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"Water Body Identification in the selected river basin of Upper Dnieper"

Inception report "Development of the research methodology"

Report on "Collection of existing paper and/or digital vector maps of a minimum 1:10,000 to 1: 50,000 scale and raster images of approximately 5 to 10 m per-pixel resolution"

Draft

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Contents

Abbreviation

BWMA	Basin Water Management Authority
EPIRB	Environmental Protection of the International River Basins
INSPIRE	Infrastructure for Spatial Information in Europe
IG	Institute of Geography NAS Ukraine
IWRM	Integrated Water Resource Management
GPS	Global Positioning System
GML	Geographic Markup Language
GIS	Geographic Informational System
GS	Geomatic Solutions, Ltd
LPA	Local Public Authority
MoE	Ministry of Environment
RBMP	River Basin Management Plan
SEIS	Shared Environmental Information System
SEI	State Ecological Inspectorate
SHS	State Hydrometeorological Service
ToR	Terms of Reference
UML	Unified Modeling Language
WFD	Water Framework Directive 2000/60/EC
WISE	Water Information System for Europe
WWSPs	Water and wastewater service providers
WTP	Waste Water Treatment Plant

Definitions

Aquifer A subsurface layer or layers of rock, or other geological strata, of sufficient porosity and permeability to allow either a significant flow of groundwater or the abstraction of significant quantities of groundwater

Agglomeration An area where the population or economic activities or both are sufficiently concentrated for a waste water works to have been put in place.

Groundwater Resource An aquifer capable of providing a groundwater supply of more than 10 m^3 a day as an average or serving more than 50 persons.

Pond Artificial body of surface water, created by damming in the water with the help of dykes or by turning off the water flow, used for fish growing or irrigation, and so on, with a volume of water, at the normal retention level, up to one million m3. 1

Reservoir An artificial body of water, constituting a reserve of water, with possible use for different purposes, with a volume of water, at the normal retention level, over one million m3.

Agriculture water use [water-use category]: Composed of livestock, animal specialty, and irrigation water use.

Beneficial use [management]: Any of a number of water uses that are recognized by a political entity as valuable to society and worthy of protection, are defined by statutes, and may need to be protected against quality or quantity degradation. These water uses include, but are not necessarily limited to, domestic, municipal, agricultural, and industrial supply; cooling in thermoelectric power generation; and instream uses that include hydroelectric power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves.

Consumptive use [irrigation]: The total amount of water taken up by vegetation for transpiration or building of plant tissue, plus the unavoidable evaporation of soil moisture, snow, and intercepted precipitation associated with vegetal growth (ASAE).

Data collection *[method]:* Implementation of appropriate procedures for obtaining necessary information to monitor status of water quantity, quality, use or flow.

Data compilation *[method]:* Procedures used to develop necessary information products about water, including but not limited to, quality assurance, statistical analysis, mathematical manipulations, integration of data from several sources, and formatting for archiving.

Discharge*:* [Hydraulics] Measurement of the output from a water source such as a well, spring, pump, stream, or a storm or flood event. An area designed to receive the output flow from pumps or structures without erosion/cavitation.

Discharge point [wastewater]: A location at which effluent is released after use into a receiving stream or infiltration bed. Also referred to as an outfall. The point from which a waste water discharge occurs

Documentation Any report, record, result, data, drawing, proposal, interpretation or other document, in written or electronic form, that is required by this license.

Domestic water use [water-use category]: Water for household purposes, such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, and watering lawns and gardens. Households include

single and multi-family dwellings. Also called residential water use. The water may be obtained from a public water supply or may be self supplied.

Effluent [wastewater]: Refers to the water that flows out of a wastewater treatment facility or other works used for the purpose of treating, stabilizing, or holding waste.

Industrial water use *[water-use category]:* Water used for industrial purposes, such as fabrication, processing, washing, in-plant conveyance, and cooling, and includes such industries as steel, chemicals, paper, and petroleum refining. The water may be obtained from a public water supply or may be self supplied.

