

A long-exposure photograph of a small waterfall cascading over mossy rocks in a forest stream. The water is blurred, creating a sense of motion and tranquility. The rocks are dark and covered in vibrant green moss. The background shows more rocks and some dry grasses, suggesting a natural, wooded environment.

Actions for better water

Layman's Report: Lessons learned and results from LIFE IP Rich Waters 2017–2024

LIFE IP Rich Waters

Project name:	LIFE IP Rich Waters (LIFE15 IPE/SE/015)
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Partner organisations:	The county administrative boards of Stockholm, Södermanland, Uppsala, Örebro, Dalarna, Norrbotten, Västernorrland, Kalmar, and Västra Götaland counties, the Swedish Agency for Marine and Water Management, the Swedish Board of Agriculture, the Federation of Swedish Farmers, the Swedish University of Agricultural Sciences, IVL Swedish Environmental Research Institute, the Hjälmarén Water Conservation Association, the Lake Mälaren Water Conservation Association, the Nyköping Rivers Water Conservation Association, Uppsala Municipality, Heby Municipality, Katrineholm Municipality, the City of Stockholm, Enköping Municipality, Upplands Väsby Municipality, the City of Västerås, Älvkarleby Municipality, Örebro Municipality, Östhammar Municipality, Sollentuna Municipality, WBAB Wessman Barken Vatten & Återvinning AB, Mälarenergi AB, Mälarenergi Vatten-kraft AB, Bioremed AB, Ecopelag non-profit association, Julmyra Horse Center AB.

Layman's Report– Lessons learned and Results 2017-2024

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Aiming for better water

There is something special about water. Especially water in motion. It's fascinating, soothing. Almost magical. We can watch flowing water and waves for a long time, in much the same way as we would gaze up at fluffy clouds or stare pensively into a crackling fire. There's something about moving water that makes you feel a bit more like a part of the world. It's "slow TV" without the TV.

I grew up around water. As a kid, the big challenge every summer was to skip across the rocks protruding from a small river in northeastern Skåne, all the way from the sawmill up to the lake, without getting wet. And the highlight of the summer was fishing, in the same river; we'd caught countless crayfish by the time we went back to school. My summers now are much the same. I still spend a lot of time fishing, both at home in Möckeln and out at sea. But the most sacred thing remains my annual fishing week in the mountains with my son, a tradition that has marked the conclusion of my summer holidays for the past 20 years.

Things happen both in and to our waters. The crayfish and trout disappeared from the river due to acidification, but the roach was saved through an early liming effort. The pike, once a common catch at our lakeside holiday home, has increasingly been replaced by zander and even some wels catfish, a fish that was previously considered more or less extinct. From my office at the County Administrative Board, I have a view of Lake Mälaren. It provides drinking water for almost 2 million people, but it is also affected by both environmental toxins and eutrophication.

We affect water in many different ways, sometimes with devastating consequences. Water is sensitive and needs to be handled with care and conservation.

The Lake Mälaren Water Conservation Association saw early on that it would be necessary to pick up the pace of water improvement efforts. In 2013, to speed up remediation work, the association started the project Mälaren – A Lake for Millions in 2013. Out of that project, the idea of applying for funding from the EU for a large project focusing on water and the environment was born. The LIFE environmental programme had just launched a new project form, integrated projects. An integrated project is large-scale and based on a regional or national plan or strategy. It should also lead to the creation of new projects. In this way, more resources are mobilised for environmental work.

In a joint effort, the Mälaren Water Conservation Association and the Water Authority of the North Baltic Sea Water District pushed through an application, which was granted EU funding in late 2016. And in 2017, the LIFE IP Rich Waters project finally kicked off.

The aim was to involve key actors important in accelerating the pace of action, at national, regional, municipal and local levels. The wish list was long; the new project aimed to include authorities, municipalities, county administrative boards, companies, research actors, and water conservation associations. And that's exactly what has been accomplished! With its 35 partner organisations, Rich Waters is one of the most extensive projects in the water field that I have ever come across. Today, we know that this broad and powerful partnership is the most important and biggest reasons for the successful results that have come out of the project.

The project has addressed five main thematic areas: restoring connectivity, reducing environmental pollutants, reducing eutrophication from agriculture, waste water and stormwater, eutrophication from internal loading, and improving water planning. From the beginning, it was clear that many of the issues were closely connected, and over the years there has been a natural exchange of ideas between those working to address them. Through it all, the collaborators shared a single aim: better water. The project's long span of seven years has created an opportunity for flexibility that I believe has been important. The ability to change focus and direction and remain flexible has yielded good results.

I am both impressed and proud of everything that the project has achieved. Measurements and source tracking of environmental toxins such as PFAS, water conservation planning on horse farms, support for municipalities in their water planning, several water parks and fauna passages, new methods against internal eutrophication... the list of accomplishments truly goes on and on. In this book, we present a selection of all the great results.

Happy reading!


Västerås May 2024



Johan Sterte

County Governor of Västmanland, Chairman of the Water Delegation of the North Baltic Sea Water District.





EU Water Framework Directive to protect our waters

Access to clean drinking water and healthy, viable lakes and waterways is a necessary condition for people, animals and plants to be able to survive and thrive. Our waters are an indispensable resource and a font of utility, pleasure and recreation. In Sweden, we take our water for granted. At the same time, many Swedish waters are eutrophicated and polluted by environmental toxins. Dams and power plants prevent fish from migrating to their spawning grounds, and the environment around rivers and streams is becoming depleted.

In 2000, the EU adopted the so-called Water Framework Directive. Under the directive, all Member States must use the same regulations to improve and protect their waters. Sweden is no exception; we are obliged to comply with the requirements of the Water Framework Directive.

But what does having “better water” mean? How do we know if the water is good enough? To assess the quality of our waters and evaluate how it changes over time, Sweden has set environmental quality standards for lakes, waterways, bays and ground-water. Lakes, rivers and coastal waters – “water bodies” – are assessed on the basis of ecological, chemical, and quantitative status.

Many aquatic environments in Sweden have major problems, the causes of which include eutrophication, physical changes, and environmental toxins. Even if action is taken to improve these environments, it may take a long time before we see the effects. Sweden’s five regional water authorities produce the action plans that describe what needs to be done to achieve our goals – and who is responsible.

LIFE IP Rich Waters has been a way to increase the pace of water improvement efforts.

Water is not a commercial product like any other but, rather, a heritage which must be protected, defended and treated as such.”

From the EU Water Framework Directive

Lake Mälaren – more than just a lake

Lake Mälaren is Sweden's third largest lake. It provides about 2 million people with drinking water. The water in the lake comes from large rivers such as Arbogaån, Hedströmmen and Kolbäcksån, as well as from a number of smaller waterways. Lake Mälaren is the heart of the North Baltic Sea Water District. The district is Sweden's most populous and extends across six counties and 74 municipalities. The catchment area also includes Lake Hjälmaren and a number of smaller lakes.

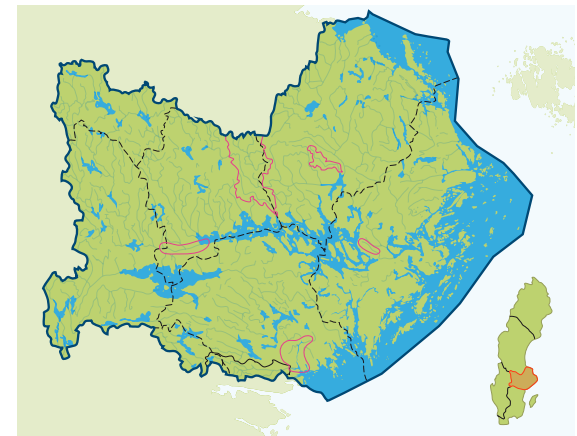
The nature in and around Lake Mälaren is of unique value. The area is home to a richly diverse array of species and offers excellent opportunities for swimming and fishing. At the same time, the lake receives emissions from cities, industries and businesses, and its beaches are exploited. The waters of Lake Mälaren flow downstream to Stockholm, where they eventually reach the Baltic Sea. The water in the sea is thus affected by pollution originating far from Sweden's coastal areas.

Many challenges affect the district's water.

- Climate change is changing the patterns of precipitation and flows. In a warmer climate, sea levels rise. In the long term, Lake Mälaren will be affected and the risk of flooding in the area will increase.

- Eutrophication is caused by nutrient discharges from, e.g. individual sewers, agriculture, and urban areas. This leads to overgrown lakes and streams, poorer water quality, and algal blooms.
- Obstacles to migration mean that fish and other aquatic animals cannot get upstream to seek food, nor reach the spawning areas in many waterways.
- Environmental toxins from previous and ongoing activities and diffuse emissions end up in the aquatic environment, harming both animals and humans.

As the authors of the Swedish Water Agency's Water Management Plan for 2022–2027 note, it is feared that nearly seven out of ten bodies of water in the country (lakes, streams, and coastal waters) will fail to meet the EU Water Framework Directive's quality requirement of good ecological status.



North Baltic Sea Water District

Sweden is divided into five water districts. The North Baltic Sea Water District is an area of 44,200 square kilometres. The district is Sweden's most populated, with 3.6 million people living here, 93 percent of whom live in urban areas. The district, which stretches over six counties and 74 municipalities, has 1,327 lakes, streams and coastal waters. The estimated value of improved water quality in surface water is SEK 145 billion.

Source: The Water Authority of the North Baltic Sea Water District





Mälaren Energi

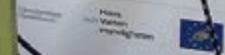
Mälaren Energi



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LIFE IP Rich Waters – speeding up the remediation work

LIFE IP Rich Waters is Sweden’s first integrated project (IP) within the EU’s LIFE environmental programme. The project was launched in January 2017 and has since tackled some of the most serious environmental problems related to water in Sweden.

