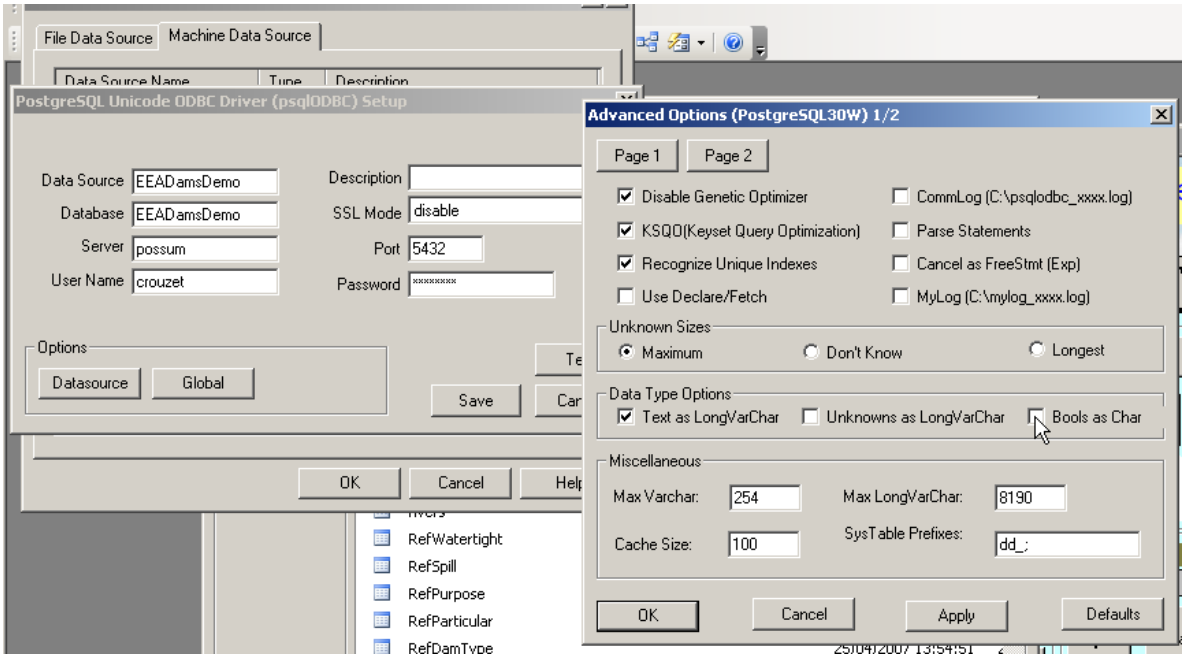


Figure 64: Setting ODBC links from MS Access® stage 3 and 4

The right hand side form is obtained by pressing the Datasource button in the Options frame. The mouse cursor indicates where to uncheck the standard Boolean setting.

Appendix 5: Matching dams from different sources

This appendix relates the integration and use of a tool developed externally by Dr R Rödel, Greifswald University, Germany.

The MS Excel® application principles

When different sources are involved and objects numerous, matching dams can become a nightmare and dramatically time consuming. Unfortunately, it happens often that collecting complementary data next to local authorities results in list not immediately comparable with the source list in Eldred2.

In the Eldred2 processing, the goal is to attribute the adequate Eldred2 ID to the external list so that the update process can be carried out effectively. As soon as several tens or hundreds of objects have to be populated with ID, automated procedures are the welcome.

There is no ultimate solution to this issue, if for example dam names are very different or presented with different spelling or attribute, especially when different languages are involved.

For his own purposes, Dr Rödel has developed an MS Excel® tool to match automatically the largest possible share of objects, and suggest possible matches and score matching result.

This programme has been slightly modified at the EEA and now operates on the following way:

- The list of dams from the external source is placed in the MS Excel® sheet. It comprises a limited number of fields (external ID, dam name, building year, wall height, river name, next town, province, country, reservoir volume).
- Eldred2 dams are placed in a standard MS Access® table named `Extern.` For the ime being, the process has not been sophisticated and this table must be in a MS Access® database in the same disk path where the MS Excel® application is (see running procedure below). Each item is read and seeks for a record in the Eldred2 extract placed in standard format in a separate MS Excel® sheet..
- When match (es) is found, the number of hits is reported, the score and the best match code from Eldred2 source.