Intake *[water supply]:* (1) Point of diversion of stream flow into a conduit or irrigation system conveyance. (2) Water infiltration into the soil.

Irrigation water use *[water-use category]:* The artificial application of water on lands to assist in the growth of crops or pasture. May also be used in greenhouses. Irrigation water use may also include application of water to maintain vegetative growth in recreational lands such as parks and golf courses. Also includes water used for frost and freeze protection of crops.

Ground water *[hydrology]:* Generally all subsurface water as distinct from surface water; specifically, that part of the subsurface water in the saturated zone (a zone in which all voids are filled with water).

Major user *[management]:* A user who withdraws, distributes, or uses water, or collects or returns wastewater at a rate averaging more than 10,000 gallons per day 0.010 million gallons per day (Mgal/d).

Protected Areas Areas designated as requiring special protection under specific Community legislation for the protection of their surface water and groundwater or for the conservation of habitats and species of European sites directly dependant on water and listed in the register established by the Agency in accordance with Article 8 of the Water Policy Regulations.

State Water Cadaster State informational system containing the record of data regarding the river network, water resources, as well as water abstraction and restitution, including hydro-technical assets.

Surface Water A discrete and significant element of surface water such as a lake, reservoir, stream, river or canal, part of a stream, river or canal, a transitional water. (European Communities Environmental Objectives).

Water user - a phisical or legal person who has a legal permision for using water object and water resources with specific environmental conditions.

I. Background and Objectives

The EPIRB project targets the improvement of water quality in the trans-boundary river basins of the wider Black Sea region and Belarus. It supports the move towards modern management tools and compliance of the EU Water Framework Directive (WFD) by building capacities, learning-by-doing, and through the development and implementation of River Basin Management Plans for selected pilot river basins according to the requirements of WFD.

The basis for the implementation of the aforementioned assignment is the 'Plan of implementation of EU Water Framework Directive into the legislation of Ukraine' according to the decree of Cabinet of Ministers of Ukraine in 2015.

The assignment contributes to "Preparation of the river basin management plans for the selected river basins of the Dnieper Basin" under the EPIRB project and in particular water body identification and typology in the selected river basins. The activity is a precursor to the River Basin Analysis and Pressure and Impact and Risk assessments which lead to the development of the River Basin Management Plans in accordance with the requirements of EU WFD.

Currently such approaches of WFD in the water body identification (based on the catchment area of rivers and the water table area of lakes) are absent in the normative documents of existing Ukrainian legislation and there is no clear typology of the water bodies within specified hydrographical areas.

The specific objectives of the assignment are to help beneficiaries identify the water bodies in the selected basins, namely the water bodies with the catchment area more than 10 km^2, lakes with an area more than 0,5 km^2, artificial and significantly modified water bodies with the catchment area more than 0,5 km^2 (ponds and reservoirs) and with length more than 10 km (canals) using GIS analysis and other tools (remote Sensing of aerial and spectral imagery by use of radar, or lidar technologies) for fulfilment of the following sub-tasks:

- preliminary identification of water bodies by categories of WFD and their digitalization in a GIS format;
- final identification of water bodies and ground verification of locations, when necessary;
- presentation of GIS layers and thematic maps, as well as feature data bases to the project beneficiary.

II. Scope of work

The area of the study will be the Pripyat River Basin. The Pripyat River is the largest tributary of the EPIRB pilot in terms of area, length and water volume in the western part of the Upper Dnieper

basin. The Pripyrat basin is located on the territory of the Republic of Belarus and Ukraine (Volyn, Rivne and Zhytomyr regions). The total river length is 775 km, of which 261 km is in Ukraine. The basin aria is 121,000 km^2. The Pripyat flows across the Polesie in the lower reaches in the basin south-east. The Catchment is very well-developed river network - about 10.5 thousand rivers. Most tributaries are completely or partially can alized due to extensive land reclamation and flood management. Among right-bank tributaries flowing through Ukraine are the Turia, Stokhid, Styr, Gorin, Stvyha, Ubort, Slovechna, Solon and Uzh rivers.