The initiative came from the Lake Mälaren Water Conservation Association and the Water Authority of the North Baltic Sea Water District. They realised that efforts to meet the requirements of the EU Water Framework Directive were moving too slowly and that important prerequisites for speeding up the remediation work were lacking. Rich Waters was created to increase knowledge about cost-effective measures, develop new methods and better data for prioritisation, and to create inspiring examples and pilot projects.

The overall goal has been to achieve and maintain good water status in all waters in the district, in accordance with the EU’s environmental objectives set out in the Water Framework Directive.

What we talk about when we talk about measures

To improve our water, we must take action. But in water management, taking action can mean different things. Sweden’s authorities and municipalities need to implement important administrative measures, such as amending regulations or prioritising a certain type of supervision or advice in their operations. These administrative measures are needed so that the physical “shovel-in-the-hill” actions can be carried out in the right place in the environment. Concrete actions, such as restoring a wetland, lead to an improvement in water quality.

Within LIFE IP Rich Waters, we have taken action on both fronts.

LIFE – The EU’s environmental fund

LIFE co-funds projects aimed at implementing European environmental and climate legislation. The focus is on the transition to a sustainable circular and energy-efficient economy, but funding is also provided to efforts to protect and improve the environment, health and biodiversity.

Integrated projects (IP) are larger in scope than traditional LIFE projects and apply a holistic approach to a national or regional plan or strategy. It is the European Commission that assesses and decides on LIFE grants.

A total of around 70 integrated LIFE projects have been approved, two of which are based in Sweden: LIFE IP Rich Waters and Grip on LIFE IP.





Strategies for better water

LIFE IP Rich Waters has addressed the biggest environmental problems for water in the North Baltic Sea Water District: eutrophication, migration barriers for fish, and environmental toxins. The overall approach has been to improve the implementation of administrative measures and to provide concrete examples of physical measures, as inspiration and good examples – to energise such efforts and boost the remediation work as a whole.

Geographical spread

The project has been implemented throughout the water district, with concrete measures spread across all counties. The broad geographical spread has meant that we have included both cities and rural areas, large and small municipalities, authorities and local actors. The sub-projects of LIFE IP Rich Waters show how remediation work can be carried out in different types of catchment areas and in municipalities with widely differing conditions.

Thematic collaborations

The 20 sub-projects were divided into five different thematic areas: improving water management, reducing eutrophication from agriculture, waste water and stormwater, eutrophication from internal loading, restoring connectivity, and reducing environmental pollutants. This has enabled close exchange between the partner organisations within each theme, fostered synergy, and increased the opportunity for new collaborations and projects.

New methods, collective knowledge

Smarter, innovative methods, increased capacity, common approaches and new, cost-effective solutions. LIFE IP Rich Waters has carried out a wide range of activities that together can enhance and improve remediation work. The sub-projects were designed to integrate different levels of societal actors and various types of expertise. This has enabled the project to address broader environmental issues and climate adaptation.

Informative examples

By implementing concrete actions in the environment, we have gained a number of good and informative examples that can inspire more efforts. All actions within the project have been carefully documented, to make it easier for others to carry out similar projects. How did the process work? What competencies are required? What does it cost? What permits are required? How can the results be evaluated?

Together, we make a difference

We all have a responsibility to protect and improve our aquatic environments. LIFE IP Rich Waters has brought together organisations whose various roles and mandates make them important actors in achieving the goals of the Water Framework Directive. Within the context of the project, 35 national authorities, county administrative boards, municipalities, companies, universities, research institutes, and water conservation associations have jointly contributed new knowledge and improved methods. Our partner organisations have carried out a number of concrete projects to test new technologies, develop new tools, and demonstrate how water improvement measures can be implemented in practice. Through national authorities such as the Swedish Agency for Marine and Water Management and the Swedish Board of Agriculture, our results have been disseminated throughout the country.

The breadth of the partnership has been one of the project's strengths. It has given grassroots actors to chance to sit at the same table as national decision-makers and discuss needs and funding issues. Researchers have teamed up with landowners to test tools in the field. The employees of county administrative boards and municipalities have created meeting places for dialogue and consensus across departmental boundaries. Water strategists and en-

vironmental officers have come to understand how important it is to have a "water buddy" in their often lonely work. Someone to whom they can turn for advice, inspiration, and concrete collaboration. Thanks to LIFE IP Rich Waters, many more people have had the opportunity to find their "water buddy".

Regular meetings have sparked synergies. The sub-projects have benefited from each other and sometimes this has led to new collaborations.

Over the past seven years, about 150 people have been involved in the project. In addition to the project management team at the County Administrative Board of Västmanland, each partner organisation has contributed project managers, experts, financial officers, and communicators. A steering group with representatives from the Swedish Water Agency, the Swedish Agency for Marine and Water Management, the Swedish Board of Agriculture, the Swedish University of Agricultural Sciences (SLU), the county administrative boards of Stockholm and Örebro, Mälarenergi, Uppsala Vatten, the Lake Mälaren Water Conservation Association, and the Nyköping Rivers Water Conservation Association has followed the project's implementation and supported the project management team in its strategic decision-making.

"The biggest lesson is that many small projects yield big results on the whole."

"The only way forward is through cooperation. This will be important in the future to increase the pace of action in the water management."

"I bring with me the importance of working with meeting places, networks and a long-term perspective to build collaborations and move forward in the work. Human relations should not be underestimated. Also to be able to put up with uncertainty in a large project like this, to be able to be flexible and adapt to what works best."





The overall objective: Good water status in the North Baltic Sea Water District

The work of Rich Waters has pursued five specific goals. Here are some examples of results in the different goal areas.

1. Mobilise capacity and resources to implement concrete actions

Physical actions: Within the context of the project, we have built water parks and fauna passages, developed technology for mussel farming and the purification of environmental toxins using willow, and restored eutrophicated lakes through aluminium treatment and low-flow dredging technology. Through detailed documentation of processes, follow-up of the results, and the dissemination of good examples, we have made it easier for others to apply for funding and implement similar initiatives. We also know more about the positive effects that actions to improve water can have on ecosystem services, climate adaptation, and the local economy.

Policy instruments: LIFE IP Rich Waters has contributed to the policy measures in the Action Plan for the North Baltic Sea Water District, thereby contributing to better Swedish compliance with the Water Framework Directive. Our evaluation shows that together, sub-projects have contributed to the implementation of 26 of the 76 policy measures in the Action Plan. These are measures for which central authorities, county administrative boards and municipalities are responsible.

Complementary actions: An important part of the EU's integrated LIFE project is to mobilise more resources for environmental work. By the end of 2023, LIFE IP Rich Waters had helped mobilise over €90,000,000 in so-called complementary actions – projects that are somehow tied to or have benefited from our work. The complementary actions that are a direct result of Rich Waters have together contributed to a load reduction of an estimated 2,780 kilogrammes of phosphorus and 1,090 kilogrammes of nitrogen per year, and have opened up 3.6 kilometres of free migration routes for fish in the district's waterways.

Capacity development: The project has led to increased capacity and knowledge among many of those whose daily work involves improving Sweden's waters. Over the years, more than 150 people have directly contributed to the work of LIFE IP Rich Waters. Many hundreds more have participated in our training courses, seminars, conferences, study visits, and other events.

2. Increase common knowledge among all target groups, in order to improve the efficiency of the implementation of the water districts' management plans

Several sub-projects have worked to develop methods that can be used to plan measures, assess which ones are most cost-effective, and develop tools to ensure that the right action is implemented in the right place – where it is most beneficial. Within the context of efforts to remediate environmental toxins, the project has contributed several major studies of Lake Mälaren and other lakes. As a result of these studies, we now have better knowledge of the substances found in sediments, water and fish and can trace the sources of pollution. When it comes to eutrophication from so-called “internal loading”, we have developed a completely new tool during the course of the project, by which to assess whether a measure is necessary and, if so, which one is most appropriate.

The project has placed great emphasis on compiling and disseminating the knowledge that it has produced, both within Sweden and to other countries in Europe. To this end, we have not only published reports and articles about our work, but also arranged a large number of seminars, webinars, conferences and study visits. The events have also created opportunities for establishing new contacts and networks.

3. Stimulate and inspire more efforts through showcase measures and high-impact actions

The project has contributed a number of physical measures of different types and scopes. What these projects have in common is that they have had a major impact and can serve as instructive examples for others. Some projects, such as the fauna passage established in central Västerås by the City of Västerås and Mälaren-ergi, or the multifunctional water parks in Västerås, Uppsala and Smedjebacken, have been well-visited by both members of the public and employees of municipalities and other relevant organisations. In other cases, new methods to reduce the nutrient load in lakes and coastal waters have been developed.



Showcase measures:

- 1 stormwater pond in an urban environment
- 3 multifunctional water parks to purify water, increase biodiversity, and create recreational opportunities
- 2 lake restorations using different techniques (aluminium treatment and low-flow dredging)
- 1 mussel farming pilot project aimed at reducing phosphorus loads in coastal waters
- 1 pilot project involving willow cultivation to clean up a contaminated area
- 2 fauna passages in urban environments
- 2 fauna passages for hydropower adaptation
- 1 Boat bottom wash
- 1 exhibition environment on a horse farm for actions against eutrophication
- 1 demonstration loop for agricultural actions

4. Reduce nutrient loads, environmental pollution, and migration barriers

Naturally, the work of LIFE IP Rich Water has had direct environmental effects, among them reduced loads of nutrients and environmental pollutants in the water and greater opportunities to create and preserve biodiversity and free migration routes for fish. But at the same time, many of the measures and initiatives undertaken as part of the project are of a long-term nature, and it will be some time before we see their full impact on the environment.