Score is a distance, hence score 0 indicates absolute match, and larger scores larger distances.

Scoring is based on the length of common string in source and target matching strings (dam name, river name) and differences in commissioning ± Y, given as parameter.

Main modifications included are the capacity of processing names with one or several quotes (e.g. **Loch Uig an t'soluis'**) since names are used in SQL query strings and ignoring jokers in numeric fields. String jokers (Null field) are taken into account as well..

The string values are compared using the ratio of length of matched string to length of source string (if identical, the ratio is 1, final value is 1-(len(s1)/len(s2)), yielding 0 is string are identical. Numeric values are computed as abs((V1-V2))/((v12+v2)/2), that makes 0 if values are identical. Final score is $(N/n)\times sum(scores)^2$, where N is the maximum number of items and n the number of items considered for each dam (for example, if river name is missing, this item is not integrated in the scoring). Rising to square smoothes small distances and enhances large distances.

Setting and running the application

First of all, prepare the external data source. It is highly recommended that this data source is under MS Access® database, placed in the source data path (e.g., under the country or provision). This database will host the external data to match and the Extern table resulting from Eldred2 extraction. The common name required by the Excel application is preferably used in this case.

Second, prepare the Eldred2 set to which the external data has to be matched. A special button in the main Eldred2 form 37: Export for matching opens a dialog in which the country (only one) and dam type large / both / non large can be exported.

The export able is named Extern and is in the Eldred2 application. This table is refreshed every time a new export is done. No message is issued.

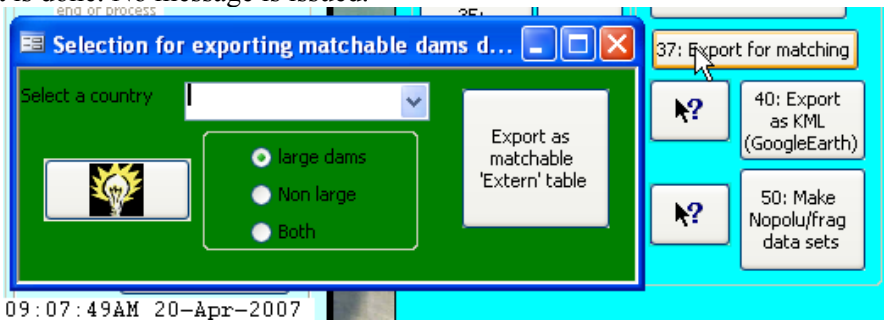


Figure 65: Dialog for exporting data to be matched

When done, this table is imported in the aforesaid database.

Data from the external source should be prepared so that they can be copied onto the MS Excel® application. This procedure is fully depending on the format of source data and is not described. By contrast, the format expected by the MS Excel® application is shown in the next Figure 66.

