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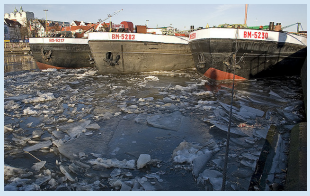

Odra-Vistula Flood Management Project

Environmetal Assessments And Management Framework Document

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1 LIST OF ABBREVIATIONS USED IN THE DOCUMENT

EA	Environental Assessment
EIA	Environmental Impact Assessment
EIA Law	the Act of July 8 2010 on special principles of preparation and execution of flood prevention constructions investments (Journal of Laws Nr 143, item 963, as amended)
EMP	Environmental Management Plan
ESE	Strategy for Energy Security and The Environment , 2020 perspective
EU	European Union
Flood Directive	Flood Directive 2007/60/WE of the European Parliament and of the Council of 23 October 2007 on the assessment and flood risks (OJ No 288 of 6.11.2007, p. 27)
GWBs	Groundwater Bodies
LSND	Long-Term National Development Strategy – Poland 2030. III Wave of Modernity.
NDS	National Development Strategy 2020
NWMA	National Water Management Authority
PIU	Project Implementing Units
PMDII	Podkarpacki Management of Drainage, Irrigation and Infrastructure
RDEP	The Regional Director for Environmental Protection
RIS	River Information Services
RP	The Republic of Poland
RWBMP	River Water Basin Management Plan
RWMA	Regional Water Management Authority
SAC	Special Areas of Conservation
SEA	Strategic Environmental Assessment

SIEE	Strategy of Innovation and Effectiveness of Economy
SMDII	Świętokrzyski Management of Drainage, Irrigation and Infrastructure
SPA	Special Protection Area
SWBs	Surface Water Bodies
VIEP	Voivodship Inspectorates for Environmental Protection
Water Law	Water Law Act of 18 July 2001 r. (OJ from. 2012, no 145 with later amendments)
WFD	Water Framework Directive 2000/60/WE of 23 October 2000 establishing a framework for Community action in the field of water policy (OJ No 32 of 22.12.2000, p. 1 with amendments)

2 PREAMBLE

This Report presenets the environmental and social impacts of a large number of structures that are planned for implementation within the Odra and Vistula River Basins.

The proposed project (Odra-Vistula Flood Management Project) comprises a selection of first-priority investments and measures that were selected after many years of basin-wide analysis and studies, complemented with detailed case-by-case analysis of each selected item. The government has embarked in the early 2000s on a nation-wide analysis of flood risks and response strategies to develop a comprehensive and long-term program for investments and measures—that will span several decades—to achieve protection levels against floods that are in line with the EU Flood Directive and good international practices. These proposed flood investments and measures were drawn from, and fully embedded in the policy and regulatory documents that are required under the EU Water Framework Directive (WFD), foremost the River Basin Management Plans (RBMPs). The government reformed its legal framework in the early 2000s to make it compatible with EU requirements. Between 2007 and 2013 the first "generation" of RBMPs for all basins was prepared, integrating water management and environmental objectives, based on year-long extensive public consultation, and drawing in a century of ground observations. While the 2013 Plans were judged "overall not compliant" with the WFD, they do meet many of the specific WFD criteria and Bank requirements. Because investments in basin management comprise small and large items, the EC's DG Environment agreed in November 2014 upon the submission of new interim Updated Master Plans that a "List 1" of 2,100 items are acceptable because well manageable and not requiring basin-wide analysis, while another 450 items on "List 2" are deemed complex and having a large footprint, requiring full basin-wide analysis through an acceptable RBMP, after 2015.

For the Project, a selection of priority investments and measures was agreed upon, and is shown as a separate Annex 7 to this Report. The selection was guided, foremost by the locations that had experienced historical records of devastating nature ("hot spots" that are recognized to be particularly vulnerable to floods, yet where mitigation measures would probably be cost-effective without being environmentally or socially complex), by the desire to work in coherent areas (thus, in certain sub-basins where individual investments and studies could generate mutual benefits), where it would be possible to build on the lessons learned and the institutions developed under the on-going Odra River Flood Protection Project, and where a generally good level of institutional readiness was confirmed. The basic criteria for selection were: prioritization within the context of the RBMPs and comparison of all possible combinations of investments to identify the least-cost and lowest-impact variants; economic analyses to select cost-effective options including a risk-based approach to investments; creating "room for the river" and floodwave retention capacity upstream, rather than constraining river flow by dikes; integration with environmental values and protection of habitats; management plans based on broad consultation with stakeholders; and sustained financing through fee collection and/or transfers from the national or regional budgets. The selection covers less than one quarter of the long list in "List 1" of the EC focusing on the "low hanging fruit". On the other hand, certain proposed investments in "List 1" were excluded from the Project notably where they would possibly affect vulnerable areas, habitats and riverine forests (including some Natura2000 sites), for example, the floodplains

of the Warta river (a tributary to the Odra) and the vegetation patches within the dike system of Sandomierz. For such investments, more extensive variant analysis will be required. Beside of regular safeguards analyses, all individual selected works and measures were reviewed through mathematical simulation of waterflow and flood routing to ascertain that they do not create incremental negative impacts on downstream or upstream communities, and, where possible, positive impact. It is important to note that the majority of the investments concern rehabilitation and modernization of existing structures.

Important guidance was derived from the flood hazard maps, prepared in 2010-2014, that indicate the river sections in the Odra Basin, in the Nysa-Kłodzko Valley and along the Nysa River, and in the Vistula Basin, that are prone to Q1% flood events. The Lower Odra map reflects the aggregate risk from summer and winter floods. The maps are based on new-generation Digital Elevation maps created from remote sensing and LiDAR surveys; they are prepared for return periods of 10, 100 and 500 years. The Project would notably seek "no regret" investments and measures[1].

This analysis yielded the identification of the following Components:

1. *The Lower and Middle Odra*, because the sub-basin is of all Polish basins the most subject to repeated summer and winter floods, the latter being caused by ice jams. This Component also would allow to maximally benefit from the existing institutional structure for project implementation created by the Odra River Flood Protection Project. The city of Szczecin (near the mouth of the river) is considered as very vulnerable because of winter floods. The city of Slubice on the right bank of the Border Odra is known to be very prone to both summer and winter floods because the flood protection works on the opposing left (German) bank already have been upgraded to the agreed Odra protection standard of 1-in-100 year floods. The Component would assist Poland meet the international agreements on the Odra management.
2. *The Nysa-Kłodzko valley* torrents and tributaries to the Upper Odra, because this tributary has a long history of very frequent (every 5-8 years) and heavy flooding causing local devastation, while at the same time also contributing significantly to the flood waters entering the Wroclaw Flood Way system. The construction of dry polders and modernization of the dikes and embankments would lead to local protection but also reduce the floodwave significantly along the Nysa river downstream as well in distant Wroclaw. It is important to note that the Flood hazard map (Map 2-2a) does not reflect well the extent of floods in the Nysa-Klodzko valley iteslf—as the flood"plain" is very narrow on the steep mountains the water flow is very concentrated and, therefore, has high energetic impact. The damages in the towns and cities are not so much caused by overflowing water but by floating debris and rolling gravel and rocks that are swept along by the kinetic energy of the water.

[1] No regret measures are those that are characterized by the following: (i) having only local impact, hydraulically and environmentally, or, if there is downstream or upstream impact, this is well understood and managed; nor are they themselves impacted significantly by the design of future upstream or downstream investments; (ii) in demonstratively vulnerable areas associated with high benefits from protection measures that are unlikely to be excessively expensive; (iv) without complex interactions across a large part of the basin that would necessitate a robustly optimized basin plan to yield the most cost-effective variant, and (v) that have a comparatively modest ecological footprint and are otherwise non-controversial

3. *The Upper Vistula*, because, beyond the Odra basin, this segment of the Vistula has the historical worst record of flood damages. The cities of Cracow, Nowa Huta (a large industrial complex and urban area adjacent to Cracow), Tarnobrzeg and Sandomierz (large industrial complexes and urban areas at the lower end of the Upper Vistula, are generally recognized as the “hot spots” (Map 2-3). In addition, in the sub-basins of the tributaries many parts are flood-prone. For several proposed works and measures, the economic rationale is confirmed and advanced documentation for works is existing, yet for other sets of investments additional studies to optimize the investments will be required before further decisions can be made on their merit. The Project will finance selected investments as well as studies that have the purpose to analyze different investment scenarios.

Flood forecasting and improved operational management, because it would assist the IMGW and the IMGW-PIB (the IMGW offices in Cracow) with further expanding their forecasting capabilities with respect to rainfall and floodwave propagation, based on the investments made under the Odra River Flood Protection Project. The Component would also finance two Operations rooms in RZGWs (Wroclaw, Cracow) to allow real-time overview of floodwave development, analysis of flood hazards such as dike breaches, and the data-driven operation of reservoirs, dry polders and barrages with the aim to minimize damages.

3 SUMMARY

Granting and improving flood security is one of the most important factors conditioning sustainable and stable social and economic development of regions of Countries. Within Odra-Vistula Flood Managment Project complex flood protection within parts of two largest Polish rivers – Vistula and Odra – was planned, in division into three Components covering Lower and Middle Odra (Component 1), Kotlina Kłodzka, constituting vast part of upper part of Odra basin (Component 2) and Upper Vistula (Component 3)

The implemented Component 1 covers a several-hundred km long section of the valley of Odra, which is the second largest river of Poland, after Vistula. On the said section, Odra flows in a wide valley of high natural value. Despite significant alterations made to the riverbed, resulting from adjusting Odra to the function of a shipping lane (mainly second half of 19th century), the valley maintained features characteristic for large lowland river, such as significant share of green areas within catchment areas, side arms of the river, oxbows, etc. Such structure of the landscape within the entire valley is reflected by high degree of coverage with protected areas, such as: national parks, Natura 200 sites, landscape parks. An important part of the valley of Odra are riparian and hornbeam forests, situated in various parts of the river valley, as well as associated animal species, especially birds. The valley of Odra also performs an important function of ecological corridor connecting northern and southern regions of Poland (it also constitutes a migratory route for bi-environmental fish migrating between upper part of Odra basin and the Baltic Sea).

Along the entire section covered with particular investments included in Component 1, due to historical significance of the valley of Odra as commercial route, many cities were established, with well-preserved historical structures. The most important and largest city in the area of implementation of the Project is the city of Szczecin, currently performing function of economic and administrative centre in the region. Some cities by Odra suffered losses caused by military activities during WW II and as a result of political decisions during PRL. In the entire valley, landscape structure shows features typical for German manner of spatial planning – cities and countries are compact, surrounded by lands used to different extent for agriculture.

Within Lower and Middle Odra the most significant flood risk is posed, in winter conditions, by ice blockages created when the flowing ice is stopped by existing obstacles such as shallow areas in the riverbed, narrowing o the riverbed and others. Also sudden changes of the river current, backwater from sea waters and northern winds add to creation of ice blockages (Lower Odra runs a typically meridional course). This in turn causes damming of waters and flooding of adjacent areas. The main aim of tasks planned for investment in this area is to reduce the possibility creation of ice blockages and enabling icebreaking as the most efficient tool for minimizing risks of winter floods. These aims may be achieved by repairing and modernizing existing regulatory structures, liquidating ice blockage-prone spots standardizing conditions of flow and motion of the rubble and reconstruction of selected bridge structures. These tasks will allow for safe passage of the ice down the river and at the same time for reducing flood risk on adjacent areas. At the same time, it is necessary to secure existing housing structures and infrastructure in selected places on the Middle and Lower Odra by constructing new and modernizing existing flood embankments.

Component 2 will be implemented on the part of upper Odra basin, covering mountain and highland part of catchment of Nysa Kłodzka (the main tributaries to Odra in its upper basin). Watercourses in this region are represented by several types of mountain and sub-mountain types characterized by rigid, stone or gravel bottom and high speed of water flow. Tasks undertaken within this Component will be implemented within the so-called Kotlina Kłodzka, in which only tributaries to Nysa Kłodzka are present. Nysa Kłodzka flows through the central part of Kotlina and on this section several right and left-hand tributaries enter to it, taking waters from mountain areas surrounding the lowering of Nysa Kłodzka. Such system of river network determines nature of flood phenomena in this area – fast increase of the amount of water in the watercourses, creation of a flood wave and its accumulation in the estuary section of the rivers. Within Kotlina Kłodzka the majority of protected areas is situated on mountain areas, surrounding the lowering of Nysa Kłodzka from the East and the West. In one case the planned investments covers a several km section of the riverbed covered by protection due to presence of valuable green areas and fish species.

Therefore, tasks planned for implementation within Component 2 should in the first place serve to reduce the flood wave and facilitate flow of flood waters. Works aimed at securing buildings and infrastructure against damage during flow of flood waters will also be carried out. Flood risk for Kotlina Kłodzka in the first place results from insufficient capacity of the beds of rivers, streams and communication objects, too little number of flood reservoirs, insufficient number and height of the embankments. Reducing the flood risk will be achieved by such tasks as construction of dry reservoirs, modernization and construction of flood embankments, increasing capacity of bridge structures.

Within Upper Vistula, where Component 3 will be implemented, the investments will be implemented within watercourses of various flow parameters and topography of the entire river valley. In the upper part of Vistula basin watercourses are of mountain and sub-mountain character, they flow through narrow valleys, with high speed of the flow and stone or gravel bottom. In the vicinity of Cracow (capital of the region) the river enters a wider valley and is classified as lowland sand-and-loam river. Below Cracow, in the vicinity of Sandomierz, where implementation of further tasks is planned, Vistula is classified as large lowland river. The valley of the river is wide, the riverbed is accompanied by additional structures, such as side arms of the river, oxbows, and other structures of high biodiversity. In the regions where works from this Component will be implemented, watercourses maintained their high natural values (many protected areas with different protective measures were designated), however from the spatial point of view only one of the planned investments will be implemented within such area).

Component 3 includes implementation of tasks, in selected areas of the catchment of Upper Vistula, within which flood protection of valuable sites will improve gradually. Particular plces of implementation of the Project will cover areas of high level of flood risk, where high flood losses were suffered in 2010. That flood was the largest hitherto recorder flood in the regions covered by the Project. Planned tasks will ensure safe passage of historically documented great water, and at the same time will increase the level of security for areas protected against higher waters. Particular investments planned for implementation within Component 3 will create a complex system of flood protection within Upper Vistula and will cover various tasks adjusted to the specificity and conditions of particular watercourses and other natural, social and economic conditions Planned tasks cover, among others, such works as: creating

additional polder retention, reconstruction of flood embankments, construction of dry reservoirs, section increase of capacity of the riverbeds and others.

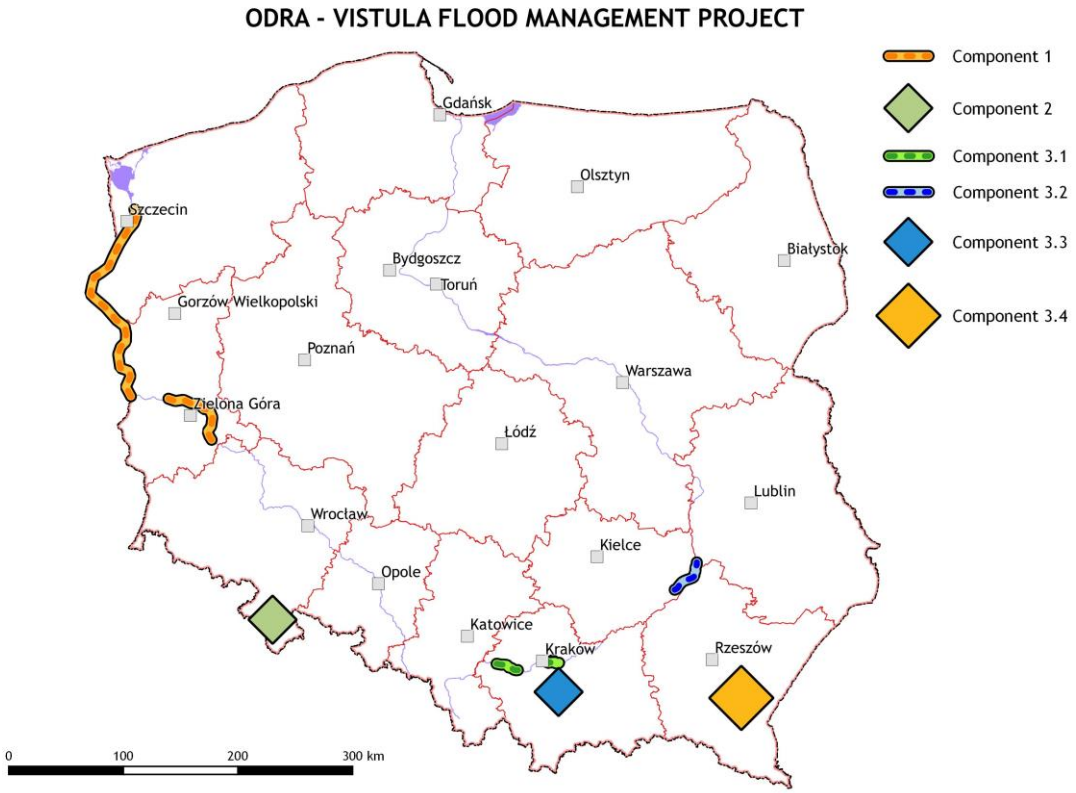

Fig. 1 General location of areas of implementation of works within particular Components within the Project

Within particular Components of the project various investments associated with reducing flood risk will be implemented. In order to identify potential adverse impacts generated by the investments, types of tasks were specified for the purpose of reducing the flood risk (Tab. 1).

Table 1. Types of tasks undertaken within particular Components of the Project (in alphabetical order).

Component	Type of tasks
Component 1: Flood Protection of the Lower and Middle Oder	construction of embankments/boulevards
	construction and renovation of elements of sailing infrastructure (groins, stop and mooring bay and marking the sailing route)
	dismantlement of structures

Component	Type of tasks
	modernization of embankments/boulevards
	reconstruction of bridges
	modernization of pumping stations
	reconstruction and modernization of hydro-engineering structures (automatic gates, forklift flood-gates and culverts, weirs, control valves)
	reconstruction and renovation of hydrotechnical structures (automatic gates, embankment sluice and culverts, weirs, water barrages)
	regulation and maintenance works in riverbeds and inter-embankment lands of natural and artificial parts of water or strongly changed parts of water and drainage ditches
Component 2: Flood Protection of Kłodzko Valley	construction of dry detention basins (front dams, side dams, relief-overflow sections)
	construction of embankments/boulevards
	dismantlement of structures
	dismantlement and modification of colliding infrastructure elements (e.g. water supply system sections, sewage system sections, roads, etc.)
	modernization of embankments/boulevards
	reconstruction of bridges
	regulation and maintenance works in riverbeds and inter-embankment lands of natural and artificial parts of water or strongly changed parts of water and drainage ditches
	reconstruction and rmodernization of hydrotechnical structures (automatic gates, embankment sluice and culverts, weirs, water barrages)
Component 3: The Upper Vistula	construction of polders
	construction of pumping stations

Component	Type of tasks
	construction of dry detention basins (front dams, side dams, relief-overflow sections)
	construction of embankments/boulevards
	changing the way of water management on the storage reservoir
	dismantlement and modification of colliding infrastructure elements (e.g. water supply system sections, sewage system sections, roads, etc.)
	modernization of pumping stations
	modernisation of embankments / boulevards
	reconstruction and renovation of hydrotechnical structures (automatic gates, embankment sluice and culverts, weirs, water barrages)
	reconstruction of bridges
	regulation and maintenance works in riverbeds and inter-embankment lands of natural and artificial parts of water or strongly changed parts of water and drainage ditches
	renovation of retention reservoirs

The purpose of Environmental Assessment and Management Framework is to identify full spectrum of measures that may be required at different stages of preparing the investments and their implementation, in order to reduce adverse impact on the environment. For that aim, given the nature and localization of the investments, analysis of possibility of occurrence of any adverse impact resulting from implementation and/or exploitation (functioning) of the investments was carried out. Information presented in this document should serve as guidelines for carrying out detailed environmental analyses at subsequent stages of preparation of implementation of the Project

Specifying the above mentioned categories of tasks served to identify all the types of potential adverse impact on the environment associate with stage of implementation and exploitation of the investment. The impacts were identified separately for each Component because of different natural specification, characteristics and material goods resources, landscape, etc. It was also verified if during the entire process of implementation and functioning of the investments adverse impacts on the following components of the environment may occur:

- Surface and ground waters,

- soils,
- noise,
- sanitary state of air,
- cultural landscape,
- monuments,
- protected areas (national parks, reserves, landscape parks, Natura 2000 sites).Within each areas of planned implementation of the Project areas of largest threat to human health and life and material foods were defined in the course of previous studio works and research and observation of flood occurrences. Adequately to the nature of given catchment within which improvements are required, different tasks were planned in relevant scope.

  Main chapters of EAMF include the following information:

- **INTRODUCTION TO BASIC INFORMATION ABOUT POLAND**

This chapter contains the most important information about the natural environment of Poland, presenting data on the geography, climatic conditions, natural resources, including basic data on demography and economy of Poland.

- **KEY ENVIRONMENTAL DATA**

This chapter presents important, from the point of view of the possible adverse impact of the investment measures, environmental information on Poland, including separate characteristics for separate Components of the project. Particular attention was paid to elements closely related to types of investment measures and their location, such as surface water, soil, protected species of plants and animals, and protected areas, including Natura 2000 sites.

- **LEGAL FRAMEWORK FOR FLOOD RISK MANAGEMENT**

The chapter presents the most important formal and legal conditions associated with measures dedicated to reducing flood risk. These conditions are discussed in the context of major European legal acts associated with water issues (i.e. the Water Framework Directive, Floods Directive) and their transposition into Polish law. It also identifies relations between the flood risk- related activities and other documents of a strategic nature at national level.

- **CHARACTERISTICS OF PROCEDURES OF THE ENVIRONMENTAL IMPACT ASSESSMENT**

The chapter contains characteristics of the formal and legal conditions for carrying out the process of environmental impact assessment in the context of the guidelines under the European and national law. The procedures for environmental impact assessment were characterized with respect to the generalized level of analysis - strategic evaluation, and at the level of individual projects that require more detailed level of studies in the field of environmental impacts.

- **PROJECT CHARACTERISTICS - DESIGN SOLUTIONS**

The chapter provides information about general and specific objectives of the Project, illustrating characteristics of various investment measures planned for implementation within the Project. Likewise, it presents the structure of the project, including its division into individual Components and tasks performed within each of them.

- **ENVIRONMENTAL IMPACTS**

The chapter describes manner of identification of potential adverse impacts generated by the various types of measures planned within the Project. It also presents a wide range of possible impacts in relation to biotic and abiotic components of the environment, as well as cultural values and material goods.

- **MINIMIZATION AND COMPENSATORY MEASURES ACTION PLAN**

Relevant measures to minimize and compensate for identified adverse impacts on the environment are proposed. These include various measures recommended for implementation at the stage of detailed design and / or execution of investment projects. In some cases, identification of mitigation measures will only be possible at the stage of the environmental assessment of individual projects.

- **MONITORING PLAN**

A general environmental monitoring system is proposed, aimed at monitoring both the scale and significance of the assumed adverse impacts and proposed minimisation activities, essential in order to properly oversee the correct implementation of minimisation measures and evaluate their effectiveness. The chapter presents environmental parameters subject to monitoring, the rationale for monitoring and parties responsible for its conducting at every stage of the Project.

- **ENCLOSURES**

Enclosures 1-3 contain analysis of mitigating measures and monitoring plan for each Component of the Project referrin to categories of activities undertaken within the investment. Enclosures 4-6 cotain maps presenting range of the investments against adminsitrative borders, surface water bodies and protected areas.

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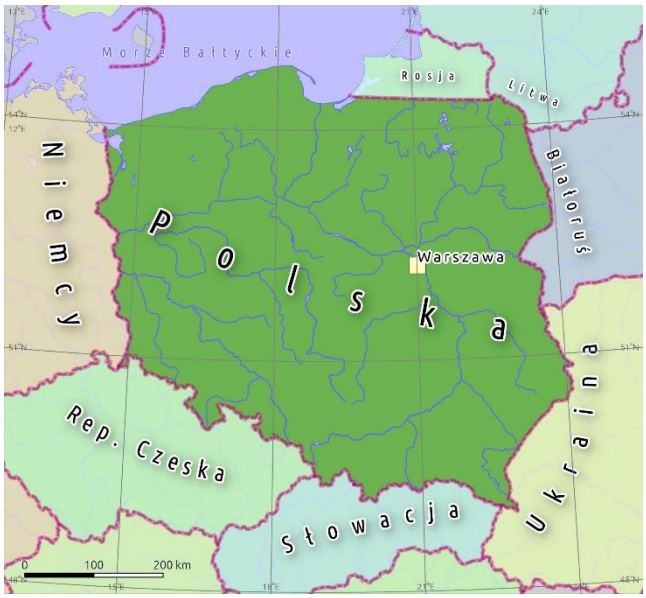
4 INTRODUCTION – BASIC INFORMATION ABOUT

POLAND



The Republic of Poland lies in the central part of European continent. It extends across from west to east between longitudes 14°07' and 24°09'E (689km) and from south to north between latitudes 49°00' and 54°50' N (649 km). Poland borders seven countries: Russia, Lithuania, Belarus, Ukraine and Slovakia, the Czech Republic and Germany. The length of the overall borderline is 3 511 km, out of which the longest border is shared with the Czech Republic (796 km). The sea border stretches over 440 km but the length of coastline is 770 km.

Poland's total surface area is 312 679 km^2 and comprises 311888 km^2 of land and 791 km^2 of sea inland water. The population of Poland has reached 38,5 mln whereas population density is measured at 123,11 of people per sq km.

Poland is divided into 16 voivodships/provinces, 66 cities/towns with city rights, 314 counties and 2479 communes. According to population and area, the Mazowieckie Voivodship stands out as the biggest one (5316,8 000 inhabitants, the area of 35558 km^2) whereas the Opolskie Voivodship belongs to the smallest one (1004,4 000 inhabitants, the area of 9412 km^2). Within Odra basin, the project will be implemented on the territory of regions of dolnośląskie, lubuskie and zachodniopomorskie.

Warsaw constitutes the capital of Poland and the city is located in the center of the country at the Vistula river in the Mazowieckie Voivodship. Warsaw has the biggest population of all Polish cities as there are 1 724 400 inhabitants. Other big cities of Poland are Gdańsk, Katowice, Kraków, Łódź, Poznań, Szczecin and Wrocław. The most important city centers, cultural landscape and most significant monuments in the regions where the project will be implemented were presented in chapters 4.2 and 4.3 of the

dokument. The largest cities directly covered by the Project are Kłodzko (28 356 citizens) and Słubice 16 902 citizens).

A public road density of hard surface in Poland oscillates around 89,8 km out of 100 km^2. The biggest public road density is present in the Śląskie and Małopolskie Voivodships (120-174 km/100 km^2) whereas the lowest density is observed in the Lubuskie, Zachodniopomorskie and Warmińsko-Mazurskie Voivodships (less than 60 km/100 km^2). The total length of public roads in Poland is 281 000 km including 1 492 km of highways. The entire Polish rail network in use is estimated to 19 328 km which gives the railway density of 6,2 km/100 km^2. The total sum of waterway and seaway is 3 655 km.

Since 1 May 2004, Poland has become the member of European Union. It also belongs to such international organizations as NATO, UN, OECD, EC and CD.

As far as area features are concerned, Poland differs considerably in geographical aspects such as geology, land morphology, climate, hydrological and hydrographic conditions as well as biodiversity.

The land morphology of Poland is distinguished by belt-shaped formation of area. We can observe strands of land structures running from south to north in the forms of mountainous ranges (the Karpaty and Sudety Mountains) , valleys, highlands, central lowlands, a lake-district belt and coastline. The highest peak Rysy (2 499 m above sea level) is located in the Tatra Mountains, the range of the Karpaty Mountains. Śnieżka (1 602 m above sea level) constitutes the highest point of Karkonosze range within the Sudety Mountains (within which part of the project is implemented - Kotlina Kłodzka in the upper region of Odra catchment). The lowest point in Poland – at 1,8 metres below sea level – is at Raczki Elbląskie, near Elbląg in the Vistula Delta.

Poland in majority belongs to the Baltic Sea Basin. The formation of the river valleys in Poland shows south-north tendency according to the inclination of the area and due to ice ages when ice-marginal valleys were created. The Vistula River is the longest river in Poland (1 022 km) with the river basin covering 193 960 km^2. The second longest river , The Odra River measures 840 km and covers 119 074 km^2. There exist right-bank tendencies of tributaries of the main rivers. High water levels of the rivers are observed in spring (lowland rivers) and in summer (mountainous rivers) as rivers are fed by rain waters or rain-snow precipitation. Low water levels are observed in autum and winter on mountainous rivers and in summer on lowland rivers. Ice cover is common on Polish rivers during winter. On Odra, ice cover appears regularly, because of meridional course of the river and distribution of average annual temperatures in the scale of the country. Temperatures in south-western Poland are higher than those in the northern part, in the area of estuary of the river to Dąbie lake, where particularly good conditions for creating ice cover occur (in static waters of the lake ice cover is created faster). In the upper part of Odra catchment (region of the so-called Kotlina Kłodzka) specific hydrological and topographic conditions occur, associated with creating and course of flood phenomena (Nysa Kłodzka on the section covered with the project drains waters from several right- and left-hand tributaries from mountain regions). Drops of catchments of particular tributaries are very large which causes fast flow of waters to the main watercourse in the region – Nysa Kłodzka and accumulation of flood wave. Characteristics of surface waters in the area of implementation of the Project is presented in chapter 4.1. The scope of works planned for implementation within the Project in the catchment of Odra and Wisła is presented in detail in chapter 8.

Within Odra basin the project will be implemented in the middle and lower course of the river and in the upper part of the basin, covering part of Nysa Kłodzka catchment.

In the area of lower and middle Odra, the main problem from the scope of flood protection is the phenomenon of creation of ice cover. It is regular, because of meridional course of the river and distribution of average annual temperatures in the scale of the country. Temperatures in south-western Poland are higher than those in the northern part, in the area of estuary of the river to Dąbie lake, where particularly good conditions for creating ice cover occur (in static waters of the lake ice cover is created faster). Ice-blockage generated floods area associated with creating of ice cover and its breakdown, which result in rising of rive waters and flooding of adjacent areas This phenomenon is very regular – I nthe past 27 years icing period on Odra did not shorten. The most efficient metho for reducing flood of this type is to keep the river clear and to make it possible for the ice floe from the middle course of the river all the way to the estuary in the Baltic Sea.

In the upper part of Odra catchment (region of the so-called Kotlina Kłodzka) specific hydrological and topographic conditions occur, associated with creating and course of flood phenomena (Nysa Kłodzka on the section covered with the project drains waters from several right- and left-hand tributaries from mountain regions). Drops of catchments of particular tributaries are very large which causes fast flow of waters to the main watercourse in the region – Nysa Kłodzka and accumulation of flood wave. The area of Nysa Kłodzka catchment is 1744.0 km^2. Within the catchment highest waters in the entire period of hydrological observations in the region was recorded in July 1997 (other catastrophic floods were recorded, among others, in 1883 and 1977). Floods in the catchment of Nysa Kodzka fo the most part occur in summer period as a result of torrential rainfall. To less extent they also occur during spring thaw period.

The project also includes Wisła catchment (catchment of Raba, San, Wisłoka and part of catchment of Wisła itself).

Raba catchment covers 1536.3 km².

Catastrophic risings on Raba usually occur between May and September, the largest most frequently in July (risings of 1903, 1934, 1960, 1970 and 1997). Frequent instances of catastrophic risings were also recorded in May (risings of 1940, 1951, 2010) and in August (risings of 1924, 1948, 1972).

Rising waves of Raba are characterized by uniquely fast rise and drop. Probable flow Q1% in the lower course of the river amounts to 1561m^3/s. Raba catchment has high variability of average rates of moving of culmination of flood waves.

Total area of San catchment is 16861.3 km². Hydrological regime of San is different than in remaining Carpathian tributaries of Wisła. It is the only right-hand tributary where spring thaw water risings are larger than summer risings. Summer risings on San very seldom have catastrophic effects.

Risings on San are characterized by lower concentration than risings on other Carpathian tributaries of upper Wisła. The wave is characterized by slow rise and slow drop. In case of the majority of risings, Wisłok does not flow during culmination of San. During spring risings on San, ice phenomena, mainly ice blockages, may have additional impact on wave transformation.

On the area of Wisła catchment, the main reason for floods are rainfall risings. Thaw risings also occur, as a result of sudden thawing of ice cover, which is often accelerated by rains. Territorial range of this type of risings is very large. It most often happens in March and April, but may also occur during entire winter, during mid-winter thaws. Ice-blockage generated floods are less frequent; these usually occur when the ice flows, as a result of ice floe accumulation.