5. Increase cost-effectiveness by improving the capacity of new technologies and innovative solutions

Sometimes we need to develop new, innovative solutions to solve environmental problems. This work is often difficult to achieve as part of regular operations, such as those of a municipality. The type of project and funding from the EU have made it possible to test new actions and develop established technologies. Within the context of LIFE IP Rich Waters, we have been able to implement and evaluate techniques for mussel farming in coastal waters, low-flow dredging to return nutrient-rich sediments to land, and fast-growing willow plants as a way to remediate contaminated soil.

In another example, the Swedish University of Agricultural Sciences (SLU) has been able to test and evaluate the use of sensors to obtain high-frequency data, in order to gain better knowledge of how water quality is affected by different flows.







The value of investing in water

Actions to improve the aquatic environment can have positive effects for society as a whole. When LIFE IP Rich Waters asked a consultant to analyse the social and economic impact of the project, it became clear that the project's water improvement measures had many benefits.

- Increased employment: many measures are done by entrepreneurs and can stimulate the local labour market.
- Well-being and health: better aquatic environments have a direct effect on our well-being. Considering accessibility and user-friendliness in the design of measures can benefit outdoor and recreational values.
- Industry development: Investing in innovation and new technology, can boost the development of various industries and lead to new similar projects.
- Investments in the aquatic environment can help create a positive image of municipalities and companies. Positive measures become concrete examples of what sustainability work is really all about. This generates greater understanding and motivation for implementing similar initiatives in the future.

Investments in the aquatic environment can also contribute to a positive image of municipalities and companies. Good measures become concrete examples of what sustainability work is actually about. This creates greater understanding and motivation for similar initiatives in the future.

In conclusion, there is a flood of great arguments for investing in water improvement measures, even if they may sometimes be perceived as expensive.

Think multifunctionally!

Water improvement measures can have several functions at the same time. For example, wetlands are multifunctional. They purify water by removing heavy metals and nutrients, provide protection against flooding, feed groundwater, promote biodiversity, and provide great recreational environments for excursions and walks. Another example of a measure that can serve multiple purposes is the creation of stormwater parks. With their many functions and exciting design, they are fantastic learning environments for children and young people.

Consider climate adaptation!

Flooding in can cause extensive damage to infrastructure and both private and public property, resulting in major costs to society. The fauna passage that has been built in central Västerås opens up the Svartån River for fish migration from Lake Mälaren. But it is also designed to reduce the risk that Svartån could flood over its banks in the future. In the summer of 2023, the construction of the fauna passage prevented the river from flooding to Fiskartorget Square, where Västerås City Hall is located.

In general, meandering, more natural waterways have a greater ability to dampen high flows and prevent flooding than straightened watercourses.

Municipal water planning ties the work together

When you think about water management work in your municipality – do you see a clear goal? Do you have an efficient organisation? Water issues permeate many parts of municipal operations, not least planning and construction processes, environmental supervision, and sewage management.

Strategic water planning involves balancing a slew of interests and requirements and ensuring the planning works both now and in the longer term. It entails creating a coherent way of working with a municipality's water issues and a basis for decision-making for the protection, development, and use of the municipality's water supply, today and in the future.

During the LIFE IP Rich Waters project, the County Administrative Board of Stockholm County has supported municipalities that want to improve their strategic water planning. The result has been a series of workshops, seminars, and webinars on various aspects of municipal water planning, including how to handle stormwater, collaboration across municipal boundaries, and funding water-focused actions.

In 2018, the first version of the Handbok för strategisk kommunal vattenplanering [Handbook for Strategic Municipal Water Planning] was published. Based on municipal experiences, the handbook describes a six-step process, from finding and justifying arguments for water planning, to following up and developing the work. It includes a number of appendices to provide further support in water management, as well as reference guiding readers to the vattenplanering.se website, which contains in-depth information and concrete examples. The model has already been used by many municipalities in their internal work, as well as by county administrative boards in their efforts to support their municipalities through advice and training.

1,000

people from 360 organisations are part of the municipal water planning network established through the project



126

municipalities have participated in our 21 seminars, webinars and conferences on strategic municipal water planning.



The water plan protects Sollentuna's ecosystem services

When Sollentuna Municipality set out to produce its water plan, the first step was to evaluate how various ecosystem services from water could be affected. The result was a water plan that takes a holistic approach to improve and ensure the quality of the municipality's groundwater and surface water while also improving management of its stormwater, wastewater, and drinking water.

This work has provided the municipality with tools to promote the good status of the municipality's water

and achieve sustainable water management in Sollentuna. It has created consensus, pride, job satisfaction and a structured way of working for the municipality.

The work has also contributed to increased knowledge of Sollentuna's aquatic environment among authorities, politicians and the general public.

"There is now a greater awareness of the challenges we all face when it comes to our work with water, but also better understanding of what the solutions might be."

**Towe Holmborn,
Sollentuna Municipality**

Enköping's stormwater plan – the most important decision in the municipality

Stormwater management has become a key issue for many municipalities. Climate change is increasing the risk of torrential rain and periods of drought, and combatting it will demand more knowledge and measures. Stormwater also threatens to pollute the lakes and waterways into which it flows.

Enköping is one of the many Swedish municipalities that need to be better equipped to combat high water flows. With the support of LIFE IP Rich Waters, the municipality has developed a stormwater plan, with

goals and strategies for the long-term, sustainable management of stormwater in densely populated areas.

"The decision to approve this stormwater plan is perhaps the most important move we will make during our term of office," commented Tomas Rådkvist, Chairman of the Technical Committee, when the plan was adopted by the Municipal Council in May 2022.



The climate and our water

There is a strong connection between climate and water issues. Global warming is changing patterns of precipitation and flows. In a warmer climate, sea levels rise. In the long term, Lake Mälaren will be affected and the risk of flooding in the area will increase. These climate changes demand more holistic thinking and better coordination to protect our water. There is also a need for a better understanding of the ecosystem services that aquatic environments create. This has been one of the focuses of our work in the LIFE IP Rich Waters project.

Flood risks and contaminated areas

How can the risks of the flooding of contaminated areas be addressed?

As part of the project, we have developed a tool to support Sweden's municipal and county administrative board employees in their efforts to deal with contaminated areas. A web-based guide provides concrete tips on how map material and various GIS layers can be used to assess risks and prioritise supervision. The content of the guide provides increased knowledge of legal support and tips on methods for handling these issues – both from behind a desk and out in the field.

Use the landscape to your advantage!

Where will all the water go? During high flows, large amounts of water risk dredging up nutrients and pollutants from flooded land and carrying them along in their currents. By identifying areas to which water can be channelled, we can minimise the negative effects and perhaps prevent major damage in densely populated areas.

In Rich Waters, we have sought solutions in the landscape itself – so-called “nature-based solutions”. Examples of such solutions include the establishment of wetlands, continuous cover forestry, and refraining from ditch cleaning.

Local knowledge of the landscape is a crucial complement to maps and calculations. In two pilot areas around the Bällstaån and Arbogaån rivers, local representatives of municipalities, water organisations, interest groups, landowners, power companies, and industries have identified which ecosystem services are important today and how sensitive they are to flooding from a local perspective.

More knowledge about the ecosystem services of water

Lakes and waterways contribute with vital ecosystem services, such as drinking water, water for agriculture and industry, and biodiversity. Other freshwater ecosystem services provide us with improved quality of life and recreation opportunities.

But what happens to these ecosystem services when the climate changes?

As part of the Rich Waters project, the Swedish University of Agricultural Sciences (SLU) has investigated the current state of ecosystem services and analysed how they may be affected in the future. Their conclusion is that more intense torrential rains and more frequent flooding caused by climate change can have a major negative impact on freshwater ecosystem services. The flooding of agricultural land can lead to increased eutrophication, which in turn results in reduced biodiversity in the waterway. A flood in an urban or industrial area can cause wastewater and pollutant leaks, thus affecting nature's ability to produce clean drinking water.

Another important conclusion is that to ensure we include the right measures in our long-term plans, we need more knowledge about how climate change affects freshwater ecosystem services. This work shows that it is important to adopt a landscape perspective when managing our ecosystems, as the boundaries between land and water will be further blurred in the future – in the event of both floods and droughts.



Eutrophication from agriculture – collaborating to take more action

Eutrophication is one of the most serious environmental problems in the North Baltic Sea Water District. More than 75 percent of our coastal waters and around a third of the district's lakes and waterways have been assessed to be clearly affected by eutrophication. Eutrophication is mainly caused by phosphorus and nitrogen from agriculture, storm-water, and household wastewater. Among other things, it leads to the overgrowth of aquatic environments and increased algal blooms. It threatens animals and plants, as well as our own enjoyment of nature, swimming and outdoor life.

Within the context of LIFE IP Rich Waters, we have employed various methods and tools to reduce eutrophication from agriculture.

The reduction of nutrient losses from agriculture has great socio-economic benefits. Together, the Swedish Board of Agriculture, the Federation of Swedish Farmers, and regional water authorities have analysed the effects of various policy instruments. One conclusion is that there are several advantages to retaining and developing the existing system of voluntary instruments. Taking more action will demand a greater investment in advice and information and increased opportunities to cooperate within a catchment area.

Collaboration with those who are directly affected by the aquatic environment is an important part of water management. Water in ditches, streams, rivers and oceans is affected by every activity that takes place on land. For this reason, the entire catchment area must be central to discussions about water issues. In a pilot project, the Swedish Agency for Marine and Water Management, in collaboration with the country's water authorities, the county administrative board and the water council, has developed a local action plan for Halland's Himleån River. Together, they are developing water quality targets and a list of actions based on local knowledge. A similar pilot project is being carried out by the Lake Mälaren Water Conservation Association with landowners around the Hjulbäcken/Sagån waterways in Västmanland. The hope is that the work with the Himleån and Sagån rivers can become a model for local participation, consensus-building and action planning.