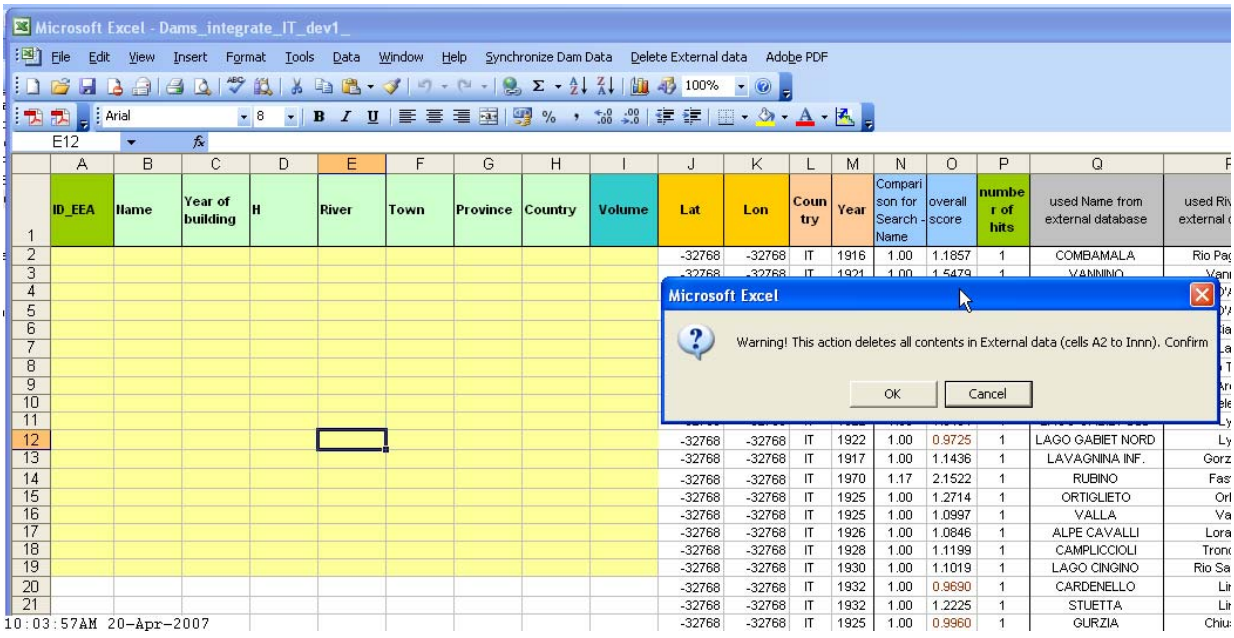


Figure 66: Excel sheet where external data is placed

The columns to fill with the external data are coloured in yellow. A button has been added on the menu to delete the external data and avoid errors in processing. The data collected from the Extern table are set in cleared cells by the programme.

When adequate data has been placed (copy and paste from an ad hoc MS Access® query is the best option), just click on the Synchronize dam data in the menu, and fill the box displayed in figure below.

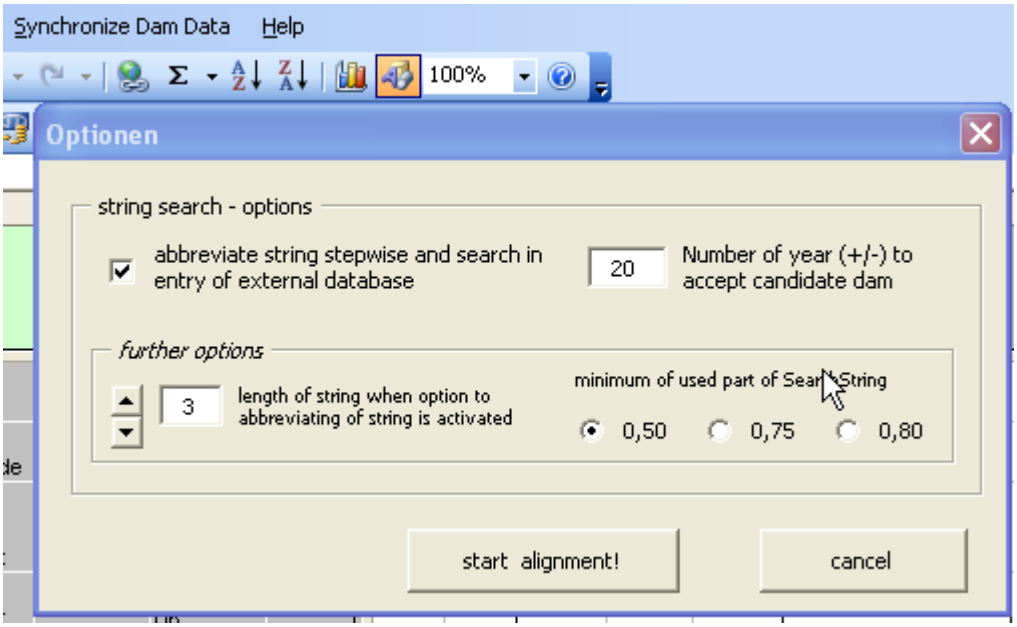


Figure 67: Synchronisation input box

The options are:

1. abbreviate (Yes/No) indicating if only the full strings should be considered or if substring may be sought for. The second option is the only one suitable to differences in spelling (*Dam_on_river (river name)* vs. *Dam_on_rivername)*
2. number of years (+/-) to input a range to limit search to reasonably close dams, this limits strongly the number of hits when option 1 is set to Yes.
3. length of string … defines the length of string that is used in substring comparison. Experience suggests that 5 might be a good option; " characters generating extra irrelevant hits,
4. minimum part of used string indicating how many characters from the input string should be used for matching purposes.

