

Conceptual Design and Further Development of the Flood Protection Management System INGE

Final Report

Customer:

**Sächsisches Landesamt für Umwelt, Landwirtschaft und Geologie
(Saxon State Office for Environment, Agriculture and Geology)**



**CENTRAL
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COOPERATING FOR SUCCESS.



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DEVELOPMENT FUND



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1 Initial situation, motive, and task

The flood protection management system INGE has been developed since 2006. It is a management system for flood control on municipal level. It is aimed for the acquisition of data and the support of the flood control activities of the local operation managements. It bundles the documents of the latter as well as their experiences and their action schedules concerning flood protection, and it provides an overview of the endangered objects in dependence of the current water levels. In case of an incidence the information can be quickly retrieved, and by means of the protocol of measures the operation can be efficiently managed and controlled.

In the context of the INTERREG IV B project "LABEL – Adaptation to flood risk in the Labe-Elbe river basin" a concept for the further development of the municipal flood protection management software INGE is to be developed and implemented.

With the call for bids of 08.06.2010 GICON was requested to submit an offer for performing this service. This offer has been submitted on 21.6.2010.

With the contract for services (file no.: 13-0345.40/8, B 037) of 22.07.2010 GICON was commissioned by LfULG Dresden to perform this service.

In the context of the services to be performed GICON prepared the first interim report "Study and Proposal for the Approach for replacing the GIS component ESRI MapObjects in INGE" in October 2010, and the second interim report "DP – detailed technological concept" in November 2010.

The present final report summarizes the results of the project and maps out further development needs.

2 Processing of the task, and obtained results

2.1 Concept development

The basic idea of the development of INGE is still the same: the municipal flood protection management system INGE is to be used to support the flood control services in Saxony. The electronic data management is considered as precondition for efficient flood risk management, in particular when it is necessary to quickly combine and disseminate information arranged in a clear and topic-related manner.

By the newly developed interface for the exchange of data with the information distribution list of the flood control centre of Saxony (LHWZ) the acceptance for the introduction of the system INGE on municipal level is to be increased, due to the fact that gauge water-level data can be retrieved promptly and automatically from the server of the LWHZ.

The intended linking between the management systems on the level of the rural districts (DISMA) and on municipal level should lead to a reinforcement of both operating levels. At this point, it must be stated that the interface to DISMA could not be processed because during the course of the project the user of DISMA did not provide any contacts or information that would have made possible to realise this project.

The XML interface that is already part of INGE was kept. It can be adapted to future requirements of DISMA and other data receivers.

So, the technology of this interface has been clarified. Only the particular contents to be transferred by means of this format and their structure have to be adapted.

The development of the data processing (DP) concept was carried out in a way that the original DP concept from 2006 of the software INGE was further developed with regard to contents and technology. In doing so we could avoid that a DP concept to be developed in 2010 only contained partial conceptual components because the development was based upon an already existing software.

For this reason the present DP concept is again a complete DP concept of the software INGE with the state-of-the-art of 2010. The DP concept was submitted as interim report in November 2010.

2.2 Adaptation of INGE to a new GIS component

In accordance with the customer and according to the then developed DP concept, since 2006 the software component ESRI MapObjects has been integrated as GIS module in INGE. At that time this module had been further developed by the manufacturer ESRI. The module proved to be reliable, and the license fees remained constant during the whole period.

In the following years ESRI offered a follow-up software for MapObjects: ArcGIS Engine as framework, together with ArcObjects as programmable components. These components are based upon the technology that is also the basis of the current ESRI products such as ArcGIS. Since the license fees of ArcObjects for each installation of INGE would have been more than five times the license fees of MapObjects a technology changeover to ArcObjects for INGE has not been made until now.

However, since that time it was foreseeable that ESRI would cease the development of MapObjects. This happened with the final version 2.4 in 2008. For example, MapObjects has not been released for Windows Vista and Windows 7, although it still functions with these operating systems after appropriate adaptation.

The INGE version 3.0 (INGE 2008) released in 2009 still uses MapObjects, but for the INGE version scheduled for 2011 a new technology has to be found that will be future-proof for the next years and that will support modern technologies such as the integration of maps from the Internet.

In the context of the task the following subtasks have to be processed:

- Analysis of GIS components available on the market with respect to their applicability in INGE (functionalities, interfaces, availability, license fees, data formats, coordinate systems...).
- Selection and recommendation of a technology for the use in INGE.