In 1986 on the Pripyat lower reaches, tens of kilometres of dikes were built to protect the river from radioactive pollution in connection with the accidental the Chornobyl nuclear power plant.

Picture 1. Map of Pripyat river basin

III. Implementation and deliverables

The tasks facing Ukraine today is to create a national infrastructure of geospatial data on water resources and ensure its development according to global trends, which provide:

• fundamentally new opportunities for research, analytics,

• the inclusion of water data in Economic , create market information,
• effective environmental protection,
• the ability to model the consequences of natural and man-made disasters, effectively prevent such phenomena,
• effective public participation in the formulation and implementation of water policies,
• quality development, monitoring and evaluation of water and environmental policies at all levels on the basis of the facts (evidence based).

Where we are. In the area of environmental policy exists the paper feudalism:
• Own data that the water managers are using are scattered, incomplete, closed,
• Inefficiently spent a large money for "computerization" due to the fragmentation and duplication of functions,
• There is no state policy for geospatial and other data, this topic is absent among priorities
• No uniform data standards and rules for handling, integration is impossible,
• Information is subject to abuse and manipulation instead of being a resource for the development of an obstacle.

In the area of environmental policy are existing paper maps issues:
• Own data that the water managers are using are scattered, incomplete, closed;
• Inefficiently spent large money for "computerization" due to the fragmentation and duplication of functions;
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• No uniform data standards and rules for handling, integration is impossible;
• Information is subject to abuse and manipulation instead of being a resource for the development of an obstacle.
The improving of new approaches using GIS technology for calculation and visualization of water objects resources also allow creating information platform for implementation of European directives in Ukraine.
The pilot project "Water Body Identification in the selected river basin of Upper Dnieper" under EU EPIRB will be launched prototyping system of water management in Ukraine. The work will consist in preparing basic spatial data Pripyat River Basin (right bank tributary of the Dnieper) in ArcGIS format.
The abovementioned activities are guided by such documents as the EU Water Framework Directive and Common Implementation Strategy (CIS) namely the CIS guidance document No 2 – *“Identification of Water Bodies”* and CIS guidance document No 9 –*“Implementing the*

Geographical Information Systems (GIS) of the Water Framework Directive". It will be necessary to assess all information that is available and analyse it for getting three main groups of GIS maps: basic information, characteristics of the river basins and protected areas.

According to the provisions of WFD the surface water bodies are all continental water bodies, including rivers, canals, lakes, reservoirs and ponds.

The following approaches of WFD will be used for the water body identification:

Rivers depending on catchment area	Lakes depending on the water table area
small: 10 – 100 km^2	0.5 – 1 km^2
average: > 100 – 1.000 km^2	1 – 10 km^2
large: > 1.000 – 10.000 km^2	10 – 100 km^2
very large: > 10.000 km^2	> 100 $km^{`2}$

The first step on implementation of contract ToR was development of the research methodology, especially in cases of lack of information on rivers with a total catchment area from 10 km^2 and lakes from 0.5 km^2;

In the next deliverable was collect an existing information on water objects in the selected river basin, including paper and/or digital vector maps of a minimum 1:10.000 to 1:50.000 scale and raster maps of approximately 5 to 10 m per-pixel resolution, in case to improve situation of.

System provides:

- collecting data on water objects and their identification,
- formation water objects,
- integration of all available data.

Background - map scale of 1: 10,000 to 1: 50,000 in the Pripyat river basin in Ukraine

Types of works:

- Maps scanning,
- Correction of Raster,
- Connection of Raster,
- Vectorization of Rasters, creating vector model and database structure attribute data,
- Development of data structures,
- Preparation of technological cycle of water objects formation (software, raster and vector data, methods of formation)
- Training course and support.

Composition of data:

The list of layers and structure:

1. Raster Image - map scale 1:10 000 - 1: 50000 on the area the Prypyat basin in Ukraine.
2. Hydrography – vectorization of water objects.
3. Monitoring of water quality – vectorization of observation points.
4. Water Management zoning.
5. Water users.

