

**The Tullstorpsån Stream Wetland Project –  
a model for building multifunctional  
wetlands  
2009-2020**



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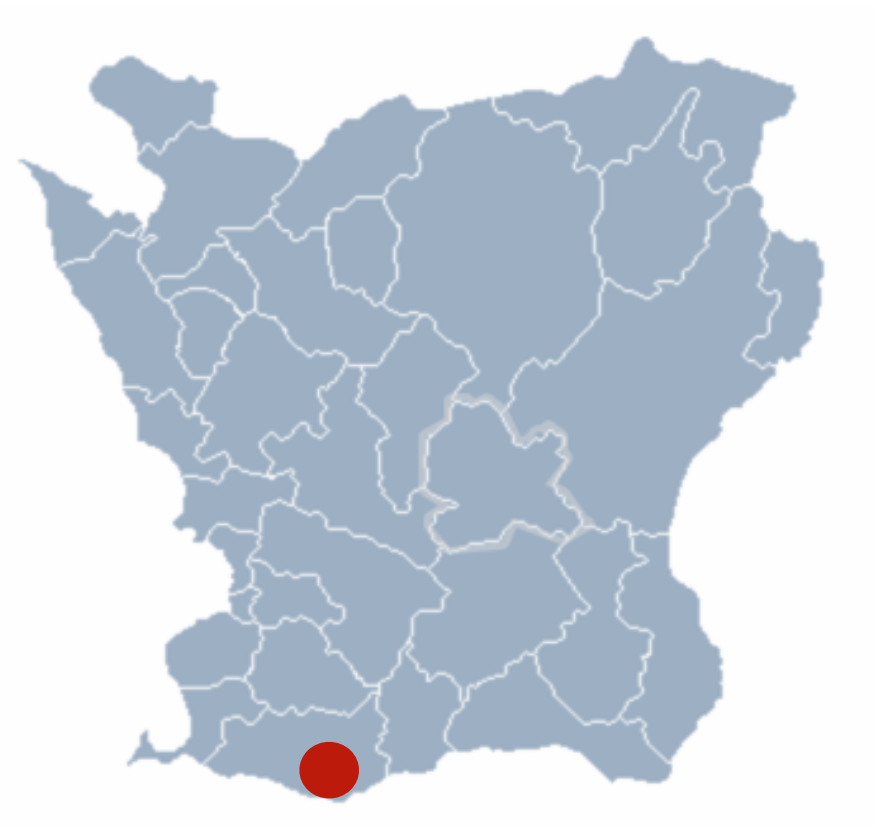
I would also like to thank the South Baltic Sea Water District for highlighting the Tullstorpsån Stream Wetland project importance as a wetland showcase project to other organisations and stakeholders working with measures against water eutrophication

The photo on the front page shows the Tullstorpsån Stream and the wetlands at Sånarp 2020.  
Photo: Hans Berggren