The selection of an appropriate GIS software for the use in INGE was carried out on the basis of an Internet-based market investigation among the leading suppliers of programmable GIS modules, taking into account the existing experiences at GICON.

The results of the investigation and the recommendation concerning the software component to be used was summarized in the 1st interim report submitted to the customer for decision-making purposes already on 5 October 2010.

The results contained in the 1st interim report can be summarized as follows:

10 GIS components that are available on the market were analysed as to their applicability in INGE according to different criteria and assessed by means of a weighted point-based system.

According to this assessment the product "TatukGIS Developer Kernel" is the most appropriate component.

The cartographic possibilities of this components that were analysed by means of a draft version of the INGE GIS were convincing, and they ensure the representation of the INGE geographical data in the existing and partially even better form and quality.

The technological conditions to be fulfilled for the use of these components do not exceed the already existing system conditions of INGE.

The installation of INGE will become easier because there will be only one DLL with a size of 6 MB to be integrated, and it will use less disc space.

Since no installation-depending license fees will accrue, savings of 120.00 € per installation and a simplification of the distribution of the software INGE are to be expected in future in comparison to the present GIS component.

The following screenshot exemplifies the use of the new GIS component in INGE:

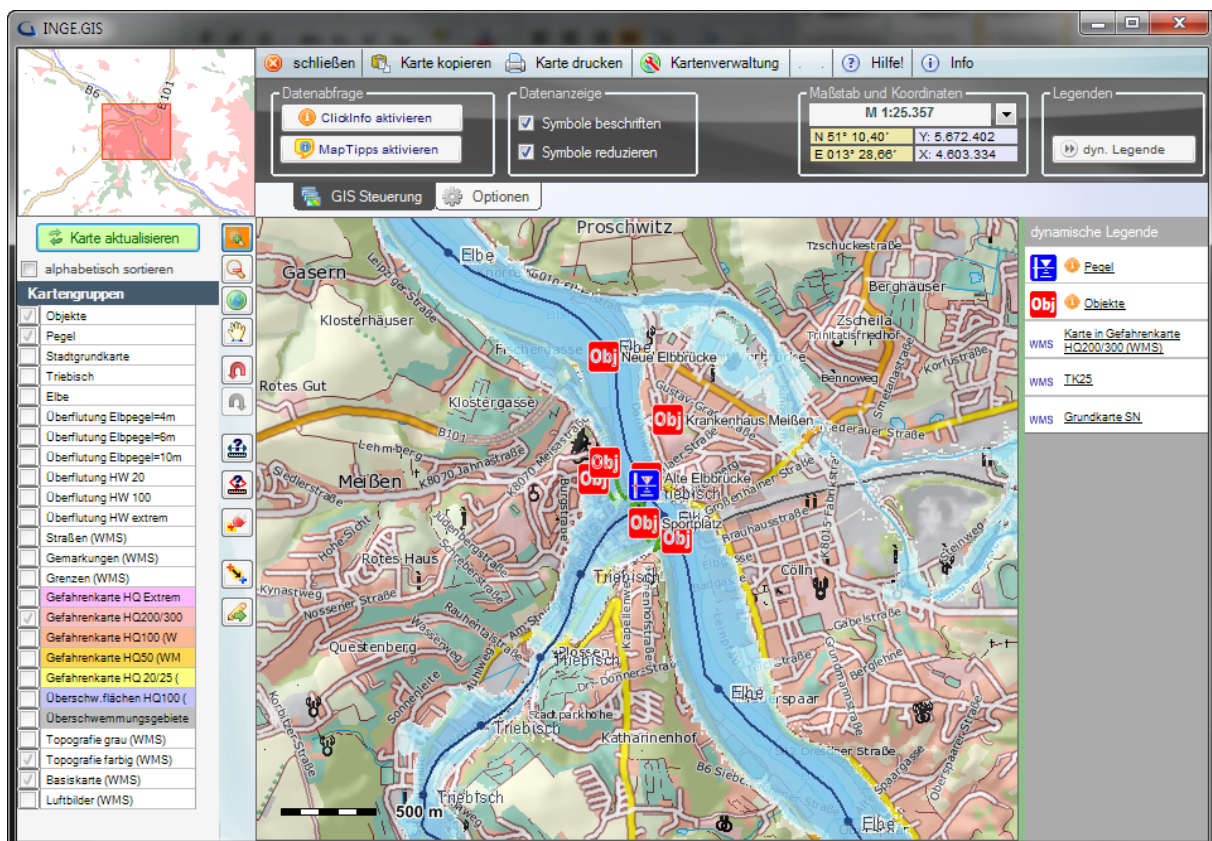


Fig. 1: INGE.GIS with new map component

The most important controls of the previous version of the software INGE could be kept so that the user does not have to accustom to a new control system of the GIS.