Layers 1 to be attached and formed. Layers 2-5 are to be structured and prepared for reshape.

All maps and data base will be creating using licensed ArcGIS.

Prepared in Pilot project database of the identified water bodies (rivers) will include mapping and initial training of 3 technical specialists from the Ministry of Ecology of Ukraine, State Agency for Water Management and Dnieper River Basin Authority for operation, maintenance and update of developed GIS database in ArcGIS software. This effective system of information support of the state of water resources management will improve the monitoring control and connection with all Dnieper river basin stakeholders.

IV. Transferring data

All data will be transferred to the MENR, SAWR and the Dnieper RBA in the form of layers of digital map in "layers" format that will be recorded on DVD media and posted on the web space that is available to the project team and beneficiaries. The attributive information of GIS layers and final report in English and Ukrainian languages will be presented too. The proposed geospatial data will not contain information about the confidential or secret objects of the information of national security. The proposed GIS layers may be used only for the purpose of water resources management and environmental protection of the river basins as well as the flood risk analysis.

V. Duration and schedule and deliverables

Deliverable 1: Development of the research methodology, especially in cases of lack of information on rivers with a total catchment area from 10 km^2 and lakes from 0.5 km^2;

Deliverable 2: Collection of existing information on water objects in the selected river basin, including paper and/or digital vector maps of a minimum 1:10,000 to 1: 50,000 scale and raster maps of approximately 5 to 10 m per-pixel resolution;

Deliverable 3: Digitalization/processing of the collected paper and/or digital vector & raster maps and creation of database in GIS format with the ground verification field works for the locations where clarification is necessary;

Deliverable 4: Creation of database of the identified water bodies, their mapping and preparation of final report, as well as hands-on initial training of 2-3 representatives from each beneficiary institution listed in Section III (MENR, SAWR and Dnieper RBA) on essential skills for operation, maintenance and update of developed GIS database in ArcGIS software.

ArcGIS Supplier Company, representing ESRI in Ukraine installed the software and provided initial GIS training for relevant specialists from MENR, SAWR and Dnieper RBA.

Duration of the assessment will be 5 months with the expected completion date of September 15, 2016.

VI. Methodology of Pilot implementation

Phase 1: Development of the research methodology and inception report

Final result 1: Methodology research was made, especially for cases with absent information about rivers with total catchment area from 10 sq.km and lakes from 0,5 sq.km.

№	Theme of works	Implementation
1	Research of existing legislative and normative-technical base.	A list of legislative and normative-technical documents, standards, SUC, which are relevant to the subject of the agreement and commented on what legal requirements should be followed during work implementation, has been collected.
2	Research of data structure requirements (object structure, classification).	The list of water objects that need identification with the use of cartographic materials has been prepared.
3	Research of the requirements to the initial cartographic data and the development of methods of their transformation into electronic and digital form.	The requirements to the initial cartographic data have been prepared. The choice of scale of the initial cartographic materials and the method of their transformation into electronic and digital form has been proved. The form of blanks (metadata cards) has been developed on electronic and digital maps.
4	Research of the requirements for the initial non-cartographic data and the development of methods of their transformation into electronic and digital form.	Methods of transformation into electronic and digital form of various reference and statistical materials and documents have been prepared.
5	Preparation of methodology of cartographic data usage for identification of water bodies in	The methodology of cartographic data usage for the identification of water bodies in the ArcGIS Software has been prepared. Special attention is

	ArcGIS Software.	paid to solving the problems of identification of small water bodies (rivers with a total catchment area of 10 km2 and lakes from 0.5 km2) with additional large-scale cartographic materials and remote sensing.
6	Preparation of inception report	Inception report with description of implemented methodological works.

Phase 2: Collection of existing paper and/or digital vector maps of a minimum 1:10,000 to 1: 50,000 scale and raster images of approximately 5 to 10 m per-pixel resolution

Final result 2: Existing paper and/or digital vector maps of a minimum 1:10,000 to 1: 50,000 scale and raster images of approximately 5 to 10 m per-pixel resolution were collected. For the entire area of Pripyat basin the 1:10000-1:50000 topography maps provide the greatest level of detail: these maps need to be scanned and georeferenced.

