

DESCRIPTION OF SITES

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Project name and acronym:	IMPROVE LIFE - Improving connectivity, hydrology, habitats and resilience in aquatic ecosystems
Name of the project area: <i>The name must be used consistently on all maps and Part B</i>	Likan
Surface area (ha): <i>Indicate the total surface of the project area in hectares, rounded to two decimals</i>	28.30 (122,8 km ²)
EU protection status (if applicable)	SCI SE0610207
	SAC
	SPA
Other protection status according to national or regional legislation (if applicable):	Natura 2000 protection status (Ch 7, §27-29, SEC). National interest for nature conservation (Swedish Environmental Code, Ch 3, § 6, SEC). National legislation of the riparian zone (Swedish Environmental Code Ch 7, §13-18, SEC). National legislation of Water Protection Area (Likenäs NVR-id 2003920) (Ch 7, §21). Water Framework Directive (2000/60/EC). Habitats Directive (Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora). Additional applicable National legislation according to The Swedish Environmental Code Ch 3, 5-7, 11, 26. Regulation of fish stocking (HVMFS 2021:7). Regulation of fisheries (FIFS 2004:37). Protected as nature reserve (1,6 %) (Swedish Environmental Code, Ch 7, § 4, SEC).
Main land uses and ownership status of the project area <i>Indicate what are, at the project application date, the main uses made of the project site (e.g. farming, tourism, urban, nature conservation, etc.). Indicate the approximate percentages (in %) of the various uses, ensuring that the total reaches 100%. Indicate also the ownership status / types of the area at the project application date (e.g. private, state, etc.) and the approximate percentages (in %) of the different ownership status / types, ensuring that the total reaches 100%.</i>	
Land use status (%): Forest (), Water () and Wetland ().	
Ownership status (%):	
Importance of the project area for biodiversity and/or for the conservation of the species /habitat types targeted at regional, national and EU level (give quantitative information if possible) <i>Justify why you have selected this particular area for your project. Explain why your choice is the most appropriate to reach the project's objectives.</i>	
<p>The river Likan project area is situated in the northern part of Värmland. The river is emptying its water into River Klarälven (Natura 2000 site, SE0610169).</p> <p>The project area consists of two watercourses R. Likan and R. Tvärlikan, which has a total length of 29 km, and holds a total catchment area of 122,8 km². Because of the great difference in altitude, 360 metres, the river has several streams and rapids. The two water courses hold the Natura 2000 status and I dominated by the Natura 2000 habitat type "water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation" (Natura 2000 code 3260).</p>	

The project area constitutes habitat for valuable benthic invertebrate taxa, such as *Ameletus inopinatus*, *Ephemerella aurivillii*, *Diura nansenii*, *Siphonoperla burmeisteri* and species sensitive to acidification, such as *Lype phaeopa* and *Ephemerella mucronate*. Moreover, 8 fish species are known to inhabit the river, such as Trout (*Salmo trutta*), Burbot (*Lota lota*), Grayling (*Thymallus thymallus*), Minnow (*Phoxinus phoxinus*) and the unique, endemic, and landlocked Klarälven Atlantic salmon (*Salmo salar*), which is prioritized in the HD and in the management plan of the downstream situated Klarälven Natura 2000 site. The Atlantic salmon is however and presently incorrectly not designated in the management plan for R. Likan, despite its inflow in to the Klarälven Natura 2000 site. R. Likans management plan will therefore be reviewed during 2023-2024.

Adjacent to the river of Likan with inflow there are two Strict Nature Reserves, Digerberget (NVR-id 2041633) and Sågbäcken (NVR-id 2032829). These are situated in the upper part of the river system and consists mainly of older coniferous mixed forest with elements of old pine and dead wood, with a variety of red-listed lichens, such as *Bryoria nadvornikiana*, *Bryoria bicolor* and *Phellinidium ferrugineofuscum*. The lower part of the river system constitutes national and regional interest in cultural environment, such as a variety of ancient monuments.

Most of the soil type in the R. Likans catchment area has a poor buffering capacity against acid substances, which makes the rivers susceptible to acid shock. The waters are thus failing to achieve good chemical status (classification according to the Water Framework Directive, WFD). To prevent acidification, the County Administrative Board of Värmland conducts extensive liming in the water system each year, through both wetlands, lime dispensers and lakes.