# Table of contents

<b>Foreword</b>	<b>7</b>
<b>Abstract</b>	<b>9</b>
<b>Abbreviations</b>	<b>10</b>
<b>I. Introduction</b>	<b>11</b>
1.1 Task and objectives	11
1.2 Development of the historical landscape	12
1.3 The Swedish National Wetland Strategy	13
<b>2. The Tullstorpån Stream Wetland Project (TSWP) 2008-2020</b>	<b>14</b>
2.1 Project setting and methods	14
2.2 Project objectives	15
2.3 Project organisation development	15
2.4 Project development over time	17
<b>3. Evaluative framework</b>	<b>19</b>
3.1 A systems perspective on complex environmental problems	19
3.1.1 A systems perspective	19
3.1.2 Boundary setting and scales	19
3.2 New modes of governance	20
3.2.1 Importance of building trust	20
3.3 TSWP and the development of the regional wetland strategy	21
3.3.1 A landscape strategy	21
3.3.2 The water strategy of Scania	21
<b>4. Methods and interviews</b>	<b>23</b>
<b>5. Results and discussion</b>	<b>24</b>
5.1 Organisation and leadership	25
5.1.1 A systems perspective	25
5.1.2 Organisation	25
5.1.3 A bottom-up perspective	26
5.2 The landowner's interest in environmental issues	26
5.2.1 Objectives	26
5.2.2 The relationship between agriculture, landowner interest and wetland development	27
5.2.3 A long-term perspective - a basis for results	27
5.2.4 Climate change	28
5.3 Social drivers	28
5.3.1 Regional authorities	28
5.3.2 The cooperation model between TSWP and the county administration	28
5.3.3 Communications with society and other wetland stakeholders	29
5.4 Economical drivers	29
5.4.1 Innovations as positive drivers	30
5.4.2 Economical barriers for wetland establishment	30
5.5 Structural barriers - economy and regulations	30
5.6 Measures to decrease barriers for wetland establishment	32
5.7 An effective wetland strategy - further analysis	33
<b>6. The Tullstorp wetland project as a road map for wetland establishment</b>	<b>34</b>
<b>7. References</b>	<b>37</b>
<b>8. Appendix: Environmental quality data</b>	<b>39</b>



The Tullstorpån Stream, Scania, southern Sweden

## Foreword

When bird watching in the Scanian landscape as a young biology student in the 1970ies, I often saw big excavators ditching the last remaining wetlands. I was indignant but also a little sad. In the 80ies the negative wetland trend seems to have turned. One or two restoration projects started and the legislation improved. My hope was that no further wetlands were to disappear in the future.

The wetland conservation problem is not new. In the 1930ies the legendary ornithologist Gustav Rudebeck, fought to preserve the vast wetlands, Vomb Meadows, located east of Lund. His fight was, however, in vain and the Vomb Meadows as a bird habitat gradually disappeared over time. Nevertheless, later ambitions to protect wetland biodiversity and bird wildlife, for example through the work to protect the ecological values of Lake Hornborgarsjön, turned out to be the starting point of a changed and more positive view of wetlands. In the 1980ies research indicated that the wetlands historically had been important as a kind of natural nutrient treatment plant. If we could restore the wetlands, they could contribute to a decrease in the eutrophication load on the Baltic Sea. Birdlife and water treatment were the motives to restore the Vomb Meadows and in 2002 Gustav Rudebeck participated in the opening of the renewed Vomb Meadows.

My optimistic view at the time was that the coveted ecosystems services could be reached through establishing large single wetlands with the support from big landowners with an explicit environmental interest. As the first successful projects were located on municipal land, the idea was that ambitious authorities should be able to solve the wetland restoration and eutrophication problems. However, over time it became evident that top-down decisions were ineffective in a landscape perspective, what was required was more systems oriented approaches. This realisation was reflected in the development of an official Wetland Strategy of Scania and the social learning over several decades on how to handle wetland funding.

The County Administration of Scania (Länsstyrelsen i Skåne), already in 1993 arranged a wetland conference focusing on the need for water in the landscape and targeting landowners and other actors. The County Administration identified the landowners as important actors in order to reach success. It was not enough that national authorities allocated subsidies in a wholesale way. The aspiration to involve landowners and other actors in the wetland establishment work has been positive and the Tullstorpsån Stream Wetland Project is a good example.

The Tullstorpsån Stream Wetland Project has managed to reach the objective to recreate a large area of multifunctional wetlands within a single catchment area, as well as to reduce nutrition inputs to the Baltic Sea. The probably most important success factors are that the project is managed by the landowners, through a democratic organisation that allows a dynamic development of the activities towards long-term objectives. The close cooperation between the Tullstorp Economical Association, the full time project manager and the County Administration of Scania has developed into a showcase model for how to successfully organise and run wetland projects. The project organisation, leadership and the holistic catchment perspective are directly transferable to other wetland initiatives and settings.