The Analysis of existing materials

The proposed methodology for collection, codification and storage of abstraction data will be based on the existing international legislation including WFD and harmonised national legislation. At the current level in Ukraine were performed works for the identification of the water bodies, including for the Pripyat River. Relevant information about water sector is very fragmentated and dispersed. Summary of the existing data are included in the table below.

Initial analised data

Information Type	Original Format	Scale	Source	Comments
1	2	3	4	5
Political boundaries	ESRIShape file	1:10000- 1:100 000	Register for administrative units	
Basin Delineation	ESRIShape file	1:50 000		
Hydrography	ESRIShape file	1:10000, 1:50 000		Design "GS"
Surface and Ground Water Bodies	ESRIShape file	1:10000 - 1:50 000	Project	
Digital Elevation Model (DEM)	ESRIShape file			Design "GS"
Digital Orthophoto	GeoTiFF	1:10000		On the basis of aerial measurements 2007-2010
Water Reservoirs and Ponds	ESRIShape file	1:10000 - 1:50 000		
Roads	ESRIShape file	1:2000 - 1:50 000		General information about access ways
Wastewater treatment plants	Format textual	1:2000 - 1:50 000		To be represented on cartographic material
River catchments	Old Maps			This includes pumping stations for irrigation and AAM
The Register environmental permit for the special use of water	Textual			It includes data from 2013
The Register of the Hydrotehnical Structures	Textual, at the present time not exist			
Protection Zones Register	Textual			
Register for water users that submit annual reports	textual, Excel			
Property Right		1:2000 -1:5000		
Water Fund Land Registry	Textual, at the present time not exist			

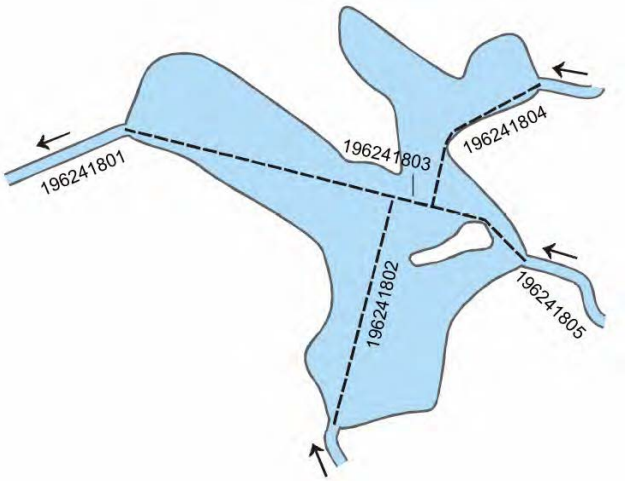
№	Theme of works	Implementation
1	Gathering and scanning of topographic maps of scale 1:50000	285 sheets maps of scale 1:50000 with a resolution of 500 dpi were gathered and scanned.
2	Proofreading and binding raster images (topographic maps in electronic form).	The radiometric and geometric correction of raster images has been made. Electronic (raster images) topographic maps in ArcGIS bound in the coordinate system WGS-84 and USK-2000 (scheme 1). The search for the most relevant remote sensing data with a resolution of 0.5-1.5 m has been performed.

Phase 3: Digitalization/processing of the collected paper and/or digital vector & raster maps and creation of database in GIS format and interim progress report

Digitizing River Network

The digitizing of river networks shall be accomplished up to the maximum possible level of detail and accuracy as this is important for the estimation of river length through GIS. The continua of water channels, flowing into and out of lakes, are modeled according to theprinciple of shortest distance using cost-surface functions. If necessary, the main water channel that crosses a lake is digitized with the help of main flow directions, deeps and other local knowledge using the principle of shortest distance (Picture 2). This alternative seems the most practical one, although local adjustments will probably have to be made in any case. In doing so, the order of tributary coding is preserved. River names must be entered into the database concurrently, as digitizing moves on.

