

EXISTING AND PLANNED STRATEGIES AND ACTIONS CONNECTED WITH COASTAL PROTECTION IN ASPECT OF PREDICTED SEA LEVEL RISE

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Long term coastal protection strategy

In 2000 a new¹ Polish long term coastal protection strategy was developed, which was next approved in 2001 by the Minister responsible for maritime economy². Basing on this strategy, in 2003 the Polish parliament (Sejm) adopted the Act on the realisation of the long term programme of coastal protection.

The new strategy adopted, as one of the main drivers of future coastal dynamics and coastal risks, the predicted by IPCC changes in sea level and storminess. However, the IPCC sea level rise predictions were slightly modified, to take into account the specifics of the Baltic Sea and of the Polish coastline. In result, the following three sea level rise scenarios were considered:

optimistic	0.3 m in 100 years,
most probable	0.6 m in 100 years,
pessimistic	1.0 m in 100 years.

It was also assumed that wind speed from most dangerous to the coast directions may increase by about 10%, and that prevailing wind directions will change from the present SW to more westerly directions.

Analyses and calculations, carried out for the most probable scenario, show that, due to sea level rise and wave runup during significant storms, land below 2.5 m above present msl may be occasionally flooded. In low coastal areas, during long periods of high sea level, the groundwater table may reach +1.25 m above present msl. If nothing would be done (the “zero option”) 120 km² of land could be lost due to erosion, and 2200 km² could be occasionally flooded during storms. Of these areas over 20% is of unique European or national natural value, and over 7% is intensively urbanised and/or industrialised.

¹ The first Polish “Long term programme of coastal protection and maintenance of beaches” was developed in 1985.

² In Poland coastal protection is in the competence of the Minister responsible for maritime economy and of the Maritime Administration

For cliff coasts, an additional risk is connected with the predicted appearance of long dry spells with high temperatures and of periods with high precipitation. Due to deep drying, cracks and fissures may appear in the cliff body, which, by forming passageways for deep penetration of rain and melt waters, may strengthen landslide processes on the coastal cliffs.

It is evaluated that at present about 300,000 people live in the direct flooding, erosion and landslide risk area, and that additionally ca. 1.7 mln. people may be indirectly affected, since their jobs are dependent on the direct risk areas. It is expected that population and job availability in the coastal zone will grow quicker than in most of the country, and therefore these numbers will probably increase in the future.

Basing on these findings, on the evaluation of effectiveness and impacts of available coastal defence and protection measures, and, last but not least, on the present and future availability of funding, several basic directions of solving coastal risk problems are adopted in the Strategy:

- the position of the coastline, as it was in the year 2000, is to be maintained along indicated in the Strategy about 30% of the Polish coast, along the rest – controlled retreat,
- to every segment of the coast should be assigned a level of safety of hinterland from extreme storm events; general indications are given in the Strategy, detailed safety levels should be determined in local plans,
- development in the coastal zone should be controlled to avoid coastal squeeze and to ensure that the level of development in risk areas and levels of safety provided by the coastal protection system are consistent with each other,
- construction practice in the risk areas must take into account the impacts of climate change (sea level rise, storminess, flooding, groundwater levels, landslides); coastal protection and maritime structures must be either designed to the predicted sea levels or should allow easy and possibly cheap adaptation in the future;
- soft coastal defence measures are preferred, hard methods are to be used very carefully and only in locations where nothing else is possible,
- activities in the sea area cannot decrease the coastal safety.

The Strategy is risk management oriented, since it is thought that proper management in the hinterland, on the shore and in the foreshore significantly reduces not just the present and future cost of coastal defence, but even more importantly – the present and future cost of development.

The basic two decision parameters of the strategy are the level of safety of hinterland provided by the coastal defence system (natural or artificial) and the position of coastline. The level of safety is defined by the maximum return period (in years) of the extreme storm, to which the coastal system still remains resistant and is able to provide safety from flooding or erosion of the hinterland. Five safety classes are proposed: not more than 20, 50, 100, 200 and 500, depending on the economical and natural values located in the hinterland, and on the possible risk to environment resulting from flooding or damage due to erosion (e.g. a waste landfill located in the risk area will require class 500 safety). Of course, when calculating the safety, sea level rise must be taken into account.

The “coastline”, or rather “nominal coastline” is defined similarly as in Dutch law. On each cross-section of the shore, the area of the soil contained in the most active part of the profile (for the Polish open sea coast typically between +2 m and -8 m) is divided by the height of the active zone (for the open sea coast – 10 m). The result of the operation yields the position of the nominal coastline (see Fig. 1).