The Tullstorpsån Stream Wetland Project will now proceed to a management phase, with new challenges. The wetland establishment have yielded many positive results but not fully realised the potentials of the project, for example, the great biodiversity values in a landscape dominated by agriculture are potential advantages. Grazing and mowing are on a decrease in spite of the project creating the highest biodiversity in a landscape perspective. The Tullstorpsån stream green infrastructure offers unique possibilities to establish mowing and grazing areas. Good examples are the Börringe mad wetlands and Beddinge mad meadows which both indicate the potential for biodiversity improvement in other parts of the catchment area. To establish a continuous and sustainable green infrastructure, long-term and predictable subsidies for the management are needed.

Möcklö, February 2021

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The catchment area of the Tullstorsån stream . The map shows restored parts with constructed and planned wetland,

## Abstract

The Tullstorpsån Stream Wetland Project (TSWP) has frequently been highlighted as a successful wetland establishment project, both in a national and international perspective. This provides a background for the commission to analyse the preconditions, development, organisation and work procedures of the project. The Tullstorpsån Stream catchment area is located of the southernmost landscape of Sweden (Scania) dominated by an intensive agriculture on high quality soils. Swedish food and agriculture policy under the 20<sup>th</sup> century has significantly transformed the landscape towards high intensity farming and, consequently, the development of significant environmental problems. The Tullstorpsån Stream catchment area was historically dominated by a high percentage of wetlands but the area has subsequently been extensively ditched to control flooding and gain arable land.

At the start, the main project objective was to reduce the phosphorous and nitrogen load to the Baltic Sea and to reach a good ecological status in the stream water. The project started 2009 and has up to July 2020 established 39 wetlands and restored 18km of stream length produced of a total wetland area of 187 ha.

The landowners constituted the Tullstorpsån Stream Economical Association (TEA) to manage the project. TEA has a board of 7 members and a full-time employed project manager. Several measures are included in the project, i.e. the construction of wetlands of different size and two-step ditches along the stream to balance flooding, the restoration of flooded meadows and remeandering of the stream and the construction of silt traps to recirculate nitrogen and phosphorous. The TSWP will after 2021 be transition into a management phase, see <https://tullstorpsan.se/projektet/tullstorpsametoden>.

This study is based on interviews with landowners (8), project managers and consultants (3) and representatives of the County Administration of Scania (2) and the Swedish Agency for Marine and Water Management (1), as well as on published articles and project reports.

The planning of the TSWP started at the same time as the development of a regional wetland strategy of Scania. Through a continuous cooperation and dialogue between the project and the county administration, TSWP has made important contributions to the subsequent strategy implementation and adaptations. The project has also contributed to the development of the National Wetland Guidelines produced by the Swedish Agency for Marine and Water Management.

TSWP has been a platform for a social learning process for the landowners, developing their local environment and wildlife interests into a more holistic perspective on the landscape ecosystem services as well as on the connection between agriculture and the environment. The study has identified several positive drivers of importance for reaching the project objectives:

- a systems perspective on the catchment area,
- the project has integrated objectives and is driven by the landowners, based on voluntary actions,
- a democratic organisation as a prerequisite for joint decision making about wetland establishment and future management,
- a democratic leadership identifying knowledge and ideas among the actors,
- the landowner's knowledge of the connection between agriculture and the environment,
- a continuous development of practical wetland construction methods, adapted to the local context,
- a full time employed project manager,

Through the interviews the following measures and improvements at national level were identified as fundamental to advance wetland establishment on a landscape scale:

- improvements to the funding system, i.e. what kind of subsidies a project can apply for as well as longer-term assurance of the flow of the funding,
- improvements to regulations and guidelines, adapting them to a systems perspective on wetlands and a balance between agricultural production and wetland establishment,
- a long-term policy concerning the terms and conditions for funding,
- a review of the Swedish interpretation of EU wetland regulations.