It is important to bear in mind that maps at the scale of 1:10000-1:50000 were issued in 1983-1993, therefore the information they contain is rather out-of-date. This is specifically related to man-made canals and irrigation systems, dams and water reservoirs.



Piture 2. River network coding in lake area

Digitization of the River Network

The next step is digitization of river network. This procedure is realized by on-screen digitizing of geo-referenced topographic maps or using special software or immediately in *ArcGIS* by its *Editor* tool. To avoid incidental omission of a tributary, all rivers must be digitized. To make network analyses possible, the digitizing must follow with the stream and layer topology must be duly considered. Using *ArcGIS* for topology check-up and editing, *Topology Tool* can be applied.

Identification of Main Rivers

At the next step it is necessary to identify the main rivers subject to the coding. In Ukraine, all rivers 5 km long or longer were coded. Our experience shows that this is the minimum river length (with very few exceptions) that is justified from the standpoint of both hydrology, and economy. The

selection of 5 km-long and longer rivers is performed in the shape file manually, through the *Editor* tool. Moving from the source to the estuary of a main river, minor tributaries are excluded and main river stretches are connected (i.e., unlinked nodes are excluded). To determine the length of each stretch, the following procedure can be used. *New Personal Geo-database* is created in *Arc Catalog*, into which the shape file of digitized river network is exported. Along with this, *Shape_Length* field is created in the database, where lengths of river stretches are recorded automatically. These lengths can change, again automatically, while the shape file is edited.

Identifying main rivers, it is also possible to use *Flow Accumulation* layer, which is calculated from DEM using *Hydrology Tool* (see the next section) and which identifies main rivers clearly. Besides, information available on topography maps must be used, river names for instance. Main rivers mostly have names, by secondary tributaries are nameless.

The attribute table linked to the layer would have the following structure: *Name_Old, Name_New, WOT, Sea, M_border, R_basin, Level_1, Level_2, ... Level_n, Area_band, WOC, Length.* Table fields must be all of *Text* type, excluding *Length*, which must be of *Double* type. After the layer of rivers that are $\geq$ 5 km long is created, the number of tributaries for large river basins shall be assessed roughly. If this number is more than 49, the longest 49 must be selected.

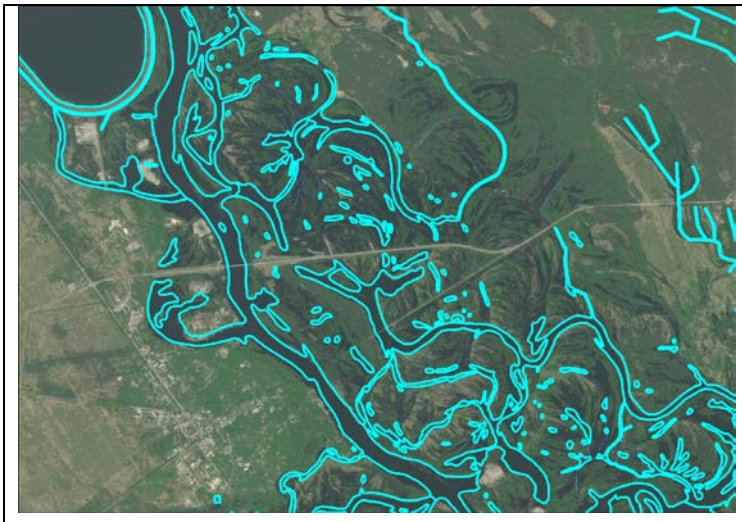
Phase 4: Creation of database of the identified water bodies, their mapping and final report and hands-on training in ArcGIS for up to 9 representatives of beneficiary institutions

Final Deliverables

Upon completion of coding activities for each river basin, a unique ArcGIS project is created (*.mxd), which includes the following layers:

- All digitized rivers - Polyline shapefile
- Main rivers (more than 5 km long) - Polyline shapefile
- Catchment basins - Polygone shapefile
- Hill shade relief - GEOTIFF raster file
- Isohypses at an interval of 10 m - Polyline shapefile