Legal basis

The Strategy provides a conceptual basis for various types of decision making in the coastal zone and technical coastal defence action. The legal basis for implementing the strategy has been gradually built up since many years. The most important regulations include:

- ***The Act “on Sea Areas of Poland and Maritime Administration” and the Order of the Board of Ministers “on the Width of the Technical and Protective Belt and Methods of Determining Their Boundaries”***: They establish the Coastal Belt, which consists of a Technical Belt and Protective Belt. The basic function of the Technical Belt is to ensure an appropriate level of safety of hinterland and proper state of environment. The width of the Technical Belt is from 10 m to 1 km, depending on the type of coastal defence system, type of hinterland and development. The Protective Belt is the area which may influence the state of the Technical Belt, and therefore development and uses in that area must be specially controlled to be consistent with state of the Technical Belt and provided by it safety. The width of the Protective Belt is from 100 m to 2 km, depending on type of hinterland. The maritime administration is made responsible for coastal protection and for spatial planning in the sea areas. By the Act on Sea Areas... and by the
- ***Act on Spatial Planning and Management*** all spatial plans, studies and other types of space use decisions concerning the Coastal Belt and ports must obtain agreement of

the territorially competent Director of Maritime Office, which therefore can, and does, put into the plans and decisions special requirements relating to land/sea interactions;

- **Construction Law:** All Construction Permits concerning the Coastal Belt, ports and the sea area must obtain agreement of the territorially competent Director of Maritime Office;
- **Water Law:** Defines the Coastal Belt as an area of direct flood risk, in which the Law imposes special restrictions on use, development and changes of surface. These restrictions may be released on special conditions by an administrative decision. In the Coastal Belt such a decision is issued by the territorially competent Director of Maritime Office. Water Use Permits concerning the Coastal Belt, ports and the sea areas must obtain agreement of the Director of Maritime Office.
- **Environmental Law and Nature Protection Law:** Protection Plans for designated areas in the Coastal Belt must obtain agreement of the Director of Maritime Office. Also Environmental Decisions for developments which can influence the marine Natura 2000 sites must obtain agreement of the Director. The Maritime Offices are also responsible for producing Protection Plans for the marine Natura 2000 areas.
- **Act on Establishment of the Programme “Long Term Programme of Coastal Protection”:** Makes the Maritime Administration responsible for the realisation of the Programme, i.e of the described shortly above Coastal Protection Strategy.

It clearly results that the maritime administration is responsible for introducing “sea issues”, in that sea-related climate change issues into the decision making system, especially into spatial planning, construction permits and release decisions.

Decision making

Practically all sea-action-related decisions are directly or indirectly connected with climate change effects. Below are briefly described the types of decisions/solutions introduced by the Maritime Office in Gdynia at various stages of the planning and permitting processes concerning the coastal belt and ports from the border with Russia to about 8 km east of Łeba.

Spatial plans and decisions on the conditions of development (issued when there is no local spatial development plan for a given area)

- Boundaries of Technical Belt, Protective Belt and ports and harbours since within these areas some special regulations become active. These boundaries mark also the areas of territorial competence of various authorities, in that of the Maritime Office.

- Level of safety of hinterland. The general principles and indicative values are given in the Strategy, but detailed values of this parameter are given especially in the studies of conditions and directions of spatial development of coastal communes/municipalities, which are indicative, and in the local spatial development plans, which are acts of local law. As earlier mentioned the level of safety influences the type and intensity of permissible development in the hinterland and also determines the basic parameters of the coastal protection system, including the space needed for it and for its maintenance.
- Reservation of space for short and medium term waterline and beach oscillations.
- Reservation of space for coastal protection measures, their future adaptation to sea level rise and additional space for their maintenance.
- Limitations on the use of beaches to ensure that the beach and foredune remain possibly “healthy” to be able to withstand at least the design storms. Typically no permanent structures are allowed on the beach, only seasonal structures (i.e. dismantled after 120 days) may be placed there, provided that the beach is sufficiently wide and high and that they are placed at least 5 m from the foredune. There are some exceptions in case of very wide, strongly accumulating beaches.
- Ban on any kind of use of the foredune except paths for pedestrians and special services. Occasionally indications on the minimum height of the crest of paths across the dunes and any additional measures to prevent flooding by storm surges.
- On cliffs - boundaries of direct risk of landslide and boundaries of safe investment related to the risk of landslides, also requirements concerning rain and melt water management.
- Boundaries of areas of direct risk of flooding.
- Statements on the level of storm surge flooding (typically +2.5 m, but this varies dependent on location due to differences in possible wind set up of coastal waters) and of possible groundwater rise (typically +1.25 m).
- Reservation of space for drainage systems, dykes, pumping stations which may be needed in the future as sea level rises.
- Where possible, location of new development outside risk areas, also outside areas which at present are not at risk but will become risk areas with the progress of climate change effects.
- Restrictions on uses increasing e.g. environmental risk in case of flooding or erosion,
- Minimum height of embankments,

- Requirements on the level of purifying rain and melt waters discharged into the sea areas (to ensure good water quality and *int.alia* improve vegetation in the sea and therefore reduce coastal erosion) – this requirement is then put into the Water Use Permits,
- Special requirements concerning crossing of the land/sea interface by cables, pipelines, etc. to ensure that they do not endanger the protection functions of the coastal system.