Valuable wetlands

In the past, it was common to drain wetlands to make more room for meadows, fields and forests. But we need wetlands – they help us take care of our water. Now landowners and the Nyköping Rivers Water Conservation Association have re-created the Erkan wetland in Kiladalen, hundreds of years after it was drained. The wetland slows down and conserves water. During high flows, the wetland fills up, and during low flows, it slowly releases the water back into the soil. In the springtime, the wetland teems with fish and fowl, and later in the season, when the water level sinks, it transforms into grazing ground. The Erkan wetland purifies the water, filtering out nutrients and thus helping to reduce eutrophication in the Kilaån River and Baltic Sea.

"We know that Lake Mälaren is nearby, and so you feel that you can do things better here. Both for the sake of my farm's profitability and for the water quality. As a farmer, that feels good. From that perspective, it's all about managing this farm so that I can leave it to my children, who also want to become farmers and continue the tradition. We're doing this for future generations."

Tomas Olsson, a sheep farmer, Kungsör





Dialogue with landowners creates commitment

A successful way to get the work with measures to improve water up and running is to start a local water office for coordination. In Kiladalen, the Nyköping Rivers Water Conservation Association and the County Administrative Board of Södermanland have done just that. In addition to working with local measures against eutrophication, the Water Office provides support in applications to improve the aquatic environment and help with documentation for permit applications, fieldwork and geographical analyses. The office also arranges inspiration days and workshops. Its efforts are based on strong local commitment from farmers and landowners. The result has been a number of new initiatives in the area, involving everything from phosphorus ponds and wetlands to low-flush toilets and reed cutting. At the same time, the cooperation between authorities and landowners has improved.

In a similar way, Uppsala Municipality has brought together stakeholders around the Hågaån River. They have established a separate Water Council, which has developed a local action plan and boosted joint water quality improvement efforts. In Västmanland, the County Administrative Board has gathered land-

owners to work with the waterways that flow into Lake Mälaren so that they can agree on appropriate actions and find financing opportunities.

Multi-level water conservation planning

A water conservation plan to reduce the phosphorus load from agriculture can be drawn up for an individual farm or for an entire catchment area. The aim is to work with farmers to identify possible risk areas for phosphorus losses and propose appropriate counter-measures. In the working method developed within the project, every part of the farm and the land is systematically reviewed to see where problems may arise. The review forms the basis for a discussion about the pros and cons of different measures and information on how they can be financed.

Above all, the approach of the County Administrative Board of Västmanland is based on commitment and participation at the local level.

“A local, bottom-up perspective super-powers the remediation work. That’s how you create sustainable measures and a long-lasting sense of responsibility.”

Anneli Carlén,
Nyköping Rivers Water Conservation
Association

25 farms in five counties have received water conservation plans within the context of LIFE IP Rich Waters.

230 people have participated in the Kiladalen project over the years.

7 approved project applications for measures in the Kiladalen Valley (LOVA and LONA funds).

Uniting around a common goal

We all share the same water. That’s why improving an aquatic environment often demands the time, energy and commitment of many different people. In Södermanland’s Kiladalen Valley, the Nyköping Rivers Water Conservation Association and the County Administrative Board, together with landowners and farmers, have implemented a wide array of water improvement measures. They have united around a common goal: better water in Kiladalen’s lakes and waterways.

Water conservation planning – good for horses and the environment

Horse keeping differs in many ways from traditional farming. That's why Rich Waters has developed a specific method for water conservation planning on horse farms. These farms often have a typical layout, with smaller, heavily-trampled outdoor paddocks that are usually muddy for much of the year. The nutrients in horse manure mix with rainwater and meltwater and can contribute to eutrophication when they end up in waterways or lakes.

With a water conservation plan, horse keepers gain better knowledge of how their farms and operations affect the aquatic environment. But above all, these plans help them identify and prioritise suitable measures, such as improving drainage, moving feeding sites, or ensuring that there is a buffer zone of vegetation between paddocks and waterways.

Many horse farms and riding facilities need concrete support to get started with environmental work. One of the horse farms that has received help with water conservation planning is the Lurbo Riding Club in Uppsala. The equestrian facility is located near the Hågaån River in southern Uppsala, and there is thus a high risk of burdening these waters with nutrient leakage from the outdoor paddocks. Thanks to its water conservation plan, the Lurbo Riding Club has been able to apply for grants and carry out extensive

work involving the drainage of its paddocks and the construction of lime filter ditches. There are many benefits, says Anna Jonson, the club's chairperson. The measures contribute to improved horse health, as well as a better work environment for the staff. But above all, reducing nutrient leakage from the horse paddocks is something we must do for the environment.

Actions at Julmyra Horse Center

On the outskirts of Heby, Julmyra Horse Center runs a trotting facility with about 200 horses. It did not take long to realise that its activities risked burdening the fragile land in the vicinity of Vansjön and Nordsjön lakes. Julmyra Horse Center has therefore created protection zones between its paddocks and the stream that runs past them. The vegetation planted in these zones slows down the progress of rainwater and prevents soil and nutrients from ending up in the water. Routines have also been established for feeding, handling manure, and mucking out the paddocks. A reduced risk of nutrient leakage is not the only result: the trotting tracks are easier to maintain, the horses have better environments in their paddocks, and the risk of parasites has decreased. To further disseminate the knowledge acquired through the project, Julmyra now serves as a model facility and regularly presents the measures it has implemented to interested visitors.

The sea starts in the paddock

Many horse farms and equestrian facilities want to improve their paddocks and protect the aquatic environment. Vallentuna Riding Club has drafted a water conservation plan and among other things, it has dug a pond that captures phosphorus from the paddocks. Thanks to the water conservation plan, the riding club has an overall picture of the risks at its facility, as well as appropriate remediation measures.

360 000 horses in Sweden.

2,7 million tonnes of manure are being produced by horses in Sweden every year.

7 horse farms have had water plans financed by LIFE IP Rich Waters.





The right action in the right place – maps to support advice and planning

Nutrients that leak from agriculture contribute to the eutrophication of our lakes, waterways and seas. The type and effectiveness of measures necessary to combat eutrophication largely depend on local conditions. Researchers at the Swedish University of Agricultural Sciences (SLU) have therefore developed modelling and maps to facilitate the remediation work. The results can be used by, e.g. catchment officers, advisors, farmers, water strategists, and other people in county administrative boards, municipalities and water conservation associations working to improve our water.

The maps have been compiled on a website, as a so-called “story map”. Here, you can zoom in on an area and visualise waterways in the landscape, erosion risks, flood risks, the potential for wetland creation, and more. The maps cover the entire Norrström catchment area, i.e. the catchment area for Lake Mälaren, Lake Hjälmaren, and a number of smaller bodies of water. The maps contain short descriptions and suggestions on how the material can be used to discuss and plan measures – for example, together with landowners. The goal is for the material to be used in Swedish water management and by people and organisations directly involved in remediation work.

The maps show local conditions and can be used, e.g. to:

- Visualise waterways (ditches, drainage, diversion)
- Assess risks of surface runoff and erosion
- See the estimated transport of nitrogen and phosphorus in the landscape
- See the potential of projected wetlands to reduce eutrophication
- Identify areas at risk of flooding

“The information in the maps makes planning water-related actions way easier. It allows us to identify problem areas and even place them in the landscape with the help of the maps.”

Gunilla Lindgren, Uppsala Municipality

Sensor data – great future potential

Using sensors, it is possible to collect continuous information about the water quality of streams and rivers. But how can high-frequency sensor measurements of water quality be used in water management? As part of the Rich Waters project, SLU and the Swedish Environmental Research Institute (IVL) have examined the quality and practical aspects of sensor measurements in waterways and demonstrated that sensors can give us more reliable calculations of how various substances are transported along with the water. Examples of the applications for sensor data in water management have also been developed. It is a challenge to be able to make use of all the information that we can obtain with the help of high-frequency data collection.

But the more we learn, the more it can benefit us in the future. According to the researchers who worked on the study, there is great future potential, with several areas of application in aquatic environmental work.

Internal loading – when the lake feeds itself

Eutrophication occurs when a body of water becomes oversaturated with nutrients. In lakes and many coastal waters, the main culprit behind eutrophication is the nutrient phosphorus, from for example water treatment plant or agricultural emissions, stormwater, or individual sewers. These emissions can cause a great deal of phosphorus to accumulate in the bottom sediment. When this phosphorus begins to leak from the sediments into the water, it results in something known as “elevated internal loading”.

We do not know in detail the extent to which there is increased internal load in Swedish lakes and coastal waters, but in many of the hundreds of waters affected by eutrophication, internal loading can be a problem. To remedy eutrophication and determine what type of measure is appropriate, we therefore need to understand the significance of internal loading.

Within LIFE IP Rich Waters, we have developed a handbook to support the assessment and decision-making process regarding measures to combat the internal loading of phosphorus in lakes. The handbook was published in April 2023 and is Sweden’s first comprehensive decision-making tool for addressing internal loading. It presents a four-step method for assessing whether a body of water is internally loaded. It also includes descriptions of possible measures and information regarding costs and funding opportunities. Measures to combat internal loading are often quite expensive and require extensive research and preparation. We need to be able to make better assessments of which lakes actually require remediation and, if so, which measures are most appropriate.

“Given the large number of eutrophicated lakes and coastal waters in which internal loading could be a problem, this tool is an important contribution. Hopefully, it can lead to more effective anti-eutrophication efforts.”

Robert Almstrand, the Swedish Agency for Marine and Water Management.

600

Swedish lakes are eutrophicated.

45

lakes were investigated to develop the method.

700

kilogrammes fish of 18 different species were caught during two weeks of electrofishing in Hjälmaren.