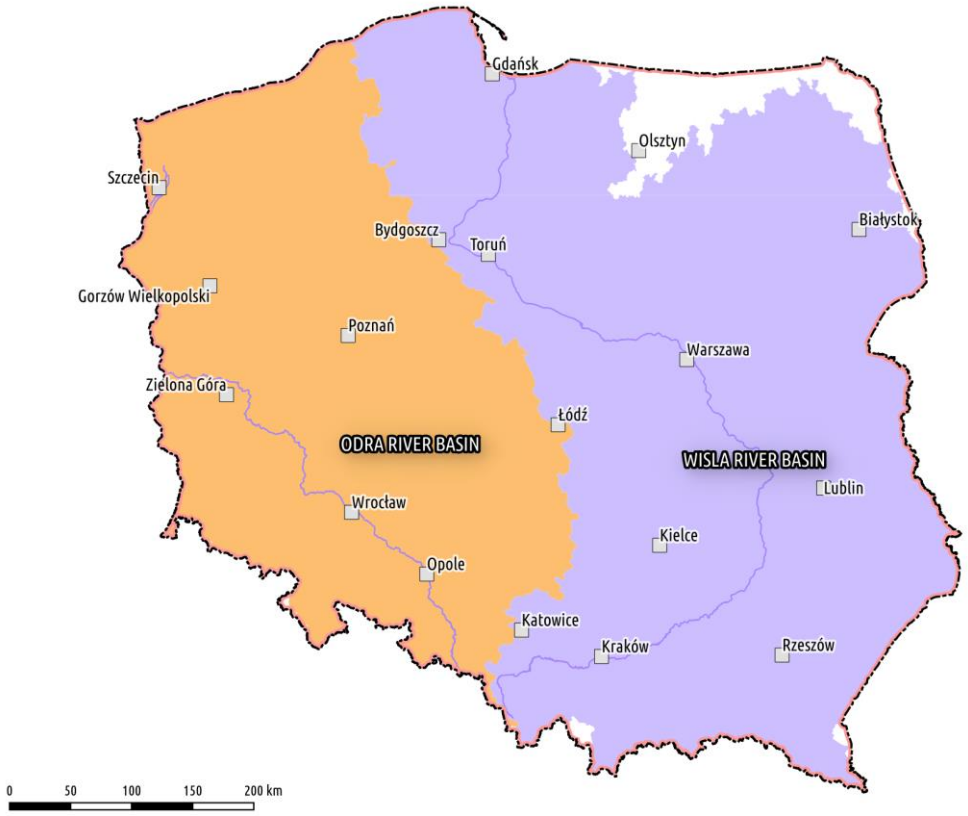


Fig.2 Odra and Vistula catchments within Poland

Vistula catchment within Cracow (capital of the region of małopolskie) covers 90.6 km^2, but within the city the river is fed by catchments of itr tributaries of total area 1200 km^2. Therefore, the city has not control over changes in the outflow from catchments feeding the river outside Cracow, and it becomes solely a passive receiver of increasing outflow in the process of development of urbanization in neighboring villages. This poses flood risk for the city, both now and in the future.Area of Sandomierz and Tarnobrzeg is a nod of several rivers, all direct tributaries of Wisła (left-hand: Koprzywianka and Opatówka right-hand San – the largest Carpathian tributary of Wisła, Łęg and Trześniówka). The rivers are embanked on both sides, however the embankments are of uneven heights. Flatness of the area causes rises on Wisła to have significant impacts on the tributaries. Range of backwaters from Wisła risings of Q1% culmination is between 7 and 11 km, which is very significant in the context of assessment and construction of a flood protection system incorporating flood embankments.

Flood problems in the area are very frequent, mostly generated by mountain right0hand tributaries of Wisła. Large risings in the nod remain in the inter-embankment for about 20 days, resulting in long-term burden to the embankments and making it impossible for the water to flow from the area by gravitation, since the embankment sluices are closed.

Characteristics of surface waters in area of implementation of the project is presented in chapter 4.1. Scope of works planned for implementation within Odra and Wisła catchments are discussed in detail in chapter 8.

Śniardwy lake, situated in the lake district belt of Mazury is the biggest Polish lake of 113,4 km^2. Hańcza lake reaches the lowest depths of 108,5 m.

Poland is dominated by the temperate climate with warm and intermediate elements. The average air temperature in 2013 ranged from 5°C to 9°C. The total precipitation in 2013 was 500 mm in the central country and 1400 mm in the mountains.

In 2013, 32,5% of the total area of Poland was covered by protected areas of great nature value. The most significant forms of nature protection include:

- 23 national parks of 314 500 ha with the biggest Biebrzański National Park (Podlaskie Voivodship) and the smallest Ojcowski National Park (2 150 ha);
- 1480 nature reserves (165 700 ha),
- 122 landscape parks (the biggest - Dolina Baryczy Landscape Park),
- 145 special protection areas (56 010 km2),

849 special areas of conservation (39 110 km2).

Presence of protected areas in the regions where the Project will be implemented are presented in chapter 4.4. of the dokument.

Among the most protected animals in Poland, we can enumerate bison, mountain goat, bear, beaver, lynx and wolf. Within Odra catchment, in regions where the project will be implemented, natural habitats and plant species are present typical for extensive valleys of large lowland rivers and sub-mountain regions in the upper part of the catchment. Flora and fauna in relevant regions are discussed inchapter 4.5.

5 BASIC ENVIRONMENTAL DATA

5.1 SURFACE WATER AND GROUNDWATER

5.1.1 POLAND

Water issues in Poland are regulated by the Water Framework Directive (WFD), which in legal terms will be presented in more details in Chapter 5. In accordance with the terminology adopted by the WFD Poland has been divided into 10 river basins - the main spatial units of water management. Areas of the Vistula and Odra drainage basins cover 97% of the area of the country. The other drainage basins are peripheral areas. Surface waters have been divided into Surface Water Bodies (SWBs) characterized by different abiotic and biotic conditions. SWBs include sections of rivers, canals, natural or artificial reservoirs, internal waters, transitional and coastal waters. They were also differentiated as natural water bodies, significantly modified water bodies (e.g. sections of rivers which were strongly anthropogenically transformed) and artificial water bodies (e.g. canals). In case of groundwater, it was also divided into Groundwater Bodies (GWBs) occurring in a particular aquifer. The main (environmental) objective of the WFD is not to cause deterioration of the quality of surface and groundwater, and also for the SWBs and GWBs to achieve in a timely manner so-called good condition of the aquatic ecosystem and water dependent ecosystems, measured by multiple parameters in the field of biotic and abiotic components of the environment. Good water condition includes, in the case of surface water: good ecological condition in terms of biological, hydro morphological and physicochemical quality elements, and good chemical condition. In the case of groundwater a good quantitative and good chemical conditions are considered. According to the WFD methodology the project impact assessment on the surface and groundwater must refer to the impact on individual SWB and GWB in the context of achieving the environmental objectives by these water bodies. WFD takes into account the possibility of deterioration of water (failure to achieve the environmental objective), provided that at the same time a number of conditions is met and so-called derogation is applied (Chapter 5).

Vistula is the largest river in Poland. Its length equals 1,047 km and is entirely located on the territory of Poland. The area of the Vistula drainage basin covers an area of 194,424 km² (including 25,725 km² outside the territory of Poland). The spring of the river is located in the Beskid Śląski, on the western slope of Barania Mountain, at a height of 1,106 m ASL. Vistula flows into the Baltic Sea in the area of Gulf of Gdańsk forming a delta called Żuławy (approx. 50 km from the estuary it separates into two streams (the other one is called Nogat). The largest left-bank tributaries of the Vistula are Nida, Kamienna, Pilica, Bzura and Brda. The largest right-bank tributaries are Raba, Dunajec, Wisłoka, San, Wieprz, Narew, Wkra and Drwęca.

Odra river is the longest inland waterway in Poland referred to as: the Odra Waterway (*Odrzańska Droga Wodna*). Its length is 854.3 km (742 km is located in Poland). The area of the Odra drainage basin covers an area of 118,861 km² (106,056 km² within the borders of Poland, which is 32.9% of the area of the country). The river begins in the Odrzańskie Mountains at a height of 634 m ASL. The average decrease equals 0.74 ‰. In the upper section it creates a natural border between Poland and the Czech Republic, and from the estuary of the Nysa Łużycka for approx. 161.7 km it marks the border between Poland and

Germany. Above Gryfino (704.1 km) it separates into two flows: the Eastern Odra and the Western Odra. In the vicinity of Szczecin the Odra flows already in several riverbeds. The biggest left-bank tributaries are: Opawa, Nysa Kłodzka, Bystrzyca, Kaczawa, Bóbr, Nysa Łużycka. The biggest right-bank tributaries are: Mała Panew, Barycz and Ina, and Warta.

5.1.2 COMPONENT 1: PROTECTION AGAINST FLOOD OF THE LOWER ODRA AND MIDDLE ODRA

The section of Odra River under investment plans, which include construction and reconstruction of embankments along with the renovation and expansion of regulatory constructions in the riverbed, is considered to be the abiotic type No. 21 - Great Lowland River. Free-flowing sections of rivers of this type are characterized by the presence of various forms of riverbed, in particular: deep tunnel valleys with a hard, sandy or gravelly bottom; sandy shoals and islands with varying degrees of stability and vegetation coverage; side arms and hollows behind the islands. Wide flood lowlands with numerous oxbow lakes with diverse degrees of connection to the river also occur. The aquatic vegetation of the oxbow lakes, hollows and side arms of the river indicate the high level of its ecological condition.

The discussed section of the Odra River is one of the fish lands of *Abramis brama*, which include middle and lower sections of major rivers with mostly sandy or muddy riverbeds, calmer currents and warm or moderately warm water. The dominant ichtyofauna species are: *Abramis brama, Abramis bjoerkna, Rutilus rutilus, Alburnus alburnus, Perca fluviatilis, Esox Lucius, Sander lucioperca.* The presence of reophile, lithophile and predatory species, as well as free migration of diadromous species indicate the high ecological condition of great lowland rivers in terms of ichtyofauna. Taking into account macro-invertebrates, the presence of organisms associated with the swift current and having higher requirement for oxygen, like larvae of *Trichoptera, Ephemeroptera,Odonata* indicate good ecological condition.

Planned investment covers two Surface Water Bodies (SWBs) of Odra situated between Wrocław and the estuary of the Nysa Łużycka:

1) PLRW6000211511 "Odra from Śląskie Embankments to Wschodni Canal", included in the Combined Water Bodies (CWBs) No. SO1108;
2) PLRW60002115379 "Odra from Wschodni Canal to Czarna Struga", included in the Combined Water Bodies (CWBs) No. SO1113.

Both water bodies were found to be significantly modified. These SWBs were considered at risk of failing to achieve environmental objectives, and for " Odra from Wschodni Canal to Czarna Struga" has been planned a derogation from the environmental objectives by 2015.

Moreover, the investment includes four SWBs of the Odra situated between the estuary of Nysa Łużycka and the estuary of the Odra and SWB of Lake Dąbie. The tasks planned within this section are construction and modernization of the flood embankments and the pumping stations, reconstruction of bridges and regulation of water in the Międzyodrze area - by unblocking and deepening the canals and reconstruction of the automatic gates, flood-gates and culverts. All mentioned SWBs were considered significantly modified and at the risk of failing to achieve the environmental objectives. Also, the derogation from the environmental

objectives by 2015 has been planned. This section, as same as previously presented section of the Middle Odra, is considered to be the abiotic type No. 21 - Great Lowland River.

The SWBs of the Middle Odra covered by the investment plans are significantly modified by man. Existing narrow embankment separates flood lowland and most of its oxbow lakes from the mainstream of the river. Most of the shoreline of the Odra in this section is regulated in the form of groynes that restrict the natural riverbed processes and prevent the formation of islands and sandbanks by focusing the current in the central part of the riverbed. For low and medium water levels they also hinder connectivity between the riverbed and oxbow lakes preserved within the inter-embankment zone. It should be noted that the patency of the Odra is maintained for the migration of diadromous fish in the section from the estuary to the Śląskie Embankments, that is the entire length of discussed SWB. However, the existing dam Śląskie Embankments containing the inefficient chamber fish ladder and damming of numerous tributaries of the Upper Odra significantly reduces further fish migration to the historical spawning areas located above mentioned SWB. The frontier section of the Odra is also significantly modified by man, in order to ensure the waterway function and flood protection. Particularly valuable habitats are preserved within the inter-embankment zone oxbow lakes, side arms of the river and the area of Międzyodrze. It should be noted that one of the objectives of the investment is to normalize water relations in the area and as a consequence to improve the state of valuable natural habitats, including oxbow lakes and natural eutrophic reservoirs (habitat No. 3150).

Table 2. SWB on which are implemented tasks under Component 1: Protection from the Lower Odra and the Middle Odra flooding

No.	SWB Code	Name	Abiotic type	Status	Condition
1	PLRW6000211511	Odra from Śląskie Embankments to Wschodni Canal	21	HMWB	bad (5)[2]
2	PLRW60002115379	Odra from Wschodni Canal to Czarna Struga	21	HMWB	bad (5)[3]
3	PLRW60002117999	Odra from Nysa Łużycka to Warta	21	HMWB	bad (5)
4	PLRW60002119199	Odra from Warta to Western Odra	21	HMWB	bad (5)
5	PLRW6000211971	Odra from Western Odra to Parnica	21	HMWB	bad (5)
6	PLRW6000211999	Odra from Parnica to the estuary	21	HMWB	bad (5)

[2] According to the VIEP monitoring data from the years 2010-2012; Moderate ecological potential - Class 3 (phytoplankton - Class 2, macrozoobenthos - Class 3, ichtyofauna - Class 3, physicochemical elements – Class 2)
[3] SWB not included in VIEP monitoring in years 2010-2012

No.	SWB Code	Name	Abiotic type	Status	Condition
7	PLLW90329	Dąbie Lake	Lake – type 3b - Lake with a high calcium content, with a large catchment outflow, not stratified	HMWB	bad (5)

According to the VIEP monitoring data from the years 2010-2012 the ecological potential of SWBs of the Odra from Śląskie Embankments to Wschodni Canal and from the Warta to the Western Odra were rated as Moderate - Class 3. The rest of the SWBs of the Odra were evaluated as Poor - Class 4, based on the assessment of the macro-invertebrates. For one SWB of the Odra there is lack of VIEP monitoring data. SWB of the Lake Dąbie got "below good potential" rating. Mentioned evaluations indicate moderate transformation of the ecosystem on the section of the river covered by the investment and lack of significant chemical pollutants (all rating of physicochemical elements in the Class 2). The results of the VIEP monitoring show higher ecological potential of discussed SWB than expected when they were differentiated. However, this potential still remains below good. According to the "Report on the condition of the environment in the Lower Silesia Voivodship in 2012." the region is dominated by water classified as Class 3 - moderate ecological condition/potential (48.8%). Good ecological condition/potential was found for 26.2% of monitored SWBs and very good condition - only for 2.5%. The poor condition/potential were determined for 15.6% of the SWBs. No SWBs were found to have bad condition/potential. In reference to these data, the results of the monitored SWB of Odra "From Śląskie Embankments to the Wschodni Canal" place it in the most strongly represented group of water bodies in the region. According to the report, "Condition of the environment in Lubuskie Voivodship in the years 2011-2012" a good ecological condition/potential was achieved by respectively 44% and 45% of investigated SWBs, Moderate by 26% and 37%, and Poor by 4 and 14%. On the other hand, according to the study "Report on the condition of the environment in Western Pomerania Voivodship in 2012" among 371 SWBs of rivers that were investigated in the years 2010-2012 the condition/ecological potential for up to 45% was defined as good or above good. While for 55% it was defined as less than good, including 26% of the SWBs found as poor condition.

Table 3. Assumptions made in determining the forecast of discussed SWBs potential (condition in Class 5 - bad) are too low, considering not finding the SWBs with determined bad condition or ecological potential in Lower Silesian and Lubuskie Voivodships. Only in the Western Pomerania Voivodship there were identified SWBs of rivers with determined bad condition/ecological potential. Results of the VIEP monitoring from the years 2010-2012 for SWBs on which are implemented tasks under Component 1: Protection from the Lower Odra and the Middle Odra flooding.

No.	SWB Code	Phyto-plankton	Macrophytes	Macro-invertebrates	Ichtyofauna	Physico-chemical elements
1	PLRW6000211511	2	l.d.	3	3	2
2	PLRW60002115379	l.d.	l.d.	l.d.	l.d.	l.d.
3	PLRW60002117999	3	2	4	l.d.	2
4	PLRW60002119199	2	1	3	l.d.	2
5	PLRW6000211971	2	3	4	l.d.	2
6	PLRW6000211999	2	l.d.	4	l.d.	2
7	PLLW90329	BPD				l.d.

Key:
l.d. – lack of data
BDC – below good condition
BDP – below good potential

5.1.3 COMPONENT 2: PROTECTION FROM FLOODING OF KOTLINA KŁODZKA

Planned tasks are located mostly within Kotlina Kłodzka Valley and include the drainage basin of the Nysa Kłodzka and its tributaries (to the Bardo Śląskie cross – this is so-called catchment of the upper flow of the Nysa Kłodzka). Mountains ranges surround Kotlina Kłodzka Valley from all sides. The western part of the Valley is created by the orlicko-bystrzycki metamorphic and the eastern by lądecko-śnieżnicki metamorphic. The Valley occupies a central part of the upper catchment of the Nysa Kłodzka and together with the Upper Nysa Trench it is the largest inter-mountain structural basin in the Sudety Mountains. Within this structural basin rivers formed vast valleys and gorges (Bardzki Gorge). The tributaries which inflow into the Nysa Kłodzka create a system of deeply cut in the surface river valleys of a typical mountainous nature. The spring of the Nysa Kłodzka is located in Śnieżnik Massif, on the slopes of Trójmorski Peak. In the upper course of the river it uses the natural tectonic depression – Upper Nysa Ditch. Then it flows through the Kotlina Kłodzka Valley and cuts Bardzkie Mountains, creating in the vicinity of Bard the antecedent gorge of Nysa Kłodzka. After leaving the Bardzkie Mountains it flows through the Sudeckie Foothills, and further through the Silesian Lowland. The Nysa Kłodzka has numerous tributaries. The left-bank tributaries include: Bystrzyca (64.2 km²), Łomnica (18.8 km²), Duna (34.7 km²),

Bystrzyca Dusznicka (200.9 km²) and Ścinawka (593.5 km²). The most important right-bank tributaries are: Goworówka (37.9 km²), Wilczka (47.0 km²), Pławna (32.3 km²), Biała Lądecka (314.6 km²) and Jaszkówka (52.9 km²). In the middle course (up to Biała Głuchołaska tributary) the Nysa Kłodzka is a lowland river. In this section the river is divided by four dams creating cascade reservoir system with max. damming of 10 m (Otmuchów Reservoir, Nyski Reservoir, Topola and Kozielno). Another reservoir will be built at an altitude of Kamieniec Ząbkowicki. The dam reservoirs disrupt the continuity of the river, changing its hydrological and ecological relationships. The area below the reservoirs is an upland catchment. The riverbed in a considerable distance is regulated and surrounded by embankments. In total there are 20 dams on the Nysa Kłodzka which constitute a barrier to fish migration and bed-load sediment flow. Within the Valley the river web creates a fan-shaped arrangement of rivers and streams. Their erosion valleys supply Nysa Kłodzka. Due to the geological structure of the ground and significant decrease of the terrain, the Nysa Kłodzka reacts very quickly to the outflow of water from mountain areas.

This section of the Nysa Kłodzka and its tributaries are located in Kotlina Kłodzka Valley surrounded by Sudety Mountains, in the Central Sudety macroregion. Geographical location determines the occurrence of abiotic types of rivers related to upland and mountainous areas. The area of the investment covers 23 SWBs representing the following abiotic types:

- Type No. 3 – Sudecki Stream (two SWB);
- Type No. 4 – Silicate upland stream with coarse substrate - West (14 SWB);
- Type No. 5 – Silicate upland stream with fine-grained substrate - West (1 SWB);
- Type No. 7 – Carbonate upland stream with coarse substrate (1 SWB);
- Type No. 8 – Small silicate upland river - West (4 SWB);
- Type No. 10 – Medium upland river - West (1 SWB).

Among 23 SWBs covered by the project, 13 belong to natural water bodies, and 10 are heavily modified water bodies.

Ecosystems of mountainous and upland streams and rivers are dominated by organisms adapted to swift current and low temperature of water, strong variations in flow rate, as well as demonstrating a high oxygen requirement. Flora and fauna of these environments is associated with rocky or gravel bed substrate, which provides a convenient feeding and breeding places for most taxa. In streams and smaller upland and mountainous rivers the dominant component of flora is phytobenthos and algae belonging to the periphyton growing on bedrock and stones. Macrophytes are quite rare, only in larger rivers, with a slightly calmer current. In water of this type macroinvertebrates are represented by *Plecoptera* and larvae of *Trichoptera, Ephemeroptera,Odonata*, which belong to the family of rheophile and cold-water, demonstrating a high oxygen requirement. Streams under abiotic types no. 3, 4 and 7 belong to the fish land of *Salmo trutta* m. *fario* – with the swift current, rocky or gravel substrate and cool water. Dominant species of the ichtyofauna are: *Salmo trutta* m. *fario, Cottus gobio, Cottus poecilopus, Thymallus thymallus.* Larger type no. 8 upland rivers belong to the fish land of *Thymallus thymallus* (in the upper courses) and *Barbus barbus* (in the lower courses) and type no. 10 rivers are the fish land of *Barbus barbus*. Rivers of the fish land of *Thymallus thymallus*, with pebbly-gravel beds, slow current and moderately cool or cool water are mostly inhabited by the dominant species: *Salmo trutta* m. *fario, Cottus gobio, Cottus poecilopus, Barbus barbus, Chondrostoma nasus.* Rivers of the fish land of *Barbus*

barbus, with gravel and sandy beds, quite swift current and moderately cool water are inhabited by the dominant species: *Barbus barbus, Chondrostoma nasus, Vimba vimba, Leuciscus cephalus, Leuciscus leuciscus, Gobio gobio.* Rivers and streams of mentioned types are also a place of spawning for diadromous species, as long as there is morphological permeability to the sea. The high rates of the ecological condition and/or ecological potential in terms of ichtyofauna in the streams and rivers of these types affects from significant occurrence of rheophile, lithophile species sensitive to oxygen deficiency and transformation of habitat. Important issue is also the ecological permeability of the water courses. Among the macroinvertebrates, presence of organisms associated with the swift current and having higher oxygen requirement: larvae of: *Plecoptera, Trichoptera, Ephemeroptera,Odonata* indicate good ecological condition.

The SWBs covered by the investment are significantly modified by man - almost half of them were classified as heavily modified water bodies. 21 of the 23 SWBs were found at the risks of not achieving the environmental objectives. The reasons for the defining of the bodies as significantly modified is presence of weirs, numerous thresholds corrections and constructions elevated to reduce the risk of flooding. For all the SWBs threatened by failure in achieving the environmental objectives derogations from the environmental objectives by 2015 has been planned. That indicates a recognition of the key role of ensuring flood safety in relation to environmental objectives for this area.

Table 4. SWB on which are implemented tasks under Component 2: Protection from flooding of Kotlina Kłodzka.

No.	SWB Code	Name	Abiotic type	Status	Condition
1	PLRW60003121613	Biała Lądecka from the spring to the Kobyla	3	NAT	2 (good)
2	PLRW600031216269	Morawka	3	NAT	2 (good)
3	PLRW6000412269	Dzik	4	NAT	2 (good)
4	PLRW6000412289	Czerwionka	4	NAT	2 (good)
5	PLRW6000412369	Kamienica	4	NAT	5 (bad)
6	PLRW60004121169	Nysa Kłodzka from the spring to the Różanka	4	HMWB	5 (bad)
7	PLRW60004121189	Domaszkowski Potok	4	NAT	2 (good)
8	PLRW60004121299	Wilczka	4	HMWB	2 (good)
9	PLRW60004121499	Bystrzyca	4	HMWB	2 (good)
10	PLRW60004121529	Pławna	4	HMWB	2 (good)
11	PLRW60004121569	Łomnica	4	HMWB	2 (good)
12	PLRW60004121589	Upper Duna including Lower Duna	4	HMWB	2 (good)
13	PLRW60004121629	Biała Lądecka from the Kobyla to Morawka, including Morawka from Kleśnica	4	NAT	2 (good)
14	PLRW60004121649	Orliczka	4	NAT	2 (good)

No.	SWB Code	Name	Abiotic type	Status	Condition
15	PLRW60004121929	Jaszkówka	4	NAT	2 (good)
16	PLRW60004122569	Posna	4	HMWB	2 (good)
17	PLRW6000512188	Bystrzyca Dusznicka from Kamienny Potok to Wielisławka	5	HMWB	5 (bad)
18	PLRW60007121839	Bystrzyca Dusznicka from the spring to Kamienny Potok	7	HMWB	5 (bad)
19	PLRW6000812159	Nysa Kłodzka from Różanka to Biała Lądecka	8	NAT	2 (good)
20	PLRW6000812199	Nysa Kłodzka from Biała Lądecka to Ścinawka	8	NAT	2 (good)
21	PLRW6000812299	Ścinawka from Bożanowski Potok to Nysa Kłodzka	8	NAT	2 (good)
22	PLRW60008121699	Biała Lądecka from Morawka to Nysa Kłodzka	8	HMWB	2 (good)
23	PLRW60001012333	Nysa Kłodzka from Ścinawka to separation of the Młynówka Pomianowska	10	NAT	5 (bad)

Table 5. Results of the VIEP monitoring in the years of 2010-2012 for SWBs on which are implemented tasks under Component 2: Protection from flooding of Kotlina Kłodzka.

No.	SWB Code	Phyto-plankton	Macrophytes	Macro-invertebrates	Ichtyofauna	Physico-chemical elements
1	PLRW60003121613	l.d.	l.d.	l.d.	2	l.d.
2	PLRW600031216269	1	l.d.	l.d.	2	1
3	PLRW6000412269	l.d.	l.d.	l.d.	l.d.	l.d.
4	PLRW6000412289	l.d.	l.d.	l.d.	l.d.	l.d.
5	PLRW6000412369	3	2	3	l.d.	2
6	PLRW60004121169	2	l.d.	l.d.	l.d.	1
7	PLRW60004121189	l.d.	l.d.	l.d.	l.d.	l.d.
8	PLRW60004121299	l.d.	l.d.	l.d.	l.d.	l.d.
9	PLRW60004121499	l.d.	l.d.	l.d.	l.d.	l.d.
10	PLRW60004121529	l.d.	l.d.	l.d.	l.d.	l.d.
11	PLRW60004121569	l.d.	l.d.	l.d.	l.d.	l.d.
12	PLRW60004121589	l.d.	l.d.	l.d.	l.d.	l.d.
13	PLRW60004121629	2	l.d.	l.d.	l.d.	1
14	PLRW60004121649	b.d.	l.d.	l.d.	l.d.	l.d.

No.	SWB Code	Phyto-plankton	Macrophytes	Macro-invertebrates	Ichtyofauna	Physico-chemical elements
15	PLRW60004121929	4	l.d.	l.d.	l.d.	2
16	PLRW60004122569	3	l.d.	l.d.	l.d.	2
17	PLRW6000512188	4	2	l.d.	l.d.	2
18	PLRW60007121839	1	l.d.	l.d.	l.d.	1
19	PLRW6000812159	3	l.d.	l.d.	l.d.	1
20	PLRW6000812199	3	l.d.	l.d.	2	BDC
21	PLRW6000812299	4	l.d.	l.d.	1	BDP
22	PLRW60008121699	4	l.d.	l.d.	l.d.	BDC
23	PLRW60001012333	2	3	l.d.	3	2

Key:
l.d. – lack of data
BDC – below good condition
BDP – below good potential

Assumption made in the forecast of ecological condition/potential of the discussed SWBs determine the condition/potential as good (Class 2) in the case of 18 SWBs, and as bad (Class 5) for 5 SWBs. According to the "Report on the condition of the environment in the Lower Silesia Voivodship in 2012." the region is dominated by water included in Class 3 - moderate ecological condition/potential (48.8%), good condition/potential was found for 26.2% of the monitored SWBs and very good conditions were found for only 2.5% of them. The poor condition/potential were determined for 15.6% of SWB. No SWBs were determined as representing bad ecological condition/potential. In the years 2010-2012 VIEP assessed 14 out of 23 discussed SWBs. For 5 out of these 14 the condition/ecological potential were determined as good and very good, for next 5 as moderate (the Class was determined mostly in terms of biological elements), and for 4 it was found poor. The results of the monitoring indicate achieving lower ranges than the ones predicted while determining the SWBs. Nevertheless, some of the rivers and streams in the region have been classified as Class 1 or Class 2 of ecological condition/potential. Such conclusion finds confirmation in the "Report on the condition of the environment in the Lower Silesia Voivodship", which indicates that the streams and smaller river courses in Sudety region represent good ecological condition/potential.

5.1.4 COMPONENT 3: UPPER VISTULA RIVER

In terms of hydrography this component includes:

- Vistula above Cracow - from the estuary of the Skawa to the estuary of the Rudna;
- Vistula and Serafa Stream within Cracow area;
- Vistula in the vicinity of Tarnobrzeg and Sandomierz including the estuary section of the San and other selected rivers in the area, mostly tributaries of the Vistula;
- Raba and its tributaries,
- San and its tributaries.

Tasks within the Component 3 are located in the drainage basin of the Vistula River in the water region of the Upper Vistula. SWBs where the individual tasks within the Component 3 are performed are presented in the tables below.

Table 6. SWB on which projects will be implemented within the Component 3.1: Protection of the towns and cities located in the area of drainage basin of the Upper Vistula and the protection of Cracow

No.	SWB Code	Name	Abiotic type	Status	Condition
1	PLRW20001921339	Vistula from Przemsza (excluding Przemsza) to Skawa	19	HMWB	bad[4]
2	PLRW20006213389	Płazanka	6	NAT	bad[5]
3	PLRW200016213512	Zmornica including the oxbow lakes of Vistula	16	NAT	bad[4]
4	PLRW200026213514	Tributary from Grodzisk	26	NAT	bad[4]
5	PLRW200026213518	Bachówka (Spytkowicki Potok)	26	NAT	bad[3]
6	PLRW200019213559	Vistula from Skawa to Skawinka	19	HMWB	bad[3]
7	PLRW20007213549	Rudno	7	HMWB	bad[3]
8	PLRW200019213775	Vistula from Skawinka to Podłężanka	19	HMWB	bad[3]
9	PLRW20009213769	Dłubnia from Minóżka (excluding Minóżka) to the estuary	9	HMWB	bad[3]
10	PLRW200026213774	Serafa	26	HMWB	bad[3]

Table 7. SWB on which projects will be implemented within the Component 3.2: Protection of Tarnobrzeg and Sandomierz

No.	SWB Code	Name	Abiotic type	Status	Condition
1	PLRW20002121999	Vistula from Wisłoka to San	21	HMWB	bad[6]

[4] Data based on monitoring of VIEP in the years 2010-2012
[5] Data based on the Water management plan for the area of Vistula River drainage basin

2	PLRW2000212319	Vistula from San to Sanna	21	HMWB	bad[5]
3	PLRW20002122999	San from Rudnia to the estuary	21	HMWB	bad[5]
4	PLRW200019219899	Łęg from Murynia to the estuary	19	HMWB	bad[5]
5	PLRW200019219699	Trześniówka from Karolówka to the estuary	17	HMWB	bad[5]
6	PLRW20002621952	Tributary from near the Sielec	26	NAT	bad[7]
7	PLRW200019219499	Koprzywianka from Modlibórka to the estuary	19	HMWB	bad[5]
8	PLRW200026219494	Gorzyczanka II	26	HMWB	bad[6]

Table 8. SWB on which projects will be implemented within the Component 3.3: Passive and active protection of the area within the catchment of Raba

No.	SWB Code	Name	Abiotic type	Status	Condition
1	PLRW200012213813	Raba from the spring to Skomielnianka	12	NAT	good[8]
2	PLRW200014213839	Raba from Skomielnianka to Dobczyce Reservoir	14	HMWB	good[7]
3	PLRW200002138599	Dobczyce Reservoir	L	HMWB	good[7]
4	PLRW200019213899	Raba from Dobczyce Reservoir to the estuary	20	HMWB	bad[7]
5	PLRW200026213899	Młynówka	6	NAT	good[7]
6	PLRW200016213896	Tusznica	16	NAT	bad[9]
7	PLRW200062138929	Królewski Potok	6	HMWB	bad[7]
8	PLRW200014213889	Stradomka from Tarnawka to the estuary	14	HMWB	bad[7]
9	PLRW200012213883	Stradomka from the spring to Tarnawka (excluding Tarnawka)	12	HMWB	bad[8]
10	PLRW200012213886	Trzciański Potok	12	HMWB	bad[7]
11	PLRW200012213874	Krzyworzeka	12	HMWB	good[7]
12	PLRW200012213829	Mszanka	12	HMWB	good[7]
13	PLRW200012213812	Poniczanka	12	HMWB	good[7]
14	PLRW200012213836	Krzczonówka	12	HMWB	good[7]
15	PLRW200012213839	Bysinka	12	HMWB	bad[8]

[6] Data based on monitoring of VIEP in the years 2010-2012
[7] Data based on the Water management plan for the area of Vistula River drainage basin
[8] Data based on monitoring of VIEP in the years 2010-2012
[9] Data based on the Water management plan for the area of Vistula River drainage basin

The main river of the area - Vistula flows through the podkarpackie lowering – Kotlina Oświęcimska, Cracow Gate (*Brama Krakowska*) and Kotlina Sandomierska dewatering the areas of Krakowsko-Częstochowska Upland and the Lesser Poland Upland (*Wyżyna Małopolska*) on the north side (left-bank tributaries) and the Foothills and the Carpathian Mountains (*Karpaty*) on the southern side (right-hand tributaries, including the Raba). Given the abiotic type, Vistula in the vicinity of Cracow is sandy-loamy lowland river. In the vicinity of Tarnobrzeg and Sandomierz, Vistula changes its nature into a great lowland river flowing widely, mainly in flat and sandy valley.