The project has developed what may be termed The Tullstorpsån Stream Model. The model is transferable to other wetland initiatives with only minor adjustments owing to local conditions. The basis for the model is that wetland projects ought to be driven by the land-owners, be voluntary and have holistic perspective on the catchment area. The holistic perspective allows nutrient retention, biodiversity and other ecosystem services in the landscape to be of equal importance. Further fundamental prerequisites are joint objectives, a full time employed project manager and a continuous dialogue with the regional county administration. Finally, a wetland project needs a well functioning structure and organisation, democratic leadership as well as physical and virtual communication with the society. The TSWP has developed a body of knowledge concerning suitable methods for wetland establishment and management. This collection of information is suitable as a guideline for other catchment areas. It will be important, before starting a wetland project to make a thorough problem inventory and a mapping of suitable potential places for wetland construction. The positive effects of nutrient retention, as well as on biodiversity and ecosystem services, also need to be taken into account. To secure the long-term project objectives a management plan need to be developed and implemented.

## Abbreviations

HAV = Swedish Agency for Marine and Water Management

LBP = Landsbygdsprogrammet

LEVA = Local water engagement

LONA = Local nature protection investments

LOVA = Local water protection projects

TEF = The Tullstorpså Economical Association

TSWP = The Tullstorpså Stream Wetland Projektet

The County administration = The County administration of Scania

The Countryside Programme (landsbygdsprogrammet), Swedish Board of Agriculture

Water Councils (Vattenråd)

VISS = The water information system



Artificial wetland, Sånarp, Lilla Beddinge 2020, constructed 2010-2011. Photo: Hans Berggren

## 1. Introduction

*"150 year ago lakes, bogs and mires were dominant parts of the landscape, and streams meandered in agricultural landscape where water was a prerequisite for the natural wetlands providing the farmers need for winter fodder for cattle. Historically, the free running water was the farmer's first ally in the struggle against hunger and need".*

Brink, P. The Scanian Water World, Skånes Natur 1965

### 1.1 Task and objectives

The Tullstorpsån Stream Wetland Project (TSWP) comprises of a string of successful wetland establishments within a catchment area, situated in southern Sweden, see p. 6 and ([www.Tullstorpsan.se](http://www.Tullstorpsan.se)). The landowners in the catchment area have been the main responsible actor in the project. The requirements for success have been evaluated through an analysis of the project's environment, development, organisation and

work procedures. The objectives of the study has been to focus on the effect of landowner participation in the wetland establishment as well as on drivers for success. The evaluation gives a systems perspective on wetland establishment and proceeds from the following aspects:

- organisation and management structure,
- ecological drivers,
- social drivers,
- economic drivers,



- stakeholders influence on the project objectives, and
- barriers and innovations.

The evaluation covers the establishment phase, which ended in 2020 when the project transitioned into a management phase. However, the full effect of the new wetlands on nutrient retention and biodiversity needs a longer time period to be evident. For example, the long-term nutrient retention of nitrogen and phosphorous depends on the management programme and biodiversity reestablishment.

## 1.2. Development of the historical landscape

The Tullstorpsån Stream's headwaters arises from a large mire complex in Fru Alstad community, see p 13, the Reconnaissance Map of Scania 1812 –1820. Historically, the stream meandered through wetlands in the valleys of a dead ice landscape created by an stagnant parts of melting ice sheet. The map shows a combination of mires and fens with numerous streams discharging into the main stream. Further south, in the area today called the Outdoor showroom (Jordberga p 8), the watercourse was bordered by wetlands. Just before the stream entry into the Baltic Sea the wetlands covered a vast area. The whole catchment area was green, wet and productive. The farmed wetlands were important for hay production and grazing and cattle manure was used as fertiliser on agriculture land, "Meadow is the mother of cropland" (Gadd 2000, Emanuelsson 2009). The grass production could be increased through flooding in the spring or through different surface irrigation systems. The nutrient content of the seeping water contributed to a high and sustainable fodder production (Emanuelsson 2009). The irrigation system on Beddinge meadows, around the mouth of the Tullstorpsån stream was active up to 1958 and has been restored as a part of the project (Carlsson 2020).