Where "number of hits" is 1 and score (distance) close to 0, matching can be considered as perfect. Distance can be slightly different from 0 because date, volumes of height may differ to some extend between sources.

The matching process may be quite long. A good option to match with Icold dams is to sort the external dataset by decreasing dam height. Hence, all candidates to be large dams will be processed first, because Icold criterion for inclusion is dam height.

The time required depends on options, 50% is the longest, reaching 2:13 hours for the UK data set whereas 1:20 only were needed with a set of 2731 dams in which to find out the 590 Eldred2 dams require approximately 1:20 hours on a powerful machine (Pentium 4 2.8 GHz, 1 GB ram). For unknown reason, response time seems sensitive to initial sorting of data into the MS Excel® sheet. This is because the system queries the Extern table several times to check all possibilities and alternate possible matches.

By contrast, the yield of the search is different, some Icold dams being unmatched despite existing in the external data set. This is because the asymmetry of search: external dam A may be compared to Icold dam A and Icold dam B, but when external dam B is processed, Icold dam B is found or not depending on the differences in spelling and length and proportion of search strings. For example, dam **Anglezarke Heapey** from Icold source and **Anglezarke (Heapey)** from BDS source are not

matched if more than 50% of the name string are imposed for matching, whereas **Anglezarke (Heapey)** is proposed to matching with **Anglezarke**

At the end, the matched dams are copied in a second sheet names “results” and sorted by increasing order of hits and scores (where many hits are found, there are several possible choices), to ease relating respective identifiers.

A1 fx ID

	A	B	C	D	E	F
1	ID	NOEEA	Hits	Score	name ID	name EEA
514	Unknown	DIT00258	1	3.531596525	NAZZANO	NAZZANO
515	Unknown	DIT00399	1	3.878591681	MAMONE	FOSSO TIMONE (MADONNA
516	Unknown	DIT00500	1	40.60532686	GIGLIARA MONTE	GIGLIARA MONTE
517	Unknown	DIT00574	1	55.0404666	SAN FELICE DI GIANO	SAN FELICE DI GIANO
518	Unknown	DIT00544	1	72.25002075	MURAGLIONE	MURAGLIONE
519	Unknown	DIT00079	2	0.5	LAGO DELLA MUTTA	LAGO DELLA VACCA
520	Unknown	DIT00569	2	0.6	SALIONZE	RIO SALITA
521	Unknown	DIT00439	2	0.833333333	CONCA	CONZA
522	Unknown	DIT00012	2	1	LAGO VERDE	LAGO VERDE
523	Unknown	DIT00299	2	1	LAGO EUGIO 2	LAGO EUGIO
524	Unknown	DIT00373	2	1	LAGO VERDE	LAGO VERDE
525	Unknown	DIT00117	2	1	CAMELI	COMELICO
526	Unknown	DIT00117	2	1.2	MELITO	COMELICO
527	Unknown	DIT00232	3	1	ARCICHIARO	BARCIS
528	Unknown	DIT00041	3	2.5	SAN CASSIANO	SAN COSIMATO
529	Unknown	DIT00512	5	2.5	LAGO D'ORTA	LAGO D'IDRO
530	Unknown	DIT00191	6	1.5	CHIAUCI	VILLA DI CHIAVENNA
531	Unknown	DIT00147	9	2	VAL CLAREA	VAL D'EGA
532	Unknown	DIT00308	10	1.25	SANTA VITTORIA	SANTA LUCE
533	Unknown	DIT00419	11	3	BARDELLO	CASTELLO
534	Unknown	DIT00401	13	1	RIO OLAI	RIO CUGA
535						

10:56:14AM 20-Apr-2007 / program /

Figure 68: Results table example

The sample results show precisely well matched dams (despite high score) and possible mismatches or ambiguous matches in the bottom part of the list. Ill matched items have to be analysed individually, because many reasons, including lack of corresponding entry in Eldred2 may explain mismatch.

The rest of the procedure depends on which data is to be imported as updates to Eldred2. the suggested procedure is the following:

- in the External_Database, updates the Extern table or derived table on the good matches,
- print out the unmatched dams for updating. In the above fig, for example, there is an ambiguous “Lago Verde” dam in two different provinces but on distinct rivers having the same name, making the application incapable of discriminating. The update are then carried out with the updating facility described in §5.2.6, Figure 23.