Electrofishing in Lake Hjälmaren

Lake Hjälmaren is one of Europe’s largest lakes with eutrophication problems. Electro-fishing, a method in which fish are stunned, captured, tested, measured and weighed, and released – all without harming them – makes it possible to calculate which fish are actually in the lake, as well as their number and size. This knowledge will better equip us to reduce eutrophication in Lake Hjälmaren.





Low-flow dredging gives Öljaren a fresh start

Lake Öljaren in Södermanland has long had major problems with eutrophication and resultant algal blooms. There is almost no life at all at the bottom of the lake, and from time to time it suffers from fish kills. When Rich Waters started in 2017, Katrineholm Municipality carried out several tests. They also had sampling results saved from the late 1970s. With the help of these data, it was possible to establish that the lake is affected by internal loading.

To help the lake with this problem while simultaneously infusing nutrients back into the cycle, Katrineholm Municipality has tested the low-flow dredging method. It might be described as vacuuming the lake. With hoses from a manned pontoon out on the lake, the top layers of the bottom sediment are sucked up and then dewatered in several steps up on land. The nutrient-rich sediment that is sucked up can be used as fertiliser and thus reenters a natural cycle. The water is then pumped to a ditch and flows back out into Lake Öljaren.

The hope is that Öljaren will regain its natural balance, with clear water and rich plant and animal life.

Katrineholm Municipality has also started a national network for the low-flow dredging method. It has attracted great interest, and members share knowledge, experiences and ideas about the method. During the project period, over 100 people have participated in study visits about the measure organised by Katrineholm Municipality.



20,500

square metres of the lake bed have been dredged.

96

cubic metres of dewatered sediment have been taken up on land.

117

kilogrammes nitrogen and 29 kilogrammes phosphorous have been extracted from the bottom sediment, based on an average value of dry matter and measured concentrations.

"The most fun has probably been getting to know all these new people and learning all sorts of new stuff, as well as seeing that this method actually works."

Jenny Herbertsson, Katrineholm Municipality



Aluminium treatment clarifies the waters of Lake Norrviken

Lake Norrviken is located in the municipalities of Sollentuna and Upplands Väsby. For several decades, nutrients (mainly phosphorus) from industry and agriculture and other pollutants have flowed into the water and been stored on the lake bottom, causing eutrophication. The lake has long been cloudy, green and unhealthy. If nothing is done, it could take more than a hundred years for it to recover.

To help the lake break this negative spiral of eutrophication, Sollentuna Municipality and Upplands Väsby Municipality have taken joint action. By injecting the bottom with aluminium chloride, a salt used in the purification of drinking water, the stored phosphorus is bound to the lake bottom.

Thanks to the aluminium treatment, the amount of phosphorus in Lake Norrviken has decreased and its nutritional status has gone from poor to good. The amount of phytoplankton has decreased, the water has become much clearer, and the depth of visibility has improved.

Lake Norrviken is of great importance to everyone who lives nearby, and many have expressed their joy over the improved aquatic environment. Just one year after the treatment, the improvement was noticeable, and the water is now so clear that bathers can see their own feet.

"The water is fantastically clean and clear. What a difference! We've enjoyed some lovely dips this summer. I hope it stays this nice. Thank you for this important project."

A resident of the area around Lake Norrviken

400

kilogrammes phosphorus is estimated to have been bound to the bottom of the lake.

136

hectares of bottom surface have been treated with 90 tonnes of aluminium.



Small mussels make a big difference

Can blue mussels be part of the solution to eutrophication in the Baltic Sea? That's what the non-profit association Ecopelag is investigating. They have tested and developed a method for mussel farming as a water improvement measure in the Stockholm Archipelago. In their work, they have identified suitable areas, developed techniques for cultivation and harvesting, and found uses for the harvested mussels.

However, from a boat crossing Erstaviken or Jungfrufjärden, none of their efforts are visible. That's because the mussel farms are submerged below the surface of the water, discernible only by buoys bobbing on its surface. The farming works by placing a cultivation substrate – a type of rope or net – during the spring, when the water is teeming with mussel

larvae. The larvae attach to the ropes and remain there while they grow.

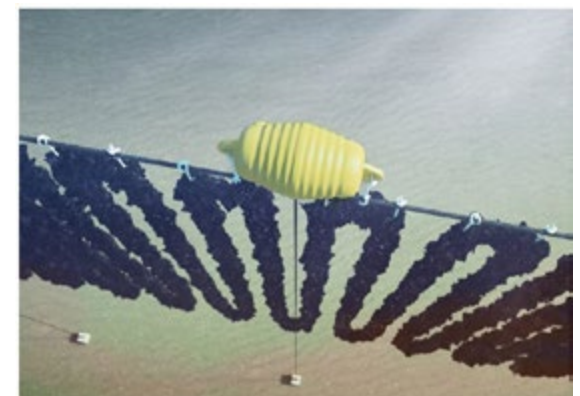
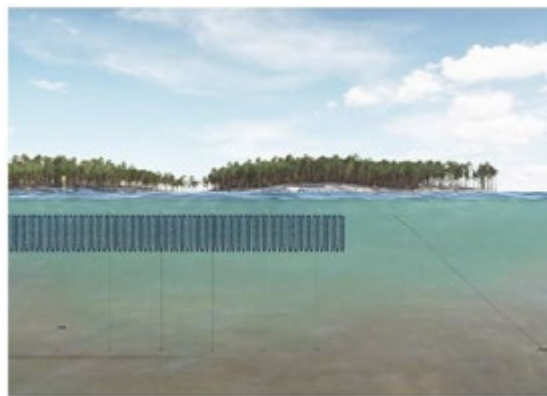
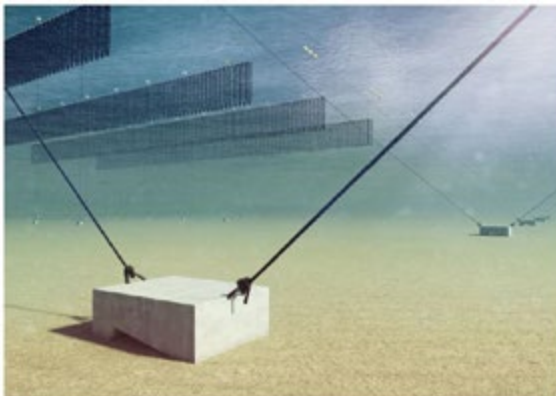
Mussels eat algae and organic particles and store nitrogen and phosphorus from the food they eat. When the mussels are then harvested, the nutrients stored within their shells follow them up on land. Every part of the mussel is used, for example as animal feed and fertilizer in agriculture. The blue mussels create a circular system between sea and land in which important nutrients are preserved and put to use.

Ecopelag's work contributes to increased knowledge about mussel farming and how cultivation can best be carried out in the prevailing conditions of the North Baltic Sea Water District.

29 500 metres of cultivation rope lie beneath the waters of Erstaviken and Jungfrufjärden.

60 tonnes of mussels have been harvested.

8,2 g of nitrogen and 0.74 g of phosphorus are absorbed per kilogramme of mussels.



Water for everyone in multifunctional water parks

Flowing through our cities, rain and meltwater pick up nutrients and heavy metals of various kinds and carry them into lakes and waterways. By forcing storm water to pass through a water park, it can be purified in a natural way. The water park's ponds capture nutrients and environmental toxins and create a wetland environment that benefits biodiversity and offers great opportunities for recreation.

Within the context of Rich Waters, three multifunctional water parks have been established. The water parks in Uppsala and Västerås purify stormwater before it reaches Lake Mälaren. In Smedjebacken, the water park serves as an additional purification step for already-treated wastewater. Through a system of ponds, the water parks capture nutrients and heavy metals before the water flows further into the lake. Measurements have shown that the ponds rid the water of cadmium, lead, phosphorus and PFAS substances, among other things.

The multifunctional water parks are good for both nature and people. Amphibians and birds are attracted by the water. The parks have nesting boxes for birds and sand piles for bees, and the areas attract bats, dragonflies and swallows. Nature quickly takes over. Just a few years after its inauguration, the benthic fauna of the Johannisberg Wetland Park were found to include 52 species, of which five were unusual. In Gottsunda, an inventory has shown that the number of species of butterflies has doubled and that dragonflies have proliferated from one to 20 species.

Paths, footbridges and jetties entice us humans into the rich and easily accessible natural environment, where we can enjoy walks, recreation and outdoor life along the water's edge. Here, visitors can get up close and personal with life in the water. That's why water parks are also a valuable resource for schools and leisure activities related to water and the environment.

The multifunctional water parks within Rich Waters also serve as demonstration sites for municipalities and other actors that want to implement similar projects. The three parks have already hosted over 70 study visits by various target groups, and more are planned for 2024.

65 000

m² of water surface in the Gottsunda Stormwater Park.

9 400

km² of water surface in the Johannisberg Wetland Park.

6 400

m² of water surface in the Smedjebacken Water Park

"The water parks show that investments in the environment and climate not only demand sacrifices, but also lead to exciting new solutions."

Hans Dahlgren, former Minister for EU Affairs







Free flowing water – essential to biodiversity

Connectivity, i.e. the ability of fish and other aquatic animals to move freely in a waterway, is a prerequisite for achieving good water status under the EU Water Framework Directive. Fish and other aquatic animals need flowing water to survive and reproduce. But many of Sweden's natural rapids have disappeared. Our waterways have been dammed and cleared of stones. This affects biodiversity. Simply put, we end up with a poorer aquatic environment. In the North Baltic Sea Water District alone, 60 percent of lakes and waterways contain obstacles that threaten biodiversity.

In the field of water issues, few topics spark as much engagement as the remediation of migration barriers in our waterways. The issue is complex and encompasses many diverse interests. A migration barrier often consists of a building or a facility that has played an important role in human development in its location. Landowners and residents usually have strong feelings about preserving the cultural environment in which they have been raised, lived, and worked. On the other side of the scale is the environmental impact caused by migration barriers.