One of the new capabilities of INGE.GIS will be the use of web-based WebMapServices (WMS) enabling the use of a broad range of map services of the Administration of Geographical Data of the Federal State or further providers.

2.3 Integration of current measuring data / forecasts

Via an XML interface of the state flood control centre (LHWZ), water gauge data (water levels, and, if possible, forecast values) will be made available. These data will be imported to the software INGE and represented by it. For the realisation of this task a detailed conception had to be designed and to be realised after consulting the customer.

The following conceptual agreements for the data exchange were made with the LHWZ:

The recall of the water gauge information will take place by means of a URL which according to the information retrieval request will contain appropriate parameters. An XML document will be returned containing the results of the request.

The URL is to be generated internally by the software INGE and shall not be available for the INGE user for safety reasons.

The request by INGE will be limited to maximal 5 water gauges per database. The INGE user will select the gauges to be requested by means of the form "data management water gauge". The request frequency by INGE will be limited to one request per hour.

In order to identify the water gauges vis-à-vis the request service of the LHWZ, the water gauge code number will be used that has to be entered by the INGE user:

Pegelkennziffer

For this purpose, to the user an extract of the Saxon water gauge list will be made available in the help function for this form.

On data request by INGE the name of the municipality of the INGE user is to be submitted as part of the request URL. This is realised by means of the program settings that can only be edited by the data management administrator:

Gemeindename:

Without entering the name of the municipality a water gauge request by INGE is not possible.

The so-requested gauge levels are available as diagram and as table, as shown in the following figure:

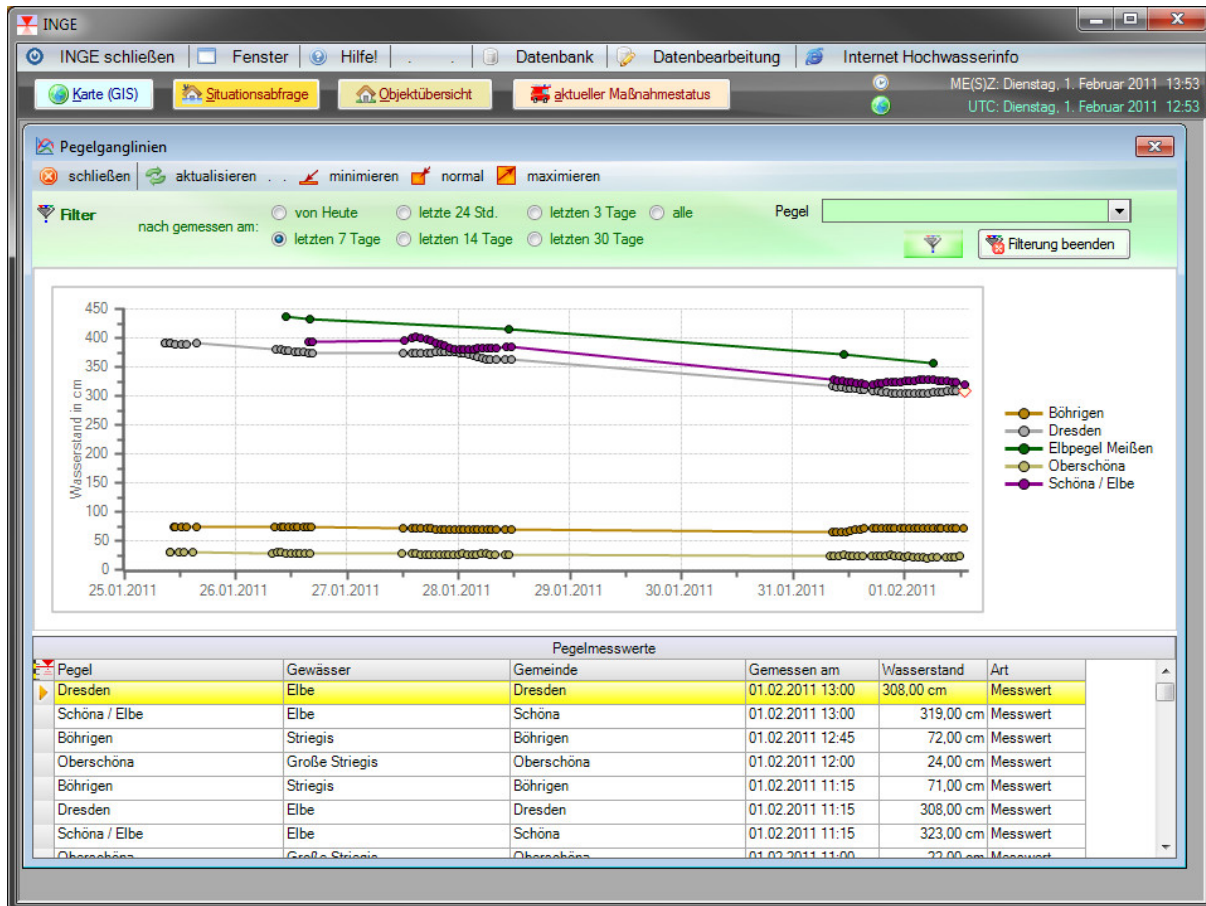



Fig. 2: Display of automatically requested gauge levels as diagram and table

2.4 Water-level-dependent generation of alarm documents


The flood-relevant objects integrated in the INGE software (e.g. embankment sections, protective structures, etc.) and the respective measures were to be linked with gauge water levels in a way that on entering the water level to be expected in the form “situation request” all objects and the related recommended measures can be edited as one compact document.

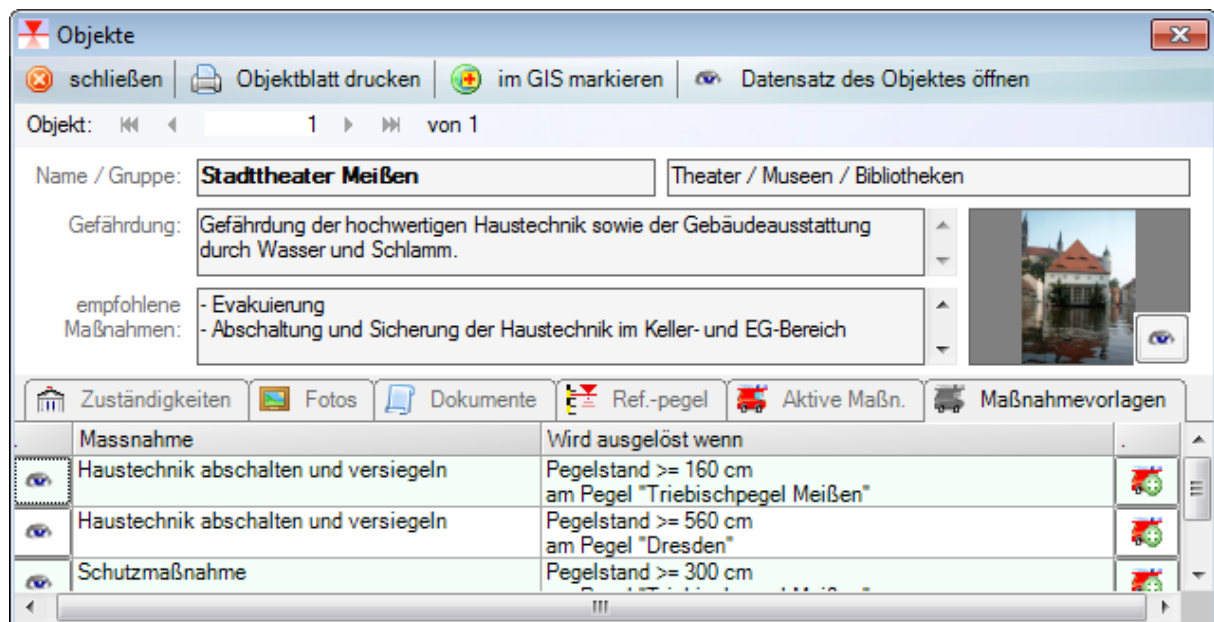
For this purpose a report was to be generated. By means of the key  [Situationsbericht drucken](#) in the above-mentioned form this report is generated and can be printed or exported as PDF, respectively.