Appendix 6: Preparing the import of non-Icold dams

Non-Icold dams are presented in many different ways, and generally do not comprise all fields contained in the Icold register structure. This is because i) data source may have no reason to use the Icold structure and ii) dams described do not match Icold structure, especially regarding small dams that have characteristics and functions out of the Icold nomenclatures.

The processing requires two steps and is preceded by a check of nomenclatures. The check of nomenclatures leads to modifying both tables of dams structure and dam uses. The completed tables are reported in Appendix 2 above.

The two steps are:

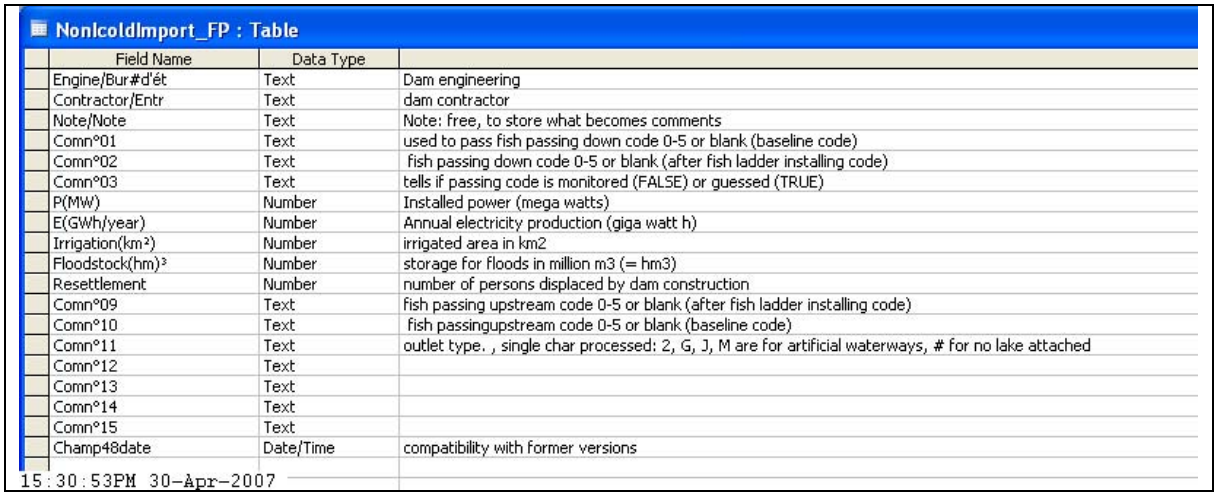
- Definition of intermediate table structure to host external data and procedures to incorporate this data to Eldred2 tables. The table is in Eldred2_work
- Procedures to prepare external data and populate the intermediate table. The source table is in the source data database and is linked as "NonIcoldImport"

The intermediate table structure is displayed below.