Just as in many parts of Europe, the Swedish wetlands were extensively ditched during

the 18<sup>th</sup> and 19<sup>th</sup> century with the aim to win more agricultural land and increase food production. Drivers for the process were population growth, governmental subsidies and mortgages as well as advisory services. The ditching and water laws 1873, 1918 and 1983 created new frameworks of governance for dewatering through mire and fen ditching, water deflection and draining (Heeb 2019). In an example from southwest Sweden, the wetland part of the catchment area decreased from 29% to 3% during this period. An effect of the first ditching law in 1873 was that unwilling landowners could be forced to pay for costs of the works and future management (Gadd 2000).

However, already in 1824 and 1841 national regulations were decided, which prescribed an obligation for the landowner to ditch their land (Sommarin 1912). The watercourse regulating enterprises increased in number as an effect of the availability of governmental expertise. These agricultural engineers were also active in the drainage of farmlands. Between 1833-1887 more than 400 000ha agricultural land was drained (Zachrisson 1922). A study by Ihse (1994) shows that wet- and grasslands were an important part of the Tullstorpsån stream landscape up to 1824. During the next decades the continuous wetland area was fragmented and only the wettest parts still remained. In the beginning of the 20<sup>th</sup> century, only grasslands along the stream and in a narrow zone around the marl ponds were left and at the end of the century the green infrastructure has declined to a strip of grasslands along the stream. This area has, during the TSWP period, been restored as an outdoor showroom and visiting centre. The historically the Swedish government has been the main driver to drain the farmland. With the 1991 Nature Protection Act the situation changed due to a ban on drainage in the southern part of Sweden. Today, the Swedish water strategy follows the EU Water Framework Directive and the National Environmental Objectives, identifying wetland reestablishment as a management tool to address some of our current and complex environmental problems.





Part of the Reconnaissance Map of Scania 1812 –1820, showing the Tullstorpsån stream with surrounding wetlands. Source: Lantmäteriverket, Topografiska kåren, Fältmättningskåren, Ingenjörskåren, SE/KrA/0052/C/14a/10-4. Bildid: K0035819 00001

### 1.3 The Swedish national wetland strategy

The task of the Swedish Water Authorities is to realise the EU Water Directive. To streamline this task, Sweden is divided into five water districts. The responsibility of each district is to develop a water management plan, coordinate water management in the district and to cooperate with national, regional and local partners,

<https://www.vattenmyndigheterna.se/om-vattenmyndigheterna/vattenmyndigheternas-uppdrag.html>. The tools are the mandatory Environmental Quality Norms (EQN), a management plan and an action programme, <https://www.vattenmyndigheterna.se/vattenforvaltning/miljokvalitetsnormer-for-vatten.html>.

The structure of the water administration includes different administrative levels and some independent organisations. Within each Water District, one of the County Administrations have the remit as regional Water Authority tasked to prepare, advice and execute the water activities. The responsibility of the municipalities is planning as well as practical water management,

i.e. of storm water and sewage systems. Involved independent organisations are Water Councils, Water Management Associations and Water Associations, which include representatives of municipalities, the County Administration, landowners, energy companies, industries and other stakeholders. The Water Councils are non-profit organisations and their tasks are, for example, water sampling, water protection activities and education. With proper bylaws and municipality funding, this kind of organisation can make for good water protection efforts. The Water Management Associations are non-profit organisations focusing on water quality monitoring and the Water Associations are by law responsible for watercourse regulation and cleaning. Beside the Water Authority, 11 other national authorities are to various degrees responsible for activities within the water management programme.

The water management programme has a clear water protection mission in urban areas but in the countryside the mission includes fragmented measures, like manure and herbicide control. To plan water measures in a landscape scale for large catchment areas, these ought to be administrated by several municipalities. In Sweden, municipi-

palties have a monopoly on planning, both detail and comprehensive planning. Only the detailed plan, which only covers parts of the built up areas, carries legal force, with the consequence that neither the municipalities nor the County Administrations have compulsory tools to solve water issues on a landscape scale without national legislation.