The county administrative boards of Västmanland, Örebro, Södermanland, Stockholm and Uppsala have worked to increase collaboration across county borders, create consensus and dialogue between different interests, and produce better data for prioritising actions.

The cost of replacing a dam

Costs often play a decisive role in deciding the most appropriate action by which to recreate free migration routes in a waterway.

The project has compiled information on more than 40 implemented measures in which dams have been removed. This compilation provides an overview of cost items and the factors that influence the total cost. For each action, a description is presented of the dam, its original purpose, the purpose of the measure, and the results of removing the dam. The report also includes photos before and after the intervention. The selected cases include various dam types and designs. Overall, the case studies provide a good picture of what it costs to replace a dam with a rapids environment or a lake outlet, as well as what factors play a role in keeping costs down.

Challenges in cities

Many Swedish cities have developed around streams, rivers and other waterways that have been important for electricity supply, transport, and other hydro-powered activities. Dams and power plants are often valuable cultural environments that bear witness to a city's history.

How, then, can we work to recreate free migration routes for fish in urban environments while simultaneously taking into account other important societal interests? Perhaps the most important issue is the actual change in the cityscape, often in a cultural heritage-rich environment. Roads, buildings and cables buried in the ground also limit the available space.

The project has evaluated different solutions in the small and medium-sized cities of Örebro, Arboga, Västerås, and Uppsala. The report contributes knowledge and inspiration that can help more cities to find suitable solutions for their waterways.



Free migration routes in the cultural environment

Many obstacles to fish migration, such as mill dams and small-scale hydroelectric power plants, constitute valuable cultural environments that stand as monuments to how life was lived in the past and to the technical solutions that contributed to our prosperity at the time. How can we best combine measures to free up migration routes while also preserving our cultural environments for future generations? The areas around the Trosaån and Kilaån rivers are two examples where there is a great need to create free migration routes for fish while taking into account many valuable cultural environments. To this end, the County Administrative Board of Södermanland has conducted general inventories of cultural-historical environments in these two areas. The remains of older industrial areas, mills and sawmills have been prioritised.

How are dam-related measures perceived?

To get a clearer picture of public opinion on measures involving dams, the County Administrative Board of Örebro interviewed more than 40 people who either own or live near a dam where water conservation measures are planned or have already been implemented. The study examined how dam owners and local residents view the value of the environment around the dam and the history of the site, their attitude towards the measures themselves, the authority's response, and the possibility of participation in the design of the measures.

Collaboration with landowners

The restoration of free migration routes for fish and the preservation of cultural environments are often presented as two contradictory endeavours. It does not have to be this way – there are many good examples of solutions that have taken both of these interests into account. For example, Gisslarbo has a centuries-old industrial history in which the river has played an important role in power production for various businesses. From 2019 to 2020, two older dams were removed in the Gisslarboån River, to open up free migration routes for fish. The project has been documented in a film, which describes how efforts were made to preserve cultural environments while simultaneously restoring natural values. The filmmakers interview landowners, local residents, and others affected by the measures. The result provides a good example of how these undertakings can be implemented in close cooperation between authorities and those directly affected by the changes.

58 cultural-historical areas of interest around the Kilaån and Trosaån rivers were identified by the County Administrative Board of Södermanland County.

120 people have participated in the project's field walks with a focus on cultural environments in water.

"Involve the people and the landowner from the very beginning. I think that's really a winning concept. You constantly hear that 'the authorities just decide'. But if you can turn that perception around, I think things will be much better!"

Lennart Ångman, a resident of Gisslarbo



Hydropower adapted to endangered species

H ydropower provides climate-friendly renewable energy. But its generation also dams up waterways, and this affects fish, animals and plants that need flowing water. Biodiversity is decreased. For a few years now, work has therefore been underway to adapt hydropower to environmental standards throughout Sweden.

In the Rällsälven River, for example, there are several endangered and threatened species. Here, Mälarenergi has created a 350-metre-long, naturalistic stream – a fauna passage – that leads water past the Rällsälv power plant dam. The passage winds through the landscape, creating as natural an environment as possible for trout and other fish. The river is also home to around 70,000 freshwater pearl mussels. This highly endangered mussel, which can live to be several hundred years old, now has better chances of surviving and reproducing.

A similar fauna passage has been built in the Hedströmmen River, near the Östtuna power plant. By moving and adding stones and gravel, the natural rapids have been restored, allowing fish and other aquatic animals to pass through. On the very first day that the fauna passage in Östtuna was opened, the critically endangered eel was spotted traversing its waters. Fish fry and other small animals and insects also thrive on its rocky bottom.

The fauna passages in the Rällsälv and Hedströmmen rivers are fine examples of how power production can be adapted to minimise the impact on the aquatic environment. They have also attracted a great deal of attention in the industry. The designs, technology and lessons learned from the project have been used in connection with current research trials aimed at advancing the environmental adaptation of Swedish hydropower.

The design of the fauna passages adjacent to the Rällsälv and Östtuna plants has also taken account future climate change. In essence, the fauna passages are self-regulating. This has improved their capacity to cope with intense rainfall and rapid inflow to the surrounding areas. They have been designed to maintain good opportunities for protection and cooling during dry periods, which is considered to be of particular importance in a changing climate.

“Perhaps the most important contribution is the dissemination of knowledge that has occurred – about technology, design, execution and more – and which can improve the conditions for achieving good water status throughout the district.”

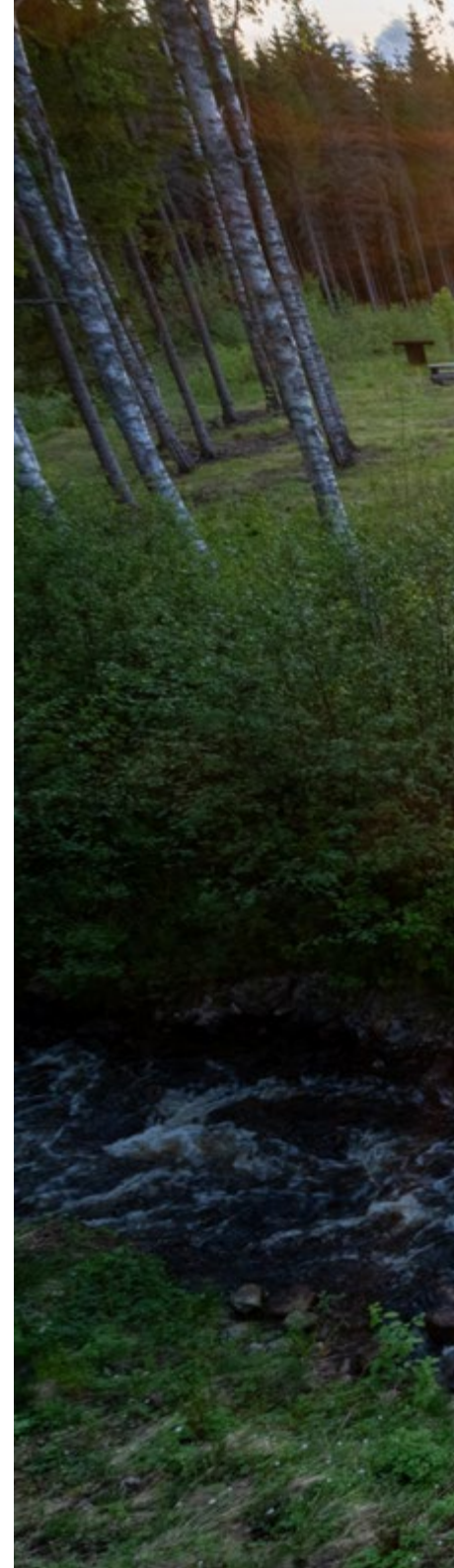
Johan Lind, consultant

285 000

square kilometres of spawning area have been made available for fish and other aquatic animals in the Rällsälven and Hedströmmen rivers.

63

trout passed through the passage near the Rällsälv power plant during 2023.









... an elegant solution, in one of Västerås' most significant historical environments, created without disturbing the aesthetic and cultural-historical values of the place. Instead, the fauna passage elevates and refines the surroundings through its play with the properties of the water. With its boulder rapids, the fauna passage enhances its surroundings. It creates a roaring symphony of rushing water that varies with the seasons.

From the jury's justification for the Västmanland Architecture Prize 2020



Fish migrating freely through a historical environment

The Turbine House in central Västerås was built in 1891 and bears witness to the city's rich industrial history and the establishment of ASEA over a century ago. But at the same time, the power plant dam, which still produces electricity, has prevented fish from migrating upstream from Lake Mälaren to the Svartån River. The Turbine House is a historically important structure; in 2024 it became a listed building. When Mälarenergi AB and the City of Västerås began planning to open the Svartån River up for fish migration, great care needed to be taken to protect the cultural environment.

Thanks to good planning, a painstaking construction process, and the open-mindedness of both politicians and Västerås residents, the 180-metre-long fauna passage was inaugurated in 2019. In the heart of Västerås, there is now a place where everyone has the opportunity to see the fish migrate while experiencing the lovely cultural environment around the Turbine House and Västerås Castle. Every spring, an increasing number of species, including red-listed fish such as eel, aspen, and river lamprey, are seen migrating upstream, seeking out new and larger spawning grounds. The passage itself has also been shown to be popular with

spawning fish. The 180-metre-long fauna passage is seen as a good example of how we can preserve energy, culture and nature, all at the same time.

Further upstream, the City of Västerås has also constructed a similar fauna passage past the dam at the Falkenbergsska kvarnen watermill. In total, about nine kilometres of free migration pathways, from Lake Mälaren up the Svartån River, have been recreated thanks to the project.

"The reflecting pool is still there, and many Västerås residents are drawn to the passage. It has become an asset to the cityscape and has improved Svartån's image."