Decisions on releasing from restrictions in force in areas of direct flood risk

The decision is issued for specific investments located in areas of direct risk of flooding, i.e. in the Coastal Belt. If the release decision is positive, then special requirements are given to ensure that the investment is not vulnerable to flooding, and that it does not have a negative influence on the flood safety in the area. Typically, the requirements may include:

- minimum ground floor level,
- additional technical measures to protect against flooding by storm surges and groundwater,
- details of location of project/investment.

Construction permits

Among others, special attention is given to the following solutions in construction designs before issuing an agreement to a construction permit:

- height of coastal protection/ flood defences,
- height of embankments, hydrotechnic structures and reserve bearing strength of foundations to increase height of structures in the future,
- height of ground floor,
- special solutions to protect buildings against flooding in case of breakdown of flood protection system and against high groundwater levels,
- protection of rainwater and drainage systems against flooding during storm surges, etc.

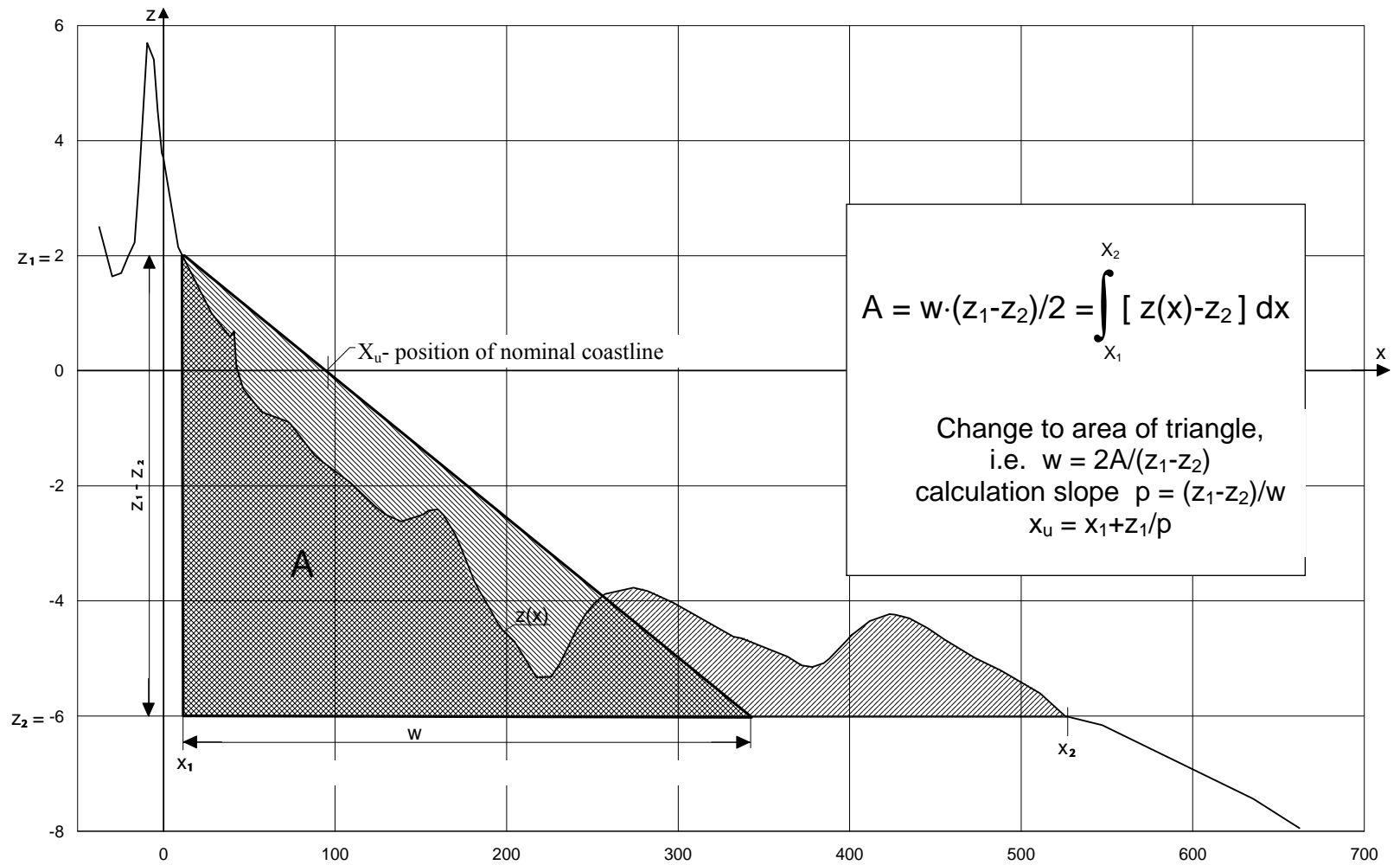


Fig. 1 Definition of nominal coastline.