Table 10: structure of table for importing non Icold data

NonIcoldImport_FP : Table

Field Name	Data Type	
Ext_code	Text	Dam code used by the external provider
is_iscold	Yes/No	TRue if dam is in the Icold register
ext_XDD	Number	Longitude (E-W) in decimal degrees
ext_YDD	Number	latitude (N-S) in decimal degrees
ext_Z	Number	Altitude in m above sea level
maxR	Number	FOR PROCESSING IGNORE IN LOADING
ext_codobstcl	Number	External code of obsatacle passing
NOEEA	Text	Internal Eldred2 code a/ if exisitng provide b/ if not will be provided during processing
NOEEA_M	Text	if filled with Eldred2 code, makes dam secondary attached to this codes dam
COD_LAKE	Text	FOR PROCESSING IGNORE IN LOADING
DatInserted	Date/Time	FOR PROCESSING IGNORE IN LOADING
CT	Text	FOR PROCESSING IGNORE IN LOADING. may be provided for follow up. Is ignored
CONTINENT	Text	FOR PROCESSING IGNORE IN LOADING. may be provided for follow up. Is ignored
RESPONSIBLE	Text	FOR PROCESSING IGNORE IN LOADING. may be provided for follow up. Is ignored
Country Name	Text	FOR PROCESSING IGNORE IN LOADING. may be provided for follow up. Is ignored
Nom du pays	Text	FOR PROCESSING IGNORE IN LOADING. may be provided for follow up. Is ignored
Dam/barrage	Text	dam provided name
Second dam/barr	Text	M default to avoid Null
MainDam/BarPrin	Text	main dam provided name
ReservoirNamNom	Text	lake provided name
Year/Année	Number	Commissionoing year becomes ic_year
ext_recalcYear	Number	alternate year (may be recomputed / ifferent) becomes year_first and if different from ic_year sets flag
ext_YDead	Number	year decommissioning / destruction
ext_YOoutServ	Number	yar of decommissioning and nevertheless still exisiting (making obstacle)
ext_YDispo	Number	year of installing fish passing facility
is_yearcorrected	Yes/No	flag (see above)
Particular#	Text	
International	Text	
River/Rivière	Text	River name (in clear) is used to set river code
City/Ville	Text	next to city
St/Et/Pr/Dpt	Text	province if available
Type/Type	Text	dam type. Refers COMPULSORILY ro reference table
Sealing/Etanché	Text	dam watertigh type. Refers COMPULSORILY ro reference table
Found/Fondation	Text	
Hig/Haut en m	Number	Dam height in metres
Leng/Long m	Number	Dam length in metres
Vol/Vol 10³ m³	Number	Dam volume (e.g. of concrete) in thousand m3
Capacit#10³ m³	Number	Impoundment volume in thousand m3
Area/Sur 10³ m²	Number	lake area in in thousand m2
Length/Long km	Number	lake lenght in km
Purp/Buts	Text	Dam purposes COMPULSORILY ro reference table
Catc/BVers#km²	Number	Catchment in km2
SpillCap/E m³/s	Number	Spillway capacity in m3 per sec
15:28:07PM 30-Apr-2007 ct		spilway type COMPULSORILY ro reference table



NonIcoldImport_FP : Table

Field Name	Data Type	
Engine/Bur#d'ét	Text	Dam engineering
Contractor/Entr	Text	dam contractor
Note/Note	Text	Note: free, to store what becomes comments
Comn°01	Text	used to pass fish passing down code 0-5 or blank (baseline code)
Comn°02	Text	fish passing down code 0-5 or blank (after fish ladder installing code)
Comn°03	Text	tells if passing code is monitored (FALSE) or guessed (TRUE)
P(MW)	Number	Installed power (mega watts)
E(GWh/year)	Number	Annual electricity production (giga watt h)
Irrigation(km²)	Number	irrigated area in km2
Floodstock(hm)³	Number	storage for floods in million m3 (= hm3)
Resettlement	Number	number of persons displaced by dam construction
Comn°09	Text	fish passing upstream code 0-5 or blank (after fish ladder installing code)
Comn°10	Text	fish passingupstream code 0-5 or blank (baseline code)
Comn°11	Text	outlet type. , single char processed: 2, G, J, M are for artificial waterways, # for no lake attached
Comn°12	Text	
Comn°13	Text	
Comn°14	Text	
Comn°15	Text	
Champ48date	Date/Time	compatibility with former versions

15:30:53PM 30-Apr-2007

In between, refer to document “reformatting LB dams” that is quite complete with respect to example of including non-Icold data in the database.

Appendix 7: Fish related data

C_Fish table stores relevant information on fish for modelling the passing capacities and building the default values related to dams. It is a reference table

Table 11: Structure of C_Fish table commented

E:\dams\Databases\E_eldred2_dev.mdb 11 April 2007
Table: C_Fish Page: 1

Comments	Columns		
	Name	Type	Size
Is 3 first cars of latin genus + 3 fisrt cars of latin species	CodFish	Text	6
Tells if fish is A(dult), J(uvenile) or B(oth)	AgeCode	Text	1
True is fish travels back after spawning (if migratory)	Is_TravelBack	Yes/No	1
Valid scientific name from FishBase	SciName	Text	50
Common name in English (related to continent)	CNameUK	Text	50
Common name in French	CNameFr	Text	50
Links to FishBase English entry	URL	Text	100
Tells if fish is virtuel (generic fishes)	is_virtual	Yes/No	1
True if fish is migratory	is_mig	Yes/No	1
A(nadromous), C(atadromous) or R(esident)	CAR	Text	1
Maximum that can be jumped (passed) in the downstream to upstream direction	ZmaxDU	Double	8
Maximum that can be jumped (passed) in the upstream to downstream direction	ZmaxUD	Double	8
Default passing code 0-5 in the downstream to upstream direction	DefCodeU	Integer	2
Default passing code 0-5 in the upstream to downstream direction	DefCodeD	Integer	2
Used during export	is_selected	Yes/No	1

The P_Fish table stores factual data related to each dam.