Staffan Jansson, Chairperson of the Municipal Executive Board of the City of Västerås

1891 the Turbine House was built in Västerås. 128 years later, thanks to the fauna passage, the fish were able to swim past the dam once again and make their way further up the Svartån River.

6 320 m² of spawning area is now available for the 30 species of fish that live in Lake Mälaren.

109 aspens migrated through the Turbine House fauna passage in 2023.

Increased knowledge about environmental toxins in our waters

Environmental toxins are often long-lived and spread easily in our waters. Hazardous substances from factories, stormwater, toxic antifouling paints, landfills, and wastewater negatively affect water quality. Some substances, such as TBT, are harmful in very small concentrations. Although many toxic substances are now banned, they continue to leak from old industrial sites and other places where they once were used. We still do not really know which environmental toxins are in our waters, nor in what amount. Within Rich Waters, we have therefore worked to take samples, conduct analyses, and trace the sources of emissions. Such data is necessary to ensure we take the right measures where they are most useful.

Better knowledge of the state of the environment of various bodies of water can actually lead to their status being lowered. In the long term, this is positive, as it also leads to new calls for action.

For example, one major initiative has involved mapping nicotine, caffeine and drug residues – from antibiotics, hormones and antidepressants – in the water. The levels vary with the seasons. For example, there

are higher concentrations of antidepressants in the autumn, and of allergy medication in the spring.

In recent years, there has been an increasing focus on identifying and tracking the sources of emissions of PFAS – highly fluorinated substances used in a range of products, such as detergents, lubricating oils, make-up, firefighting foam, food packaging, and functional clothing. Our water treatment plants are not designed to remove pharmaceutical residues or PFAS. Even if some are captured, significant amounts are still released into the waters of Lake Mälaren – from which two million people get their drinking water.

The six county administrative boards included in the project have followed several courses of monitoring that variously contribute to increasing their common knowledge of which environmental toxins are present in our waters and where they come from. For example, metals have been examined in mining areas, and sediments from both Lake Mälaren and smaller lakes have been tested for environmental toxins. In another important result, the project has led to better collaboration between organisations that work with environmental toxin testing. The County Administra-

tive Board of Stockholm has made measurements and information about PFAS available to the public via a web-based map, a so-called “story map”.

The investigations of the project complement the environmental monitoring intrinsic to water management.

Our important groundwater

Groundwater is the water found in cavities and cracks in the soil and bedrock. Sooner or later, it reaches our streams, rivers and lakes. Many of our most important groundwater reservoirs are located in places covered with roads and heavily exploited for the mining of natural gravel. Sometimes landfills are located adjacent to groundwater bodies. By taking samples and analysing the groundwater, it is possible to detect environmental toxins such as heavy metals, PFAS, pesticides, oil pollution and the like. The test results can then be used to trace the sources of pollution.

1 327

surface water bodies and 643 groundwater bodies exist in the North Baltic Sea Water District.

500

measurements in specific bodies of water have been made within the context of the project. Through them, around 300 cases have been discovered in which one or more substances threaten the water status

577

individual substances have been analysed in surface water, groundwater, sediment, fish, and otter.





Fast-growing willows take care of environmental toxins

Sweden has many old garbage dumps that continue to leach metals and other environmental toxins into our waters, despite the fact that they are no longer in use. One of the country's many old landfills is located in Älvkarleby. Here, Älvkarleby Municipality and the company Bioremed AB have planted fast-growing willow trees in an attempt to clean up the contaminated area.

The plantings are irrigated using water cycled through the area in a closed loop. When it rains at the landfill, leachate is formed. The leachate is led out into two ponds, where it is then used to irrigate

the willow trees. This prevents leachate pollution from reaching the surrounding waterways. The willows have been growing even faster than expected, because they are irrigated continuously. The municipality therefore expects to be able to harvest them more often than first expected, thus enabling them to clean the soil faster.

After harvesting, the trunks and branches are chipped on-site and transported to a heating plant for incineration. At the heating plant, the flue gases can be cleaned of pollutants and the ash can be disposed of properly. The first two harvests show that the roots, stems and leaves of the willows absorb heavy metals and toxic

substances – including PFAS. The plants purify both the soil and the leachate.

In the long term, harvesting and burning the willows in this way will make it possible to clean up the landfill. In the meantime, the surrounding waterways will be protected from the environmental toxins that previously flowed onwards into the Baltic Sea.

The country's municipalities are required by law to remediate leachate from landfills. Willow cultivation offers a new solution to the problem.

“The project is important, as it can demonstrate a cheap and effective method that can be used in thousands of Swedish landfills to prevent leakage of environmental toxins and the pollution of lakes, waterways, and ultimately the Baltic Sea.”

Mauritz Ramstedt, Bioremed AB



25 000 cuttings have been planted.

170 cubic metres of willow have been harvested on two occasions.

8 different heavy metals and several PFAS substances are being absorbed by the willows.

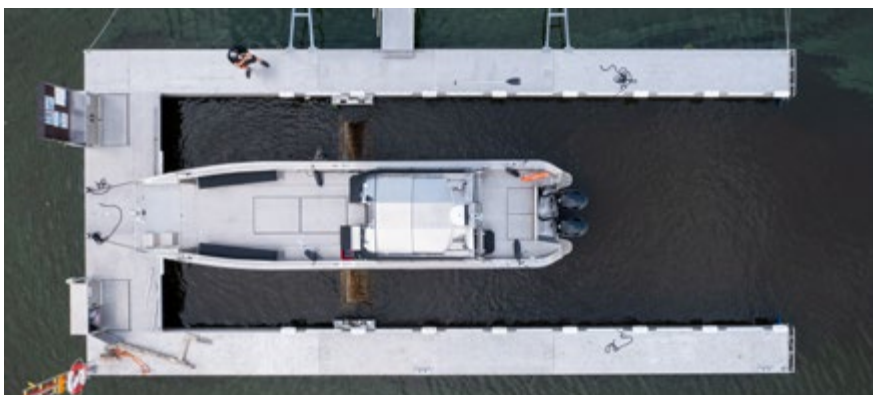
Sustainable boating in Lake Mälaren

There are currently just over 3,000 municipal berths in Västerås. Measurements have revealed that the waters of marinas often are contaminated with high levels of the endocrine disrupting substance tributyltin (TBT). Paints containing TBT have long been banned, but were once used to prevent algae and other fouling on boats, mainly in marine environments.

A sustainable alternative to using toxic antifouling paints is to use a power-washer to rid boat hulls of fouling. At the request of local boat owners and boat clubs, the City of Västerås has set up a boat hull cleaning station.

To use the boat washing service, the owner must be able to prove that the hull of their boat is unpainted or painted with an approved topcoat. To this end, the City of Västerås also offers owners the opportunity to measure the levels of antifouling paint on their vessels' hulls using a so-called "XRF meter" that quickly and easily identifies the metals contained in the paint. If the measurement shows that the paint is free of environmentally hazardous substances, they can simply book an appointment at the boat washing location.

The hull washing service in Kraftverkshamnen facilitates sustainable boating in Lake Mälaren. The goal is that within a few years, the hulls of all leisure boats in the municipality's ports will be protected by non-toxic paints. To move forward in this effort, we need to work together. The Mälaren Water Conservation Association and the City of Stockholm have therefore created a network for sharing experiences and creating consensus on issues relating to environmental toxins tied to recreational boating activities in the municipalities around Lake Mälaren.



400

leisure boats have used the boat hull washing service since its inauguration in 2020.

100

measurements of boat hulls have been conducted using XRF gauges every year since 2020.

23

municipalities along the shores of Lake Mälaren have joined the cooperation network working to eliminate toxic antifouling paints.

"When a port works actively to contribute to better water quality in Lake Mälaren, it also increases its attractiveness."

Karin Spets, the city of Västerås



We've made waves!

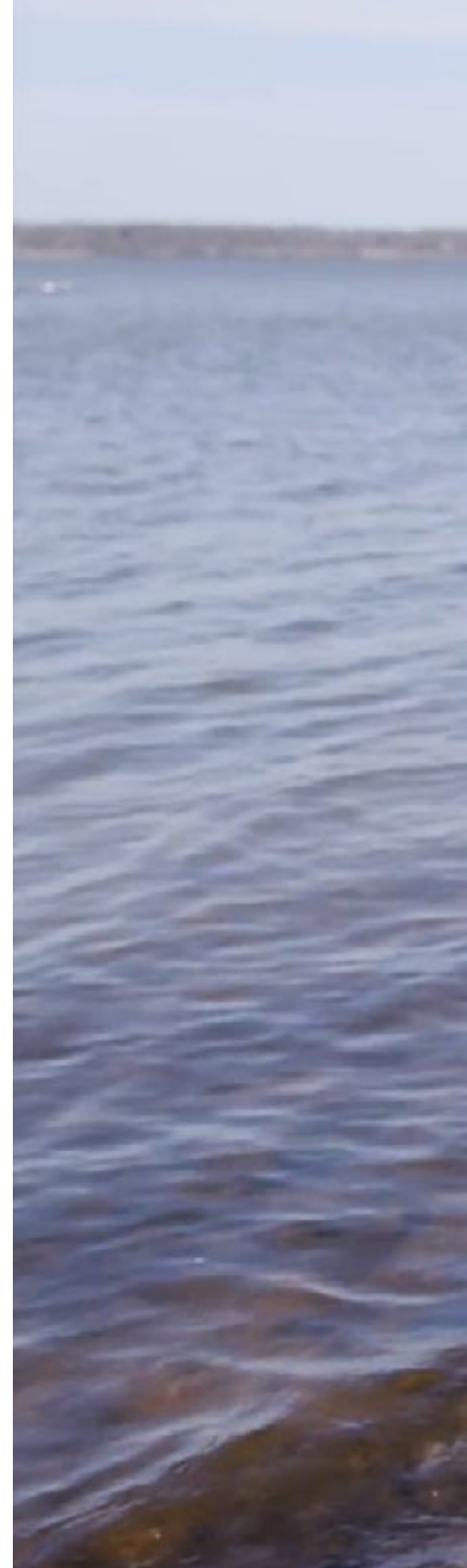
Through Rich Waters, we have implemented a number of concrete measures to make our aquatic environment better. These activities are important – but they're not enough. To bring about noticeable improvements in the aquatic environment, these actions must be multiplied exponentially. An important aspect of this has therefore been to work with project development and to help mobilise more resources that can improve our waters in a range of ways.