A large proportion of the catchment area consists of wetlands of which many are heavily affected by ditches. The widespread drainage of wetlands and the straightening of watercourses through these types of biotopes has resulted in disconnected links between water and land, which in turn has affected the wetlands' retention of water, filtering sediments, nutrients, and other substances. This in turn leads to for example high color of incoming water and increased risk for low flows during dry periods and on the contrary high flows during wet periods. Hence, besides to decrease CO₂-emissions, measures to increase the wetlands' retention of water and to recover previous water regimes are important for improving both the hydrological and indirectly also the ecological status of R. Fämtan. The rewetting of wetlands will also be directly beneficial for the biodiversity in target areas. Today, around 600 species (plants, fungi, insects, amphibians, and birds) that depend on wetlands are red listed in Sweden and another nearly 300 species that use the wetlands are on the list. Among birds that breed in the R. Likan catchment are the fish-eating species Red-throated Diver (A001), Black-throated Diver (A002) and ospreys (A094). The restoration measures in watercourses and adjacent wetlands also benefit otters (1355) through expected increased prey base of fish, crustaceans, amphibians, and larger aquatic insects. The rewetting measures will create more suitable habitat for the Hazel Grouse (A104), Black Grouse (A409) and Western Capercaillie (A108). Humid environments with a rich field layer, where there is an adequate abundance of insects, are of great importance for their hens and chickens. Wood Sandpiper (A166), European Golden Plover (A140) and Crane (A127) nest in wetlands in forest and marsh mosaics next to R. Likan. Rewetting of damaged marshland increases the area of suitable habitat for the species by more than 130 hectares. At the same time, overgrowth is slowed down. The habitat of the Three-toed Woodpecker (A241) at Likan includes natural coniferous forest and various types of swamp forests. Rewetting of damaged bog and forest land creates more dead wood in the area in the short term, while the proportion of deciduous trees increases. The positive effects on both hydrology, ecosystems and biodiversity will be achieved by an extensive plugging of excavated trenches (so-called trench plugging) strategical wetland-areas (130 ha), together with mud-traps in the riparian zone to prevent episodic disposal of fine particulate matter into the R. Likan.

Additionally, more than 10 ha of stream area within the project area is significantly affected by the clearing of larger structures such as stones, blocks and dead wood that preceded the extensive log driving – era during the mid-2000th century. This has resulted in both a lack of heterogeneity, reduced habitat-area, and quality for especially the endangered Atlantic salmon population and trout, reduced connectivity both longitudinally and with floodplains, as well as reduced water retention. During the logging-period, several smaller dams with associated water reservoirs were also constructed to facilitate effective log-driving downstream. These dams are now obsolete but still and severely affect the longitudinal connectivity. Comprehensive habitat restoration by returning substrate like stones and boulders back to the water and the removal of obsolete dams are therefore important tasks for the project.

As forestry is a widespread trade within the project area several roads for log-trucks have been constructed during the past 100 years. As these roads often passes over larger and smaller streams road-culverts are very common.

Unfortunately, many of the culverts are not designed properly to achieve longitudinal connectivity for the stream inhabitants. A major commission for the project is therefore to adjust or replace these culverts to facilitate free migration, mainly for fish.

About 25 years ago, a fish passage was constructed in the lower part of R. Likan. The aim was to allow the upstream passage of both salmon and trout, who migrates from Lake Vänern and through R. Klarälven each year, and by this drastically increase the habitat area for these species in R. Likan. The old fish passage has however now played its role and therefore one suggested action is to build a new and robust passage.

Altogether, the impact of numerous anthropological activities has had a severe and negative effect on the Likan Natura 2000-site and its designated species. Therefore, in this project there must be a combined approach of habitat restoration in streams and rivers, hydrological restoration of wetlands by plugging ditches, and improvement of longitudinal connectivity (dam removal, replace faulty road culverts and construction of fish passage). These mitigations will substantially augment the hydrological regime, habitat quality, migration, and biodiversity in the project area. Hence, this will enhance habitat conditions and production of fish and thereby improve the conservation status of the Natura 2000-site and its main target species, such as Atlantic salmon and secondary target species, such as Trout and Grayling. In addition, freshwater pearl mussel (*Margaritifera margaritifera*), which is prioritized in the HD, has not been inventoried in the area before, and will therefore be conducted within the project. If freshwater pearl mussels are found, morphological rehabilitation needs to be designed in accordance with this fact. Finally, liming activities in the catchment area will be adapted so that no biota is negatively affected by acidification.

An action plan for morphological river restoration together with measures for improved connectivity by removing migration barriers has recently been developed for R. Likan by the Klarälven Water Council (Klarälvens vattenråd). This plan will serve as an important basis for upcoming and more detailed descriptions of needed measures, and for application of necessary licenses and permits.

The conservation status of the site will be improved by the following actions:

Work package 2 Preparing concrete restoration and conservation actions

Task 2.2 Permit and licences

Work package 3 Restoring connectivity

Task 3.1 Dismantling or bypasses at obsolete dams

Task 3.2 Removing migration barriers at road culverts

Work package 4 Habitat restoration

Task 4.1 Habitat restoration in rivers

Work package 5 Restore hydrological regime

Task 5.2 Restoration of mires by plugging or filling ditches