P_Fish : Table

Field Name	Data Type	
NOEEA	Text	
year_V	Number	
SpCode	Text	Fish species code
SpAge	Text	"A" Or "J" Or "0" Or "B" Adult Both Juvenile or joker
c_PassUpp	Number	Code 0-5 /joker for upstream movement
c_Pass_Down	Number	Code 0-5 /joker for downstream movement
is_guessed	Yes/No	tells if data is computed or set from direct inserting
Is_Mig	Yes/No	True if fish is migratory
D2U_yield	Number	P in Downstream to Upstream
D2U_delay	Number	D in Downstream to Upstream
D2U_ftg	Number	F in Downstream to Upstream
U2D_yield	Number	P in Upstream to Downstream
U2D_delay	Number	D in Upstream to Downstream
U2D_ftg	Number	F in Upstream to Downstream
TypApparatus	Text	Type of passing device
Comment	Memo	Free comment (source comment if any)
IDSource	Text	Code of data source (points to CodOther)
dateInserted	Date/Time	

Figure 69: P_Fish structure (passing characteristics provided per dam)

The NOP_Fish table stores the modelled fish passing characteristics for dams, hence comprising factual data from P_Fish and modelled data as discussed in the main report.

NOP_Fish : Table

Field Name	Data Type	
CodNOPScen	Number	
NOEEA	Text	
year_V	Number	
SpCode	Text	
SpAge	Text	tells if A(dult) J(uvenlie) or B(oth)
DirT	Text	to U(pstream) to D(ownstream) or B(oth)
SPCodeSource	Text	
c_PassUpp	Number	Code 0-5 /joker for upstream movement
c_Pass_Down	Number	Code 0-5 /joker for downstream movement
is_guessed	Yes/No	tells if data is computed or set from direct inserting
is_modeled	Yes/No	Tells if data is modelled (TRUE) or from source
Is_Mig	Yes/No	is fish modeleld migratory
AgeSp	Number	Compatibility with prior version. useless
D2U_yield	Number	
D2U_delay	Number	
D2U_ftg	Number	
U2D_yield	Number	
U2D_delay	Number	
U2D_ftg	Number	
TypApparatus	Text	
Comment	Memo	
IDSource	Text	
dateInserted	Date/Time	date of recordset (codenopscen) creation
is_done	Yes/No	for processing

11:00:34AM 12-Apr-2007

Figure 70: structure of NOP_Fish

The NOP_dams export structure is provisional, and may evolve with next requirements related to sediment and hydraulic fragmentation.

Nop_Dams : Table

Field Name	Data Type	
NOEEA	Text	
c_Year	Number	
CodeScen	Number	
Is_main	Yes/No	
year_first	Number	
is_Historic	Yes/No	
year_dead	Number	
ic_CONTINENT	Text	
CT	Text	
ic_High_m	Number	
Code_Obstacle	Number	
ic_Purpose	Text	
HydroPw_HR	Number	
ic_damType	Text	
is_Icold	Yes/No	
x_DD	Number	is best avaiable coordinate
y_DD	Number	is best avaiable coordinate
Score	Number	
is_validated	Yes/No	
Dam_name	Text	
River_Name	Text	
Next_To_City	Text	

Figure 71: Structure of NOP_dams (V 2.08)

The NOP_CFish table is a copy of table C_Fish, less the field required for processing. Field names are identical. Its structure is not reported.