Among the mountain tributaries of the Vistula and the Raba the dominant, in terms of the abiotic type, are streams and small flysch rivers, mostly flowing in the slightly sinuous V-shaped valleys. Direct tributaries of the Vistula, flowing in its valley are mostly sandy or gravelly lowland streams.

San is the largest Carpathian tributary of Wisła. In abiotic terms, in its upper course it is a flysch stream, then it changes into a small flysch river, middle highland river, sand-and-clay lowland river, and in its lower course it is a large lowland river. The valley of the river and the riverbed are therefore abundant in morphological forms reflecting varied abiotic types. The lar gest tributary of San is Wisłok. In terms of abiotic types, it shows similar variability to that of San, although in its lower course it is a sand-and-clay lowland river. Characteristic of San's upper part of catchment are large water reservoirs: Solina reservoir, created as a result of constructing a dam on San on km 325+400 and Myczkowce reservoir created as a result of constructing a ground dam on San in Myczkowce on km 319+000.

The quality of water in this region is influenced mainly by water consumption, introduction of municipal and industrial wastewater and zonal pollution. On the condition of water and ecosystems dependent on them, affects not only the chemical pollution but also the hydropower constructions in riverbeds and river valleys.

The vast majority of SWBs under Component 3 were designated as significantly modified water bodies, which means that most of the anthropogenic transformation of rivers are very large. Vistula was considered significantly modified over the entire length of the studied area mainly due to the presence of dams and damming creations preventing fish migration, changes in the SNQ related to hydroelectricity and the presence of embankments restricting natural lagoons and isolating the oxbow lakes.

Also in the catchment of the Raba, most of SWBs under Component 3 are strongly modified, mainly due to the presence of barriers for fish migration in the form of numerous barrages, threshold corrections, anti-bed-load sediment dams and water reservoirs. Due to these reasons, the condition of a large part of the SWBs has been identified as bad.

The main utility level of groundwater in discussed area is related to the quaternary formations in the valley of the Vistula. The thickness of the sandy-gravel deposits ranges from 20 to 30 m. The Major Groundwater Reservoirs (MGR) present in the valley of the Vistula and the major tributaries are mainly of a porous type. Tasks implemented under Component 3 are located within 11 GWBs (PLGW2200151, PLGW2200150, PLGW2200139, PLGW2200138, PLGW2200126, PLGW22 00125, PLGW2200127, PLGW2200157, PLGW2200158, PLGW9000159, PLGW2200160). Groundwater here are characterized by good chemical condition and in vast majority by good quantity.

5.2 LANDSCAPE SIGHTS AND CULTURE AND MONUMENTS

5.2.1 POLAND

Polish territory of the present day was over the centuries a place where different cultures, religions and nationalities were blending. Despite numerous wars and the country's location in the arena of military operations, in many places historic buildings, urban systems, man-made garden and park landscapes and unique art objects were preserved. The basic act regulating the care of cultural and historical heritage is the Act of 23 July 2003 on the conservation and care of monuments (ie. Dz. U. of 2014., Pos. 1446, as amended). The law in this respect distinguishes between three main groups (types) of monuments:

1) Immovable heritage objects, eg. the cultural landscape, urban systems, works of architecture and construction, parks, cemeteries

2) Movable heritage objects, eg. works of fine arts, crafts and applied arts, numismatics, industrial products

3) Archaeological heritage objects eg. burial mounds (kurgans), places of historical settlements, burial grounds.

At the same time aforementioned act determines the types of monument protection as follows:

1) Registration

2) Recognition of a historical monument,

3) Creating a cultural park

4) Establishing protection in local land development plan or an administrative decision obtained in the investment cycle, eg. in the decision on land development.

An additional form, similar to the heritage register, is the municipal heritage register led by the voyt, the mayor or the president.

The structure of the conservation service department is part of government administration, in which the following bodies are distinguished:

a. national level: Chief Art Conservator, empowered by the Minister of Culture and National Heritage in this respect;

b. regional level: Provincial Art Conservator acting on behalf of the Governor.

The notion of cultural landscape in the Polish law is formulated only in the Act of 23 July 2003 on the protection and conservation of monuments (ie. Dz. U. of 2014., Pos. 1446, as amended). The legal definition in Art. 3 paragraph 14) of aforementioned legal act defines cultural landscape as a space historically shaped by human activities, including products of civilization and the natural components. Past experience has shown that the current regulations in this area are insufficient as is exemplified by the legislative work carried out by the Office of the President of the Republic of Poland. It seems that the notion of cultural landscape should have a broader meaning under the umbrella of spatial order notion.

Because of the many changes in the law, the protection of the spatial and cultural landscape, which should be done at the level of local development plans is currently very weak.

Planning procedures that due to the large number of frequently conflicting interests related to finance, public investment and restrictions on the right of ownership, often do not cease for as long as several years, and in the case of urban areas, even a decade. The lack of proper planning to ensure the processes results in uncontrolled development, urban sprawl, the investment implementation without proper technical and social infrastructure.

A municipal government plays a fundamental role in ensuring spatial order, securing cultural landscape in Poland.

5.2.2 COMPONENT 1 FLOOD PROTECTION OF THE LOWER AND MIDDLE ODER

Areas adjacent to the Oder valley in the middle and lower sections have diverse preserved monuments and artifacts of natural heritage. Due to its location, i.e. several centuries within the German sphere of influence, the largest group of buildings under protection are those dating back to the 18th and 19th centuries with the development of agriculture along the river banks. A particular increase in interest in the area occurred in the second half of the 19th century when two- stage hydrotechnical works on the regulation of the Oder were done. In the first half of the 20th century the hydraulic structures associated with irrigation and generating electricity were completed on the river. The Oder was for centuries an important trade route, especially for Central European countries without access to the sea. Throughout history many cities were founded on the river banks, serving as commercial or military ports: Głogów, Bytom Odrzański, Nowa Sól, Sulechów, Krosno Odrzańskie, Słubice, Górzyca, Kostrzyń (on the Oder) on the Polish side, and Eisenhüttenstadt, and Frankfurt (on the Oder) in Germany. The most important and the largest city in the project is Szczecin, which is currently performing the functions of the regional economic and administrative center. The above-mentioned cities in many cases suffered heavy losses as a result of World War II activities and then due to political decisions during the communist era. For example, the destruction of the Old Town in Kostrzyn, Głogów or Szczecin should be pointed out. Only now, nearly 70 years after the end of the war, land development projects related to the pre-war urban grid (Głogów, Szczecin) are introduced. Apart from the indicated cities, one can also point to the centers that have retained nearly all of its historic fabric, eg. Słubice or Nowa Sól.

As mentioned above, the process of regulating the Oder took place in the second half of the 19th century and continued till the first half of the 20th century. That period coincided with rapid development of means of transport, including railways. Currently, the Oder is intersected by several bridges which have unique technical features, eg. the drawbridge on the railway No 273 in Szczecin Podjuchy district or unused for more than 70 years old railway bridge in the region of Siekierki, which is also the longest bridge crossing the Oder.

Areas adjacent to the Oder in the lower and middle course are areas developed in a manner indicative of German culture planning. Settlements (towns and villages) are closed (buildings centered) and are surrounded by arable land. Part of the land used for agricultural production systems has drainage system connected with the Oder through the system of canals. Areas away from towns and villages are often large forest complexes, eg. the stretch of forest running along the river between Cedynia and Kostrzyn on the Oder. The Oder corridor itself and its valley, despite it being shaped by a man to a large extent as a result of hydraulic engineering, forms a coherent whole in the landscape of the area. A characteristic feature of

the cities along the Oder is the proximity of buildings to the river banks - as it results from a close link between the development of the centers and the Oder. The Oder valley in the lower and middle section as a result of territorial changes after World War II became a bordering river. As a result of these transformations some urban centers were divided into two separate towns in spite of the strong bond between them. Derelict bridges, closed down railway lines, and roads cut short by the river banks are all symbols of the broken bonds. The new borders of the country as well as closed communist political system have also led to changes in the urban centers of gravity along the Oder in eastern direction - to the capitals of regions on the Polish side. The limitations associated with the operation of the border area and its strategic importance for the defense of the country also significantly hampered the development of investments in the immediate vicinity of the Oder. What remained in areas of liquidated Polish border crossings after entering the Schengen zone was partly developed infrastructure in the form of fences, buildings of the Border Guards, and parking spaces, which has not been utilized. Border bazaars, markets and shopping places, however, still function as attractive retail outlets for German citizens due to price differences.

To sum up, a large transformation of the landscape and spatial development take place in the area currently functioning as urban centers where the environment has been transformed over the centuries. The very area of the Lower Oder and the adjacent territory, despite the transformations associated with flood protection and regulation of the river, retains many natural characteristics and human impact on the environment is limited only to human settlements (villages).

5.2.3 COMPONENT 2: FLOOD PROTECTION OF THE KŁODZKO VALLEY

Kłodzko Valley area, where the projects under Component 2 will be implemented, is a part of Kłodzko Land - corresponding to the historical area of the former Kłodzkie County. The area largely coincides with the territorial division of supra-local level – Kłodzkie county. The grounds of Kłodzko have high cultural wealth, which is inherently linked with the history of the area. Over the centuries, the current Kłodzko district was successively ruled by the Polish Kingdom until the twelfth century.Then it came under Czech and the House of Habsburg rule respectively. As a result of the three Silesian wars, the area was ultimately passed under the German (Prussian) rule in the 18th century. It was only as a result of territorial changes after World War II (1945) that the area was included in the boundaries of the so-called Polish Western Lands. Rich history, multi-cultural influences resulting from prolonged periods of belonging to a different state and administrative structures, and various religious influences led to a very varied tissue of historic buildings in Kłodzko Valley. Also, due to the fact that during World War II the area of Kłodzko was not affected by war activities, a large number of objects with unique cultural and historical features have been preserved. The sites under different forms of conservation protection are primarily concentrated around the existing urban centers, which is characteristic for areas under German control and influence, ie. the development of buildings within the towns and villages and the lack of so-called sprawl development. This means that the remaining areas, except compact development within the village mainly for agricultural purposes, do not have the sites and assets requiring protection. There are former German residential and utility buildings under conservation protection on farmlands in rural housing plots.

Among places of special cultural and historical significance, health resorts, towns with preserved urban layout, and historic bridges should be distinguished in the area of Kłodzko. The main centers of the year-round tourist traffic in Kłodzko Valley are spas that already started their operation in the 18th century and were fully developed in the 19th and 20th centuries. The most popular example is Kłodzko Spa Complex consisting of Kudowa Zdrój, Duszniki Zdrój and Polanica Zdrój. Lądek Zdrój and Długopole Zdrój are also important health resorts. As it has been mentioned, these centers developed in the 19th century in particular and the valuable monuments connected with spa functions date back to that period.

After a period of Silesian wars in the 18th century the area of Kłodzko was not affected by any war activities. Therefore, towns like Bystrzyca Kłodzka, Bardo, and particularly Kłodzko preserved the historic urban layout derived from the Middle Ages with the objects, i.e. market, church, and town hall characteristically centrally situated in towns founded under German law. Moreover, there is a fortified complex of Kłodzko Fortress, where sites from the 17th, 18th and 19th centuries are preserved.

Unique objects in the scale of Poland are also bridges: in Bardo (on the river Nysa), Kłodzko (in Młynówka) and Lądek Zdrój (St. John Bridge on the river Biała Lądecka), dating back from the 15th century and 16th centuries. These objects are also of interest due to the fact that they are in constant use, and the change in architectural styles can be observed thanks to their reconstructions over the centuries.

Kłodzko Valley landscape and its land development is largely conditioned by the mountain terrain. Both towns and villages are located in the valleys of the river Nysa Kłodzka and its tributaries. The development-restricting terrain (located in the valleys) also contributed to the development of the villages along the roads and other transport routes, resulting in a landscape dominated by the so-called „ulicówki“ (linear settlement). Urban centers are relatively small, the population does not exceed the number of 30,000 residents, but their characteristic feature is the compact urban development, often of high historical value in central parts. By contrast, health resorts which began to flourish in the late 19th and early 20th century are characterized by the city-like density, with the dominating houses such as manor houses and small villas. The central part of a health resort is not a market but usually some green area (eg. The Spa Park in Polanica Zdrój).

Apart from a few examples of buildings, there are no concentrated industries and large manufacturing plants in Kłodzko Valley. The valley floor is dominated by arable land, meadows and pastures, and the hills surrounding it are covered with forests.

Natural landscape of Kłodzko Valley has not significantly changed throughout history, making it an attractive area for tourists for its natural beauty and spas.

5.2.4 COMPONENT 3: THE UPPER VISTULA

Component 3.1: Protecting towns in the basin of the Upper Vistula and Cracow shall be implemented in areas of specific cultural values. Cracow and its historical heritage has a significant place in the civilization and culture of Central Europe in terms of European history of urban planning and architecture. These features are characterized by a high historical, artistic, and symbolic value and the authenticity of the substance and its chronological continuity that is unique in the scale of Poland. Cracow, the former capital of the Polish state

(until the 17th century.) has also a special place in the minds of Poles. There are unique historical buildings and architectural complexes in the city. Wieliczka, which houses one of the oldest mines in Europe, the Wieliczka Salt Mine, presents equally high cultural value. Cracow and Wieliczka are the first Polish sites included in the UNESCO World Heritage Site.

Component 3.2: Protection of Sandomierz and Tarnobrzeg shall be implemented in a culturally heterogeneous area. Since the early Middle Ages these areas have developed along the river and have a great heritage and a large number of historic buildings. There are two major urban centers, Sandomierz and Tarnobrzeg, in the area of the component implementation. Sandomierz is distinguished by unique historical and cultural values, and is considered to be the most valuable historical urban-landscape unit in Poland. At the same time the city became the capital of the Central Industrial District, which was under construction in the 30s of the 20th century and ceased to be built aftter World War II. The nature of Tarnobrzeg, in turn, was shaped by the discovery of deposits of sulfur in the 50s of the 20th century. The small, peripheral town of Tarnobrzeg quickly expanded to its present size.

Component 3.3: Passive and active protection in the basin of the Raba will in turn be implemented in the area, which cultural landscape is shaped by non-compact development (except for the centers of villages), sometimes spontaneously scattered to the hill tops. Mostly religious buildings (churches) dominate. Landscape and mountain location results in the tourist development of this area (including winter tourism). The most important monuments include the traditional architectural objects - wooden houses and farm buildings in the characteristic style, manor-grange settlements, churches and religious monuments of landscape architecture.

Component 3.4 Passive and active protection in the basin of San will be implemented in large part on an area where development is not varied, localized in the valley of San and its tributaries. The area's history reaches celtic culture, but them ost characteristic monuments are associated with medieval ethinc groups named Łemkowie and Bojkowie. One of the most significant values of cultural landscape of the region is composition of antique rural buildings in the surrounding nature. Particulat attention suld be paid to monuments of wooden sacral architecture – Greek-catholic churches. On the steep slopes of San valley castles were located, such as Sobień, Leski castle, also belonging to valuable monuments of the region.

5.3 TANGIBLE PROPERTY

5.3.1 POLAND

The concept of tangible property has a very broad definition, the meaning of which can be very different depending on the subject of analysis - from the strictly civil point of view tangible properties can encompass both movable and immovable items. Due to the subject of this report and the Consultant's tasks, ie. the environmental impact assessment of projects

in the field of flood protection, for the purposes of the works the term “tangible property“ will include immovable objects and their parts (as defined in civil law), in particular:

- Residential buildings;
- Communication objects: roads, railways, airports;
- Industrial sites;
- Storage and logistic facilities
- Food processing facilities;
- Technical and transmission infrastructure;
- Public buildings;
- Farms with arable land, meadows and pastures;
- Other properties.

Higher density of tangible properties as defined here is present in urban areas, particularly in cities, where the mixing of the different manufacturing, service, and social functions takes place.

The following cities forming centres of agglomeration in areas where Project will be carried out:

- Kraków
- Sandomierz
- Tarnobrzeg
- Kłodzko
- Szczecin
- Zielona Góra

High density of capital and population is observed within those urban centers and adjecent areas (mainly around Kraków and Zielna Góra). At the level of development plans of provinces (region) there are also sub-regional centers acting as centers of services and jobs of local importance, often going beyond the scope of a single district (ie. land district).

5.3.2 COMPONENT 1: FLOOD PROTECTION OF THE LOWER AND MIDDLE ODER

In the Oder Valley section encompassed by Component 1, the following urban centers: Szczecin, Gryfino, Świnoujście, Kostrzyń, Słubice, Nowa Sól and Krosno can be indicated as places of the highest concentration of capital, services and material goods. Szczecin, the agglomeration formed around a strong industrial, commercial, administrative, and scientific center, plays the most important economic role among the above-mentioned cities. Other indicated cities, after the changes of state borders in 1945, began to gravitate towards the main centers in the provinces (capitals and the headquarters of the provincial assemblies). Their economic development is not as tightly connected with the use of the Oder as it is in Szczecin. Due to its location and a wide range of available services and opportunities for development, the city attracts new residents, which is related to the phenomenon of urban

development, including satellite municipalities. The existing rural communities and small towns will be transformed in the sense of resignation from agricultural production for housing development.

Other indicated cities act as sub regional and regional centers. Some of them take advantage of their position near the border with Germany as well as lower salary in Poland (in euro), and are focused on acquiring investments in the form of modern industrial plants to areas of special economic zones or prepared (armed) real estate for investment. Improving quality of communication network, in particular road infrastructure, also affects the availability of these cities. Nevertheless, along with the economic changes gradual depletion of the population in the border areas takes place. It results from a change in the structure of the national economy and the division of The Oder Valley between Poland and Germany, whereby towns situated on the river lost their role as the leading centers for both banks. Despite the Polish accession to Schengen Area, the process of "re-bonding" will last several decades. The settlement structure, inherited after a long period of German rule in the area, plays an important role in the functioning of these centers. Villages and smaller towns are concentrated at the sub-regional and regional centers, which limits the processes of urban sprawl.

5.3.3 COMPONENT 2: FLOOD PROTECTION OF THE KŁODZKO VALLEY

Spatial structure of the area of Kłodzko and and the location of relevant material goods is tightly connected with the terrain. The building development is spread along thoroughfares mainly in river valleys, running parallel to these watercourses. The dominant function of land use in the area of analysis is agricultural production. Basic services are carried out on the premises of the municipalities, wherea the city of Kłodzko is the regional center. The city, with the county office, has administrative and service function, and is a place of concentration of capital within a special economical zone. Other municipalities within the Kłodzkie county have practically no industrial sites, apart from those associated with the mining sector (mineral aggregates). Tangible properties of a very high value to the area of Kłodzko are clustered together complexes of spa resorts, which are often the basis for the local economy development. Local climate, access to sources of healing waters, developed tourism, a wide range of activities and typically spa-like cultural landscape make this area very attractive.

Agriculture has an important role in the economy of the region because of the fertile soil, i.e. brown earth. Over 65% of the acreage of agricultural land is used for arable purposes. There are also muds along the river, which, due to their fertility make it an attractive place for farming.

5.3.4 COMPONENT 3: THE UPPER VISTULA

Component 3.1: Protecting towns in the basin of the Upper Vistula and the protection of Cracow.

The project will be implemented in the area of Greater Cracow, which determines the character of tangible properties located in the area of impact. In the area of Cracow,

Wieliczka municipality has a total 812 726 inhabitants. Therefore, there is a large number of educational institutions (48 nurseries, 380 kindergartens, 490 schools, 84 secondary schools and 13 universities), and health care facilities (587) and hospitals.

Cracow and Wieliczka are the cities of Cracow Industrial District. Of the 131 068 registered businesses 10 165 of enterpreneurs declare industrial activity. The dominant industries are steel, electrical machinery and chemical (including pharmaceuticals and sodium) industries. Agricultural activity is of lesser importance. The structure of firms by employment size class shows the dominance of micro-enterprises, ie. the smallest firms employing not more than 9 people.

There are also 14 wastewater treatment plants and a municipal waste incinerator is currently being built on the subject area.

A well-developed network of roads and technical infrastructure (high-voltage networks, water and sewage networks, pipelines, and heat pipelines) operates in this area. Drinking water and water for industrial needs is drawn from surface water (the Rivers: Sanka and Rudawa) and the groundwater reservoirs.

Component 3.2: Protection of Sandomierz and Tarnobrzeg

The area covered by the project is diversified in terms of urbanization and tangible properties. Two cities stand out here: Sandomierz and Tarnobrzeg, which are the home to a total of 73 289 people. The cities have a fairly well-developed network of kindergartens and schools, health care facilities and hospitals. They have a good road and technical infrastructure. There are approximately 8.5 thousand entrepreneurs. Highly developed chemical industry (Tarnobrzeg), sulfur mining (Tarnobrzeg), glassworks (Sandomierz) are among the main industries. The remainder of the area, inhabited by a total of approx. 75 000 people, is purely agricultural in nature. Agricultural production focuses on horticulture (mainly apples and cherries) and gardening. Social and technical infrastructure is less developed, with the exception of the road infrastructure. The main industries in the region are industrial processing of fruit and vegetables.

Water for industrial purposes is mainly drawn from surface waters. In other cases groundwaters dominate.

Component 3.3: Passive and active protection of the Raba basin

The municipalities where the Subcomponent will be implemented is constituted by the population of 89 353 inhabitants. Myślenice is a well-developed electrical and clothing industry center as the city is included in the Cracow Industrial District. The analysed area has a large number of educational institutions: 1 nursery, 58 kindergartens and 69 schools. It also has a well-developed medical infrastructure, including 56 clinics.

There are 16 072 enterprises, including 1007 industrial and 208 agricultural businesses, operating in the municipalities where the project will be implemented. The structure of firms by employment size class shows the dominance of micro-enterprises, ie. the smallest firms employing not more than 9 people.

The road network in the are is well developed; there are three national roads (transit), where the road No. 7 is part of the E77 international road. The remaining technical infrastructure is

at a low level. Approximately 60% of the population uses water from waterworks. Water is drawn from seepage spring areas (less frequently surface water) and the groundwater reservoirs, mostly illegally. The drainage system is best developed in Myślenice (approx. 50% of the population).The level of sewer systems in the remaining areas ranges from 20 to 3%. Similarly, gas-heating infrastructure is at a low level. Electrotechnical intrastructure is relatively well developed.

Component 3.4 Passive and active protection of the basin of the San

Area of implementation of this Component is differentiated. Undeveloped sections of the valley of San interweave with bigger or smaller villages and large cities such as Przemyśl, Saok, Lesko, Jarosław, while due to specificity of mountain regions the area of catchment of San is in the first place covered with forests and farmlands, and housing estates (including those within large cities) take 2.49% of the area. Communication takes 0.56% , industrial areas 0.3% and farmlands almost 50% of San's catchment area. The program will cover selected areas within San catchment exposed to the threat of flooding. On threatened areas 7431 housing buildings were identified, 9362 outbuildings, 961 public buildings and 178 industrial facilties. Flood risk area covers 516.473 km^2 of urbanized land (housing, industrial buildings and communication) and 1.965 km^2 of rural areas.

5.4 PROTECTED AREAS

5.4.1 POLAND

As a result of the high diversity of landscapes and ecosystems in Poland there is a wide network of protected areas, which consists of eight national forms of protection and one Europe-wide form (Natura 2000 sites). In the past it often impeded the transformation of nature by man. The highest form of protection are national parks, then there are nature reserves and Natura 2000 sites. In the first two cases, human activity within the areas is strictly subordinated to the protection of natural values. In case of Natura 2000 such activity is possible under existing rules, provided that it is not possible to execute projects which might have negative impact on the objects of conservation in the area, which are particular species and natural habitats.

5.4.2 COMPONENT 1: PROTECTION FROM THE LOWER ODRA AND THE MIDDLE ODRA FLOODING

Individual tasks included in the component will be implemented within or in the areas immediately adjacent the Odra riverbed. In the middle and lower courses, although some regulation processes were made in the past, the valley of the river retains a very high level of natural value what is reflected in a variety of protected areas established in the valley of the river. Protected areas established in the valley of the Odra are part of both the national protection system (landscape parks, nature reserves, national parks) and the European system of protected areas (Special Protection Areas - SPA, Special Areas of Conservation -

SAC). The valley also plays a very important role as an ecological corridor of European importance.

Table 9. Protected areas within the borders of project site, the surroundings and vicinity of the tasks implemented under Component 1

Task	Name of the area	Spatial relation (coincides with, in the vicinity < 500 m, in the surroundngs < 5 km)
1A.1 - Chlewice-Porzecze. Backwater embankment of Odra River at Myśli River	Lower Odra PLH320037	Area spatially coincides with the area of the investment.
	Valley of the Lower Odra PLB320003	Area spatially coincides with the area of the investment.
	Estuary of the Warta Landscape Park	Area spatially coincides with the area of the investment.
	Estuary of the Warta PLC080001 (SPA, SAC)	Area located in the surrounding of the investment within approx. 5 km distance.
	Estuary of the Warta National Park	Area located in the surrounding of the investment within approx. 5 km distance.
1A.2 - Flood protection of Ognica village on Odra River	Lower Odra PLH320037	Area located in the surrounding of the investment within approx. 5 km distance.
	Valley of the Lower Odra PLB320003	Area located in the surrounding of the investment within approx. 5 km distance.
1A.3 - Osinów-Łubnica. Modernization of inter-embankment	Lower Odra PLH320037	Area spatially coincides with the area of the investment.
	Valley of the Lower Odra PLB320003	Area spatially coincides with the area of the investment.
1A.4 - Flood protection of Radziszewo and Daleszewo villages on Odra River at 726+400-727+960 km	Lower Odra PLH320037	Area spatially coincides with the area of the investment.
	Valley of the Lower Odra PLB320003	Area spatially coincides with the area of the investment.
	Bukowe Hills PLH320020	Area located in the surrounding of the investment within approx. 2 km distance.
	Wełtyńskie Lake PLB320018	Area located in the surrounding of the investment within approx. 4.5 km distance.
	Wełtyńska Refuge PLH320069	Area located in the surrounding of the investment within approx. 1.7 km distance.
	Bukowe Hills PLH320020	Area located in the surrounding of the investment within approx. 1.8 km distance.

Task	Name of the area	Spatial relation (coincides with, in the vicinity < 500 m, in the surroundngs < 5 km)
	Valley of the Tywa PLH320050	The area is located in the vicinity of the investment within approx. 2.2 km distance.
1A.5 - Modernization of Marwicki polder	Lower Odra PLH320037	Area spatially coincides with the area of the investment.
	Valley of the Lower Odra PLB320003	Area spatially coincides with the area of the investment.
	Bukowe Hills PLH320020	Area located in the surrounding of the investment within approx. 2 km distance.
	Wełtyńskie Lake PLB320018	Area located in the surrounding of the investment within approx. 4.5 km distance.
	Wełtyńska Refuge PLH320069	Area located in the surrounding of the investment within approx. 1.7 km distance.
	Bukowe Hills PLH320020	Area located in the vicinity of the investment within approx. 1.8 km distance.
	Valley of the Tywa PLH320050	Area located in the surrounding of the investment within approx. 2.2 km distance.
1A.6 - Restoring natural values of Lower Odra Valley by improving retention and flood protection capacities of Międzyodrze	Lower Odra PLH320037	Area spatially coincides with the area of the investment.
	Valley of the Lower Odra PLB320003	Area spatially coincides with the area of the investment.
	Bukowe Hills PLH320020	Area located in the surrounding of the investment within approx. 2 km distance.
	Wełtyńskie Lake PLB320018	Area located in the surrounding of the investment within approx. 4.5 km distance.
	Wełtyńska Refuge PLH320069	Area located in the surrounding of the investment within approx. 1.7 km distance.
	Bukowe Hills PLH320020	Area located in the surrounding of the investment within approx. 1.8 km distance.
	Valley of the Tywa PLH320050	Area located in the surrounding of the investment within approx. 2.2 km distance.
1B.1 - Reconstruction of river control infrastructure on Odra River. Adaptation to the conditions of Class III roadway. Stage II	Kargowskie Bends of the Odra PLH080012	Area spatially coincides with the area of the investment.
	Middle Odra Valley PLB080004	Area spatially coincides with the area of the investment.

Task	Name of the area	Spatial relation (coincides with, in the vicinity < 500 m, in the surroundngs < 5 km)
	Gryżyny Tunnel Valley PLH080067	Area located in the surrounding of the investment within approx. 2.6 km distance.
	Gryżyński Lnadscape Park	Area located in the surrounding of the investment within approx. 2.6 km distance.
1B.2 - Modernization works on boundary sections of Odra River	Middle Odra Valley PLB080004	Area spatially coincides with the area of the investment.
	Krzesiński Landscape Park	Area spatially coincides with the area of the investment.
	Pliszki Valley PLH080011	Area spatially coincides with the area of the investment.
	Estuary of the Ilanka PLH080015	Area spatially coincides with the area of the investment.
	Lower Odra PLH320037	Area spatially coincides with the area of the investment.
	Lower Odra Valley PLB320003	Area spatially coincides with the area of the investment.
	Estuary of the Warta Landscape Park	Area spatially coincides with the area of the investment.
	Estuary of the Warta PLC080001 (SPA, SAC)	Area spatially coincides with the area of the investment.
	Estuary of the Warta National Park	Area spatially coincides with the area of the investment.
	Krzymowskie Hills PLH320054	Area located in the surrounding of the investment within approx. 3 km distance.
1B.3 – Construction of docking-mooring infrastructure	as above	as above
1B.4 - Improvement of flood water-flow from Dąbie Lake in winter	Lower Odra PLH320037	Area spatially coincides with the area of the investment.
	Estuary of the Odra and Szczeciński Lagoon PLH320018	Area spatially coincides with the area of the investment.
	Wilderness in Stępnickie Forest PLH330032	Area located in the vicinity of the investment within approx. 2 km distance.
1B.5 - Dreding of Klucz-Ustowo ditch	Lower Odra PLH320037	Area spatially coincides with the area of the investment.

Task	Name of the area	Spatial relation (coincides with, in the vicinity < 500 m, in the surroundngs < 5 km)
	Bukowe Hills PLH320020	Area located in the surrounding of the investment within approx. 3 km distance.
1B.6 - Reconstruction of bridges to ensure a minimum clearance	Chrobotkowe Conifer Forests near Brzózka PLH080031	Area located in the vicinity of the investment within approx. 4 km distance.
	Estuary of the Warta PLC080001 (SPA, SAC)	Area spatially coincides with the area of the investment.
	Estuary of the Warta National Park	Area spatially coincides with the area of the investment.
	Lower Odra PLH320037	Area spatially coincides with the area of the investment. However some elements of the project are also located in the surrounding of the protected area within approx. 4 km distance from its borders.
1C.1 - Extension and construction of flood embankments (protection of Słubice)	Słubickie Riparian Forests PLH080013	Area spatially coincides with the area of the investment.
1C.2 – Reconstruction of Czarny Kanał and Racza Struga	Słubickie Riparian Forests PLH080013	Area located in the vicinity of the investment within approx. 3.4 km distance.

In reference to 10 protected areas possibility of occurrence of adverse impacts associated with implementation of particular investment was confirmed. They will in the first place result from planned flood protection investments such as: construction and modernization of flood embankments, regulatory and maintenance works within riverbeds and inter-embankment embankment areas, recreation of structures associated with sailing routes (groins). Impacts that may occur were analyzed in detail in chapter 10 of the present document. For the majoriy of areas predicted adverse impacts will be of little range and intensity. During further works associated with implementation of particular attention should be paid to Natura 2000 sites: Dolina Dolnej Odry PLB320003, Dolina Środkowej Odry PLB080004, Dolna Odra PLH320037 covering large areas of valuable natural habitats an habitat sof species associated with the Valley of Odra.