Graphical data	Attribute data



Code	Type	Name	Name_u	Name_e
42				
42				
42				
47	канал			
47	канал			
47	канал			
41		Припять	Прип'ять	Pripyat'
42				
42				
42				
42				
47	протока			
47	протока			
42				
42				
42				
42				

Picture 3. Example of existing information on hydrological network and water objects

Identification of waste water discharges Objects in the Prypyat area. The proposed methodology for data collection, codification and storage of abstraction data

To achieve the objectives and requirements of sustainable development is necessary to know precisely both quantitatively and qualitatively the natural resources we have, their distribution in space and time. Water resources management requires the production of appropriate amounts of water and of appropriate quality as well as the pollution exclusion cases.

Comparative analysis of the material (analog and digital), will be one of the basic methods applied by the BWMA team. A separate accent will be put on strong communication with relevant institutions and main stakeholders. All steps and deliverables will be coordinated with stakeholders.

The Codification will be made according to the River Basin's code, subbasin and water body where each catchment and discharge point will be located.

A brief description of the actions in each step follows as a table in the lines below:

SUMMARY OF STEPS AND ACTIVITIES IN LUSP PROCESS. Development of Water Resource Management Information System (WRMIS) including GIS mapping of water abstraction and wastewater discharge locations for the Pripyat pilot area in Ukraine planning process

STEPS	ACTIVITIES	METHODS	MAIN OUTPUTS

I. Preparation	Kick off meeting of the team members and the schedule development Identification of responsible institutions, which collected information and are responsible for elaboration of the registers. Make contact with institutions and create awareness on development process Study Laws/bye-laws, Regulations and Policies on Water resource management Plan required maps § information from the responsible institutions	discussions/ meetings dialogue desk study and analysis of data	Report on the current situation Necessary attributive information Classification scheme of water abstraction points (intakes, catchments) Classification scheme of water discharges points
2.Data Collection and Analysi of Existing Situation	▪ Analysis of the curent situation. Comparation of the dates presented in the different documets and sources. Identification based on cartographical materials of the position of water intake points Identification based on cartografical materials of the position of water discharge points	Observation Behavior analysis of cartografical maps	Information about: Water intakes points Water discharges points Identification according to cartographical materials
3.Formulation of Action Plan	▪ Composition of attributive information Objects identification that have not been identified yet based on cartographic materials (field activities) Elaboration of the schemes of water intake and discharge points Sending letters cartographic material and textual for Local Public Authorities form Prut river basin (LPA) for informing and complete identification by attributive data	Preparing scheme for each LPA from pilot river basin	Forms completed for each water object Information about: Water intake points Water discharges points unidentified cartographic points Develop scheme Completion information
4. Designig of DB for water abstraction and wastewater discharge points	Analysis of the information received from LPA and other relevant institutions II. Developing a database and filling GIS layers	Mapping Report Writing	Layers compiled with the information
5. Filling databases and their integration into GIS	▪ Develop methodology of coding attributes ▪ Filling DB Visualization of data, and transfer them into GIS	Design and completion of the Data Base (DB)	
6. Evaluation of results and public information for their using	Organization the process of using (view, analysis and drafting reports etc.) (WRMIS)	Discussions Public Information Presentation of report	Examples of the reports
7. Measures for DB updating	Establishing the rules for and updating and how to add the changes	Ensuring the data interoperability	

Inventory

At present, as mentioned there is no comprehensive database of points of water abstraction (intakes), discharges and water users. These data are distributed between different players, with different accuracy and content depending on the institution holding this information.

Analysis of materials containing information on water use (reports, tables, registers, cartographic-digital / analog etc.). All points will be positioned in the Spatial reference information USK-2000 with the following characteristics: In order to determine the spatial position of intake and discharge water points will be used the existing cartographic material, which was developed in the VGS coordinate system. Identification will be made by the comparative method.

With the help of the Ortophoto available on Internet, also using search engines like www.bing.com we will be able to identify the proposed points with good precisions and the most updated photos.