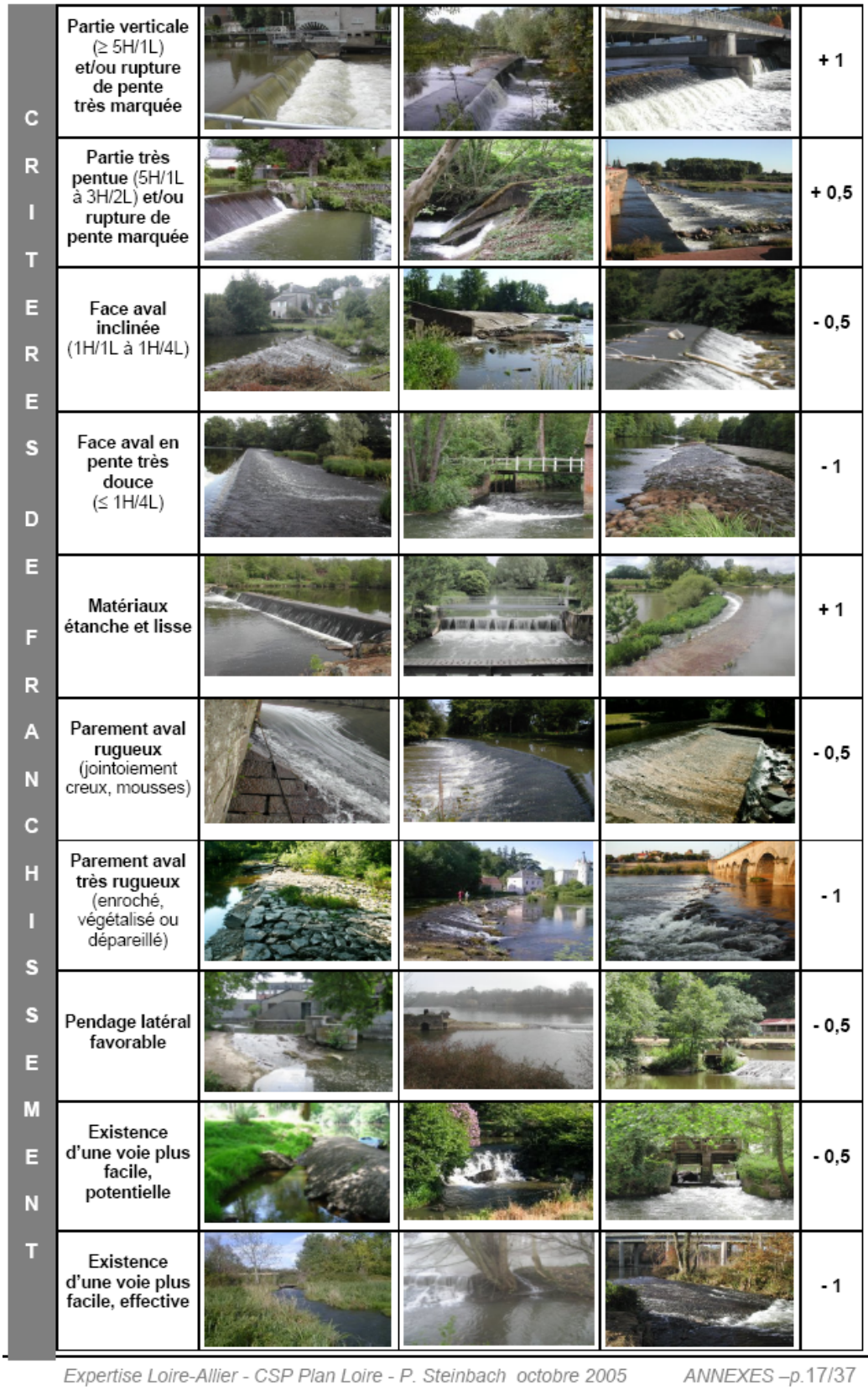


Figure 72: Examples of changes in passing difficulties as result of dam type.

Source:(Conseil Supérieur de la Pêche, 2005a)

Appendix 8: Suggested table for hand filling

Dam name				EEA code	
Alt name				Ext code	
Province				Country	
Commune					
On river				Year creation	
X (DD)				Year Dead	
Y (DD)					
Dam height(m)		Dam Vol (10^3 m^3)			
Impoundment (10^3 m^3)		Lake area (10^3 m^2)			
Lake name				Lake Z	
Uses					
Hydro power prod		Irrigation (ha)			
Comments					
URL					