5.4.3 COMPONENT 2: PROTECTION FROM FLOODING OF KOTLINA KŁODZKA

Activities in the field of active and passive flood protection implemented under Component 2 will be performed in the upland and mountainous part of the catchment which is characterized by high natural values. The central part of the region of planned work is crossed by the valley of Kotlina Kłodzka, on the east surrounded by an upland and mountainous areas from which flow down the tributaries supplying the Nysa Kłodzka.

The upper part of the Nysa Kłodzka catchment is highly covered with a network of protected areas which include both, areas designated at the national level (national parks, nature reserves, landscape parks) and areas which are part of protected areas at the European level - Special Protection Areas (SPAs) , Special Areas of Conservation (SACs). Protected areas in this region are clustered on the mountain areas (Stołowe Mountains Bystrzyckie Mountains, Śnieżnik Massif) due to the highest natural values preserved in these areas (mainly as a result of low anthropic pressure and relatively low degree of transformation of the environment).

Within the area covered directly by the investments under Component 2, potentially significant conflict occurs with the Biała Lądecka Natura 2000 site (PLH020035) which includes a significant section of the Biała Lądecka riverbed.

Table 10. Protected areas within the project site, the surroundings and vicinity of the tasks implemented under Component 2

Task	Name of the area	Spatial relation (coincides with, in the vicinity < 500 m, in the surroundings < 5 km)
2A.1 - Construction of "Boboszów" - a dry flood control reservoir on Nysa Kłodzka River	Bialskie Mountains and Śnieżnik Massif PLH020016	Area located in the vicinity of the investment, the nearest place, approx. 2 km from the border of the site.
	Śnieżnicki Landscape Park	Area located in the vicinity of the investment, the nearest place, approx. 2 km from the border of the site.
2A.2 - Construction of "Roztoki Bystrzyckie" - a dry flood control reservoir on Goworówka stream	Bialskie Mountains and Śnieżnik Massif PLH020016	Area located in the vicinity of the investment, the nearest place, approx. 2.6 km from the border of the site.
	Śnieżnicki Landscape Park	Area located in the vicinity of the investment, the nearest place, approx. 2.6 km from the border of the site.
2A.3 - Construction of "Szalejów Górny" - a dry flood control reservoir on Bystrzyca Dusznicka River	Piekielna Valley near Polanica PLH020010	Area located in the vicinity of the investment, the nearest place, approx. 3 km from the border of the site.
	Stołowe Mountains PLB020006	Area located in the vicinity of the investment, the nearest place, approx. 2.2 km from the border of the site.
	Stołowe Mountains PLH020004	Area located in the vicinity of the investment, the nearest place, approx. 2.2 km from the border of the site.
2A.4 - Construction of "Krosnowice" - a dry flood control reservoir on Duna stream	Krowiarki Mountain Range PLH020019	Area located in the vicinity of the investment, the nearest place, approx. 1.4 km from the border of the site.
2B.1 - Flood protection of Nysa Kłodzka River Valley	Krowiarki Mountain Range PLH020019	Area located in the vicinity of the investment, the nearest place, approx. 40 m from the border of the site.
	Valley of the Bystrzyca Łomnicka PLH020083	Area located in the surrounding of the investment, the nearest place, approx. 4 km from the border of the site.

Task	Name of the area	Spatial relation (coincides with, in the vicinity < 500 m, in the surroundings < 5 km)
2B.2 - Flood protection of Ścinawka River Valley	Gorge of Nysa Kłodzka near Morzyszowo PLH020043	The area is located in the vicinity of the investment, the nearest place, approx. 4 km from the border of the site.
	Stołowe Mountains PLB020006	Area located in the surrounding of the investment, the nearest place, approx. 2.7 km from the border of the site.
2B.3 - Flood protection of Biała Lądecka River valley and Morawka River	Biała Lądecka PLH020035	Area spatially coincides with the area of the investment.
	Bialskie Mountains and Śnieżnik Massif PLH020016	Area spatially coincides with the area of the investment.
	Złote Mountains PLH020096	Area located in the vicinity of the investment, the nearest place, approx. 50 m from the border of the site.
	Śnieżnicki Landscape Park	Area spatially coincides with the area of the investment (section under work km 34+500 to 35+012 is located within the area, also the Morawa river is located within the area).
2B.4 - Flood protection of Bystrzyca Dusznicka River Valley and Kamienny Potok River	Stołowe Mountains PLB020006	Area spatially coincides with the area of the investment.
	Stołowe Mountains PLH020004	Area located in the surrounding of the investment, the nearest place, approx. 2.7 km from the border of the site.
	Piekielna Valley near Polanica PLH020010	Area spatially coincides with the area of the investment.

As regards 5 protected areas, possibility of occurrence of adverse impacts associated with implementation of particular investment was confirmed. They will in the first place result from planned flood protection investments such as: construction and modernization of flood embankments, regulatory and maintenance works within riverbeds and inter-embankment embankment areas, construction of dry reservoirs. Impacts tha may occur on protected areas were analyzed in detail in chapte 10 of the present document. For the majority of areas predicted adverse impacts will be of little range and intensity. articualr attention should be paid to Natura 2000 site Biała Lądecka PLH020035, where the object of protection are valuable natural habitats and animal species directly associated with the riverbed.

5.4.4 COMPONENT 3: UPPER VISTULA RIVER

Upper Vistula water region is an area of extraordinary natural values, which is confirmed by a significant number of forms of nature protection. Due to the specific nature of the project special attention should be paid to those which are spatially or functionally related to river valleys. The largest protected valley area is represented by those important to the

Community – e.g Tarnobrzeska Vistula Valley PLH180049, Valley of the Lower San PLH180020, the Raba with the Mszanka PLH120093, the Tarnawka PLH120089, the Wiśliska PLH120084 - established for the protection of habitats that are characteristic for the valleys: riparian communities (forests and scrubland), meadows, oxbow lakes, herb fringe, pioneer, as well as xerothermic vegetation or compilation of both. These precious pieces of watercourse beds - sometimes unregulated or poorly transformed - are also a place of rare species of plants and animals occurrence, including representatives of the avifauna, herpetofauna, ichtyofauna and lepidopterofauna and serve as ecological corridors. Important role in the protection of populations of rare species of birds play Special Protection Areas (SPA), including Lower Skawa Valley which is located at the estuary of the Skawa into the Vistula PLB120005. This area serves as a rest place during the spring and autumn migration of birds. Protection of valuable habitats - though generally on a smaller area - is also fulfilled through setting of the nature reserves. One of them is "Vistula near Zawichost" established for the preservation of the breeding refuges, feeding and resting places during migration of rare and typical for the valley of the Vistula birds, especially *Charadriiformes*. A different role in the protection of ecosystems of the river valleys is assigned to landscape parks (e.g. Bielańsko-Tyniecki Landscape Park), which generally protect not only natural but also landscape, historical and cultural values of the area. Particular protection is applied to the valley of San – the majoriy of its length is included in Natura 2000 sites. Apart from the Lower San Valley PLH180020 natural habitats and species associated with the river – in particular valuable fish species – are protected by San Rive PLH180007 and Upper San Basin PLH180021, and above Solińskie Lake by Bieszczady PLC180001. The list of sites designated for the protection of natural or slightly modified sections of San is supplemented by among others, natural reserves,: Krywe, Przełom Sanu pod Grodziskiem or a Natura 2000 site Sanisko in Bykowce PLH180045.

Table 11. Protected areas within the project site, the surroundings and vicinity of the tasks implemented under Component 3

Task	Name of the area	Spatial relation (coincides with, in the vicinity < 500 m, in the surroundngs < 5 km)
Expansion of the Vistula river flood embankments in Cracow	Nowohuckie Meadows PLH120069	in the surroundings, at a distance of approx. 1 km
	Bonarka nature reserve	in the surroundings, at a distance of approx. 3.3 km
	Bielańsko-Tyniecki Landscape Park	in the surroundings, at a distance of approx. 4.5 km
Construction of the controlled dry polder system above Cracow, located on the section between the estuary of the Skawa river and Cracow	Rudniański Landscape Park	coincides with the investment
	Bielańsko-Tyniecki Landscape Park	in the surroundings, at a distance of approx. 1.3 km
	Tenczyński Landscape Park	in the surroundings, at a distance of approx. 2.3 km
	Przeciszów nature reserve	in the surroundings, at a distance of approx. 600 m
	Żaki nature reserve	in the surroundings, at a distance of approx. 1.6 km
	Kajasówka nature reserve	in the surroundings, at a distance of approx. 2.7 km

Task	Name of the area	Spatial relation (coincides with, in the vicinity < 500 m, in the surroundngs < 5 km)
	Bukowica nature reserve	in the surroundings, at a distance of approx. 3.1 km
	Lipowiec nature reserve	in the surroundings, at a distance of approx. 3.4 km
	Wiśliska PLH120084	coincides with the investment
	Rudniańskie Modraszki – Kajasówka PLH120077	in the surroundings, at a distance of approx. 850 m
	Rudno PLH120058	in the surroundings, at a distance of approx. 3.2 km
	Valley of the Lower Skawa river PLB120005	coincides with the investment
Improving flood safety in the valley of the Serafa river in urban areas of Cracow and Wieliczka	Groty Kryształowe nature reserve	in the surroundings, at a distance of approx. 2.9 km
	Bonarka nature reserve	in the surroundings, at a distance of approx. 4.2 km
Flood protection in the estuary section of the Atramentówka river including construction of a Koćmierzów pumping station with accompanying infrastructure	Tarnobrzeska Vistula Valley PLH180049	coincides with the investment
	Pieprzowe Mountains PLH260022	in the surroundings, at a distance of approx. 3.7 km
	Pieprzowe Mountains nature reserve	in the surroundings, at a distance of approx. 4 km
Flood protection in the area of Struga A watercourse along with the reconstruction and upgrading of Nadbrzezie pumping station	Tarnobrzeska Vistula Valley PLH180049	in the vicinity, at a distance of approx. 350 m
	Pieprzowe Mountains PLH260022	in the surroundings, at a distance of approx. 1.4 km
	Pieprzowe Mountains nature reserve	in the surroundings, at a distance of approx. 1.4 km
	Valley of the Lower San river PLH180020	in the surroundings, at a distance of approx. 3 km
Upgrading of the band-type embankment which protects Pilkinkton Glassworks and residential area in Sandomierz from flooding	Tarnobrzeska Vistula Valley PLH180049	coincides with/in the vicinity, to approx. 50 m
	Pieprzowe Mountains PLH260022	in the surroundings, at a distance of approx. 2.2 km
	Pieprzowe Mountains nature reserve	in the surroundings, at a distance of approx. 2.6 km
Securing of Koprzywianka embankments: left embankment on km 0+00-12+900, right embankment on km 0+00-14+400	Tarnobrzeska Vistula Valley PLH180049	coincides with/in the vicinity, to approx. 50 m
	Pieprzowe Mountains PLH260022	in the surroundings, at a distance of approx. 2.8 km
	Pieprzowe Mountains nature reserve	in the surroundings, at a distance of approx. 4 km
Construction of the pumping station in Szewce village	Tarnobrzeska Vistula Valley PLH180049	in the surroundings, at a distance of approx. 3.3 km
Upgrading of the pumping station in Zajeziorze village	Tarnobrzeska Vistula Valley PLH180049	in the surroundings, at a distance of approx. 3.3 km
Upgrading of the right embankmnet of the Vistula river on the distance of 13.959 km, the right embankmnet of	Vistula near Zawichost nature reserve	coincides with/in the vicinity, to approx. 50 m
	Pniów nature reserve	in the surroundings, at a distance of approx. 1.1 km

Task	Name of the area	Spatial relation (coincides with, in the vicinity < 500 m, in the surroundngs < 5 km)
the San river on the distance of 2.193 km and left embankment of the Łęg river on the distance of 0.112 km in the Gorzyce and Radomyśl municipalities	Pieprzowe Mountains nature reserve	in the surroundings, at a distance of approx. 600 m
	Tarnobrzeska Vistula Valley PLH180049	coincides with/in the vicinity, to approx. 50 m
	Pieprzowe Mountains PLH260022	in the vicinity, at a distance of approx. 450 m
	Valley of the Lower San river PLH180020	coincides with/in the vicinity, to approx. 50 m
	Wilderness of the Janowskie Forests PLH060031	in the surroundings, at a distance of approx. 1.8 km
	Gorge of the Vistula in Małopolska region PLH060045	in the surroundings, at a distance of approx. 1.3 km
	Janowskie Forests PLB060005	in the surroundings, at a distance of approx. 1.4 km
Dobczyce reservoir flood reserve enlargement from 33.8 mln m^3 to 43 - 54.5 mln m^3	Zamczysko na Rabą nature reserve	in the surroundings, at a distance of approx. 4.7 km
Polder Mikluszowice near Raba river construction	Valley of the Gróbka river PLH120067	in the surroundings, at a distance of approx. 2.8 km
	Niepołomicka Primeval Forest PLB120002	in the surroundings, at a distance of approx. 750 m
Krzyworzeka reservoir modernization	Refuge of bats of Island Beskid PLH120052	in the surroundings, at a distance of approx. 750 m
Tusznica dry polder construction	Wielkie Błoto Peatland PLH120080	in the surroundings, at a distance of approx. 1.9 km
	Niepołomicka Primeval Forest PLB120002	in the surroundings, at a distance of approx. 1.2 km
Potok Królewiecki 2 dry polders construction	N/A	N/A
Dopływ z Łężkowic dry polder construction	Wielkie Błoto Peatland PLH120080	in the surroundings, at a distance of approx. 4.4 km
	Niepołomicka Primeval Forest PLB120002	in the surroundings, at a distance of approx. 3.5 km
Porębianka dry polder construction	Raba along with Mszanka PLH120093	in the surroundings, at a distance of approx. 3.7 km
	Gorczański National Park	in the surroundings, at a distance of approx. 3 km
Krzczonówka dry polder construction	Raba along with Mszanka PLH120093	in the surroundings, at a distance of approx. 700 m
Krzyworzeka dry polder construction	N/A	N/A
Stradomka 3 dry polders construction	Refuge of bats of Island Beskid PLH120052	coincides with the investment
	Tarnawka PLH120089	in the surroundings, at a distance of approx. 3.2 km
	Wiśnicko-Lipnicki Landscape Park	in the surroundings, at a distance of approx. 3.6 km

Task	Name of the area	Spatial relation (coincides with, in the vicinity < 500 m, in the surroundngs < 5 km)
Raba embankments/ boulevards construction and modernization	Valley of the Gróbka river PLH120067	in the surroundings, at a distance of approx. 2.8 km
	Niepołomicka Primeval Forest PLB120002	in the vicinity, at a distance of approx. 300 m
	Dębina nature reserve	in the surroundings, at a distance of approx. 950 m
	Długosz Królewski nature reserve	in the surroundings, at a distance of approx. 2.5 km
	Zamczysko nad Rabą nature reserve	in the surroundings, at a distance of approx. 750 m
	Raba along with Mszanka PLH120093	coincides with the investment
	Lubogoszcz PLH120081	in the surroundings, at a distance of approx. 4.5 km
	Luboń Wielki nature reserve	in the surroundings, at a distance of approx. 4.9 km
	Luboń Wielki PLH120043	in the surroundings, at a distance of approx. 4.9 km
Poniczanka embankments/ boulevards construction	Gorczańska Refuge PLH120018	in the surroundings, at a distance of approx. 3.9 km
	Gorczański National Park	in the surroundings, at a distance of approx. 4.6 km
Słonka boulevards construction	Gorczańska Refuge PLH120018	in the surroundings, at a distance of approx. 2.3 km
	Gorczański National Park	in the surroundings, at a distance of approx. 2.6 km
	Luboń Wielki nature reserve	in the surroundings, at a distance of approx. 4.6 km
	Luboń Wielki PLH120043	in the surroundings, at a distance of approx. 4.6 km
Krzczonówka embankments construction	N/A	N/A
Bogdanówka embankments construction	N/A	N/A
Kaczanka boulevards construction	Raba along with Mszanka PLH120093	in the vicinity, at a distance of approx. 150 m
Bysinka boulevards construction	Zamczysko nad Rabą nature reserve	in the surroundings, at a distance of approx. 1.8 km
Krzyworzeka embankments construction	N/A	N/A
Lipnik embankments construction	Refuge of bats of Island Beskid PLH120052	in the surroundings, at a distance of approx. 2.8 km
Stradomka embankments construction and modernization	Tarnawka PLH120089	in the vicinity, at a distance of approx. 100 m
	Wiśnicko-Lipnicki Landscape Park	in the surroundings, at a distance of approx. 4 km
Potok Sanecka embankments construction	Tarnawka PLH120089	in the surroundings, at a distance of approx. 2.7 km
	Wiśnicko-Lipnicki Landscape Park	in the surroundings, at a distance of approx. 3.7 km

Task	Name of the area	Spatial relation (coincides with, in the vicinity < 500 m, in the surroundngs < 5 km)
Potok Królewiecki upgrading of bridge	N/A	N/A
Słomka upgrading of bridge	Raba along with Mszanka PLH120093	in the surroundings, at a distance of approx. 2.8 km
	Lubogoszcz PLH120081	in the surroundings, at a distance of approx. 4.4 km
	Meadows near Kasina Wielka PLH120082	in the surroundings, at a distance of approx. 4.4 km
Bysinka upgrading of 6 bridges	Zamczysko nad Rabą nature reserve	in the surroundings, at a distance of approx. 1.8 km
	Gościbia Forest nature reserve	in the surroundings, at a distance of approx. 4.7 km

5 km from investment planned for implementation are: 1 natonal park, 15 natural reserves, 4 landscape parks and 21 Natura 2000 sites (of which 18 are sites of Community importance). Only in 7 cases likely risk of occurrence of adverse impacts on the object of protection should be considered. Apart from Rudniański Landscape Park these refers Orly to areas designaed for protection of natural habiats and habitats of species associated with river valleys: Raba z Mszanką PLH120093, Tarnobrzeska Dolina Wisły PLH180049, Wiśliska PLH120084, Dolina Dolnego Sanu PLH180020, Dolina Dolnej Skawy PLB120005 and Wisła pod Zawichostem reserve. Scope and scale of potential impacts are however dependent upon adopted solutions and minimizing and kompensatory measures.

5.5 FLORA AND FAUNA

5.5.1 POLAND

On the territory of Poland, in comparison to other countries of Central Europe, there is a high degree of biodiversity and fairly well preserved structure of habitats. For the most part it is due to the high diversity of ecosystems beginning with the mountains in the south of the country, through broad river valleys (Vistula, Odra) to Pomerania and the Baltic Sea. Throughout the whole country there have been very well-preserved fragments of natural systems, including fragments of lowland forests with natural features located in the Bialowieża Primeval Forest National Park. In the south biodiversity is mostly represented by the areas of the mountain ranges of the Sudety and the Carpathian Mountains (*Karpaty*), in the central part by a vast river valleys, and in the northern parts the natural conditions are primarily determined by the proximity of the Baltic Sea.

One of the distinguishing features of Poland are well preserved river valleys with a distinctive system of plant communities, changing along with the distance from the riverbed and diverse impacts of water flooding. These ecosystems are subject to regionally various, but fairly low anthropic pressure. They belong to area of particular responsibility of Poland in the context of conservation of European natural heritage.

5.5.2 COMPONENT 1: PROTECTION AGAINT FLOOD OF LOWER ODRA AND THE MIDDLE ODRA

Tasks planned under Component 1 are located within the middle and lower part of the valley of the Odra river. In this area the river flows in a wide valley and in a number of sections it is characterized by well-preserved natural habitats system and related to them species. The riverbed, although some regulation processes made in the past, is the refuge of many rare species of fish and also plays an important role as a migration corridor for diadromous fish. The first flood terrace is covered with riparian forests and alluvial meadows. An important element of this part of the valley are oxbow lakes characterized by specific communities of flora and fauna, some of which are the result of natural processes. While the others are the effect of the old regulatory work. In the areas which are subject to occasional floods have evolved hornbeam forests. Currently the tens of meters high slopes on the edges of the valley are covered in many places with rare communities of thermophilic vegetation.

5.5.3 COMPONENT 2: FLOOD PROTECTION OF THE KŁODZKO VALLEY

Tasks under the component will be implemented in areas with moderate and high nature values. Watercourses within which the passive and active flood protection will be implemented are characterized by fairly well (although highly diverse in each section) preserved structure of habitats related to the riverbed. Riverbeds of courses such as Nysa Kłodzka, Biała Lądecka, Bystrzyca Dusznicka in which the substrate is dominated by rocks and gravel, carry well-oxygenated water of a high flow rate. That is why they are places of occurrence of species such as *Salmo trutta fario, Cottus gobio, Cottus poecilopus, Thymallus thymallus.* Most species in the area under Component 2 belong to the typical fauna representing the foothills and lower mountain zone (e.g. birds species: *Motacilla cinerea*, *Cinclus cinclus* related to the swiftly flowing water rich in various species of aquatic invertebrates). Within the Kotlina Kłodzka most watercourses are inhabited by the otter, which presence is conditioned by the right ichtyofauna and batrachofauna and the presence of sections of rivers with natural boundary slopes.

The boundary slopes, in areas where mountain watercourses do not flow through built up areas are covered by riparian forest communities (willow riparian woodland and alder-ash type) and on some parts by herb fringe communities. The flood plains of rivers are dominated by grassland, mainly fresh meadows, smaller areas by alluvial meadows. Valuable forest communities are clustered in the higher parts of the mountain ranges, where generally work will not be performed. Valuable plant species are associated with natural or semi-natural vegetation enclaves under extensive agricultural use. Areas fulfill such function in many places in immediate adjacent to the rivers. The most valuable flora in the area, covered by the planned work is the valley of the Biała Lądecka river. Along several kilometers of the river there are located communities of *Batrachium penicillatum*, species occurring only at two sites in Poland.

5.5.4 COMPONENT 3: UPPER VISTULA RIVER

Upper Vistula water region is an area of highly differentiated morphology. This area includes mountain, submontane, highland and lowland landform. This great diversity of abiotic factors reflects in the diversity of the animate nature: natural habitats, flora and fauna. Numerous rare and protected habitats are related to the river valleys of the region (including the ones being subject of Community's interest). Some of them occurred due to proximity of the watercourse and impacts associated to it. Riparian communities belong to this category: riverside riparian willow and poplar with accompanying riverside wicker, lowland, foothill and mountain riparian alder forests, ash-alder forests and elm-ash forests, moors as well as wet meadows and of variable moisture content (including alluvial meadows related to the valleys of the great rivers), wet and fresh meadows, riverside herb fringe communities, "veil" shrubs communities and also the communities of therophytes on the muddy banks of rivers. The second group consists of valleys associated habitats. However they are not directly related to the presence of valleys and environmental conditions related to that. Within this group can be mentioned, e.g.: calcareous grasslands, thermophilic thickets and subcontinental hornbeam, located on the edges of valleys and highlands. With such variety of habitats this area is a place of occurrence of many valuable species of plants and animals. In the case of fauna, for special attention deserve representatives of birds and fish, for which the river valleys and streams - especially those not significantly modified by man - are not only natural habitat of living, but also the migration corridors. In this region such corridor (particularly important for the continuity of river morphology for *Acipenser sturio* or *Salmo salar*) is the Vistula along with the San and the Raba to Dobczyce reservoir.

5.6 SOIL

5.6.1 POLAND

Layers of high thickness (fertile river alluvial deposits) are present in the valleys of the Odra and Vistula rivers. On those, the fluvial muds (alluvial soils) have developed. Due to the granulometric composition the alluvial soils contain: light sandy soils, medium sand-clay soils and heavy clay soils. In majority these are the clay-silt formations containing high level of fine fractions, with strong clayey sands interbedding. The share of each fraction varies, depending on the shape of the valley, height above river level, distance from the riverbed, etc., and also on the degree of hydrotechnical constructions. Development of the fluvial muds at areas of the low terraces was related to deforestation of the catchment and increased supply of fine fractions to riverbeds. Rivers containing high level of these structures show tendency to meander and lateral migration of the riverbed. Seasonal flooding lead to constant increase of the soils levels. Inhibition of flood water flow leads to a sudden change of soil moisture conditions and degradation. Fluvial muds are characterized by high productivity and are included in II and III valuation class. Peat soils and loamy soils can be found in the tunnel valleys of oxbow lakes and depressions in which the groundwater table is near the surface and where occur plants preferring highly moistured soils. The higher floodplain terraces are dominated by podsols and pseudo-podsols. They got developed at least rich, sandy or loose poorly clayey grounds. In terms of valuation classes they are in V

and VI class. These soils have no significant meaning for agriculture and are mainly covered by forests. Brown soils are characterized by high value that is why they are included in II, III and IV Class of valuation.

5.6.2 COMPONENT 1: PROTECTION AGAINT FLOOD OF LOWER ODRA AND THE MIDDLE ODRA

The area of the Odra drainage basin is adjacent to: in the east - the Vistula drainage basin, in the south - the Danube drainage basin, in the west - the Łaba drainage basin. Its area can be divided into three major parts:

- Upper Odra river (from spring to Wrocław)
- Middle Odra river (from Wrocław to the estuary of the Warta)
- Lower Odra river (from the estuary of the Warta to Szczeciński Lagoon).

Soil conditions are varied due to the variability of the geological structure and topography of the area. In the area of river valleys there are mainly alluvial soils, fluvial muds (of light, medium and heavy type), peat soils and podsols. It is worth noting that there is a large area of marsh soils and black earth (near Starogard Szczeciński, Pyrzyce). The basin area is dominated by glacial soils, primarily podsols and brown soil. The least fertile soils include the one developed on sandy dunes or outwash sands: podsols and pseudo-podsols.

5.6.3 COMPONENT 2: FLOOD PROTECTION OF THE KŁODZKO VALLEY

The soils occurring in the Kotlina Kłodzka Valley are conditioned by geology of the terrain. In the area of river valleys alluvial soils have developed. In valleys of Nysa Kłodzka and its tributaries there are medium and heavy alluvial soils, stony fluvial muds, silt and peat soils. In the zone of upper Pleistocene terrace and glacial tills areas podsols, gleysols and brown soils have developed. In the zone of steep slopes on the rock rubble (waste of rock) there have developed shallow deluvial soil levels classified as mountain soils: leached brown soils, brown acidic soils, podsols. Higher parts of the hills include initial soils and poorly developed types (rocky and quartz-flint). Over a large area there are also loess and loess-like formations. In the build-in area the soils got degraded.

5.6.4 COMPONENT 3: UPPER VISTULA RIVER

Area of Component 3 includes river valleys, where the dominant fluvial mud soils developed on river alluvial sediments. The ground contains different types of formations: from sands, loamy sands, through dust and clay to the medium and heavy clays. In the upper parts of the valleys of tributaries e.g. Raba, San rivers and outside the valleys, there occur brown soil and in some places even black earth, gray soil and loess formations.

The wide valleys of Vistula and San rivers are mostly covered by grassland of different quality and arable land classified as mostly wheat and rye complexes. The large part of the Raba and San catchments are used for forestry.

The types of soil in the catchment area is important in modeling of flood events. Permeability of the soil determines i.e. retention properties of the site and catchment response time during rainfall. These data are used to estimate flood risk ratio, especially in mountainous catchments where the steepness of the slopes of the valley increases the rapid inflow of water from areas of low permeability of soil (especially agricultural) into the riverbed.

5.7 AIR QUALITY

5.7.1 POLAND

Factors affecting the air quality in Poland are industry, transport, agriculture and municipal-living sources of pollution (e.g. individual heating of houses). The largest share in emissions of sulfur dioxide (SO_2) in Poland has the energy sector (52.1%), which also generates 33.1% of the annual emissions of nitrogen oxides (NO_x) and 7.6% of PM10 (particulates). Transportation is mainly responsible for emission of NO_x (31.6%), it also emits 9.1% of PM10. Residential and commercial sector emits the most of particulates into the atmosphere (46.2% of the annual emissions) and its share in annual emission of NO_x equals 9.5%. Industry is responsible for the 19.2% of emission of SO_2, 11.9% of NO_x and 5.9% of PM10 emission.

Air quality in Poland varies spatially, depending on the proximity to industrial and energy centers, type and concentration of industry, the size of the transport in the area and density of the road network, as well as the concentration of the population.

The air quality assessment in Poland is conducted by the Voivodship Inspectorates for Environmental Protection (VIEP) as part of the annual assessments of air quality in assigned zones throughout the whole country. For the purposes of air quality assessment Poland was divided into 46 zones (in accordance with Art. 87 item 2 of Environmental Law). Monitoring is carried out by stationary or mobile measuring stations using mathematical models of the pollution spreading and objective methods of estimation. It measures the following compounds: SO_2, NO_x, PM10, lead (Pb), ozone (O_3), benzene (C_6H_6), carbon monoxide (CO), arsenic (As), cadmium (Cd), nickel (Ni) and benzo[a]pyrene. These air pollutants are emitted into the atmosphere mainly in the combustion process.

5.7.2 COMPONENT 1: PROTECTION AGAINT FLOOD OF LOWER ODRA AND THE MIDDLE ODRA

The area covered by the tasks under Component 1 is located within the 3 zones designated for assessment of air quality in Poland: lubuska zone, zachodniopomorska zone and Agglomeration of Szczecin. According to the characteristics of the main sources of air

emissions, affecting the concentration of compounds covered by VIEP annual assessment of air quality, atmospheric pollutants are emitted:

- in lubuska zone primarily from fuel combustion in individual furnaces and transport,
- in zachodniopomorska zone from surface sources (sources of communal living nature, individual fuel combustion in furnaces), point sources, i.e. large power plants, thermal power plants and industrial facilities (chemical, shipbuilding and wood), as well as transport,
- in Agglomeration of Szczecin from fuel combustion in individual furnaces, large industrial centers and transportation.

The concentrations of most of the compounds being monitored within the zone fully meet the criterion of protection of human health: in lubuska zone (except PM10, As, benzo[a]pyrene) in zachodnipomorska zone (except benzo[a]pyrene) and in Agglomeration of Szczecin (except benzo[a]pyrene).

The sanitary condition of the air along the valley of the Odra river is diverse, as a result of uneven concentration of population, the density of the road network, as well as the location of industrial and energy centers, manufactures (on both the Polish and German side). The main direction of air flow in these areas is west, which favors transport of atmospheric pollutants from behind the western border of the country).

5.7.3 COMPONENT 2: FLOOD PROTECTION OF THE KŁODZKO VALLEY

Kotlina Kłodzka is located in Lower Silesian zone designated for the purposes of air quality assessment in Poland. According to the characteristics of the main sources of air emissions, affecting the concentration of compounds covered by VIEP annual assessment of air quality, atmospheric pollutants are emitted by burning fossil for energy purposes and individual heating and transport. The concentrations of most of the compounds being monitored within the zone fully meet the criterion of protection of human health (except PM10, As, benzo[a]pyrene and ozone).

In Kotlina Kłodzka is located one automatic station for measurement of concentrations of atmospheric pollutants. Monitoring is supplemented by mobile measurements. Air quality within location of each elements under Component 2 is varied due to uneven concentration of population, the location of industrial centers and manufactures, as well as the course of the main transport routes. In the ner vicinity of the investment site can be observed exceeded levels of particulates (PM10) and benzo[a]pyrene, which are mainly emitted in the process of heating homes. The morphology of the terrain (a significant land decrease, the surrounding mountain ranges) also cause increase of the concentration of atmospheric pollutants by creating local hollows.

5.7.4 COMPONENT 3: UPPER VISTULA RIVER

Area of Component 3 includes both dense settlement areas – e.g. Kraków and undeveloped areas - location of polders above Cracow or parts dry polders in the catchment of Raba and

San. Hence, the sanitary condition of the air is different depending on the particular location. The most unfavorable situation is in Cracow, where in regards to so-called low emission during the heating season, along with the location of the town and unfavorable meteorological situation, the norms for particulates concentration are often greatly exceeded.

Such situation also occurs in built-in mountain valleys, where the movement of air masses is difficult. Low emissions during the heating season, along with a temperature inversion phenomenon also causes periodic exceedances of air pollution in these areas.

5.8 NOISE

5.8.1 POLAND

Environmental standards for the acceptable levels of noise are regulated by the regulation pursuant to the delegation included in Art. 113 par. 1 of the Act of 27 April 2001. - Environmental Law (Journal of Laws of 2013 Pos. 1232 as amended). The law differentiates acceptable intensity levels depending on:

1) The type of settlement (housing, buildings associated with youth stay)
2) Type of area (health resorts, cities of more than 100 thousand citizens, recreation areas)
3) Time of day (day, night).