2.5 Process simplifications in the program

By the analysis of user experiences possibilities for the simplification of the program processes were found. This concerns the following routines that were accordingly modified:

- In the function “ClickInfo” of the GIS the intermediate step “display of the information” was removed; the information is shown directly after clicking on the object on the map.
- In the object data sheet the scheduled measures for the object are shown in an additional tab when the user is logged in as data administrator. In this way the user already gets an

overview of the respective scheduled measures on the object data sheet that can be immediately turned into an active measure by clicking on the key :



Objekte

Objekt: 1 von 1

Name / Gruppe: **Stadttheater Meißen** Theater / Museen / Bibliotheken

Gefährdung: Gefährdung der hochwertigen Haustechnik sowie der Gebäudeausstattung durch Wasser und Schlamm.

empfohlene Maßnahmen: - Evakuierung
- Abschaltung und Sicherung der Haustechnik im Keller- und EG-Bereich

Zuständigkeiten Fotos Dokumente Ref.-pegel **Aktive Maßn.** Maßnahmevorlagen




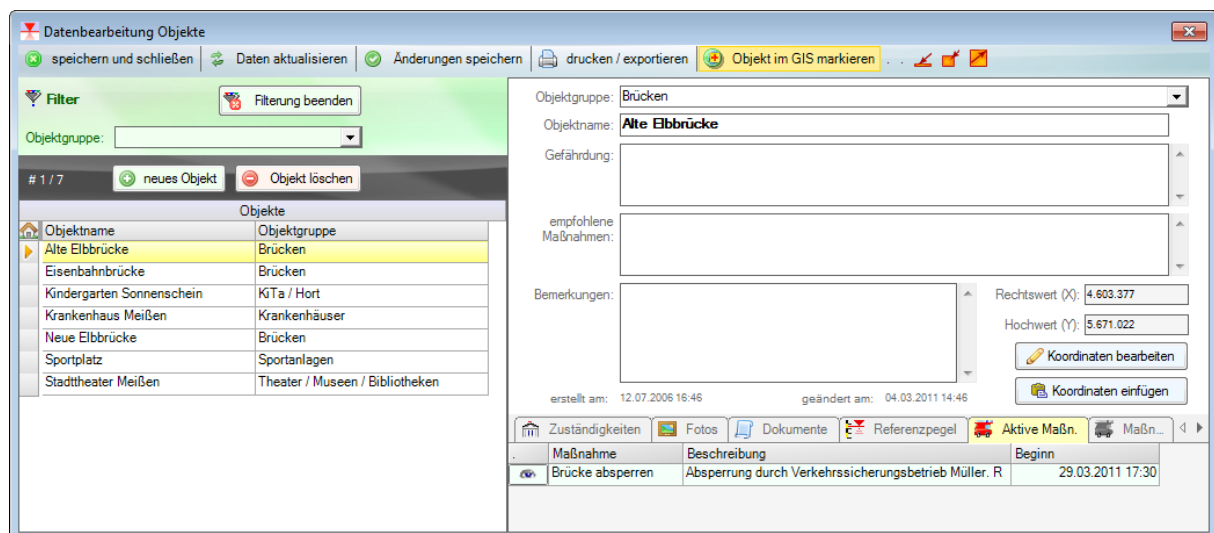
Maßnahme	Wird ausgelöst wenn	
Haustechnik abschalten und versiegeln	Pegelstand \geq 160 cm am Pegel "Triebischpegel Meißen"	
Haustechnik abschalten und versiegeln	Pegelstand \geq 560 cm am Pegel "Dresden"	
Schutzmaßnahme	Pegelstand \geq 300 cm	

Fig. 3: Object information with indication of the scheduled measures appropriate for the object

- Another tab in the object data sheet contains the active measures for the object. A direct link to the measure status enables the administration of the status entries of the active measure in case of an operation.



Datenbearbeitung Objekte

speichern und schließen Daten aktualisieren Änderungen speichern drucken / exportieren **Objekt im GIS markieren**

Filter Filterung beenden

Objektgruppe:

1 / 7 neues Objekt Objekt löschen

Objektname	Objektgruppe
Alte Elbbrücke	Brücken
Eisenbahnbrücke	Brücken
Kindergarten Sonnenschein	KiTa / Hort
Krankenhaus Meißen	Krankenhäuser
Neue Elbbrücke	Brücken
Sportplatz	Sportanlagen
Stadttheater Meißen	Theater / Museen / Bibliotheken

Objektgruppe: Brücken
Objektname: **Alte Elbbrücke**
Gefährdung:
empfohlene Maßnahmen:
Bemerkungen:

erstellt am: 12.07.2006 16:46 geändert am: 04.03.2011 14:46

Rechtswert (X): 4.603.377
Hochwert (Y): 5.671.022
Koordinaten bearbeiten
Koordinaten einfügen

Zuständigkeiten Fotos Dokumente Referenzpegel **Aktive Maßn.** Maßn...