A few examples:

- More than 80 complementary actions have been launched – projects which, like Rich Waters, contribute to the implementation of the Water Authorities' action plan, but which have funding from other sources. The money may come from the EU, or from national initiatives such as LOVA and LONA.
- We have organised 38 webinars and training sessions aimed at making it easier for municipalities and other change-makers to apply for funding from, e.g., the Interreg programmes or LOVA.
- 67 municipalities within the North Baltic Sea Water District have participated in our various project development activities. For example, we have supported municipalities in writing project applications and in joint application efforts, including for projects involving equine facilities and eutrophication.
- We have participated in conferences in Sweden and collaborated with other countries on new projects, for example through other integrated European LIFE projects.

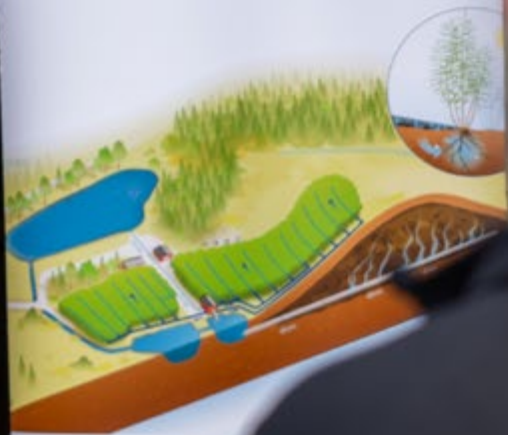
By participating in LIFE IP Rich Waters, our partner organisations have broadened their contacts and gained opportunities to find new partners. In several cases, this has led to new funding for remediation work. For example, the Nyköping Rivers Water Conservation Association has implemented a collaborative project together with the Stockholm Resilience Center aimed at clearing the path from grants to actual measures in the landscape. In collaboration with the World Wide Fund for Nature, the Swedish Water Conservation Association has also launched an Interreg project focused on eutrophication and coordination of measures related to waters of the Baltic Sea.

All in all, we see that our efforts have created a ripple effect in all our thematic areas – environmental toxins, eutrophication, water planning, and free migration routes for fish. These new projects take us a few steps further in our work to improve water quality.





Salixodling för sanering av förorenad mark



Salix odlas på den över-
innehåller miljögifter, tas
Salixen skördas och för-
tas omhand. De
suger upp nya miljö-
system där all





Results that benefit others

Methods, tools, lessons learned, handbooks and good examples of measures to improve water... All the results achieved in LIFE IP Rich Waters will benefit those working with water issues – from national authorities to local catchment officers.

To this end, the project has invested heavily in the communication and dissemination of results. By continuously involving the concerned target groups in study visits, field walks, seminars and workshops, we have ensured that our findings are well anchored. We have organised thematic conferences and numerous webinars. We have met with politicians, government agencies, journalists, interest groups, associations, and schools to talk about our results and what we can do together to improve and protect our aquatic environment. Our stand at the Sweden International Horse Show was visited by thousands of horse enthusiasts, many of whom responded to a survey about horses and the environment. The project has sparked dialogue and increased collaboration between actors across geographical and administrative boundaries. This will lead to smarter solutions and better decisions, as well as streamlining our use of resources.

Work processes, methods and lessons learned from every Rich Waters sub-project are documented in reports, films and articles, all of which are available on the website www.richwaters.se and via our partner organisations.

A better aquatic environment will bring benefits to us all. But it is the organisations and people who work to achieve our water management goals that will have direct uses for our results.

Here are some examples of how our results have been used by different target groups:

- National authorities have gained greater insight into local conditions.
- Sweden's water authorities have received more data on environmental toxins and eutrophication that can serve as a basis for action plans and provide good examples and methods to support the implementation of measures.
- The county administrative boards have achieved better consensus, established common measurement methods, and been able to carry out relevant pilot projects.
- Municipalities have received support in their remediation work and water planning, as well as in applying for funding for new measures.
- Water conservation associations have been able to implement concrete measures and gain new partners.
- Advisors and catchment officers have benefited from new methods and tools for water conservation planning.
- Farmers and landowners have been involved in the local remediation efforts.
- Riding schools and horse farms have greater understanding of the environmental impact of horse keeping and what measures can be taken to address it.



Inspirational and knowledge-building encounters

Many measures can make our aquatic environments more accessible and pleasant for both people and animals. By celebrating the inauguration of realised projects and arranging family days, field trips and study visits, we have both demonstrated and recounted the results of LIFE IP Rich Waters, how we achieved these changes, and the difference they make for the environment.

Conferences, seminars and workshops present opportunities to share hard-won lessons and knowl-

edge, make contacts, and gain inspiration for further work. The project has arranged a number of popular Inspiration Days on the themes of water planning, agriculture measures, work to mitigate the problem of environmental toxins, and on restoring free migration routes for fish. These Inspiration Days have combined presentations, workshops and field visits. In addition, our partner organisations have arranged various other meetings on these topics.

The COVID-19 pandemic made it more difficult to meet in person, but at the same time it gave us an opportunity to reach out to more people throughout the country via digital channels. For example, our Digital Talks series attracted a total of about 300 people for informal webinars on various municipal water planning issues.







Water knows no boundaries

Water knows no boundaries. What we do in Sweden affects other countries around the Baltic Sea, and vice versa. Many European countries face similar challenges in terms of their aquatic environments and the effects of climate change. We have a lot to learn from each other.

Working within an EU project provides great opportunities for international exchange and collaboration. Over the years, Rich Waters has participated in several major meetings centred around LIFE projects. In April 2021, we arranged a three-day digital conference for all water-related integrated LIFE projects in Europe, dubbed the Water IP Network Meeting, which brought together 150 people from 15 countries.

We have visited Danish, Estonian, Finnish and British project sites and have hosted colleagues from other parts of Europe at our own. Both the project management team and those involved in several of our sub-projects have been invited to talk about the Rich Waters' results at conferences and seminars, from Portugal in the south to Iceland in the north. Two sub-projects contributed digital presentations to the 2021 IWA World Water Congress and Exhibition.

This international exchange has yielded new perspectives, inspiration, and increased knowledge about our common waters.

A few closing words

After seven years, our work to improve our common waters is now coming to an end. Sweden's first LIFE IP project, Rich Waters, is about to close. In this book, we have endeavoured to summarise our accomplishments and discoveries. Through text and pictures, we have striven to show how we have worked to achieve the five key goals of our project.

Reviewing this publication filled me with immense pride. It was incredibly heartening to read a summary of all the good examples of how we have worked together to achieve and surpass our goals. But besides everything we've presented here – what else will we carry with us after this project ends? The list of lessons we have learned is long, but here are a select few.

As County Governor Johan Sterte mentions in the foreword, our project's spirit of partnership has been an invaluable success factor. The network created has been absolutely essential to the implementation of Rich Waters, and many of us can already see that these new contacts will be of great help in our continued efforts moving forward.

All the thematic meetings, workshops and joint events that we have arranged over the years have given us the opportunity to get to know each other, understand the issues at hand, and help each other advance our efforts to improve our waters. The project has given us time to meet and work together. Even if we are fully aware of what needs to be done to

speed up the pace of action, we rarely have time to take action within the framework of our regular assignments.

And there's another word that I associate with Rich Waters – flexibility. Thanks to the project's lengthy time span of seven years, we have been able to follow the development of our various themes over a long period. We have been able to focus on different parts of the project during different periods of time, and could also shift focus where needed. The issue of eutrophication is one example. In that respect, the project started out focusing primarily on agriculture, but over time we realised that there was a great need and demand for similar efforts on horse farms – not least in the wake of the publication of the Swedish Government's eutrophication report in 2020.

Just like everyone else, our project was also affected by the COVID-19 pandemic. Out of nowhere, all our conditions changed. We had to be even more flexible and transition to more digitally-based ways of working. As a result, our results were disseminated on a more national scale than before.

When I look back, I am infinitely impressed by everything we have achieved together – both the concrete measures taken to change the aquatic environment and the knowledge gained about the status of our waters, new technology, processes, and costs. There can be no doubt that we have now established an extensive common knowledge bank.

A colleague recently asked me what the most important conclusions from LIFE IP Rich Waters are. In brief, here's my answer:

- Invest in catchment officers and local collaboration!
- Let things take time! Long-term funding that will extend beyond terms of office is required
- Look at what others have done and how they have solved their various challenges; their examples can provide real inspiration. Also be generous in sharing your own experiences.
- Demonstrate the societal and socio-economic benefits of water improvement efforts

In closing, and as the very last lines of this book about LIFE IP Rich Waters:

I would like to extend an enormous and warm thank you to everyone who has been involved in our project in various ways. Many thanks for your knowledge, time, curiosity and commitment. It has been a privilege to work with you over these past years. We have truly made huge strides in improving our waters, and together we have helped shape a brighter future for our aquatic environments. Thank you!

Åsa Erlandsson
Project Manager





Havs
och Vatten
myndigheten

After almost seven years of work to improve the North Baltic Sea Water District's aquatic environment, the EU project LIFE IP Rich Waters is coming to an end. This book summarises the project and its results in text and images. It features stunning pictures by nature photographer Johan Hammar.