For the projects potentially or always affecting the environment, consisting in renovation, construction, reconstruction or modernization it is necessary to examine the impact of their implementation on the acoustic environment during the administrative procedure finalized by obtaining the decision on the environmental conditions. In justified cases, the investigating authority may, after obtaining the opinion of the competent sanitary inspector, order in the decision:

a. The preparation of a full environmental impact assessment including predicted acoustic environment impact;
b. The evaluation of environmental impact assessment including predicted acoustic environment impact on the stage of obtaining by the investor a construction permit or equivalent;
c. The post-project analysis of the effectiveness of environmental protection equipment

In addition, within the government administration functions the Inspection for Environmental Protection. It controls the implementation of environmental laws and rational use of natural resources. State Environmental Monitoring is carried out as part of this activity along with the subsystem which controls noise emissions and assessment of the acoustic climate.

The tasks of Inspection for Environmental Protection are performed at two levels:

a) National – by General Inspector for Environmental Protection (GIEP),
b) Regional – by Voivodship Inspectors for Environmental Protection (VIEP).

5.8.2 COMPONENT 1: PROTECTION AGAINT FLOOD OF LOWER ODRA AND THE MIDDLE ODRA

Investments carried out under Component 1 are located in the zachodniopomorskie and lubuskie voivodships. As indicated by the strategic documents of these regions and their projects, the main negative impact on the acoustic environment is caused by the transport (road and rail types) and the industry. Particularly vulnerable to exceedances of environmental standards in this area are cities and urban areas. This means that the sources of the noise emission along the Odra River coincide with the routes and the location of urban centers. There are port complexes (Szczecin-Świnoujście) located on the discussed watercourse including related infrastructure. The functioning of this strategic (from national economy point of view) transshipment terminal is also associated with higher level of road and rail traffic. What is more, due to attractive location at the crossroads of communication routes, proximity to a large logistics bases it is associated with the operation of industrial facilities which are also the source of the negative acoustic impacts.

Some large industrial centers near the Odra river are also located outside of Szczecin (as a metropolitan area). These are:

- Dolna Odra Power Plant near Gryfino;
- Mineral Resources Mine near Bielinek;
- Kostrzyn-Słubice Special Economic Zone including subzones in the cities of Kostrzyn, Nowa Sól, Bytom Odrzański and Słubice;
- Steel mill in Eisenhüttenstadt (Germany).

Regarding traffic noise - its sources cross the Odra river point wise - at bridges (road and rail communication). Such constructions are located mostly in the vicinity of urban centers, which means that the negative acoustic impacts and norms exceedance cumulate in urban areas rather than at the entire length of the river.

5.8.3 COMPONENT 2: FLOOD PROTECTION OF THE KŁODZKO VALLEY

In accordance with the strategic documents for the kłodzki district the main source of noise is the industry and transport. Due to the relatively small area of the district and low degree of industrialization of the region, the number of objects particularly affecting the acoustic is small:

- Timber-sawing Carpentry Export-Import Company in Nowa Bystrzyca;
- Boiler room in residential area of Kłodzko at 1 Dąbrówki Str.;
- Rock Minerals Mine "Świerki" in Świerki;
- The Art Glasswork "Barbara" in Polanica.

Due to the development of public transport, an important source of noise is traffic, which is also related to the increasing number of cars. In addition to strictly local communication, the region is subject to continuous tourism. Depending on the time of year and the weather can occur periods of increased interest. This is due to the proximity of Wrocław and well-developed and diverse tourist base: health resorts, hiking, biking, skiing, which increases the

attractiveness of the area. Lack of convenient rail transport between Wrocław and cities-spas results in increased car traffic, and this reflects in higher acoustic impact. It is important to note that Polish law establishes more stringent acoustic standards for health resort areas.

5.8.4 COMPONENT 3: UPPER VISTULA RIVER

In this area noise is mostly related to transport, operation of factories and airports. Due to the spatial scale, the most troublesome is the noise generated by motor vehicles. It covers spatially the largest population and area. The problem concerns not only highly urbanized areas, e.g. Cracow, but also places like the valleys of Raba, San and their tributaries, where the main roads run mostly at the bottom of the valley near the riverbed. Due to increasing number of vehicles and the increase of traffic, noise standards in the areas adjacent to roads are often exceeded, even at night.

6 LEGAL FRAMEWORK OF FLOOD RISK MANAGEMENT

6.1 FLOOD RISK MANAGEMENT PLANS

On European level, general framework for developing Flood Risk Management Plans is contained in the provisions of Directive 2000/60/EC of the European Parliament and the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (EU Journal of Laws L 327 of 22.12.2000, p. 1 with amendments; hereinafter: Framework Water Directive; WFD) and directive 2007/60/EC of the European Parliament and the Council of 23 October 2007 on the assessment and management of flood risks (EU Journal of Laws L 288 of 6.11.2007, p. 27 with amendments, hereinafter: the Flood Directive).

WFD requires developing river basin management plan for each basin and programmes of action in order to achieve good ecological and chemical status. Implementing the programmes may also contribute to reduce results of flood (article 11 (3) letter l of WFD). However, reduction of flood risk does not constitute substantial aim of this directive.

Framework for flood risk assessment and its management for the purposes of reducing adverse effects on human health, environment, cultural heritage and economic activity, associated with floods on the European territory is the main aim of the Flood Directive. The main instrument for achieving this aim is flood risk management plan, coordinated at the level of basin or coastal area. The plans should be prepared and published by 22 December 2015.

Flood risk management plans are drawn on the basis of flood hazard maps and flood risk maps, prepared in accordance with article 6 of the Flood Directive. The maps subsequently become part of the flood risk management plan.

In accordance with article 9 of the Flood Directive, member states are obliged to coordinate application of the Flood Directive and WFD, with particular impact on increasing efficiency, exchange of information and feasibility of reaching synergy and common benefits, regardful of environmental aims set out in the WFD. In consequence, the Flood Directive imposes obligation to draw up first flood risk management plans and their reviews in coordination with reviews of the river basin management plans established by WFD. Information from flood hazard maps and flood risk maps should be consistent with information presented in accordance with WFD.

Provisions of WFD and the Flood Directive were transposed to the polish law by the Law of 18 July 2001 – the Water Law (consolidated text: Journal of Laws of 2012, pos. 145 with amendments). In accordance with provisions of this Law, flood protection is the responsibility of organs of government and local government administration, and it is planned with regard of flood hazard maps, flood risk maps and flood risk management plans. Flood protection is implemented regardful of all the elements of flood risk management, in particular of prevention, protection, proper preparation and reaction in case of occurrence of flood, reconstruction and drawing conclusions in order to reduce potential adverse effects of flood on human health, environment, cultural heritage and economic activity.

Main planning instrument dedicated to flood risk management is flood risk management plan. The plans are prepared for basins and water regions and they include all the element of flood risk management, in particular flood prevention, flood protection and information on the state of preparation in case of occurrence of flood. reconstruction and drawing conclusions in order to reduce potential adverse effects of flood on human health, environment, cultural heritage and economic activity. Content of the plan is listed in article 88g (2) of the Water Law. The plans should be reviewed every 6 years.

Flood risk management plans encompass a catalogue of activities aimed at achieving aims of flood risk management, while a document entitled water maintenance plan includes,among others, indication of planned activities in the scope of flood protection or removing effects of flood, ensuring flow of ice and counteracting the occurrence of adverse ice phenomena, and ensuring functioning of water structures, in particular their proper technical and functional condition, with indication of entities responsible for implementation of these activities, and justification of necessity of their implementation (regardful of assumed effects of their implementation), estimate cost-benefit analysis resulting from the planned activities, and in case of activities concerning maintenance of water structures – with indication of scope, size, approximate localization, deadlines and manners of their implementation. Therefore, as regards technical means of flood protection, flood risk management plans will be concretized and refined by water maintenance plans.

As for procedural aspects of preparing flood risk management plans, in accordance with article 88h of the Water Law, plans for basins are approved and updated by resolution of the Council of Ministers. Projects of these plans are drawn by the President of National Water Management Authority in agreement with minister for water management. Projects of plans for water regions are prepared by directors of Regional Water Management Authorities. If the basin is partially located on the territory of another member state, the President of National Water Management Authority, in agreement with minister for water management, initiates cooperation with organs of this state in order to prepare common international flood risk management plan or a set of aligned flood risk management plans for international basin.

6.2 Strategic document at national level – relation with Flood Risk Management Plans

The main strategic document setting out main trends, challenges and scenarios for social and economic development of the country and direction of spatial development of the country with regard for the principle of sustainable development is **the Long-term Strategy of National Development – Poland 2030** (LSND). The document defines three strategic areas: competitiveness and innovation of the economy (renovation), balancing development potential of polish regions (diffusion) and effectiveness and efficiency of the state (effectiveness). LSND and the Concept of Spatial Management of the Country create framework for Mid-term Strategy of Country Development 2020 and nine strategies concerning:

- Innovation and Effectiveness of the Economy,
- Development of Transportation,
- Energetic Security and Environment,

- Regional Development,
- Human Capital Development,
- Social Capital Development,
- Sustainable Development of Village, Agriculture and Fishing,
- Efficient State,
- Development of National Security System of the Republic of Poland.

LSND indicates necessity to implement flood protection. Flood risk management plans constitutes one of the elements that leads to fulfilling activities from the scope of increasing environment protection by minimizing flood risk. In accordance with LSND flood systems should support renovation of agricultural and food sector, by increasing productivity and competetiveness. The plans are complementary as regards implementation of this direction of intervention.

National Development Strategy 2020 (NDS) is a document based on LSND. It indicated necessity of adjusting emergency response system to greater number of emergency situations, which is consistent with flood risk management plans. NDS states that the plans shall include all the activities aimed at minimizing flood risk. Provisions of the plans will also be taken into account in spatial planning documents. NDS also sets out assumptions that should be accounted for in the flood risk management plan.

Moreover, the document lists activities that are consistent with the plan and that should be converted to activities within different strategies, e.g. introducing construction standards allowing for reduction of losses resulting from natural disasters in the Energy Security and Environment until 2020 (ESE) strategy. ESE also lists investment activities minimizing flood risk – which is complementary to the flood risk management plans prerequisites.

- **Spatial planning**

Spatial planning in implemented on the basis of strategic document entitled **Concept of Spatial Management of the Country** (the Concept), adopted on 16 March 2012 by the Council of Ministers. Flood risk management plans enter into a complex relation with the Concept. They become detailed provisions for aims and activities from the Concept, but also fulfill some of its aim on their own.

- **Innovation and Effectiveness of the Economy**

Strategy of Innovation and Effectiveness of Economy (SIEE) does not directly refer to flood risk and flood protection. However, it does imply necessity of implementing a task concerning application of sustainable architecture, including, among others, taking into account the climatic and topographic factors. The plans also indicate activites that should lead to reducing constructing on areas at risk of flooding.

- **Transportation**

As regards transportation, the strategy in question is the Strategy for Development of Transportation until 2020 (with 2030 perspective). The document is focused, among others, on the aims that should be fulfilled by transportation in Poland. Implementation of flood risk management plans will influence transportation sector by reducing influence of weather phenomena (including flood) on the infrastructure.

In accordance with provisions of the strategy, directions of intervention in the scope of improving inland water transportation management will cover, among others, taking account of inland sailing during construction and renovation of hydrotechnical structures. Renovation and constructon of hydrotechnical structures is include in the tasks that, in accordance with flood risk management plans, should lead to reducing the flood risk.

Planned system of harmonized river information services will cover general hydrological information, which constitutes element of implementation of non-technical measures listed in the flood risk management plan and it fulfills the aim of flood risk management constituting in reduction of flood effects during the floodby improving forecasting and warning on meteorological and hydrological hazards.

- **Energy security and environment**

As regards energy security and environment, key role is played by ESE for achieving the main objective, which is securing livelihood of present and future generations regardful of environment protection and creating conditions for sustainable development of a modern energy sector, callable of granting energy security for Poland as well as competitive and efficient economy, and specific objective constituting in sustainable management of environment resources, a direction of intervention was provided, constituting in managing waters for flood protection, draught and water deficit. Flood risk management plans are one of the instruments for this direction, and they are complementary to the task conciting in adjusting the wate management sector to climate changes.

ESE mentions flood risk management plans as element of activities aimed at adjusting water economy to climate changes. It also includes a list of factors that should be taken into account in activities aimed at minimization of risks – these are cost-benefit analysis, human life and health, environment protection, cultural heritage and economic activity.

Finally, ESE establishes direction of intervention consisting in organizing spatial management, which is to large extent influenced by costs associated with flood protection resulting from lost water retention areas, building over areas threatened by flood, and associated costs of removing flood damages.

Complementary to the system of integrated strategies for development of Poland is the Strategic Plan for Adaptation of Sectors and Areas sensitive to climate changes. Within the plan, flood protection is one of the highest priorities, along with functioning of systems of warning and response in satiations of extreme events (falling within group of non-technical tasks covered by flood risk management plans), adaptive activities in agriculture, forestry, transportation and urban infrastructure (storm sewer system).

6.3 Requirements of the Framework Water Directive in the scope of implementation of flood investments (stage of environmental decision)

As a rule, WFD is based on the so-called framework control, constituting only in indicating conditions that should be fulfilled by the addressee undertaking actions and limited to indicating results of these actions. However, the Directive comprises different types of

obligations imposed on member states., which requires individual identification of character of its provisions in order to estimate the scope of obligation of transposition imposed on member states. As regards article 4 (7) WFD, its character indicates necessity of precise and clear transposition to the national law. This provision creates mechanism of assessment of activities the implementation of which may lead to exacerbation of state of the water environment, in accordance to which:

- failure to achieve good groundwater status, good ecological status or, where relevant, good ecological potential

- failure to prevent deterioration in the status of a body of surface water or groundwater that is the result of new modifications to the physical characteristics of a surface water body or alterations to the level of bodies of groundwater,

- - failure to prevent deterioration from high status to good status of a body of surface water that is the result of new sustainable human development activities

does not constitute breach of WFD provision if the following conditions are fulfilled jointly:

1. all practicable steps are taken to mitigate the adverse impact on the status of the body of water;
2. the reasons for those modifications or alterations are specifically set out and explained in the river basin management plan and the objectives are reviewed every six years;
3. the reasons for those modifications or alterations are of overriding public interest and/or the benefits to the environment and to society of achieving the objectives set out in paragraph 1 are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development;
4. the beneficial objectives served by those modifications or alterations of the water body cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option.

Step 1: Identification of water protection objective in the meaning of article 4 (7) WFD

Water protection objective should be indicated referring to the body of water subject to impacts. All the objectives are listed in article 4 (1) letter a WFD.

Should the impact also concern protected areas listed in Annex IV WFD, in the meaning of article 4 (1) letter c) WFD, objectives for given areas should be indicated. If more than one objective applies to a given body of water, more restrictive objective should be selected, in accordance with article 4 (2) WFD.

Step 2: Identification of impacts on water protection objectives

Impact of changes in physical characteristics on the parameters of potential/state of water that should be achieved/maintained has to be explained on the basis of the following scheme:

- assessment of current state of elements, including description of methodology used for establishing state of particular elements,
- identification of measures enabling achieving environmental objective from WFD in the scope of ecological state/potential for the entire SWB,
- factors of impact of the investment on elements decisive for achieving the objective for the entire SWB,
- indicating why no threat for achieving environmental objectives is stated as a result of occurrence of specific factors of impact, with account for measures enabling achieving the objective.

Given the fact that it is possible that the EIA report is not prepared for the investment, the above mentioned information should be verifiable on the basis of the Project Infromation Card.

Potential threat of not achieving water protection objectives should lead to the necessity of imposing obligation to prepare EIA report for a group II investment; otherwise, it will not be possible to apply article 81 (3) of the EIA Law.

Step 3: Verification of premises from 4 (7) – (9) WFD

- Premise 1.: Were all practicable stepstaken to mitigate the adverse impact on the status of the body of water?

It should be indicated how, in reference to parameters deciding on the possibility of achieving objective for a given body of water, actions were undertaken in order to maximally mitigate effects of a given investment on a given objective. If it is not possible to implement potential minimizing measure, justification should be given. It should also be indicated what monitoring obligations were adopted in order to verify efficiency of minimizing measures.

- Premise 2.: Are the reasons for those modifications or alterations specifically set out and explained in the river basin management plan and the objectives are reviewed every six years?

If derogation form article 4 (7) is applied to the investment in a river water basin management plan (RWBMP), justification for derogation from the plan should be quoted. If the investment is not covered by derogation on the date of issuing environmental decision, the organ in charge of the proceeding should impose on the applicant the obligation of delivering detailed information on reasons justifying implementation of the investment to the President of the National Water Management Authority, on the basis of article 38j of the Water Law.

- Premise 3.: Are the reasons for those modifications or alterations of overriding public interest and/or the benefits to the environment and to society of achieving the objectives outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development?

Fulfilling this premise will be justified if it is indicated that water protection objectives may not be achieved due to protection of interests associated with implementation of the investment. The proviosion provides possibility of overriding environmental objectives in the face of necessity of protection.

- Overriding public interest,
- Human health,
- Human security.

The last possibility of derogating from environmental objectives from WFD is associated with precedence of the investment implementing principle of sustainable development. The justification should indicated what criteria of weighing interests were taken into account by the organ deciding on the precedence.

- Premise 4.: Cannot the beneficial objectives served by those modifications or alterations of the water body, for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option?

Applying the premise should be justified by presenting varianting process of the investment at the following levels:

1. Selection of method of achieving the objective (e.g. choice of lood protection measure),
2. Localization variants,
3. Technological and design variants,
4. Organizational and functional variants (e.g. I nthe scope of water management in the reservoir).

It should be explained to the greatest possible extent why lack of possibility of implementing options more favorable from the point of view of the water state of protection was stated for particular variants. This may be associated with technical unavailability or disproportionate costs.

- Premise 5.: Does the application of derogation permanently exclude or compromise the achievement of the objectives of WFD in other bodies of water within the same river basin district?

It should be proved that due to their nature and scope impacts of the investment do not collide with achieving protection objectives in other water bodies in the same river basin. The point here is to identify a causal relationship between changes in physical characteristics resulting from implementation of the investment and the possibility of occurrence of threats for achieving objectives for other water bodies within the same river basin in case derogate from article 4 (7) WFD was not applied. It should be assumed that is impact of the investment in question did collide with achieving the objectives in other water bodies within the same river basin without applying derogation from article 4 (7) WFD, it would be necessary to introduce the derogation (resulting in the obligation of delivering relevant information to the President of NWMA for the purposes of updating RWBMP).

- Premise 6.: Does the application of the new provisions guarantee at least the same level of protection as the existing Community legislation?

The justification should in particular refer to the requirements set out in the following directives:

1. Directive 85/337/EEC of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment (EU Journal of Laws L 175 of 5 July 1985, p. 40);
2. Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (EU Journal of Laws L 206 of 22 July 1992, p. 7);
3. Directive 2001/42/EC of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment (EU Journal of Laws L 197 of 21 July 2001, p. 30).

In the context of directives 2001/42/EC and 85/337/EEC, general information should be stated on variants of the investment (at strategic level in reference to Directive 2001/42/EC, and as regards an investment in reference to Directive 85/337/EEC) as well as on minimization and compensation at the stage of the investment.

As regards Directive 92/43/EEC, it has to be noted that in case of confirming adverse impact on a Natura 2000 site integrity lack of alternative variants of implementation of the investment should be proved, as well as providing compensatory measures securing integrity of Natura 2000 network.

7 CHARACTERISTICS OF ENVIRONMENTAL IMPACT ASSESSMENT PROCEDURES

7.1 LEGAL GROUNDS: EU LAW AND NATIONAL LAW

Rules governing procedures on environmental impact assessments from international and community law (respectively the Aarhus convention and SEA, EIA, Habitats Directives) are transposed to the polish legal regime by the Law of 3 October 2008 on access to information on the environment, public participation in environment protection and environmental impact assessments (Journal of Laws No 199, pos. 1227; hereinafter the EIA law) and the Law of 16 April 2004 on the nature protection (Journal of Laws No 92, pos. 880 with amendments hereinafter the Law on nature protection).

The EIA Law states:

- Rules and procedures concerning:
  - Providing information on the environment and its protection,
  - Environmental impact assessments (including transboundary assessments);
  - Principles of public participation in the environment protection;
  - Organs of administration competent in cases concerning providing information on the environment and its protection and environmental impact assessments.

7.2 STRATEGIC ENVIRONMENTAL IMPACT ASSESSMENT

The EIA Law defines SEA as proceeding on the assessment of impact on the environment results of implementation of a policy, strategy, plan or programme, encompassing, in particular:

- Agreeing on the level of detail of information included in the environmental impact forecast,
- Preparing environmental impact forecast,
- Obtaining required opinions,
- Granting public participation in the proceeding.

SEA is required for:

- concept of spatial management of the country, study of conditions and directions of spatial management of municipality, plans of spatial management[10] and strategy of regional development;

[10] Minister for construction, spatial and housing management in agreement with minister for environment and minister for health may, by the means of resolution, impose additional reqiurements concerning forecast of environmental impact regarding projects of plans of spatial management, in consideration of specific needs of spatial planning at the level of municipalty and taking into account: 1) form of the forecast; 2) scope of issues that should be identified and analyzed in the forecast; 3) territorial range of the forecast; 4) types of documents including information that should be considered n the forecast.

- policies, strategies, plans or programmes regarding industry, energy, transportation, water management, waste management, forestry, agriculture, fishery, tourism and use of land, developed by organs of administration, that set out framework for subsequent implementation of investments that are likely to have significant impact on the environment;
- policies, strategies, plans and programmes other than already listed, the implementation of which may result in significant impact on a Natura 2000 site if they are not directly related to Natura 2000 site protection or are not result from this protection.

SEA is also required in case of projects of documents other than those listed above, if the organ preparing the document, in collaboration with organ for environment protection, notices that it creates frames for subsequent implementation of investments that are likely to have significant impact on the environment, and that implementation of the document may have significant impact on the environment.

In the light of EIA law, SEA proceeding should constitute of the following steps[11]:

- agreeing on the scope and level of detail required for the forecast with organ od environmental protection and organ of sanitary inspection;
- preparing SEA forecast for the project of the programme;
- granting public participation in the SEA proceeding;
- delivering projects of the programme and SEA forecast to the organ of environment protection and organ of sanitary inspection for appraisal;
- referring in the final version of the project to conclusions from the forecast, opinions of organ for environment protection and organ of sanitary inspection as well as remarks and motions filed within public participation;
- enclosing to the approved plan/programme a summary containing justification for the selection of given document in reference to considered alternative variants and information on the manner in which SEA forecast, opinions of the organ for environment protection, organ of sanitary inspection, conclusions from public participation procedure were used, as well as information on the methods and frequency of conducting analyses of implementation of the programme's provisions;
- analysis of effects of implementation of the plan/programme in the scope of impact on the environment, in accordance with adopted methods and frequency.

Organ giving opinion within SEA is the General Director for Environment Protection (GDEP) – in case of documents developed and altered by central organs of government administration, and RDEP in case of other documents. Main Sanitary Inspector gives opinion and aligns documents prepared and altered by organs of central government administration within the SEA, and the same function is performed by province sanitary inspector in case of plan of spatial management; state regional sanitary inspector is responsible in case of remaining documents.

[11] With appropriate modifications on the basis of article 113-117 of the EIA Lae in case of transboundary proceeding Or on the basis of articles 34-35 of the Law on nature protection in case of habitat assessment.

7.3 IMPACT ASSESSMENT FOR INDIVIDUAL INVESTMENTS

As for legal grounds of proceeding on the assessment of individual investments, it should be noted that the EIA Law defines is as proceeding on the assessment of environmental impact assessment consisting in particular of:

- Verification of EIA report,
- Obtaining required opinions and alignments,
- Granting public participation in the proceeding.

EIA is obligatory for the following types of investments that are likely to have significant impact on the environment:

- Planned investment always likely to have significant impact on the environment (group I investment);
- Planned investment potentially likely to have significant impact on the environment, if the obligation to carry out EIA was imposed by the organ in charge of the proceeding (group II investment).

EIA is carried out as a part of:

1) Main stage of the proceeding, i.e. issuing environmental decision,
2) Implementation stage (the so-called reassessment), which is proceeding on issuing construction permit, decision approving building project, decision on consent for resuming construction works and decision on consent for implementation of a road investment (the so-called building decisions):
   - If the necessity of carrying out the second EIA was stated by the organ issuing environmental decision;
   - On the motion of party planning implementation of the investment, filed to the organ issuing the decisions;
   - If the issuing building decision states that the motion for issuing the decision was changed with respect to requirements set out in the environmental decision.

EIA constituting part of the procedure of issuing environmental decision[12] is carried out by the organ competent to issue the decision. EIA constituting part of issuing building decisions is carried out by RDEP.

Organs issuing decision on environmental conditions are:

1) Regional Director for Environment Protection (RDEP) – for investments from group I;
2) starosta – in case of land consolidation, echange or division of land,
3) director of regional directorate of State Forests – in case of change of a forest owned by the State Treasury into a farmland,
4) mayor, city mayor or president of the city – for remaining investments.

[12] As for the main stage, issuing decision on environemnta condition preccedes obtaining Rother investment decisions listed in article 72 (1) and (1a) of the EIA Law.

In case of group I investments, the applicant may file the motion for issuing environmental decision together with a Project Information Card and motion for determining the scope of the report (instead of delivering the EIA report at once).

The organ determines the scope of the report regardful of modern state of art and methods of research, as well as existing technical capabilities and availability of data. Resolution on the scope of the EIA report is issued after obtaining opinion from RDEP and, if applicable, from organ of State Sanitary Inspection.

The obligation of conducting EIA for a planned investment from group II is imposed in a resolution, on the basis of Project Information Cards by the organ issuing environmental decision. The resolution also set out the scope of EIA report. It is issued after consulting RDEP and, if applicable, organ of state sanitary inspection, also if the organ does not find it necessary to perform EIA.

If an EIA is carried out, organ issuing environmental decision has to agree on the conditions of implementation of the investment with RDEP and, if applicable, with organ of state sanitary inspection prior to issuing the decision[13]. In his aligning resolution, RDEP sets out conditions of implementation of the investment and his standpoint on the necessity of carrying out EIA,as well as proceeding on transboundary environmental impact within the proceeding on issuing building decisions.

Before issuing environmental decision, the organ in charge of the proceeding grants public participation in the EIA proceeding. It is obligatory to justify and publicly announce the decision, in accordance with rules set out in the EIA Law.

As for the implementation stage (the reassessment), EIA report prepared within EIA constituting part of proceeding on issuing a building decision should include specific and detailed information compliant with data gathered from the building project and other information obtained after decision on environmental conditions is issued and following investment decisions, if already issued, as well as determine level and manner of considering requirements regarding environmental protection imposed in these decisions.

After receiving the EIA report, organ issuing the building decision agrees on the conditions of implementing the investment with RDEP, which in turn requests the main organ to grant public participation and organ of state sanitary inspection for issuing an opinion.

The main organ issues the building decision taking into account conditions set out in the environmental decision and in RDEP's resolution. The organ is obliged to impose obligation of performing natural compensation or requirements in the scope of preventing, reducing and monitoring of the impact of the investment – if such need results from the EIA. The building decision has to be justified and announced publicly following the rules set out in the EIA Law.

As for the assessment of impact on Natura 2000 sites, it should be mentioned that in case of group I and II investment the assessment constitutes part of proceeding on issuing environmental decision and at the stage of reassessment (if applicable). Moreover, organ

[13]That is investments for which the following decisions are reqiured: construction permit, decision on consent for resuming construction works, decision on consent for demolition of a nuclear facility, decision on conditions of building and management of land, decision on consent for implementation of a road investment, decision on deermining localization of a railway, decision on determining localization of a highway, decision on determining localization of Euro 2012 investments.

issuing a decision required prior to implementation of a given investment other than investment likely to have significant impact on the environment which is not directly related with protection of a Natura 2000 site or that does not result from this protection, is obliged to consider if the investment is likely to have potential significant impact on a Natura 2000 site (these are the so-called group III investments). Assessment of impact on a Natura 2000 site constituting part of mentioned proceedings is conducted by RDEP. After receiving relevant documentation from the organ in charge of the main proceeding, prior to issuing the aligning resolution RDEP requests the main organ to grant public participation. After the public consultations are over, RDEP issues resolution on the obligation or lack of obligation of carrying out assessment of impact on a Natura 2000 site. If the assessment is required, RDEP demands delivery of a report on the assessment of impact of the investment on a Natura 2000 site and specifies scope of the report.

As regards plans and programmes and all the groups of investments (I-III), RDEP issues resolution on aligning conditions of implementation of the plan/investment if the assessment of impact on Natura 2000 site shows that the plan/investment will not have adverse impacts on the site, or if the assessment shows that the impact will occur, but premises from article 34 of the Law on nature protection are fulfilled. If the premises are not fulfilled and the occurrence of impact in confirmed in the assessment, RDEP refuses to agree on the conditions of implementation of the plan/investment. If the significant adverse impact on the environment refers to priority habitats or species, requirements for issuing consent are much stricter – the only justification is protection of human health and life, securing general safety, reaching beneficial consequences of primary importance to the environment resulting from necessary requirements of overriding public interest, after obtaining opinion of the European Commission.

7.4 PUBLIC PARICIPATION IN EIA OF INVESTMENTS

Public participation in proceedings leading to issuing of a decision is regulated, among others, by Aarhus convention, ratified by Poland. In accordance with its provisions, the citizens are granted access to information on the environment and may actively participate in administrative proceedings. Allowing the society to take part in EIA procedure is one of the most significant elements of the assessment. Responsibility to grant public participation lays on the administrative organ incharge of the proceeding on environmental conditions of consent, within which EIA is carried out. Moreover, the organ in charge of the proceeding on issuing investment decision encompassing second EIA or assessment of impact on a Natura 2000 site grants public participation in the proceeding.

Public participation is required for investments that are always likely to have significant impact on the environment (the so-called group I) and for those investments potentially likely to have significant impact on the environment (the so-called group II) and investments likely to have impact on Natura 2000 sites (other than investments likely to have significant impact on the environment) on which obligation of carrying out EIA or assessment of impact on a Natura 2000 site was imposed.

Public participation in the proceeding on issuing environmental decision begins when a public announcement is made on the commencement of environmental impact assessment, including opportunity to access EIA report and necessary documentation in the case, as well as opportunity to file remarks and motions regarding the proceeding (which may be filed within 21 days).

In case of investments that raise social controversies, it is recommended that the Investor undertakes his own consolations that may begin much earlier, e.g. at the stage of planning the investment, so that the society gets familiar with the planned investment, doubts are explained and the public consultations are closed after 21 days. It is also possible to organize public discussions regarding the investment, with participation of interested parties. It should be noted that when documentation is delivered to the public, it is often impossible or very difficult to introduce major changes to the scope of the investment due to the fact that this would result in necessity of preparing new materials and re-opening the case by the organ. Any activity undertaken at early stage, e.g. before motion for issuing environmental decision is filed may facilitate obtaining the decision without delay.

In order to grant public participation in the process of issuing the decision, organ of administration informs the public by the means of public announcement on the planned investment and initiating procedure on issuing environmental decision and EIA. The announcement also contains information on the opportunity of accessing documentation, place of its presentation, opportunity to file remarks and motions within 21 days, manner and place of filing remarks and motions, organ of administration that will consider them, organs of administration taking part in the assessment and, if relevant, on the date and place of holding administrative hearing open to the public. The announcement is published on the website of Bulletin of Public Information of the organ in charge of the proceeding, in a manner customary for the place of the seat of the organ, in a manner customary for the place of the planned investment. If the seat of the organ is situated in a different municipality than municipality of the planned investment – also by pressinformation or in a customary manner.

After publishing this information, public participation takes place, consisting in accessing documentation of the case and filing remarks and motions. Remarks and motions must be filed within 21 days, after this deadline they will not be considered.

This stage of EIA is open to all interested parties. Any manner of participating is admissible (remarks and motions must be filed in a written form, orally to the protocol or by means of electronic communication).

All the reservations filed within public participation should be accounted for before decision on environmental conditions is issue.

Eventually, decision requiring public participation is announced publicly, together with information on the ways in which it is possible to access its contents.

8 WORLD BANK REQIUREMENTS - PROCEDURES

8.1 OP / BP 4.01 ENVIRONMENTAL ASSESSMENT

The Bank requires Environmental Assessment (EA) of projects proposed for Bank support to ensure that they do not have, or mitigate potential negative environmental impacts. The EA is a process whose breadth, depth, and type of analysis depend on the nature, scale, and potential environmental impact of the proposed project. The EA evaluates a project's potential environmental risks and impacts in its area of influence; examines project alternatives; identifies ways of improving project selection, siting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout project implementation. The EA takes into account the natural environment (air, water and land); human health and safety; social aspects; and trans boundary and global environmental aspects. The Borrower is responsible for carrying out the EA and the Bank advises the Borrower on the Bank‘s EA requirements.

