A TYPE OF PEATLAND RECULTIVATION: ESTABLISHING OF WATER RESERVOIRS

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This type of recultivation foresees the creation of artificial water bodies in the former peat extraction sites — to install water reservoirs for agricultural, fisheries, recreational or complex use.
It is the most appropriate type of restoration for the further use of such developed peat extraction sites in areas where the bog has been formed by a water body being overgrown. After peat extraction, the former peat extraction site is flooded with the purpose of utilizing this area for pond management, waterfowl living, biodiversity conservation and/or recreation. Over a longer period of time, if appropriate, management measures are not taken (reed, sedge mowing, etc.), it is expected that the water reservoir will overgrow with herbaceous plants characteristic to mires.

The purpose of the real estate's use — a land of water objects, land use — land under water.

Figure 1 **Water Reservoir in Seda mire (L.Kalniņa)**

Conditions under which this scenario is possible: The scenario is possible if the area is not in the airport protection zone

The type of top peat layer: not a determining criterion.
It should be considered that the type of peat that forms the surface of the area to be restored and the thickness of its layer is a partially limiting factor and should be dug away for the successful functioning of the water reservoir. If the remaining peat layer is raised bog type peat, it indicates that the bog has been formed by paludification of the mineral soil and therefore there will be insufficient groundwater supply required for a water reservoir. Precipitation water will not be enough to exist in the reservoir.

Thickness of the top peat layer: partially determining criterion, if the peatland before the flooding is overgrown, then the remaining peat layer is a partially limiting factor, as it will contribute to the faster overgrowth of the water reservoir, poorer water quality, which in turn will limit its use in water management. It is different, if the water reservoir is designed solely for the protection of waterfowl, then islands can be preserved or specially created for bird nesting.
If the peatland before the flooding is overgrown, the peat layer should be dug away, leaving as little peat as possible (maximum 0.1-0.15m) or dug until the mineral soil, as the remaining peat layer can rise to the surface.

pH values of the top peat layer: not a decisive criterion

Average groundwater level: it is desirable to have the highest possible level of water (groundwater + surface), which would ensure a stable level in the water body.

Average number of days in a year when the area is flooded: all year

Degree of decomposition of the peat: - well-decomposed fen type peat that does not float.

Composition of the sediment forming the mire base of the area to be restored: restrictive criterion
- Medium and well permeable (sand, clay sand) – this scenario is problematic or impossible if the bottom is made up of water-permeable sediments and does not infiltrate into groundwater.
- Low permeability (fine aleirite, clay, sandstone) - is not a limiting criterion. Scenario implementation is possible.
- Airtight (clay, dolomite, limestone, marl) is not a restrictive criterion. Scenario implementation is possible.

Hydrological and hydrogeological conditions of the territory:
- Feeding from precipitation (not possible because it does not ensure overflow of the territory all year).
- Groundwater inflow into intervertebral hollows (possible).
- Bordering with a watercourse whose annual average water level exceeds the height of the surface of the area to be restored (is possible).

The hydrological and hydrogeological conditions of the area to be restored (the type of water supply to the territory) are also an essential precondition. Hydrological conditions are not suitable for the implementation of the chosen restoration scenario if the main feeding method of the territory is only precipitation.

A pond or pond system is an artificial water body that is classified as a hydrotechnical building according to the normative regulations. When installing a pond, the Cabinet regulations on drainage systems and construction of hydrotechnical structures must be observed. This means that prior to the implementation of the activity, in accordance with the requirements of regulatory enactments, it is necessary to develop a construction plan that regulates the design and construction of drainage systems and hydrotechnical structures.
Water reservoirs are a suitable form of restoration in areas where the peat layer has been developed up to the mineral soil, then the water will be characterized by a higher degree of mineralization, normal or alkaline pH and other chemical parameters.

It is necessary to perform hydrotechnical calculations on the amount of water entering and its evaporation rate in order to find out in what part of the restored area it is possible to implement the planned restoration scenario, how deep the reservoir will be and whether the water will cover the flooded area all year round.

Table 1 **Conditions under which the recultivation scenario is possible**

The type of the top peat layer	Not a determining criterion
Thickness of the remaining peat layer	0.1-0.15m
pH values of the top peat layer used	Not a determining criterion
Average groundwater level	Highest possible level of water (groundwater + surface)
Number of days per year when the area is flooded (days per year)	All year
Degree of peat decomposition	Well decomposed fen type peat
Peat deposits coverage with stumps	Not a determining criterion

In peat extraction sites, where the establishment of reservoirs is planned as a type of recultivation, the development of peat deposit is planned to be carried out as close as possible to the mineral soil. If there is sapropel under the peat, remove the peat until the sapropel sediment and do not carry out loosening or ploughing.

If the area to be restored is to be used for nature conservation measures, mainly as a habitat for waterfowl, the reservoir does not have to be deep and there are no special requirements for water quality. Similarly, if the complete extraction of the remaining peat layer is economically unprofitable or impossible, area flooding measures may be carried out on the remaining peat layer. By implementing such a scenario, the bed of the water body will contain sediments rich in organic substances, which will promote overgrowth of the water reservoir, and possibly a bog in the future.

Figure 4 **Water Reservoir in peatland, Netherlands (L.Kalniņa)**

GHG emissions

The impact on GHG emissions calculations assumes that the reservoir has been formed in an area where a sufficiently thick layer of transitional or fen type peat has left and GHG emissions correspond to the average values in the recultivated area. As an alternative scenario, the preservation of the existing state in the peat extraction field is evaluated. The impact on GHG emissions has been assessed for a 30-year period following the implementation of the scenario. Following the implementation of the scenario, GHG emissions will increase by 7.4 tonnes CO_2 eq. ha^{-1} per year compared to the initial situation. Total GHG emissions in this scenario over the calculation period correspond to 13.6 tonnes of CO_2 eq. ha^{-1} per year.

Signs indicating that a restoration scenario has been implemented

- The requirements and technical solutions included in the extraction project for mineral resources or the restoration plan have been implemented in the territory or its part and those are related to the restoration of a peat extraction site have been fulfilled;
- The area to be restored, or part of it, is fully covered by water throughout the year, reaching the foreseen level;

By performing the above-mentioned work, the peat extractor has installed a water reservoir, and for this reason has performed the tasks foreseen in the extraction project of mineral resources: to prepare the territory for restoration. Further actions must be taken by the landowner.

Economic use - The area is well-kept, its rational economic use continues, while providing recreation and socio-economic aspects.

Biodiversity - Biodiversity is being developed in a previously exploited area. The area provides a home for bird species, a resting place for migratory waterfowl, and a variety of other species. The area is attractive for recreation, it is managed. Depending on the depth of the water, its chemical composition and other factors, the mire's ecosystem will be restored over a longer period of time.

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