Maßnahme	Beschreibung	Beginn
Brücke absperren	Absperrung durch Verkehrssicherungsbetrieb Müller. R	29.03.2011 17:30

Fig. 4: Object data sheet with tab for active measures

- Each scheduled measure can now be assigned to one or several critical water levels of the reference gauge levels that should lead to its activation.

Objekt	Maßnahme erforderlich wenn
Neue Elbbrücke	Pegelstand \geq 34,6 cm am Pegel "Triebischpegel Meißen"
Neue Elbbrücke	Pegelstand \geq 870,2 cm am Pegel "Dresden"
Alte Elbbrücke	Pegelstand \geq 450 cm am Pegel "Dresden"
Neue Elbbrücke	Pegelstand \geq 900 cm am Pegel "Elbpegel Meißen"

Fig. 5: Assignment of the scheduled measures to water levels of the reference water gauges and appropriate objects

3 Further approach

The task upon which the project described in the present final report is based did not cover all tasks and needs that were recognized and classified as necessary to be realized in the course of the present project execution by the customer LfULG and by GICON as project executor.

In the following the topics that should be followed up from today's point of view are summarized.

- It must be possible to assign any number of objects with critical water levels at any water gauges to the scheduled measures in order to simplify the management of the scheduled measures. By means of the situation request subsequently a concrete procedure for the concerned objects should be generated on the basis of the assigned scheduled measures.
- It must be possible to administrate events. Besides flood events, exercises, too, can be considered as events. For each event it must be possible to provide a precise chronology of the executed measures.
- Measures that were already executed in the course of an event or that are being executed must not be indicated again for execution in a new situation request for the same event.
- For the user it must be possible to switch between
 - the complete administration of measures, and a

- “simple” program version without administration of measurements (see below).
 - In the simple program version no events and scheduled measures are administered. However, the user should be able to create measures and to link objects with critical water levels of the reference water gauges. In the situation request all objects concerned and additionally the information of the “recommended measures” of the requested object are indicated.
 - In the complete program version all operative data types such as events, scheduled measures, measures and statuses of measures as well as their respective links with objects and reference gauges are used in order to be able to manage complex courses of events, too, in a traceable manner.
- Based on the display of active measures at the object it should be possible to reach and use the dialogue for the entry of a new measurement status (e.g. in preparation, under progress, completed) in a short way.
 - GIS: On the situation map, at each object the minimum status of measurements for all measures of the object should be visible by means of colour marking.
 - GIS: It should be possible to draw ready-made, pre-defined symbols to use the map more efficiently as situation map. However, the symbols on the map should not be linked with the measures in the database.
 - GIS: In the GIS it should be possible to enlarge the useable map area by hiding all controls. This is in particular of advantage when INGE is used as situation overview in a situation room.
 - Database: Implementation of an automatic transfer of status measures to be defined from INGE by email to a list of recipients to be specified.
 - Database: Establishment of the possibility to import or export the INGE address database to contacts folders of MS Outlook.
 - GIS: Modification of the object and measure status from the GIS by selecting the concerned object on the map.
 - For the mobile use it is necessary that the software INGE can be applied from a USB memory stick without installation required.
 - The present DP concept of the software INGE is to be adapted appropriately with respect to the formulated modifications.
 - Development of a concept for the execution of training courses.
In this context it must be examined which training methods, such as
 - central training events,
 - in-house training courses at the premises of the user,

- electronic training material for self-contained trainings on CD or for download,
- web-based training courses ("webinars")

would be the most appropriate.

Feedbacks from the users indicate that for INGE users training needs exist that have to be less oriented towards the general specialist use of the program but more towards the creative handling of the software and the use of the less evident possibilities of the program.

In this context, in particular

- the functional area of the GIS and its map administration, and
- the complex administration and use of events, scheduled measures, measures and statuses of measures

are of importance. These features are new ground for many users who mostly only have experiences with Office applications.

Experience shows furthermore that the provision of a user manual of usually more than 100 pages is not sufficient.

The users who are involved in the daily operating duties must study at least the basics of the theory of a software in order to be able to use it efficiently und to get a feeling of success with it.

The mostly – and under pressure of succeed and time – practiced learning-by-doing usually only leads to partial successes.

For this reason the user should either

- be motivated by appropriate means to take the time to study the basics and the advanced functions of a software, or
- to get the required time and the opportunity by means of user training courses.

In this context a training concept should lead to concrete recommendations that will be implemented after realisation of the proposed program upgrades.

Freiberg, 30.03.2011

made:

noted:

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