The Bank classifies the proposed projects into three major categories, depending on the type, location, sensitivity, scale of the project and the nature and magnitude of its potential environmental impacts.

- **Category A**: The proposed project is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works.

- **Category B:** The proposed project‘s potential adverse environmental impacts on human population or environmentally important areas-including wetlands, forests, grasslands, or other natural habitats- are less adverse than those of Category A projects. These impacts are site specific; few if any of them are irreversible; and in most cases migratory measures can be designed more readily than Category A projects.

- **Category C:** The proposed project is likely to have minimal or no adverse environmental impacts.

As regards categories A and B, EA Has to encompass public consultation with society affected by the implementation of the investment and with NGOs in the scope of environmental aspects of implementation of the Project. The borrower initiates consultations at the earliest possible stage and the consultations continue throughout entire implementation of the project.

8.2 OP / BP 4.04 NATURAL HABITATS

The conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long-term sustainable development. The Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats and their functions in its economic and sector work, project financing, and policy dialogue. The Bank supports, and expects borrowers to apply, a precautionary approach to natural resource

management to ensure opportunities for environmentally sustainable development. The Bank promotes and supports natural habitat conservation and improved land use by financing projects designed to integrate into national and regional development the conservation of natural habitats and the maintenance of ecological functions. Furthermore, the Bank promotes the rehabilitation of degraded natural habitats. The Bank does not support projects that involve the significant conversion or degradation of critical natural habitats.

8.3 OP / BP 4.11 PHYSICAL CULTURAL RESOURCES

Physical cultural resources are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Their cultural interest may be at the local, provincial or national level, or within the international community. Physical cultural resources are important as sources of valuable scientific and historical information, as assets for economic and social development, and as integral parts of a people's cultural identity and practices. The Bank assists countries to avoid or mitigate adverse impacts on physical cultural resources from development projects that it finances. The borrower addresses impacts on physical cultural resources in projects proposed for Bank financing, as an integral part of the environmental assessment (EA) process. When the project is likely to have adverse impacts on physical cultural resources, the borrower identifies appropriate measures for avoiding or mitigating these impacts as part of the EIA process. These measures may range from full site protection to selective mitigation, including salvage and documentation, in cases where a portion or all of the physical cultural resources may be lost.

8.4 OP / BP 4.36 FORESTRY

The Policy envisages the protection of forests through consideration of forest-related impact of all investment operations, ensuring restrictions for operations affecting critical forest conservation areas, and improving commercial forest practice through the use of modern certification systems. In the process of forest conservation interventions, especially the local people, the private sector and other pertinent stakeholders should be consulted. In general, the Policy aims at reducing deforestation and enhancing the environmental and social contribution of forested areas.

8.5 OP / BP 4.12 INVOLUNTARY RESETTLEMENT

This Policy is based on assisting the displaced persons in their efforts to improve or at least restore their standards of living.

The main purpose the Policy is that development undertakings should not cause the impoverishment of the people who are within the area of influence of the undertakings. In

cases where resettlement of people is inevitable, or in cases where loss of assets and impacts on the livelihood of the PAPs is experienced, a proper action plan should be undertaken to at least restore, as stated above, their standard of life prior to the undertakings. Concerning public consultation, resettles as well as the host communities should be consulted for the successful implementation of the resettlement process. The views of the consulted resettles and the host communities should be incorporated into the Resettlement Action Plan including the list of their choices.

8.6 OP / BP 4.37 SAFETY OF DAMS

Design and construction of new dams implemented as part of a project financed by the Bank need to be supervised by experienced and competent professionals. Moreover, the borrower should adopt and implement certain dam safety measures for the design, bid tendering, construction, operation, and maintenance of the dam and associated works.

The Bank distinguishes between small and large dams:

- Small dams are normally less than 15 meters in height.
- Large dams are 15 meters or more in height. Dams that are between 10 and 15 meters in height are treated as large dams if they present special design complexities. Dams under 10 meters in height are treated as large dams if they are expected to become large dams during the operation of the facility.

For small dams, generic dam safety measures designed by qualified engineers are usually adequate. For large dams, the Bank requires:

a) reviews by an independent panel of experts (the Panel) of the investigation, design, and construction of the dam and the start of operations. The Panel consists of three or more experts, appointed by the borrower and acceptable to the Bank, with expertise in the various technical fields relevant to the safety aspects of the particular dam;

b) preparation and implementation of detailed plans: a plan for construction supervision and quality assurance, an instrumentation plan, an operation and maintenance plan, and an emergency preparedness plan;7

(c) prequalification of bidders during procurement and bid tendering, and

d) periodic safety inspections of the dam after completion.

As for existing dams and dams under construction (DUC), the Bank may finance the following types of projects that do not include a new dam but will rely on the performance of an existing dam or a DUC:

- power stations or water supply systems that draw directly from a reservoir controlled by an existing dam or a DUC;
- diversion dams or hydraulic structures downstream from an existing dam or a DUC, where failure of the upstream dam could cause extensive damage to or failure of the new Bank-funded structure; and irrigation or water supply projects that will depend on the storage and operation of an existing dam or a DUC for their supply of water and could not function if the dam failed. Projects in this category also include operations that require increases in the capacity of an existing dam, or changes in the characteristics of the impounded materials, where failure of the existing dam could cause extensive damage to or failure of the Bank-funded facilities.

If a project involves an existing dam or DUC in the borrower's territory, the Bank requires that the borrower arrange for one or more independent dam specialists to:

(a) inspect and evaluate the safety status of the existing dam or DUC, its appurtenances, and its performance history;
(b) review and evaluate the owner's operation and maintenance procedures; and
(c) provide a written report of findings and recommendations for any remedial work or safety-related measures necessary to upgrade the existing dam or DUC to an acceptable standard of safety.

The Bank may accept previous assessments of dam safety or recommendations of improvements needed in the existing dam or DUC if the borrower provides evidence that:
(a) an effective dam safety program is already in operation, and
(b) full-level inspections and dam safety assessments of the existing dam or DUC, which are satisfactory to the Bank, have already been conducted and documented.

Necessary additional dam safety measures or remedial work may be financed under the proposed project. When substantial remedial work is needed, the Bank requires that

(a) the work be designed and supervised by competent professionals, and
(b) the same reports and plans as for a new Bank-financed dam be prepared and implemented.

For high-hazard cases involving significant and complex remedial work, the Bank also requires that a panel of independent experts be employed on the same basis as for a new Bank-financed dam.

9 PROJECT DESCRIPTION – CONCEPTUAL IDEA OF DESIGN SOLUTIONS

9.1 PROJECT OBJECTIVE

The objective of the project is to provide protection of people and property against flooding in the basin of the largest rivers in Poland, i.e. the Odra and the Vistula Rivers.

9.2 PROJECT COMPONENTS

9.2.1 COMPONENT 1: PROTECTION FROM THE LOWER ODRA AND THE MIDDLE ODRA FLOODING

The scope of flood control includes securing the areas located along the Lower and Middle Odra riverbed on the section of the free-flowing Odra River from the town of Nowa Sól to the Nysa Łużycka River mouth, the border section of the Odra River, i.e. from the Nysa Łużycka River mouth to its branching into the Odra Zachodnia and Odra Wschodnia Rivers (within the town of Widuchowa), on the section of the Odra Zachodnia and Odra Wschodnia Rivers along with the Międzyodrze area and Dąbie Lake. The entirety of required work has been divided into three sub-components: 1A - Flood protection of areas in Zachodniopomorskie Province, 1B - Protection of Middle and Lower Odra River, 1C - Flood protection of Słubice city

9.2.1.1 Sub-component 1A - Flood protection of areas in Zachodniopomorskie Province

The main purpose of flood control in Zachodniopomorskie Province is to build a system of integrated water management in the Odra River basin, which will take into account such aspects as flood protection of adjacent areas, protection of the Odra River water quality as well as of the natural and cultural environment. All the tasks under sub-component 1A solve the problems with flood protection comprehensively, covering the areas that are the most exposed to the flood risk. Sub-component 1A comprises the following tasks:

- **1A.1 - Chlewice-Porzecze. Backwater embankment of the Odra River by the Myśla River**. The task objective is flood protection of the towns of Chlewice and Porzecze against high waters of the Odra River and backwaters of the Myśla River (the right-bank tributary of the Odra River) with an embankment around the developed areas of the town of Chlewice.

- **1A.2 - Flood protection of Ognica village on Odra River**. The task objective is to secure the areas adjacent to the Odra River against flood waters and to improve drainage of water from reclaimed agricultural land.

- **1A.3 - Osinów - Łubnica. Modernisation of inter-embankment**. The task objective is to ensure an uninterrupted flow of any high waters and ice down the Odra River and the inter-embankment zone by limiting the conditions conducive to the formation of ice jams that result in the accumulation of flood waters during the spring thaw. The tasks listed above will enhance safety of the near-bank areas in Gryfino District.

- **1A.4 - Flood protection of Radziszewo and Daleszewo villages on Odra River at 726+400-727+960 km** The task objective is flood protection of the towns of Radziszewo and Daleszewo against high waters of the Odra River by building new embankments.

- **1A.5 - Modernisation of the Marwice polder**. The task objective is flood protection of the towns of: Marwice, Krajnik, Krzypnica and part of the town of Gryfino along with the industrial plants, including: Elektrownia Dolna Odra, Przedsiębiorstwo Usług Komunalnych Gryfino, Przedsiębiorstwo Energetyki Cieplnej and a sewage treatment plant of a total area surface of 1500 ha. The task is composed of three stages:
    - Stage 1 - Krajnik - Marwice. Modernisation of the embankment on the Wschodnia Odra River at km 712+100 - 708+862
    - Stage 2 - Mniszki - Gryfino. Modernisation of the embankment on the Wschodnia Odra River at km 720+935 - 718+850
    - Stage 3 - Modernisation of the Krajnik pump station

- **1A.6 - Restoring natural values of the Lower Odra Valley by improving retention and flood protection capacities of Międzyodrze area**. The task objective is to reach a hydrological balance in the entire Międzyodrze area between the two Odra River distributaries: Odra Zachodnia and Odra Wschodnia, by making canals, ditches and hydraulic engineering devices operate in such a way as to ensure adequate irrigation and rapid drainage of natural areas while improving the flood safety level in the areas adjacent to the Odra River.

9.2.1.2 Sub-component 1B - Protection of the Lower and Middle Odra River.

The threat of flooding in winter conditions is posed by ice jams formed as a result of run-off ice blockage by the existing barriers, which results in water damming and flooding of the adjacent areas. Due to its specific nature, flood protection of Polish and German riverside localities on the Lower and Middle Odra River boils down to prevention of ice-jam floods and to ensuring a free flow of meltwater. The main objective of the investment is to reduce the possibility of the formation of ice jams and to facilitate icebreaking operations as the most effective tool to minimise the risks of floods in winter. These objectives will be achieved by: renovation and modernisation of existing regulating structures, elimination of jam-conducive areas, standardisation of the conditions of flow and river load movement as well as modification of the existing bridge structures. These actions will ensure safe carriage of ice

down the river, and thus reduce the risk of flooding in adjacent areas. Sub-component 1B comprises the following tasks:

- **1B.1 - Reconstruction of river control infrastructure on the Odra River. Adaptation to the conditions of Class III roadway. Stage 2**. The task objective is to improve water transport conditions on the free-flowing Odra River section and to adapt it to Class 3 waterway by increasing its average depths and by ensuring a more balanced transport of river load. The free-flowing Odra River from the barrage in Brzeg Dolny to the Nysa Łużycka River mouth is a Class 2 waterway. This 260 km-long section is characterised by the worst technical parameters and navigation conditions. Given the large scope of the undertaking, the planned investment has been divided into two stages: Stage 1 (in progress) covering the river section in Dolnośląskie Province and Stage 2 (planned) covering the Odra River section in Lubuskie Province from the town of Nowa Sól (from km 427+500) to the Nysa Łużycka River mouth (to km 542+400). As part of the investment there are plans to reconstruct the existing regulating structures and de-clog the Odra riverbed. These measures will reduce the amount of jam-conducive areas by standardising the condition of flow and movement of river load, while adaptation of the river to Class 3 waterway will make it possible to implement a winter anti-ice protection programme and introduce icebreakers participating in icebreaking.

- **1B.2 - Modernisation works on boundary sections of Odra River** The border-side Odra River covers the river section from km 542+400 (the Nysa Łużycka River mouth) to km 704+100 (the bifurcation into the Odra Zachodnia and Odra Wschodnia Rivers in the town of Widuchowa). The task objective is to facilitate icebreaking operations (obtaining a standardised depth of at least 1.80 m) and – by stabilising the flow conditions and eliminating jam-conducive areas – to facilitate ice carriage from the Odra River to the Baltic Sea. On the border-side section, the Odra River is a regulated river. The maintenance condition of the regulating structures on both the German side and the Polish side is insufficient. This has led to terrestrialisation and progressing reduction of the waterway depth in the recent decades. On some sections these obstacles make it virtually impossible to carry out ice-breaking operations and to carry ice down the river; this, in turn, poses a significant threat to flood protection. The scope of planned work is based on the existing regulating structures, while no changes will go beyond the existing riverbed. As it was agreed between the Polish and German side, the undertaking has been divided into stages. The first stage comprises the elimination of commonly determined limiting areas (priority), while the subsequent stages will comprise the remaining work in line with the conceptual idea approved by the two parties.

  The task is composed of two implementation stages:

  - Stage 1 - Modernisation works on boundary sections of Odra River to provide good conditions for ice-breaking in winter
  - Stage 2 - Reconstruction of river control infrastructure on boundary sections of Odra River

- **1B.3 - Construction of berth and mooring infrastructure.** The task objective is to improve the navigation conditions on the Lower Odra River and border-side Odra River, on the section from the Nysa Łużycka River mouth to Dąbie Lake, by building berth and mooring infrastructure and new signage of the waterway. As part of the task, berth and mooring infrastructure for icebreakers will be built in Szczecin. The target outcome is joint utilisation of the port infrastructure by the Water Management Office, the base of ice-breakers and all the vessels owned by RWMA [Regional Water Management Authority] in Szczecin. In winter, the outcomes of the task implementation will comprise increased efficiency and safety of ice-breaking operations using ice-breakers with a possibility to use the newly established berths.

  The task is composed of two implementation stages:

  - Stage 1 - Construction of docking-mooring infrastructure
  - Stage 2 - Construction of docking-mooring infrastructure on Lower Odra and on its boundary sections and new marking of the shipping lane.

- **1B.4 -** Improvement of flood water-flow from Dąbie Lake in winter. The task objective comprises deepening of the shipping route on Dąbie Lake to facilitate winter ice protection programmes and navigation of ice-breakers participating in ice-breaking on the lake. Dąbie Lake is the main basin of ice float flowing from the upper sections of the Odra River. Irrespective of the place where the ice jam occurs, each ice-breaking operation on the Odra, Warta and Noteć Rivers must commence on Dąbie Lake to which the ice float from the entire river area must be carried. This task is therefore the key element of winter flood protection on the Odra River.

- **1B.5 - Dredging of Klucz-Ustowo ditch** The Klucz-Ustowo ditch is a branching of the Wschodnia Odra River at km 730.5 which merges with the Odra Zachodnia River at km 29.8. The task objective is to improve the current situation of the waterway by increasing its current depth. In winter the investment will facilitate winter ice protection programmes and operation of ice-breakers participating in ice-breaking on this section of the river.

- **1B.6 - Reconstruction of bridges to ensure a minimum clearance** The task objective is to ensure an adequate clearance for ice-breaking operations involving river ice-breakers by modifying the existing bridge structures crossing the waterway. The existing bridges on the Odra River are a real barrier to winter ice protection programmes and operation of ice-breakers participating in ice-breaking. As part of the task one bridge is to be modified – the one which is the biggest obstacle to effective ice-breaking operations, namely the railway bridge at km 733.7 of the Regalica River in Szczecin.

9.2.1.3 Sub-component 1C - Flood protection of the town of Słubice

The flood of 1997 was a real threat to Słubice, as a result of which the town inhabitants had to be evacuated. The long-term water emergency condition impaired the embankments in the Słubice area. Potential loss of stability and a break in the embankments would be catastrophic for the town – due to its low altitude almost entire Słubice would be under water. In order to improve flood protection of the town of Słubice, strengthening and widening of the existing embankment along the Odra River are planned, along with a construction of a new encircling embankment securing Słubice from the north – task 1C.1, and reconstruction of the beds of the Czarny Kanał and Racza Struga Canals – task 1C.2.

- **1C.1 - Extension and construction of flood embankments** The task objective is to protect the town of Słubice against flood by reinforcing and widening of the existing embankment along the Odra River (from km 582+500 to km 588+000) and building a new encircling embankment from the north (the embankments starts at km 587+400 of the Odra River course). The scope of work comprises modification of the existing embankment on the approx. 6.9 km-long section and building a new embankment on the 5.9 km-long section.

- **1C.2 - Reconstruction of Czarny Kanał and Racza Struga** The task objective is to facilitate proper drainage of the adjacent areas and discharge of surface water to the Racza Struga and Czarny Kanał beds by restoring the proper technical condition of the existing hydrotechnical devices. The undertaking comprises the reconstruction of the Racza Struga bed on a 2 km-long section as well as the reconstruction of the Czarny Kanał bed on a 4.1 km-long section.

9.2.2 COMPONENT 2: FLOOD PROTECTION OF THE KŁODZKO VALLEY

The scope of flood control of the Kłodzko Valley covers flood protection of the inhabitants (approx. 234,000) and of developed areas of a total area surface of 497 ha. It comprises protection of humans and animals along with property. The investment provides for the individual protection of approx. 250 households as well. The flood risk in the Kłodzko Valley is mainly attributable to the insufficient throughput of the river beds and communication structures, insufficient number of flood reservoirs and insufficient number and height of embankments. This is accompanied by the poor technical condition of the existing anti-flood structures which do not ensure flood protection to the inhabitants of the river-bank areas. The scope of work involved in flood protection of the Kłodzko Valley covers active protection actions - sub-component 2A, as well as passive protection actions - sub-component 2B.

9.2.2.1 Sub-component 2A - Active protection

The scope of active protection comprises the construction of four dry detention basins: Boboszów on the Nysa Kłodzka River, Roztoki Bystrzyckie on the Goworówka Stream, Krosnowice on the Duna Stream and Szalejów Górny on the Bystrzyca Dusznicka River. The purpose of the proposed basins is – by reducing the culmination of flood waves and reducing the size of flows – to minimise the risk in the river valleys on which they are located, and indirectly also on the Nysa Kłodzka River and thus throughout the Kłodzko Valley. Currently, there are two dry detention basins in the Kłodzko Valley: Miedzygórze on the Wilczek Stream – max. capacity of 0.83 million cubic m and flooding area at the maximum damming – 6.6 ha, and Stronie Śląskie on the Morawa River: max. capacity of 1.4 million cubic m and flooding area at the maximum damming of 25.0 ha. The number and capacity of the existing basins are insufficient; in order to protect the Kłodzko Valley from flooding it is necessary to take actions enhancing active protection in the area. At the stage of preliminary study work, the location of thirteen flood control reservoirs was analysed. When choosing the most optimal solutions, the following aspects were analysed: the ability to protect large population centres which suffered during the previous floods, especially in 1997 and 1998; the size and nature of the catchment area expressed by the ratio of the reservoir capacity to the catchment area (reduction capacity of the reservoir); topographic opportunities of the reservoir location; quantity and size of collisions with existing infrastructure and land development; local government's attitude reflected in placing the investment in the local land use plans of municipalities. Sub-component 2A comprises the following tasks:

- **2A.1 - Construction of "Boboszów" - a dry flood control reservoir on Nysa Kłodzka River** The dry detention basin is planned in the Nysa Kłodzka River valley in the towns of Boboszów and Pisary, above the locality of Międzylesie. The maximum capacity of the basin is 1.4 million cubic m, while its flooding area at the maximum damming is 21.0 ha. The direct advantage of the basin construction is flood protection of the towns of Boboszów and Międzylesie, which suffered during the flood of 1997. The Nysa Kłodzka River is characterised by rapid high waters, while the centenary water flow rate against the annual is approx. 220, i.e. it is very high; this only proves the validity of the basin construction.

  The barrier length along the crown axis is 230.0 m, while its height in the highest spot is 17.0 m. Water will flow through the barrier cross-section via outlets and slope overflows along the right abutment of the barrier. In the investment area there are 16 buildings colliding with the planned basin. Five of them are residential buildings, mainly cottages, while other buildings make up farms. The elements which also collide with the investment are an MV line providing power to the villages in the vicinity, an overhead telecommunication line and a county road between the villages of Boboszów and Pisary.

- **2A.2 - Construction of "Roztoki Bystrzyckie" - a dry flood control reservoir on Goworówka stream** The dry detention basin is planned in the Goworówka Stream valley above the Roztoki locality. The maximum capacity of the basin is 2.7 million cubic m, while its flooding area at the maximum damming is 48.0 ha. The direct

advantage of the basin construction is flood protection of the town of Roztoki and - in conjunction with the “Boboszów” basin – protection of the town of Bystrzyca Kłodzka, which suffered great damage during the flood of 1997. The Goworówka River is characterised by rapid high waters, while the centenary water flow rate against the annual is approx. 180, i.e. it is very high; this only confirms that the river needs to be tamed before it enters the Nysa Kłodzka River, thus proving the validity of the basin construction.

The barrier length along the crown axis is 750.0 m, while its height in the highest spot is 15.5 m. Water will flow through the barrier cross-section via outlets and slope overflows along the right abutment of the barrier. In the investment area there are no buildings colliding with the planned basin. The elements which collide with the investment are an MV line, gas pipeline and a county road between the villages of Roztoki and Goworów.

- **2A.3 - Construction of "Szalejów Górny" - a dry flood control reservoir on Bystrzyca Dusznicka River** The basin is planned in the valley of the Bystrzyca Dusznicka River near the locality of Szalejów Górny and above the town of Szalejów Górny. The maximum capacity of the basin is 9.9 million cubic m, while its flooding area at the maximum damming is 118.7 ha. The basin is to control 64% of the entire Bystrzyca Dusznicka catchment area, which will significantly affect the flow in the river below the basin and enhance flood protection of the town of Kłodzko.

  The barrier length along the crown axis is 735.0 m, while its height in the highest spot is 19.3 m. Water will flow through the barrier cross-section via an overflow weir and outlets. In the investment area there is one building colliding with the planned basin. There are no utilities in the investment area.

- **2A.4 - Construction of "Krosnowice" - a dry flood control reservoir on Duna stream** The basin is planned in the Duna River valley, in its mouth section, approx. 500 above m the town of Krosnowice. The maximum capacity of the basin is 1.9 million cubic m, while it flooding area at the maximum damming is 44.0 ha. The Duna catchment area is only slightly afforested (20%), which increases the rapidity of high flood waters. The centenary water flow rate against the annual is approx. 260, i.e. it is very high; this only confirms that the river needs to be tamed before it enters the Nysa Kłodzka River.

  The barrier length along the crown axis is 450.0 m, while its height in the highest spot is 15.7 m. Water will flow through the barrier cross-section via a slope overflow and outlets. In the investment area there are no buildings colliding with the planned basin. The elements which collide with the investment are an MV line and a telecommunication line.

9.2.2.2 Sub-component 2B - Passive protection

The scope of passive protection covers flood protection of the areas along the four main rivers in the Kłodzko Valley: Nysa Kłodzka, Ścinawka, Biała Lądecka with the main left-side tributary – the Morawka, and Bystrzyca Dusznicka with the main left-bank tributary – the Kamienny Potok River. The built-up areas will be protected as class II or III of importance. Passive protection comprises: modification and renovation of the existing bank protection measures and enhancing the throughput of river and stream beds; construction of new and modification of existing embankments and floodwalls; (works carried out within developer areas or in their direct vicinity in scope necessary for protection of developer areas)enhancement of throughput of the existing dams and barrages; enhancement of throughput of the existing bridge and footpath structures; individual protection of households or moving the developed areas that are impossible to protect outside the flooding areas. Sub-component 2B comprises the following tasks:

- **2B.1 - Flood protection of Nysa Kłodzka River Valley** The scope of work related to flood protection of the Nysa Kłodzka River covers the section starting from km 179+500, i.e. the lower design stand of the “Boboszów” reservoir, to km 113+000, i.e. above the locality of Bardo. In total, work will be performed on a 66.5 km-long river section. As part of entire work, in particular the following will be performed: section-based modification and renovation of the existing bank protection measures (wihtin developer areas or in their direct vicinity); enhancing the throughput of river and stream beds; construction of new embankments and floodwalls on the section whose total length is 14.5 km; modification of the existing embankments and floodwalls on the section whose total length is 6.5 km; enhancement of throughput of 38 bridge and footpath structures; enhancement of throughput of 13 dams and barrages; and moving approx. 145 developed areas beyond the flooding areas.

- **2B.2 - Flood protection of Ścinawka River Valley** The scope of work related to flood protection of the Ścinawka River Valley covers the section starting from km 26+850, i.e. from the Polish - Czech border, to km 0+000 i.e. to the Nysa Kłodzka River mouth. In total work will be performed on a 26.8 km-long river section. As part of entire work, in particular the following will be performed: section-based modification and renovation of the existing bank protective measures and enhancing the throughput of river and stream beds; construction of new embankments and floodwalls on the section on sections necessary for protection of developed areas (whose total length is 8.5 km); modification of the existing embankments and floodwalls on the section on sections necessary for protection of developed areas whose total length is 1 km; enhancement of throughput of 20 bridge and footpath structures; enhancement of throughput of 5 dams and barrages; and moving approx. 105 developed areas beyond the flooding areas.

- **2B.3 - Flood protection of Biała Lądecka River valley and Morawka River.** The scope of work related to flood protection of the Biała Lądecka River Valley covers the section starting from km 36+400, i.e. above the locality of Stronie Śląskie, to km 0+000 i.e. to the Nysa Kłodzka River mouth. The scope of work related to flood protection of the Morawka River Valley covers the section starting from km 6+900, i.e. above the locality of Nowa Morawa, to km 0+000 i.e. to the place where it enters the Biała Lądecka River, at the level of Stronie Śląskie. In total, work will be performed on a 36.40 km-long section of the Biała Lądecka River and a 6.90 km-long section of the Morawka River. As part of entire work, in particular the following will be performed: section-based modification and renovation of the existing bank protective measures (on sections necessary for protection of developer areas) and enhancing the throughput of the beds of the two rivers; construction of new embankments and floodwalls (where necessary for proteciton of buildings) on the section whose total length is 25.0 km (for the two rivers); modification of the existing embankments and floodwalls on the section whose total length is 4 km (for the two rivers); enhancement of throughput of 23 bridge and footpath structures (for the two rivers); enhancement of throughput of 9 (for the two rivers) dams and barrages; and moving approx. 60 developed areas beyond the flooding areas.

- **2B.4 - Flood protection of Bystrzyca Dusznicka River Valley and Kamienny Potok River** The scope of work related to flood protection of the Bystrzyca Dusznicka River Valley covers the section starting from km 30+000, i.e. above the locality of Duszniki Zdrój, to km 0+000, i.e. the place where it enters the Nysa Kłodzka River. The scope of work related to flood protection of the Kamienny Potok River Valley covers the section starting from km 9+900 to km 0+000, i.e. the place where it enters the Bystrzyca Dusznicka River, at the level of Szczytno. In total work will be performed on a 30.00 km-long section of the Bystrzyca Dusznicka section and a 9.90 km-long section of the Kamienny Potok. As part of entire work, in particular the following will be performed: section-based modification and renovation of the existing bank protective measures and enhancing the throughput of the beds of the two rivers; construction of new embankments and floodwalls on the section whose total length is 8.0 km (for the two rivers); modification of the existing embankments and floodwalls on the section whose total length is 6.5 km (for the two rivers); enhancement of throughput of 66 bridge and footpath structures (for the two rivers); enhancement of throughput of 12 (for the two rivers) dams and barrages; and moving approx. 50 developed areas beyond the flooding areas.

9.2.3 COMPONENT 3: UPPER VISTULA RIVER

Component 3 Upper Vistula is located in the area of 3 provinces: Małopolskie, Podkarpackie and Świętokrzyskie.

The planned actions comprise the following Components which, at the same time, are the detailed Project objectives:

Component 3.1 – Passive protection of Upper Vistula towns and Cracow

Component 3.2 – Protection of Sandomierz and Tarnobrzeg

Component 3.3 – Passive and active protection in Raba sub-basin

Component 3.4 – Passive and active protection in San sub-basin

Component 3.1 – Passive protection of Upper Vistula towns and Cracow

In order for the protection measures in the Krakow agglomeration to be effective, it is necessary to maintain high water levels as low as possible within the city, in the conditions of precipitation water management control and steering their discharge to into river receiving bodies. Such task requires building of adequate protection structures in the city and in the catchment areas as well as in the Vistula River valley above Krakow.

The component will comprise modification of the Vistula River embankments in Krakow on the total length of 21 km in three sections. The embankments to be modified are the last fragments of protection structures that have not been modified since the flood of 2010 in Krakow.

The component also comprises the required supplementary measures in the Vistula River valley above Krakow with respect to additional retention capacity of high waters to lower the water table within the city. Although large water retention capacity exists in the large tributaries of the main Vistula course (147 million cubic m, in the reservoirs on the Mała Vistula, Sola, Skawa Rivers), it fails to meet the expectations of protection of the city itself with respect to flows higher than passive protection throughput in the city. Under such circumstances, additional polder retention is to be created reaching 90 million cubic m of the operating capacity in the Vistula River Valley on the section from Oświęcim to Krakow. As part of this component implementation, the following is planned: development of all the documents and performance of all the administrative procedures as a result of which legally binding administrative decisions will be obtained to commence construction work at the next stage.

To protect part of Krakow and Wieliczka, as part of the component implementation, the construction of retention capacity is planned in the form of four dry detention basins along with the necessary actions to stabilise the Serafa and Malinówka River beds (the Vistula River is the receiving body of these rivers) and modernisation of the existing embankments and construction of supplementary embankments on specific sections. The planned actions will complement an investment which was launched as a consequence of the flood of 2010; construction of the dry detention basin “Bieżanów” on the Serafa River (completion date: August 2015).

The division of Component 3.1 into sub-components and tasks in presented in Table 11.

Table 12. Sub-components and tasks of Component 3.1 – Protection the towns in the Upper Vistula basin and protection of Cracow

Sub-components	Tasks
3.1.a Development of the embankments of the Vistula River in Krakow	3.1.a.1 Section 1 - left embankment of the Vistula River from the Wanda Bridge to the Przewóz barrage along with the backwater embankments of the Dłubnia River and Kanał Portowy (7.131 km)
	3.1.a.2 Section 2 - left embankment of the Vistula River from the Przewóz barrage to Suchy Jar

	(3.165 km)
	3.1.a.3. Section 3 - right embankment of the Vistula River from the Dąbie barrage to the Przewóz barrage (10.657 km)
3.1.b Enhanced flood safety in the Serafa River Valley	3.1.b.1 Serafa 2 with a dam at km 9+223 of the Serafa River, capacity of 50,000 cubic metres
	3.1.b.1 Malinówka 1 with a dam at km 0+220 of the Malinówka River, capacity of 115,000 cubic metres
	3.1.b.1 Malinówka 2 with a dam at km 2+320 of the Malinówka River, capacity of 55,000 cubic metres
	3.1.b.1 Malinówka 3 with a dam at km 3+017 of the Malinówka River, capacity of 80,000 cubic m
3.1.c. Technical assistance - design work involved in polder construction	3.1.c.1 Feasibility study and construction plans and specifications for five polders in the Vistula River, above Krakow

Component 3.2 – Protection of Sandomierz and Tarnobrzeg

Kotlina Sandomierska is a Vistula River node and an area of mouths of several important tributaries, including the largest Carpathian tributary of Vistula - San. The area is protected with embankments the condition and protection effectiveness of which was verified by the flood of 2010 (the largest in the history of the region); the majority of Sandomierz was flooded and significantly destroyed. Under the Component, modernisation of the Vistula River embankments will be performed as well as of the embankments of its tributaries within the Vistula River backwaters; moreover, the necessary modernisation of the pump station system will be performed which protects the landside of the embankment during high water flows. The modernisation also comprises synchronisation of embankment crown coordinates along their course and on both river banks to adapt them to the same safety level on the protected area. Due to historical conditions the current embankment crown coordinates in the area do not match one another.

Division of Component 3.2 **– Protection of Sandomierz and Tarnobrzeg** into sub-components and tasks is presented in the table.