Below one can see some examples of the catchment and discharge points obtained in the Pripiyat River Basin. Some examples of the points obtained:

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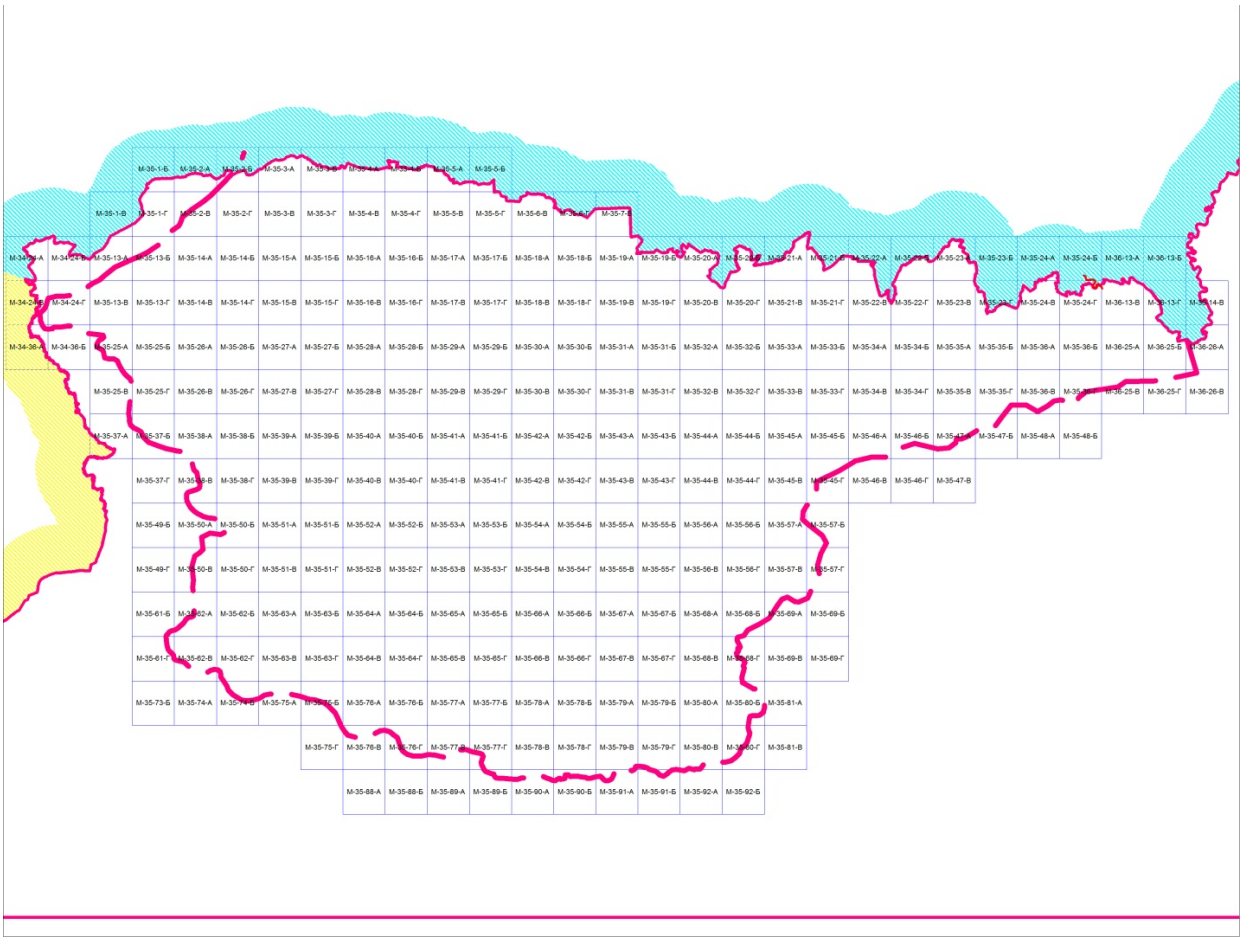
ANNEXE 1.



Scheme 1. Cartogram of the initial cartographic materials scale 1:50 000