Table 13. Sub-components and tasks of Component 3.2 – Protection of Sandomierz and Tarnobrzeg

Sub-components	Tasks
3.2.a Sandomierz Flood protection (SMDII)	3.2.a.1 Flood barrier in the area of the Atramentówka River estuary along with construction of the Koćmierzów pumping station with auxiliary infrastructure
	3.2.a.2 Flood barrier in the Struga A watercourse along with development of the Nadbrzezie pumping station

	3.2.a.3 Development of a perimeter embankment protecting the Huta Szkła Pilkinkton (glassworks) against flood waters along with the residential estate in Sandomierz
	3.2.a.4 Securing the embankments of the Koprzywianka River: left embankment km 0+00-12+900, right embankment km 0+00-14+400
	3.2.a.5 Construction of a pumping station in the town of Szewce
	3.2.a.6 Extension of a pumping station in the town of Zajeziorze
3.2.b Tarnobrzeg flood protection (PMDII)	Vistula right bank extension (length: 13.959 km), San right bank extension (length: 2.193 km) and Łęg river left bank extension (0.112 km) in Gorzyce and Radomyśl Municipalities

Component 3.3 – Passive and active protection in Raba sub-basin

The Raba River basin is mountainous farming and forestry area. At the same time, the area is highly developed with settlements in the valley of the Raba and its tributaries. Approx. 6410 buildings may be flooded with 500-year water, of which 45% are residential buildings and 214 are industrial structures, along with 399 public utility buildings. There are about 10,000 people at risk in this zone. Given the mountainous nature of the basin, the people and their property are exposed to erosion of the high water bed as well as to flooding of the naturally shaped terrain. These phenomena occur simultaneously during every consecutive damming up in the Raba River basin, causing significant damage, also below the Dobczyce retention reservoir. The increase in the basin area surface of high flood activity below the reservoir frequently reduces the protective impact of the dam. This was the case during the flood of 2010 (the largest flood recorded in the region so far). The current size of flood reserves of the capacity of 33.8 million cubic meters failed to retain flows from the reservoir at the level of non-damaging flow (300 cubic m/s). Therefore, as part of this component, there are plans to increase the amount of the flood reserve of the Dobczyce reservoir from 33.8 million cubic m to 44-54 million cubic m in the period from the beginning of May to the end of September, each year, and to build retention capacity on the Raba River major tributaries both downstream and upstream of Dobczyce reservoir, reaching the desired effect for the settlement areas situated in the valley of the Raba River.

Construction and modernization of flood embankments is also planned within the Component. New embankments and boulevards will protect developed areas in the valley of Raba and its tributaries. The embankments were planned on loosely developed urbanized areas and in the centers of villages, within developed areas, consutrction of boulevards was planned, due to limited available space.

Preliminary division into sub-components and tasks of Component 3.3 – **Active and passive protection of the Raba basin** is presented in the table below.

Table 14. Sub-components and tasks of Component 3.3 – Active and passive protection of the Raba basin

Sub-components	Tasks (preliminary division)
Flood protection programme for the Raba basin	**3.3.1** Dobczyce reservoir flood reserve enlargement
	3.3.2 Polder Mikluszowice near Raba river construction
	3.3.3 Krzyworzeka reservoir modernisation
	3.3.4 Tusznica dry polder construction
	3.3.5 Potok Królewiecki 2 dry polders construction
	3.3.6 Dopływ z Łężkowic dry polder construction
	3.3.7 Porębianka dry polder construction
	3.3.8 Krzczonówka dry polder construction
	3.3.9 Krzyworzeka dry polder construction
	3.3.10 Stradomka 3 dry polders construction
	3.3.11 Raba embankments/ boulevards construction and modernisation
	3.3.12 Poniczanka embankments/ boulevards construction
	3.3.13 Słonka boulevards construction
	3.3.14 Krzczonówka embankments construction
	3.3.15 Bogdanówka embankments construction
	3.3.16 Kaczanka boulevards construction
	3.3.17 Bysinka boulevards construction
	3.3.18 Krzyworzeka embankments construction
	3.3.19 Lipnik embankments construction
	3.3.20 Stradomka embankments construction and modernisation
	3.3.21 Potok Sanecka embankments construction
	3.3.22 Potok Królewiecki upgrading of bridge
	3.3.23 Słomka upgrading of bridge
	3.3.24 Bysinka upgrading of 6 bridges

Component 3.4 – Active and passive protection of the San basin

Existing Floyd objects doe not guarantee full Floyd protection o nt he area of San catchmen together with Wisłok, which results in lage losses each year. Supplementary to the existing lood protection, preliminarilly construction of 24 dry polders was planned, of Total capaciy 128 521 m^3, with the largest one – Niewistka reservoir – 92 400 m^3. Apart from reservoirs, construction of 214 sections of enbankments on San tributaries was planned, as well as of sections of ekbankments on San itself. Total length of planned embankments amounts to 91.05 km.

Table 15. Tasks of Component 3.4 – Active and passive protection of the San basin – dry detention basins

Lp	Dry detention basin	Capacity [m3]	Surface [ha]
1	Niewistka (San)	92 400	1 560.6
2	Czaszyn (Osława)	15 100	187.5
3	Maćkówka (Mleczka)	11 300	311.0
4	Podgaj (Sanoczek)	7 260	119.8
5	Nowosielce (Pielnica)	530	19.6
6	Golcowa (Ropa)	453	10.8
7	Charytany (Szkło)	241	9.3
8	Blizne (Orzechowski)	230	18.7
9	Golcowa (lewy dopływ Golcówki)	180	4.5
10	Brzozów (Jakla)	105	3.9
11	Brzozów (Sietnica)	96	8.0
12	Przysietnica (lewy dopływ Sietnicy)	94	3.9
13	Grabówka (Grabówka)	85	3.8
14	Górki (Leluta)	80	9.4
15	Niebocko (Grabówka)	79	4.9
16	Niebocko (Bośnia)	72	3.6
17	Lalin (Stobnica)	52	1.7
18	Domaradz (Budziszański)	50	3.9
19	Stara Wieś (Góra)	43	3.4
20	Blizne (Golaszewski)	34	3.4
21	Niebocko (lewy dopływ Grabówki)	17	1.0
22	Niebocko (prawy dopływ Grabówki)	13	1.0
23	Niebocko (Bośnia)	8	0.6
24	Tyrawa Solna (Tyrawka)	bd	bd

Table 16. Tasks of Component 3.4 – Active and passive protection of the San basin – polders

No	Polder	.Capacity [thous. m3]	Surface [ha]
1	Dry polder Niewistka (San)	92 400	1 560.6
2	Dry polder Czaszyn (Osława)	15 100	187.5
3	Dry polder Maćkówka (Mleczka)	11 300	311.0
4	Dry polder Podgaj (Sanoczek)	7 260	119.8
5	Dry polder Nowosielce (Pielnica)	530	19.6
6	Dry polder Golcowa (Ropa)	453	10.8
7	Dry polder Charytany (Szkło)	241	9.3
8	Dry polder Blizne (Orzechowski)	230	18.7

9	Dry polder Golcowa (left Golcówka tributary)	180	4.5
10	Dry polder Brzozów (Jakla)	105	3.9
11	Dry polder Brzozów (Sietnica)	96	8.0
12	Dry polder Przysietnica (left Sietnica tributary)	94	3.9
13	Dry polder Grabówka (Grabówka)	85	3.8
14	Dry polder Górki (Leluta)	80	9.4
15	Dry polder Niebocko (Grabówka)	79	4.9
16	Dry polder Niebocko (Bośnia)	72	3.6
17	Dry polder Lalin (Stobnica)	52	1.7
18	Dry polder Domaradz (Budziszański)	50	3.9
19	Dry polder Stara Wieś (Góra)	43	3.4
20	Dry polder Blizne (Golaszewski)	34	3.4
21	Dry polder Niebocko (left Grabówka tributary)	17	1.0
22	Dry polder Niebocko (right Grabówka tributary)	13	1.0
23	Dry polder Niebocko (Bośnia)	8	0.6
24	Tyrawa Solna (Tyrawka)	bd	bd

Table 17. Tasks of Component 3.4 – Active and passive protection of the San basin – sections of enbankments planned for implementation in San catchment

No	River	Length [km]	Average heigth [m]
1	San	9.11	1.58
2	Solinka	0.44	2.50
3	Wańkówka	1.96	1.90
4	Olszanica	1.47	1.41
5	Osława	2.09	1.50
6	Osławica	0.78	1.87
7	Tarnawa	1.37	1.66
8	Płowiecki	0.27	1.18
9	Sanoczek	1.61	1.94
10	Tyrawka	0.75	3.94
11	Witryłów	0.18	1.93
12	Baryczka	0.67	1.06
13	Olszówka	0.65	1.80
14	Drohobyczka	0.74	1.22
15	Jawornik	0.25	1.26
16	Stupnica	4.23	1.68
17	Kamionka	2.36	1.58

18	Wiar	11.12	1.34
19	Wisznia	3.13	2.04
20	Rada	0.32	1.36
21	Szkło	0.22	1.19
22	Dopływ w Rudołowicach	0.19	1.44
23	Łęg Rokietnicki	8.22	2.29
24	Sołotwa	3.47	2.05
25	Lubaczówka	0.84	1.66
26	Tributary from Sieniawy	0.07	0.90
27	Złota II	1.68	1.39
28	Jagódka	2.13	1.97
29	Trzebośnica	1.78	1.73
30	Łada	3.90	1.37
31	Bukowa	5.59	1.40
32	Biała	0.22	0.88
33	Młynówka	0.17	1.13
34	Nieplanka	0.11	1.29
35	Leszczynka	0.77	1.65
36	Wisłok	0.76	1.04
37	Pielnica	2.99	2.07
38	Lubatówka	1.00	1.21
39	Stobnica	3.44	1.76
40	Gwoźnica	0.07	2.77
41	Czarna	2.06	1.89
42	Sawa	2.68	1.34
43	Mleczka	4.34	1.33
44	Markówka	0.83	1.05
45	San	9,11	1,58
46	Solinka	0,44	2,50
47	Wańkówka	1,96	1,90
48	Olszanica	1,47	1,41
49	Osława	2,09	1,50
50	Osławica	0,78	1,87
51	Tarnawa	1,37	1,66

52	Płowiecki	0,27	1,18
53	Sanoczek	1,61	1,94
54	Tyrawka	0,75	3,94
55	Witryłów	0,18	1,93
56	Baryczka	0,67	1,06
57	Olszówka	0,65	1,80
58	Drohobyczka	0,74	1,22
59	Jawornik	0,25	1,26
60	Stupnica	4,23	1,68
61	Kamionka	2,36	1,58
62	Wiar	11,12	1,34
63	Wisznia	3,13	2,04
64	Rada	0,32	1,36
65	Szkło	0,22	1,19
66	Dopływ w Rudołowicach	0,19	1,44
67	Łęg Rokietnicki	8,22	2,29
68	Sołotwa	3,47	2,05
69	Lubaczówka	0,84	1,66
70	Dopływ spod Sieniawy	0,07	0,90
71	Złota II	1,68	1,39
72	Jagódka	2,13	1,97
73	Trzebośnica	1,78	1,73
74	Łada	3,90	1,37
75	Bukowa	5,59	1,40
76	Biała	0,22	0,88
77	Młynówka	0,17	1,13
78	Nieplanka	0,11	1,29
79	Leszczynka	0,77	1,65
80	Wisłok	0,76	1,04
81	Pielnica	2,99	2,07
82	Lubatówka	1,00	1,21
83	Stobnica	3,44	1,76
84	Gwoźnica	0,07	2,77
85	Czarna	2,06	1,89

86	Sawa	2,68	1,34
87	Mleczka	4,34	1,33
88	Markówka	0,83	1,05

The general progress of Component 3 varies. Some tasks have already had their environmental decisions awarded (Component 3.2), while some of the planned actions are still at the pre-Feasibility Study stage.

9.3 PROJECT SCHEDULE

Subcomponent	Cost estimate [mln PLN]		Name of task		Masterplan	Prefeasibility Study			Feasibility Study					Permits			Bidding documents	Start of tender	Commencement date	Completion date	Cost estimate		Concept Note cost estimate [mln PLN]	Tasks running cost estimate [mln PLN]
						Technical concept	Feasibility study	Preliminary cost estimate	EIA Raport	Report on water and law matters	Construction design	Detailed design	Construction coast estimate	Environmental decision	Water permit	Building permit					[mln PLN]	[mln Euros]		
1	*2*		*3*		*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*
COMPONENT 1 - PROTECTION AGAINST FLOOD OF LOWER AND MIDDLE ODRA																								
1A - Flood protection of areas in Zachodniopomorskie Province	**1057,21**	**136,75**	9,83	**1A.1**-Chlewice-Porzecze. Backwater embankment of Odra River at Myśli River	YES 1_31_O	-	-	-	**YES**	**YES**	**2011**	**2011**	**2011**	**2012**	**2012**	**2013**	2015	2015	2015	2017	9,83	2,46	**264,30**	**1043,00**	**0,00**
			2,71	**1A.2**-Flood protection of Ognica village on Odra River	APGW*	**2014**	-	**2014**	2016	2016	2016	2017	2017	2016	2017	2017	2017	2017	2017	2017	2019	2,71	0,68			
			16,57	**1A.3**-Osinów-Łubnica. Modernization of inter-embankment	APGW*	**2014**	-	**2014**	2016	2016	2016	2017	2017	2016	2017	2017	2017	2017	2017	2017	2019	16,57	4,14			
			5,66	**1A.4**-Flood protection of Radziszewo and Daleszewo villages on Odra River at 726+400-727+960 km	YES 3_499_O	**2014**	-	**2014**	2016	2016	2016	2017	2017	2016	2017	2017	2017	2017	2017	2017	2019	5,66	1,42			
			14,20	**1A.5**-Modernizacja polderu Marwickiego — STAGE I-Krajnik - Marwice. Modernization of flood embankment on East Odra River at 712+100 - 708+862 km	YES 1_34_O	-	-	-	**2012**	**YES**	**2012**	**2012**	**2012**	**2013**	**2013**	**2013**	2015	2015	2015	2017	14,20	3,55			
			6,55	**1A.5**-Modernizacja polderu Marwickiego — STAGE II-Mniszki - Gryfino. Modernization of flood embankment on East Odra River at 720+935 - 718+850 km	YES 1_33_O	-	-	-	**2012**	**YES**	**2012**	**2012**	**2012**	**2013**	**2013**	**2013**	2015	2015	2015	2017	6,55	1,64			
			1,90	**1A.5**-Modernizacja polderu Marwickiego — STAGE III-Modernization of Krajnik pump station	APGW*	**2014**	-	**2014**	2016	2016	2016	2017	2017	2016	2017	2017	2017	2017	2017	2017	2019	1,90	0,48			
			79,33	**1A.6**-Restoring natural values of Lower Odra Valley by improving retention and flood protection capacities of Międzyodrze	YES 3_496_O	2016	-	**2014**	2017	2018	2018	2019	2019	2018	2019	2019	2019	2019	2019	2019	2021	79,33	19,83			

1B - Protection of Middle and Lower Odra River		**701,95**	99,90	**1B.1**-Reconstruction of river control infrastructure on Odra River. Adaptation to the conditions of Class III waterway. Stage II		YES 1_486_O	-	**2012**	-	**2010**	**YES**	**2013**	**2013**	**2013**	**2011**	**2013**	**2013**	2015	2015	2015	2018	99,90	24,98				
			192,51	**1B.2**-Modernization works on boundary sections of Odra River	STAGE I-Modernization works on boundary sections of Odra River to provide good conditions for ice-breaking in winter	YES 3_381_O	**2014**	**2006**	**2014**	2017	2018	2018	2019	2019	2018	2019	2019	2019	2019	2019	2022	192,51	48,13				
			207,75		STAGE II-Reconstruction of river control infrastructure on boundary sections of Odra River	YES 3_392_O	**2014**	**2006**	**2014**	2017	2018	2018	2019	2019	2018	2019	2019	2019	2019	2019	2022	207,75	51,94				
			21,80	**1B.3**-Construction of docking-mooring infrastructure	STAGE I-Construction of docking-mooring base for icebreakers	YES 1_198_O	**2013**	**-**	**2014**	2016	2017	2017	2017	2017	2017	2018	2018	2018	2018	2018	2020	21,80	5,45				
			22,01		STAGE II-Construction of docking-mooring infrastructure on Lower Odra and on its boundary sections and new marking of the shipping lane	YES 3_393_O	2018	**-**	**2014**	2019	2019	2019	2020	2020	2019	2020	2020	2020	2020	2020	2022	22,01	5,50				
			98,37	**1B.4**-Improvement of flood water-flow from Dąbie Lake in winter		YES 1_6_O	**2009**	**2004**	**2009**	2016	2017	2017	2017	2017	2017	2018	2018	2018	2018	2018	2020	98,37	24,59				
			2,38	**1B.5**-Dreding of Klucz-Ustowo ditch		YES 3_390_O	**-**	-	**2014**	2016	2016	2016	2017	2017	2016	2017	2017	2017	2017	2017	2019	2,38	0,60				
			57,23	**1B.6**-Reconstruction of bridges to ensure a minimum clearance		-	2016	-	**2014**	2016	2017	2017	2017	2017	2017	2018	2018	2018	2018	2018	2020	57,23	14,31				
1C - Flood protection of Słubice city		**218,51**	212,94	**1C.1**-Extension and construction of flood embankments		YES 1_152_O	-	-	-	**2011**	**YES**	**2013**	**2013**	**2013**	**2011**	**2011**	**2014**	2015	2015	2015	2018	212,94	53,24				
			5,57	**1C.2**-Reconstruction of Czarny Kanał and Racza Struga			-	-	-	**2011**	**YES**	**2013**	**2013**	**2013**	**2011**	**2011**	2015	2015	2015	2015	2018	5,57	1,39				
COMPONENT 2 - FLOOD PROTECTION OF KŁODZKO VALLEY																											
2A - Active protection	**1283,94**	**471,58**	79,76	**2A.1**-Construction of "Boboszów" - a dry flood control reservoir on Nysa Kłodzka River		YES 1_501_O	**2012**	**2004 2009**	**2012**	**2014**	2015	**2013**	2015	2015	2015	2015	2016	2016	2016	2016	2019	79,76	19,94	**320,99**	**1324,40**	**0,00**	

			111,20	**2A.2**-Construction of "Roztoki Bystrzyckie" - a dry flood control reservoir on Goworówka stream	YES 1_458_O	**2013**	**2004 2009**	**2013**	**2014**	2015	2015	2016	2016	2015	2015	2016	2016	2016	2016	2019	111,20	27,80			
			170,70	**2A.3**-Construction of "Szalejów Górny" - a dry flood control reservoir on Bystrzyca Dusznicka River	YES 1_502_O	**2012**	**2004 2009**	**2012**	**2014**	2015	2015	2015	2015	2015	2015	2016	2016	2016	2016	2019	170,70	42,68			
			109,92	**2A.4**-Construction of "Krosnowice" - a dry flood control reservoir on Duna stream	YES 1_444_O	**2013**	**2004 2009**	**2013**	**2014**	2015	2015	2016	2016	2015	2015	2016	2016	2016	2016	2019	109,92	27,48			
2B - Passive protection		**812,36**	283,92	**2B.1**-Flood protection of Nysa Kłodzka River Valley	-	2017	**2004 2009**	**2004**	2018	2018	2018	2019	2019	2018	2019	2019	2019	2019	2019	2022	283,92	70,98			
			165,97	**2B.2**-Flood protection of Ścinawka River Valley	-	2017	**2004 2009**	**2004**	2018	2018	2018	2019	2019	2018	2019	2019	2019	2019	2019	2022	165,97	41,49			
			198,52	**2B.3**-Flood protection of Biała Lądecka River valley and Morawka River	-	2017	**2004 2009 2011**	**2004 2011**	2018	2018	2018	2019	2019	2018	2019	2019	2019	2019	2019	2022	198,52	49,63			
			163,95	**2B.4**-Flood protection of Bystrzyca Dusznicka River Valley and Kamienny Potok River	-	2017	**2004 2009**	**2004**	2018	2018	2018	2019	2019	2018	2019	2019	2019	2019	2019	2022	163,95	40,99			
	2341,15	**2341,15**	**2341,15**																		**2341,15**	**585,29**	**585,29**	**2367,40**	**0,00**

(*) - Tasks reported by the implementation unit

2014 - Date of realization of documentation or decicion obtaining

YES - Realized documentations or received decisions in accordance with the declaration of the implementation unit - materials during completing and and veryfication

(-) During veryfication

2017 - Dates proposed

1 Euro = 4PLN

Component 3: Upper Vistula

Component	Cost estimate	Name of contract	Masterplan	Prefeasibility Study or Flood Protection Concept	Feasibility Study	Water permit	Environmental decision	Building Permit	Bidding Documents	Start of tender	Commencement Date	Completion Date	Cost estimate	Tasks running Cost estimate
	mio €												mio €	mio €
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
Komponent 3 – Górna Odra														
Upper Vistula River														
3.1 Passive protection of Upper Vistula towns and Cracow	463,6	Constuction of Vistula embankments in Cracow	Y	Yes/No	2016	2016	2016	2017	2017	2017	2018	2020	39,40	0,39
		Dry polders designs	N	Yes	2016	2018	2018	2022	2022	na	na	na	9,60	
		Flood protection in Serafa Valley	Y	No	2012	2016	2012	2017	2018	2018	2019	2020	18,70	0,19
3.2 A Protection of Sandomierz and Tarnobrzeg		(S MDII)	Y	Yes	2015	2014	2014	2015	2015	2015	2016	2019	83,30	0,83
		(P MDII)	Y	Yes	na	2015	2015	2015	2015	2016	2017	2019	28,10	0,28
3.3 Pasive and active protection in Raba sub-basin		Raba Programme	N	Yes	2017	2017	2017	2018	2018	2018	2018	2021	88,10	0,88
3.4 Pasive and active protection in San sub-basin		San Programme	N	Yes	2016	2018	2018	2020	2020	2020	2021	2025	196,40	1,96
													463,60	**4,54**

10 VARIANT'S ANALYSIS

Variant's Analyses are particularly important in view of Water Framework Directive (WFD) which stipulates that projects posing potential threat to achieving environmental goals SWBs (body of surface water) and GWBs (body of groundwater) (mainly hydrotechnical) show that there is no other, more environmentally advantageous option which could be used to achieve the project objective. The range of alternatives has to be as wide as possible and needs to be determined by the project goal, not limiting the scope to a given protected area. This approach meets another objective of WFD, i.e. catchment approach to water management. What it means is that it is not necessary to affect the river in section A in order to protect it against flooding, but the retention in the upper part of the basin of section A should be increased by building a dry container and causing fewer changes in water habitats. It is also important not to cause damage to adjacent territories while a flood protection project is implemented in terms of both environmental protection and flood risk in adjacentt territories. Those aspects have been integrated into Components 1, 2, and 3 in the course of Variant's Analyses.

This manner of drawing variants for investment is also appropriate and efficient for minimizing other threats for the environment relating to resources of valuable elements of fauna and flora. It should be also recognized that environmental aims for waters in places where protected areas are present (reserves, national parks, Natura 2000 sites and others) constitute protection aims for these areas. Therefore, drawing variants with regard for WFD gives a result in the context of selecting environmentally optimal option of implementation of the investment.

10.1 COMPONENT 1: FLOOD PROTECTION OF THE LOWER AND MIDDLE ODER

The project goal as for Component 1 is flood protection of selected parts of the Lower and Middle Oder basin. The actions taken within Component 1 are one of many groups of tasks aimed at improving flood protection of The Lower and Middle Oder.

With these conditions in mind, the objective of Variant's Analysis was finding the preferred variant from a specific number of investment planning options: limiting flood risk to a various extent, characsterized by different investment and maintenance costs, its impact on environment and changes in inhabitants' social lives. It was assumed that the preferred variant for The Lower and Middle Oder Project, in view of flood risk connected with runoff from the upper(upstream) basin as well as ice jam risk, should include reconstruction and modernisation of the present infrastructure and river training.

SUBCOMPONENT 1A – PROTECTION OF WEST POMERANIAN VOIVODSHIP AREA

The main goal in West Pomeranian Voivodship is creating an integrated water resources system on the Oder, which will encompass such aspects as flood protection of the adjacent

land, preparing preventive area development plan, river purity, environmental and cultural protection.

Specific hydromorphological conditions of Lower Odra (wide river valley, flow of waters in two parallel riverbeds, passing of waters from a very large catchment area) make flood risk reduction methods used in other regions inapplicable in the analyzed area. Theoretically, in order to safeguard housing estates and infrastructure against flood, the following solutions could be considered:

1) construction of retention reservoirs,

2) construction of polders,

3) construction and modernization of flood embankments,

4) improving conditions for draining flood waters and ice within existing catchments areas.

In conditions of a large lowland river and passing of large water masses from remaining parts of the catchment in the sections covered by planned investments, constructing retention reservoirs is inapplicable. Such solution would mean occupying large portions of land, which in turn results in significant adverse impacts in social, economic and natural scope.

Part of tasks will be carried out within the so-called border Odra, where waters flow in two riverbeds and a very wide inter-embankment area with features of a catchment polder (width of the area designated for passing of waters between the riverbeds is approx. 2.5 km). Construction of additional polders above this area is not possible due to the lack of large available areas for this purpose. Theoretically the lands could be obtained, but at large cost and with adverse impacts in social, economic and natural scope. Also, expected results in the form of significant reduction of flood wave enabling protecting of sensitive housing estates and infrastructure would most probably not be achieved.

Tasks approved for implementation such as modernization and construction of flood embankments, improvement of conditions of flow of flood waters constitute optimal solutions due to:

- Significant reduction of necessity of occupying new lands – as compared with other solutions,
- Lower investments costs, including significantly reduced as compared with other solutions costs of purchasing the land and liquidating existing housing estates and infrastructure,
- Enabling flow of flood waters through marsh areas constituting important mainstays of natura habitats and animal species (in particular birds) covered by various forms of nature protection.

Particular investments will be subject to drawing further variants (in the scope of localization, technological and other details) at subsequent stages of implementation, in order to, e.g. reduce impacts on natural values, improving economic efficiency, reducing potential adverse social and economic impacts on local scale.

According to the assumptions, the undertaken actions are long-standing tasks, dealing with flood protection of flood zones comprehensively.

SubComponent 1A consists of the following tasks:

- 1A. 1- Chlewice-Porzecze. Backwater embankment of the Oder near the Myśla,
- 1A. 2 – Flood protection of Ognica on the Oder,
- 1A. 3 – Osinów – Łubnica. Modernizing the inter-embankment zone,
- 1A. 4 – Flood protection of Radziszewo and Daleszewo on the Oder at 726+400-727+960km
- 1A. 5 – Modernizing Marwicki polder, including:
  - STAGE I – Krajnik – Marwic. Modernizing the embankment on the Easter Oder at 712+100-708+862 km;
  - STAGE II – Mniszki – Gryfino. Modernizing the levee on the Eastern Oder at 720+935-718+850 km;
  - STAGE III – Modernizing Krajnik pump station;
- 1A. 6 – Environmental restoration of the Lower Oder Valley through the improvement of retention and flood protection capacities of Międzyodrze.

Variant creation related to modernizing flood embankments lies in analysing solutions concerned with modernizing actions performance so that the negative impact is minimized. The variants that were selected for the performance:

- involves the minimum scope of cutting trees and shrubs
- don't require or minimize the new access road infrastructure
- involve limited actions and presence of construction equipment only to the crest of the embankment;

The reason behind erecting new embankments is usually not having the possibility to find new solutions which guarantee an equal level of safety for the protected community and infrastructure. Thus, variant creation becomes technical in nature and concerns the course and parameters of the embankment in order to minimize the negative impact both during the construction and later use.

The variants that were selected for the performance:

- don't (or almost don't) cause the contraction of the protected habitats;
- don't (or almost don't) cause the separation of as few habitats as possible from the river;
- don't affect localities of protected plants and animals.

Furthermore, similar criteria as for embankment modernization variant selection are adopted for the construction stage.

Construction schedule takes into account the breeding season of birds and other animals.

Subcomponent 1B – THE MIDDLE AND LOWER ODER PROTECTION

Reducing flood risk in the area of Lower and Middle Odra mainly constitutes in reducing risks from blockage floods – accumulation of ice at the section from estuary of the river in the vicinity of Dąbie lake and on other blockage-prone places or places where the ice flow on the river is difficult.

In the scope of preventing occurrence of blockage-generated floods, several alternative options of counteracting this phenomenon include:

1) permanent barriers,
2) floating barriers,
3) icebreaking with the use of hovercrafts,
4) icebreaking with explosives,
5) removing the ice with ice-breakers.

These options vary as to their effectiveness and possibility of using them in given conditions of flow and system of river network.

Permanent barriers

Made of steel or reinforced concrete stakes fixed in the bottom, which cause the ice blockage to accumulate in a designated place, where it does not create losses in material goods and at the same time prevents ice-blockages below, e.g. in a place where such blockage could have adverse impact on housing estates and existing infrastructure. The place where the dam is located requires strengthening the bottom and construction o a relief channel for draining the surplus of water. It is not possible to construct this type of dam within Lower Odra since it would cause accumulation of ice on long sections and lack of control over th process. This type of dam may only be used on rivers of relatively low flow and low amount of ice flowing down the river.

Floating barriers

Barriers created by wooden stakes or steel pontoons floating on the surface of the water, connected with a rope and anchored at the bottom. The barrier may be installed at the beginning of blockage period and dismantled after it is over. Its main task is to create a blockage at a designated place. When the accumulated ice-cover overweighs buoyancy force its elements sink and part of the accumulated ice flows down the river. Next, the barrier surfaces again and continues to block the ice flow. Use of this method is limited in the valley of Odra, and potentially may cover only selected estuary sections of several tributaries. Potential installation of barrier of this type has to be preceded by relevant mathematic modeling so that validity of costs is checked each time.

Breaking the ice with hovercrafts

In this method, air flow produced by hovercrafts rips the ice cover on which it moves. The method can be used mainly on water reservoirs with even and uniform ice cover. It is not applicable for Lower and Middle Odra.

Breaking the ice with explosives

This method was to a limited extent used in the past, mainly for point threats for valuable object such as bridges, hydrotechnical structures, etc. However, it is not as efficient as it should be, causing solely breaking the blockage without really creating conditions for its flow down the river. In 1982 explosives were used to prevent ice-blockage flood on Vistula in the area of Płock, which did not have any influence on lowering the level of water. The threat was eliminated by ice-breakers and clearing the entire waterway. Also, this method has highly adverse social and natural impacts.

Removing the ice with ice-breakers

Most commonly used and safest method of removing ice-blockages on large rivers. Ships of specific construction are used for this purpose, with large mass and low immersion. Ice-breakers crush the ice using their mass and start a wave on the river, which causes further crushing. One of the most important features influencing efficiency of this method is creating a clear waterway for the ice to gradually flow down the river, once the ice is crushed. In the case of Middle and Lower Odra, clear way must be ensured on the entire section (which obviously does not meant that the works have to be carried out on the entire section of Odra), so that the ice crushed in the upper parts o the watercourse can flow freely in the direction of Dąbie lake and further, to Vistula.

Therefore, reducing ice-blockage generated flood risk is most effective when the ice-breakers are used. Because the analyzed section of Odra was regulated as early as in the 19th century in order to enable sailing, solutions considering this premise and constituting in improving sailing conditions in the area of Middle and Lower Odra were also adopted.

Variants for selected investments included in the Subcomponent will be drawn in detail in the scope of technologies and scope of works at the stage of preparing details EMP.

- 1B.1 – reconstruction of regulating system of the Oder. Adaptation to 3rd class of waterway. STAGE II
- 1B.2 – modernizing the bordering part of the Oder:
  - STAGE I – modernizing the bordering part of the Odra in order to ensure ice-breaking in winter
  - STAGE II – renovation and modernization of regulating system of the bordering Oder
- 1B.3 – Building parking and mooring infrastructure:
  - STAGE I – building parking and mooring infrastructure for ice-breakers;
  - STAGE II – building parking and mooring infrastructure on the Lower Oder and bordering part as well as new marking of navigable waterways.
- 1B. 4 – Improving the flow of flood water from Dąbie Lake in winter
- 1B.5 – Klucz-Ustowo tunnel dredging
- 1B.6 – Reconstruction of the bridges to ensure minimum clearance

The actions planned in this Component are the key factor in ice jam flooding prevention. These actions are mainly concerned with implementation phase. Therefore, in this Component new alternative solutions limiting the negative impact during construction phase are considered. The subject of the analysis was mainly comparison between the impact of construction-phase related activities, modernization of the water ward area, and the variant of the landward actions. The landward variant was unequivocally demonstrated and recommended for implementation, which limited the impact on natural habitats and species present in the river valley. As far as dredging was concerned, different forms of extracted material use were considered so as to show the most beneficial solution or solutions for the environment. As far as regulating actions were concerned, variant method at this stage related to the smoothest conveyance and navigability possible on the modernized section.

Subcomponent 1C – SŁUBICE FLOOD PROTECTION

Słubice flood protection is one of the most important aspects of the Lower and Middle Vistula flood protection.

With the multi-criteria analysis for this subcomponent, the adopted benchmark was a variant of "zero", ie. variant showing the current status and allowing the identification of objects and people at risk of flooding, should the investments be absent. Sub-component consists of the following tasks.

- 1C.1 - expansion and construction of levees
- 1C.2- rebuilding of Czarny Kanał and Racza Struga

The following alternative categories of technical activities seemed to be applicable:

- construction of polders and dry reservoirs
- modernization and construction of other embankments
- construction of floodway

A series of variants of planned investments as well as all basin-related investment ideas, including polder and flood control reservoir construction, floodway construction, modernization and construction of dikes , regulating and draining works. Environemental criteria included: impact on conservation area, natural habitats, protected species of plants and animals, and water environmental objectives described in Water Framework Directive. New tasks have been formulated in compliance with the preferred variant. The tasks envisage modernization of existing dikes in sections, new dikes construction, modernizing and clearing works in the channels. Variants of tasks related to the modernization of the levees was based on a review of technology solutions for the implementation of the modernization so as to minimize negative impact. Options for building new embankments took the form of technical variants, concerning the course and the parameters of embankments so as to minimize the negative impact during both construction and operation.

10.2 COMPONENT 2: FLOOD PROTECTION OF KŁODZKO VALLEY

The scope of protection against flood of Kłodzko Valley residents include flood protection of the people(about 234 thousand people) and built-up areas with a total area of approximately 497 hectares, including the protection of human and animal lives as well as material values. The protection of about 250 households on an individual basis is also envisaged. Kłodzko Valley flood risk is primarily due to the insufficient capacity of rivers, streams and transport facilities, insufficient polders, insufficient number and height of embankments. On top of that, the technical condition of existing flood protection facilities is very poor and it does not ensure flood protection for residents inhabting the bank areas. The extent of the works related to Kłodzko Valley includes active (subcomponent 2A) and passive (subcomponent 2B) defence actions.

The final group of tasks in a component is the result of carrying out a series of analyses and consultations over many years as well as making a series of selections by performing the following multi-criteria analyses.

10.2.1 SUB-COMPONENT 2A - ACTIVE PROTECTION

The range of active protection includes the construction of four detention reservoirs and include the following tasks:

- 2A.1 - Construction of a detention reservoir "Boboszów" on the river Nysa Kłodzka.
- 2A.2 - Construction of a detention reservoir "Glen Bystrzyckie" on the stream Goworówka.
- 2A.3 - Construction of a detention reservoir "Szalejów Top" on the river Bystrzyca Dusznicka.
- 2A.4 - Construction of a detention reservoir "Krosnowice" on the stream Duna.

The purpose of the proposed reservoirs is to reduce the culmination of flood waves, the size of flows, and the flood risk in the valleys of the rivers where they are localized, as well as to indirectly reduce the flood risk also on the river Nysa Kłodzka and thus the entire Kłodzka Valley. There are currently two detention reservoirs operating in the area of Kłodzko Valley: Międzygórze on the stream Wilczka, with a maximum capacity of 0.83 million m^3 and flooding surface of 6.6 ha at the maximum damming, and Stronie Śląskie on the Morawa River with a maximum capacity of 1.4 million m^3 and flooding surface flooding of 25.0 ha. at the maximum damming. The number and capacity of existing reservoirs is insufficient and it is necessary to take active measures to increase the Kłodzko Valley active flood protection.

Set of tasks eventually included in the Sub-component is a result of multi-criterion analysis and consultations which led to the final selection of the scope of active flood protection in Kotlina Kłodzka.

The final group of tasks in a component is the result of carrying out a series of analyses and consultations over many years as well as making a series of selections by performing the following multi-criteria analyses.

The starting point for the analyses was a group of storage reservoirs developed in 1978 by Hydroprojekt Wroclaw: 30 reservoirs with the parameters and functions of mainly multi-purpose reservoirs.

The University of Agriculture scrutinized previous locations of the reservoirs in six former voivodships: Wrocław, Opole, Zielona Góra, Jelenia Góra, Wałbrzych and Legnica, including all locations in the Kłodzko Valley reservoirs proposed by Hydroprojekt Wroclaw.

A ranking list of 17 reservoirs in the Kłodzko Valley was selected in the analysis. The top ten constituted all reservoirs which are included in sub-component tasks, with three of them filling the top four spots.

Additional analyses and the research conducted at the University of Agriculture led to the creation of a new list of 13 reservoirs. It was assumed in the course of the analysis that flood protection of the polders"dry flood control reservoirs" should be built. The reservoirs of this type are present currently e.g. in the upper catchments of the rivers in the Sudetes in the number of 10 and they work perfectly if they have capacity sufficient to efficient reduction of flood wave in a given catchment

Final selection of reservoirs for implementation was subject to the following criteria:

- Possibility of protecting large human agglomerations that suffered in previous floods, in particular in 1997 and 1998,
- Size and nature of catchment, expressed by proportion of capacity of the reservoir to the catchment area, indicating reduction capacity of given reservoir,
- Topographic possibility of locating reservoirs with as little collision with land development as possible,
- Positive attitude of local governments, expressed by including the investment in local spatial development plans.

Given the above, ranking list of reservoirs was prepared, that acted as basis for selecting investments most optimal from the point of view of efficiency of the tasks.

Construction of dry flood reservoirs in Kotlina Kłodzka is compliant with passive protection tasks, i.e. section works improving flood security along the watercourses (see below).

10.2.2 SUB-COMPONENT 2B – PASSIVE PROTECTION

The scope of passive protection covers flood protection areas along the four major rivers of the Kłodzko Valley: the Nysa Kłodzka, the Ścinawka, the Biała Ladecka the main left tributary of the Morava River and the Bystrzyca Dusznicka with the main left tributary of the River Kamienny Potok. Built-up areas will be protected with the second or third class of validity. Passive protection includes: reconstruction and renovation of existing bank revetments, the increase in flow capacity of rivers and streams, the construction of new or reconstruction of existing embankments and protective walls, the increase in flow capacity of existing dams and regulatory levels, the increase in flow capacity of the existing bridges and footbridges,

individual security of households or transferring the household that are impossible to protect outside the flood inundations. 2B subcomponent includes the following tasks:

- 2B.1 - Flood protection of the Kłodzka Valley.
- 2B.2 – Flood protection of the Ścinawka Valley
- 2B.3 - Flood protection of the Biała Ladecka Valley and the River Morava.
- 2B.4 - Flood protection of the Bystrzyca Dusznicka valley and the River Kamienny Potok

Three variants of the program implementation of the Kłodzko basin flood control were analyzed, differing in the approach and, thus, the scope of investment.

Option I consisting mainly in increasing capacity and clearing waterbeds, construction of new embankments and modernization of existing embankments and retaining walls in the valleys of the largest rivers: the Nysa Kłodzka, the Biała Lądecka, the Bystrzyca Dusznicka, and the Ścinawka and within 12 smaller tributaries.

It is a variant of the smallest range of investment and a very limited impact in achieving the strategic objective, which is ensuring the full flood protection in Kotlina Klodzka .

Due to the need to obtain the maximum effect of flood protection intensification and concentration of activities in the river beds would be required. This is an environmentally unfavorable variant as it is involved with the transformation of existing habitats.

Option II consists in using only the active protection solutions involving the implementation of the flood control reservoirs in the following locations:

1. Boboszów reservoir on the river Nysa Kłodzka
2. Nagodzice reservoir on the river Nysa Kłodzka
3. Roztki Bystrzyckie reservoir on the stream Goworówka
4. Goszów reservoir on the river Biała Lądecka
5. Bolesławów reservoir on the river Morava
6. Krosnowice reservoir on the river Duna
7. Szalejów reservoir on the river Bystrzyca Dusznicka
8. Tłumaczów reservoir on the river Ścinawka
9. Sarny reservoir on the river Włodzica

It is a variant of the biggest scope of investment and very large effects in achieving the strategic objective, which is full flood protection of the Kłodzka basin. It is also a variant causing social conflicts because 4 of the above flood protection reservoirs are not accepted by the local community. Those reservoirs include: Nagodzice on the Nysa Kłodzka, Goszów on the Biała Lądecka, Bolesławów on the Morava and Tłumaczów on the Ścinawka. The areas where reservoirs would be located are planned for residential development investments, but also technical infrastructure investments [roads, power lines, etc.]

This is an environmentally moderately favourable variant as it allows to minimize riverbeds activities; however, it does not allow for the achievement of the strategic objective, as it can be carried out only in 50%, ie. only 4 reservoirs: Szalejów, Krosnowice, Boboszów, and Roztoka Bystrzycka achieved a social consensus.

Option III involves the use of active and passive protection measures, ie. the implementation of both flood protection reservoirs and regulating riverbeds and embankments (flow capacity increase).

The material scope of this option involves the use of flood protection solutions covering 16 Kłodzka Valley streams the most significant valleys and 4 flood control reservoirs. Therefore, it is divided into stages and tasks according to the following schedule:

Stage I comprises the following tasks:

- Boboszów reservoir on Nysa Kłodzka,
- Roztoki Bystrzyckie reservoir on Goworówka,
- the valley of Nysa Kłodzka from Bard Śl. to the estuary of Biała Lądecka,
- the valley of Bystrzyca Dusznicka with Szalejów Górny reservoir,
- Krosnowice reservoir on Dun,
- the valley of Biała Lądecka (part I).

Stage II comprises the following tasks:

- the valley of Nysa Kłodzka above the estuary of Biała Lądecka,
- the valley of Ścinawka,
- the valley of Biała Lądecka (part II),
- the valley of Morawa,
- the valley of Kamienny Potok.

9.2.3 SUMMARY

Option III is a variant of a compromise as it is economically, socially and environmentally feasible. It enables to achieve the strategic objective due to the balanced approach to the social and natural aspects. This variant became the basis for delineating the tasks of component 2.

Conducted analyses of efficiency of reduction of flood wave show that the efficiency is highest within Kotlina Kłodzka when solutions constituting in combining construction of dry reservoirs with section construction and modernization of flood embankments and liquidating other obstacles prohibiting free flow of flood waters. Approved final scope of the project ensure the highest efficiency taking into account number of protected inhabitants and impact on reduction of flood risk within the capital of the region – Kłodzko (situated below the majority of larger tributaries of Nysa Kłodzka in the mountain part of the catchment). These

investments have also obtained preliminary social acceptance and in some cases (dry reservoirs, selected section of river) are minutely recognized in the scope of possible impacts on the environment (they will not have significant impacts of protected areas an other elements of the environment).

Therefore, investments with the highest efficiency as regards reduction of flood risks and lack of reservations associated with social and environmental aspects were selected for implementation.

10.3 COMPONENT 3: THE UPPER WISLA

As it was mentioned in the previous section, the aim of the Project in terms of Component 3 is flood protection of selected areas of the Upper Vistula basin. These areas were selected having in mind the losses caused by the flood in 2010. These areas included the area of Cracow (protection of the city against floods generated by the upper part of the Vistula basin), a sub-basin of the Raba and the Vistula valley between Tarnobrzeg and Sandomierz, together with a section of the San estuary. The actions taken under Component 3 are among many groups of activities aimed at improving flood protection of the Upper Vistula basin.

Given the above conditions, the purpose of to carrying out variants' analysis was to find a variant of implementation of the investment that would optimally balance such factors as:

- Flood protection as the main purpose of works
- Costs of implementation of works and maintenance of buildings
- Impact on cultural environment and social live of residents
- Impact on natural environment.

Among the analyzed options solutions constituting in removing part of buildings outside the area of flooding were also considered – the documents indicated places where technical protection (flood investments) is not rational.

Thus, the decision-maker or the relevant institutions, municipal and regional authorities would be left to decide on the possible further reduction of flood risk by the transfer of residents outside the risk zone.

However, It should be noted that due to the nature of the protected areas, e.g. some of the largest cities in the Upper Vistula valley with Cracow, the options associated with the transfer of building investments outside the flood risk zone could pertain to only some parts of the analyzed area.

Supplementary to variants' analyses supporting non-technical means were also considered, in the form of, for instance, financial or legal incentives, educational activities, etc.

Component 3.1 - Protection of the towns in the basin of the Upper Vistula and the protection of Cracow

Variants' analysis for Component 3.1 was determined by existing configuration of flood devices within zone of strict city development. Flood embankments of Vistula river together

with backwater embankments on tributaries and retaining walls on the area of city of Cracow were constructed at the beginning of 20th century and in the interwar period. Threats for Cracow and the vicinity are in the first place caused by too little capacity of some sections of the inter-embankment area and by poor technical condition of the embankments (e.g. by existing preferential ways of filtration, improper inclination of slopes and lack of thickening of the soil under the embankments). Moreover, flood risk is also generated by tributaries of Vistula on the area of Cracow, e.g. Serafa.

In the process of selecting optimum variant of set of investments implemented within Component 3.1 aimed at flood protection of Cracow, the following variants of investments together with conditioning factors were considered:

1) Increasing the embankments within the city in accordance with requirements for class I of hydrotechnical structures.

Variant Analysis for Component 3.1 was determined by the existing configuration of protective devices in the rigid conditions of the city. Embankments (including the Vistula river embankments on tributaries) and the protective fortresses of the city of Cracow were built in the early years of the 20th century and in the interwar years. Although there was no need for the construction of sections of embankments during the passage of the flood wave of 2010, the main problem and the risk was the existence of privileged ways of filtration, improper inclination of slopes, lack of sealing the substrate under the ramparts, and poor technical condition of buildings, which at that point were not thoroughly modernized after the 1997 flood.

A parallel issue is the level of the existing flood protection system in the city. According to the regulation, proper grade of embankment crown must meet the specifications for class I structure, ie. for water Q0,1% of approx. 3600 m^3 / s. The average height of the Cracow embankment in meters ranges from 1.0 m to 7.0 m. It is estimated that raising the embankments and Vistula boulevards to the extent specified in the regulation would amount to between 2.3 and 4.0 m above the status quo. Due to architectural and landscape reasons as well as social and economic concerns, there is no consent to implement such a large increase in the embankments and boulevards. This condition was included in the currently implemented and planned projects and investments, and the degree of the flood protection of the city corresponds to the largest documented historical high water levels, where the conveyance of high waters of the Vistula in the area of Cracow is provided.

It should be emphasized that such a height that is theoretically required for embankments and boulevards in Cracow, is due to insufficient width of the great water river bed flowing trough the city center. The distance between embankments in their downtown section from the mouth of the Rudawa to a railroad bridge of Krakow-Tarnow line is only 145 m. The distance between the embankments of the Vistula above this section is 350 m and below 420 m. There was an idea in the past to construct a bypass channel for the section with insufficient riverbed width of the great water. As a result of the expansion of the city center along the river and the natural terrain, the channel can not be rerouted so that its mouth was located below the section with insufficient width. In addition, it is not allowed in the area

reserved for the construction of the channel to build the facilities having the conveyance balancing insufficient riverbed width.

Analysis of the effectiveness of the protective activities of the existing volume of water retention on all the major tributaries of the Vistula River mainstream (147 million m^3 in reservoirs at the Mała Vistula, the Sola, and the Skawa), did not confirm the expected level of protection impact for the city itself with flows higher than the capacity of passive protection in the city.

These factors determine the direction of the search for the best possible actions to improve the prevention of the city from flooding. Their effect is to be able to maintain the lowest possible states of the great water within the city. Therefore, these factors need to be focused on the modernization of the embankments to improve the technical condition, the local embankment heightening, and looking for opportunities to retain water above the big city.

In accordance with aforementioned conditions, the modernization of those sections of embankments which still remained to be rebuilt after the floods in 1997 and 2010 was proposed in the Component.

The second task is to improve safety within and in part (Wieliczka municipality) of Cracow agglomeration in the Serafa valley through the construction of four flood control reservoirs with the necessary works accompanying it. Due to the frequency of flood events in the Serafa catchment, the task was considered a priority at this stage of the tasks associated with flood protection of Cracow from the Vistula river and flood risk reduction in the backwater of the river.

The third proposed task is to prepare documentation for the planned construction of a system of dry polders above Cracow with an estimated capacity of 90 million m^3. As a result, an adequate flow regime of the Vistula should be maintained for the sake of the city's protect from flooding as required.

2) Construction of a relief channel for Cracow

Another solution ad dressing too little capacity of the riverbed within the city was supposed to be construction of a relief channel draining surplus of flood water at the section where the inter-embankment area of Vistula is too narrow.

Distance between the embankments in the downtown section from the estuary of Ruddawa to the Cracow – Tarnów railway bridge is only 145 m. Above this section the distance amounts to 350 m and below it – 420 m. However, because of development of the city centre along the river and natural topography, no location that would ensure voiding the narrow section of the inter-embankment and appropriate capacity was found for the potential channel. Therefore, **implementation of variant constituting in construction of a relief channel provide to be impossible.**

3) Modernization of existing embankments of Vistula in Cracow

Due to lack of possibility of implementing tasks described in points 1-2 and because of poor technical condition of the embankments, **implementation of modernization of embankments was selected, in the following scope:**

- Strengthening of the body of existing embankments by their condensing and construction of anti-filtration barriers in the body and in the soil under the

embankment in order to eliminate filtration through the body and soil under the embankment,

- Repair of embankment structures (culverts, passages),
- Raising sections of the crown of the embankments with correction of ordinates of 0.15-0.5 m,
- Unification of width of the crown of the embankments with its hardening, construction of service roads with adjustment to the existing communication routes

This variant was accepted as optimal in combination with remaining tasks from Component 3.1 described in subsequent points. It should be added that planned modernisation of the embankments constitutes next stage of modernization of all the embankments of Vistula and its direct tributaries within Cracow.

3) Increasing retention of Vistula catchment above Cracow

Given the conditions described in previous points it should be concluded that it is not possible to increase the capacity of the inter-embankment area within Cracow itself. Therefore subsequent steps should concentrate on finding a solution that would allow for stopping part of the flood wave before Cracow.

Analysis of efficiency of flood protection impact of existing retention reservoirs on all large tributaries of upper Vistula (147 mln m^3, in reservoirs on Mała Wisł, Sola, Skawa) shows that protection of Cracow is insufficient when flows exceed those that fit the existing inter-embankment area within the city. This means that during flood reservoirs of the Upper Vistula basin located on Vistula tributaries above Cracow hold too little water to successfully lower flood wave on Vistula in Cracow in the present condition of the embankments.

Proposed solution included construction of system of controlled polders above Cracow. This solution is currently formed as general concept and detailed analyses, including variant analyses of localization and size of polders will be carried out within the present Project.

4) Limiting flood risk on Vistula tributaries within Cracow – Serafa valley

Taking into account tasks supporting lowering flood risk in Vistula backwater zone in the vicinity of Cracow, this task proved to be a priority at this stage of implementation of tsks associated with flood risk protection of Cracow from Vistula side together with lowering flood risk in the river's backwater zone. On the other hand, implementation of the task will significantly reduce flood risk witin Cracow and part of Wieliczka municipality located in Serafa valley.

Regardful of the aim of the task – reduction of flood risk from Serafa three variants of implementation of works were analysed:

- Regulation of Serafa riverbed. For the riverbed to contain flood waters, reconstruction is required, to create a deep artificial riverbed of regular shape, which was rejected due to environmental reasons. Moreover, this variant would require construction of part of embankments and reconstruction of all the bridge structures.
- Construction of flood embankments. Implementation of the variant, due to its localization in an urban area would require expropriation on a large scale as well as

significant reconstruction of technical infrastructure. This variant of works was therefore rejected.

- Construction of dry reservoirs. Dry reservoirs will be used only during floods and their implementation will not result in significance intervention in the riverbed. The variant also assumes construction and modernization of embankments only at selected sections. Because of conditions associated with natural and cultural environment this variant proved to be optimum and approved for implementation.

Summing up, Component 3.1 will include implementation of the following tasks:

- Modernization of embankments within Cracow and documentation associated with construction of system of dry polders above Cracow. Due to the lack of possibility of obtaining relevant capacity of the inter-embankment area within the city by adopting other solutions (raising the embankments or construction of a relief channel) and too little existing retention on Vistula and its tributaries above Cracow this variant of scope of works proved to be optimal

- Construction of 4 dry reservoirs on Serafa – one of tributaries of Vistula in Cracow as means of reduction of flood risk in the river valley and at the same time in the backwater zone of Vistula. Since this variant is most advantageous from environmental, social and economic points of view, construction of a system of dry reservoirs was accepted as optimal variant of the scope of works in the valley of Serafa,

All the implemented tasks should significantly improve flood protection within Cracow and its vicinity.

Component 3.2 - Protection of Sandomierz and Tarnobrzeg

In 2010 and 2011 in the vicinity of Sandomierz and Tarnobrzeg numerous breakdowns within the embankments took place (Vistula embankments in Koćmierzów and on other watercourses in the area). Afterwards, substantial analysis of causes of breakdowns was carried out, as well verification of available hydrological historical data; necessary hydraulic modelling research was carried out for the flow of great waters on the section of Vistula from bridge in Nagnajów to Zawichost. On these grounds capacity of the inter-embankment area was determined, so as to enable safe passage of waters of particular likelihood of occurrence. In order to achieve relevant capacity of the inter-embankment area between Tarnobrzeg and Sandomierz, and at the same time increase the level of flood security in these two citites several variants were considered:

- variant I: removing greenery from the inter-embankment area – variant rejected due to: (a) significant adverse impact on Natura 200 sites; (b) lack of sufficient lowering of the table of water despite significant intervention in the environment, therefore reconstruction of the embankments would also be necessary; (c) future costs of maintenance of the embankments

- variant II: Increasing the distance between Vistula embankments on the section between bridge in Nagnajów to Łęg estuary – variant rejected due to: (a) large scale of resettlements; (b) significant reconstruction of infrastructure (c) occupying new

lands – large environmental, economic and social costs; (d) topography of land preventing obtaining relevant capacity

- variant III: Lowering Q1% water table by constructing relief channel at the section from bridge in Nagnajów to Łęg estuary- variant rejected due to topography and development of the land and associated large economic, social and environmental costs

- variant IV: Deepening and increasing cross-section of Vistula riverbed - variant rejected die to large environmental costs (intervention in the riverbed on a protected area) and economic costs, as well as lack of stability of the results of implementation of the task resulting from hydromorphological processes (section of Vistula of predominant sedimentation), which is associated with large costs of maintenance at the stage of exploitation,

- variant V: Raising the crown of the embankments for achieving capacity of the inter-embankment for Qm = Q1% with existing state of greenery on the inter-embankment – variant rejected because of: (a) too large raising of the ordinate of embankments that would lead to increasing risk on the land side of the levee in case of accident, (b) occupying vast space on the inter-embankment area associated with implementation of works – large environmental costs on a Natura 2000 site; (c) necessity of additional significant reconstruction of the embankments on all tributaries of Vistula, which generates large economic costs and causes many technical problems,

- variant VI: –raising flood embankments regardful of polder retention and keeping the riverbed and the inter-embankment area in a condition not worse than present – **variant accepted for implementation because of the following factors:**

    - raising the embankments of maximally 1.4 m, which is acceptable from the point of view of flood protection of the land side of the levee,

    - combining modernization of the embankments with polder retention above Tarnobrzeg planned for implementation within II stage of works, not covered by the present Project,

    - planned construction of polders will also allow for reducing intervention into the inter-embankment area of Vistula on protected areas (Natura 2000 sites) – the variant assumes maintaining present state of the inter-embankment area, and if this proves to be impossible, increasing polder retention so that lower capacity of the inter-embankment area is compensated for

Therefore variant VI combines different forms of flood protection, allowing for adopting optimum model of protection for the area of Tarnobrzeg and Sandomierz.

The variant also included unification of height ordinates of flood embankments on Vistula tributaries in the analyses area. The variant was also supplemented with flood protection of the land side of the levee by construction or modernization of the pumping station together with accompanying structures.

Component 3.3 Passive and active protection of the Raba catchment

With the multi-criteria analysis for Component 3.3 Passive and active protection of the Rab catchment the benchmark adopted was a variant of "zero", ie. variant showing current status and allowing the identification of objects and people at risk of flooding, should the investments be absent.

The following alternative categories of technical activities were assumed:

• Construction of reservoirs,

• Construction of dry reservoirs,

• Construction of polders,

• Increasing flood reserves in the existing reservoirs,

• Modernization and construction of embankments

• Construction of relief channels,

• Relocation of levees,

• Reconstruction of the boulevards,

• Restoring the equilibrium conditions in the river bed with the exploration of natural retention and maintenance of the watercourse migration corridor.

Model of selecting the most advantageous variant for the entire catchment of Raba was based on the following assumptions:

1) The catchment was divided into smaller task units (e.g. catchments of tributaries), within which localization of particular categories of technical tasks were analysed, using a multi-criteria analysis methods. The following criteria were taken into consideration (Tab. 15).

Table 18. Criteria for multi-criterion analyses in the catchment of Raba

Group of criteria	Criterion no	Criterion
Flood criteria	1	Reduction of value of potential losses within the reach of 1%water [PLN]
	2	Reduction of risk for people within the reach of 1% water
	3	Reduction of culmination of the flood wave (reduction of flow in the cross-section of the estuary of a given catchment for Q1% flow]
Social criteria	4	Occupancy of land for the entire variant [ha]
	5	Number of resettlements associated with implementation of the variant
	6	Sum of protected public buildings of particular significance for Q0.2%

		water[number of objects]
Environmental criteria	7	Impact on protected areas (national parks, natural reserves, Natura 2000 sites) [grading in points]
	8	Threats for natural habitats and (if recognized) for protected species [grading in points]
	9	Impact on national and regional ecological corridors [grading in points]
	10	Impact on aims of water protection in the meaning of Water Framework Directive [grading in points]
Economic and implementation criteria	11	Capital expenditures [PLN]
	12	Average value of maintenance costs (calculated on the basis of a 100 years period) [PLN]
	13	Technical level of difficulty of implementation [grading in points]

2) The following types of variants were used in the analyses within particular task units:

- **„W0"** – variant presenting current state, lack of investments, reference level
- **„WI"** – variant including investments from existing plans and programs, compilation of all the hitherto investment ideas in the catchment;
- **„WIIA", „WIIB", „WIIC"** ….. – planning variants of the Investor, including those incorporating elements of "WI" variant.

3) Selection of particular variants was made on the basis of multi-criterion analysis using chosen research methods, e.g. comparative analysis (each criterion was ascribed significance, and then calculations were conducted in spreadsheets)

4) Results from particular task units were then referred to the level of the entire catchment of Raba, with division into the following variants:

- **„W0" variant** (existing flood protection),
- **„WP" variant** (including implementation of preferred variants selected during multi-criterion analyses for particular task units)
- **„WP+" variant** (including top rated tasks localized within particular task units, improved with selected retention tasks localized in Z02-Z18 catchments resulting from

intended reduction of risk in Z01 catchment and having additional positive impact on Vistula).

- **„WP++" variant** („WP+" variant additionally enriched with tasks reducing flood risk from the main watercourse - Raba, that could not be analysed previously, without taking into account real impact of all tasks in the entire catchment)

Because the number of combinations of comparable variants for particular task units at the level of the entire catchment of Raba would be very large, the selection was limited in the course of further consultations, in accordance with criterion presented in pt 4. Currently, SEIA for the investment Program in Raba catchment takes place. During the procedure preliminary variants were modified and their final scope will be approved after the SEIA procedure is completed.

Within the preferred option, the tasks were formulated, in which systematic modernization of the existing embankments, constructing new embankments, constructing dry reservoirs, and constructing polders were envisaged. The program of the preferred option was additionally strengthened through activities limiting the flood risk of the main stream by the modernization of the main principles of water use in the Doboszyce storage reservoir and by increasing the flood reserve for the improvement of flood protection in the river valley during the flood.

Component 3.4 Passive and active protection in the basin of the San

Schematic model of variants for the catchment of San is very similar to the model for the catchment of Raba. The catchment of San was also divided into task units, and selection of particular variants was made on the basis of multi-criterion analysis, using groups of criteria presented in the table 15.

11 ENVIRONMENTAL IMPACTS

Investments comprised by all three Components of the project represent different types of hydrotechnical investments associated with construction of new and improvement of existing flood protection systems in the area of upper Odra basin Kotlina Kłodzka (Component 1), middle and lower part of Odra basin (Component 2) and upper part of Vistula basin (Component 3).

Therefore, all the planned tasks are similar in terms of potential environmental impacts resulting from features of areas of implementation of the investments. All the investments will be situated within river valleys, and the implementation and impact zone will cover particular elements of the environment in the area – most often riverbeds and, to different extent, functionally or spatially associated areas.

Analysis of particular investments led to selecting the following types of tasks that will be implemented within particular investments constituting part of the Components:construction of dry detention basins (front dams, side dams, relief-overflow sections,

- renovation of retention reservoirs,
- changing the way of water management on the storage reservoir,
- construction of embankments/boulevards, modernization of embankments/boulevards,
- construction of polders,
- regulation and maintenance works in riverbeds and inter-embankment lands of natural and artificial parts of water or strongly changed parts of water and drainage ditches,
- modernization of pumping stations,
- reconstruction of bridges,
- dismantlement of structures,
- dismantlement and modification of colliding infrastructure elements (e.g. water supply system sections, sewage system sections, roads, etc.),
- construction and renovation of elements of sailing infrastructure (groins, stop and mooring bay and marking the sailing route,
- reconstruction and renovation of hydrotechnical structures (automatic gates, embankment sluice and culverts, weirs, water barrages).

Environmental impacts generated by particular types of tasks are similar as regards manner and mechanisms of impact within each Component.

However, depending on their scale and localization, they will be of different significance and likelihood of occurrence. Categories of significance and likelihood of occurrence are presented in tables 19 and 20.

Table 19. Impact assessment - Consequence

Significance	Addressed
Significant	Most severe, alternative will be proposed through environmental hazard risk management
Important	Severe, alternative/avoidance will be proposed through environmental hazard risk management
Moderate	Less severe, measures will be proposed to minimize impact
Little	Less severe, mitigation measures will be proposed
Present – insignificant	Less severe. Mitigation and enhancement measures will be prepared if possible
N/a	No impact, enhancement measures will be prepared if possible
Positive	Positive impact

Table 20. Impact assessment - Likelihood

Likelihood	Definition
Certain	The activity will occur under normal operating conditions.
Very likely	The activity is very likely to occur under normal operating condition.
Likely/possibile	The activity is likely to occur at some time under normal operating conditions.
Unlikely	The activity in unlikely to but may occur at some time under normal operating conditions.
Very unlikely	The activity is very unlikely to occur under normal operating conditions but may occur in exceptional circumstances.

On the basis of documentation available at the present stage of implementation of the project, framework environment impact assessment was conducted for specified tasks for each Component of the Project. Adequate measures minimizing and compensating for adverse impacts were proposed as well as manners of conducting environmental monitorin within each Components (data presented in Annexes 1-3 to the EAMF).

12 ANNEX

Annex 1. Genreric Mitigation and Monitoring Plan. COMPONENT 1 - PROTECTION AGAINST FLOOD OF LOWER AND MIDDLE ODRA

Annex 2. Genreric Mitigation and Monitoring Plan. COMPONENT 2 - FLOOD PROTECTION OF KŁODZKO VALLEY

Annex 3. Genreric Mitigation and Monitoring Plan. COMPONENT 3 - UPPER VISTULA RIVER

Annex 4. Administrative boundaries

- 01 - Kotlina Kłodzka - administrative boundaries
- 02 - Odra Środkowa - administrative boundaries
- 03 - Odra Dolna - 1 - administrative boundaries
- 04 - Odra Dolna - 2 - administrative boundaries
- 05 - Odra Dolna - 3 - administrative boundaries
- 06 - Upper Vistula – 1 - administrative boundaries
- 06 - Upper Vistula – 2 - administrative boundaries
- 06 - Upper Vistula – 3 - administrative boundaries
- 06 - Upper Vistula – 4 - administrative boundaries

Annex 5. Water Bodies

- 01 - Kotlina Kłodzka - water bodies
- 02 - Odra Środkowa - water bodies
- 03 - Odra Dolna - 1 - water bodies
- 04 - Odra Dolna - 2 - water bodies
- 05 - Odra Dolna - 3 - water bodies
- 06 - Upper Vistula – 1 - water bodies
- 06 - Upper Vistula – 2 - water bodies
- 06 - Upper Vistula – 3 - water bodies
- 06 - Upper Vistula – 4 - water bodies

Annex 6. Designated areas

01 - Kotlina Kłodzka - designated areas

02 - Odra Środkowa - designated areas

03 - Odra Dolna - 1 - designated areas

04 - Odra Dolna - 2 - designated areas

05 - Odra Dolna - 3 - designated areas

06 - Upper Vistula – 1 - designated areas

06 - Upper Vistula – 2 - designated areas

06 - Upper Vistula – 3 - designated areas

06 - Upper Vistula – 4 - designated areas

Annex 7. Odra-Vistula Flood Management Project – List of priority investments as of January 2015