Sweden has a water information system (VISS) with classifications and maps of all the larger lakes and watercourses as well as of ground water and coastal waters. VISS provides a water status classification, environmental quality norms (EQN), monitoring data and data about protected areas and suggested measures, see <https://viss.lansstyrelsen.se/About.aspx>, <https://viss.lansstyrelsen.se//Search.aspx?searchType=MeasureTypes>

However, VISS as a tool hasn't been used by TSWP owing to that the information and assessments available were less detailed than the local information. At the beginning of the project, TSWP decided to start water sampling to create a better basis for decision and in order to be able to evaluate planned measures. When the TSWP started 2008, VISS was a relative poorly known concept and no management programmes had been adopted. Instead TSWP defined project objectives where the initial objective was a reduction of nutrients in the stream water through wetland establishment. In 2008 it was decided that fulfilment of the water environmental quality norm of the stream was to be evaluated 2020. The TSWP work with the EQN has been dynamic over the establishment phase with a continuously improving the water quality.

## **2. The Tullstorpsån Stream Wetland Project (TSWP) 2008-2020**

### **2.1 Project setting and method**

The Tullstorpsån Stream Wetland Project (TSWP) started 2009 with the overall objectives to decrease the nutrient contribution to the Baltic Sea and to reach good ecological water status. TSWP includes the catch-

ment areas of the Tullstorpsån and Grönbybäcken streams, situated in the southernmost part of Sweden, see map on p 6. It is a wetland project initiated and run by the landowners along the watercourse and ongoing for more than 10 years. During the period 2009-2020, 39 new wetlands were built and 18 km of the streams restored resulting in a total wetland area of 187 ha, see Table 1, Appendix. Given a catchment area of 63km<sup>2</sup>, the project has recreated 3% of the area to wetlands. The recreation of this type of green infrastructure, in a modern agricultural landscape with no wetlands, is a very valuable achievement providing the landscape with a network of multifunctional wetlands (Ihse 1994).

TSWP has received funding for 2020-2021 to continue wetland restoration activities, see <https://tullstorpsan.se/rappporter/nyhetsbr ev/april2020>). During the project period a new parallel project, TSWP2, was started 2016 focusing on nutrient and water circulation (<https://tullstorpsan.se/projektet/tullstorpsan-2>). For more information about TSWP see <https://tullstorpsan.se/projektet>. The landowners in the catchment areas founded the Tullstorpsån Stream Economy Association (TEA) with 60 members. The TEA board has seven members. Due to the project transfer to mainly wetland management, phase 2, a Management Group of three members has been established. During the project, the TEA has employed a full time autonomous project manager.

The Tullstorpsån stream catchment area is located in a landscape dominated by intensive agriculture on the most-productive arable land found in Sweden. From the middle of the 19<sup>th</sup> century, Sweden needed an increased food production both for economic growth and in order to produce enough food for a growing population. Swedish agricultural policy, therefore, strived for increased productivity resulting in a transformation of the cultural landscape with the attendant environmental problems. In this perspective, the 1879 ditching law was important in order to drain

“swamps” and gain arable land, resulting in a modern agricultural landscape with no wetlands, (Heed 2019). Out of a sense of responsibility both for soil quality and for the next generation’s possibility to continue farming, the then landowners tried to find strategies and modern management methods to protect the long-term productivity of the soil.

Today, the landowners cultivate conventional crops like rapeseed, wheat, sugar beet, onions, potatoes, corn and rye but also alternative crops like white clover. The agricultural objective is a profitable production of high quality primary products from a sustainability perspective taking soil, biodiversity and environmental perspectives into account. The landowner perspective is several generations and one of the most important goals is to transfer the farm to the next generation.

The Tullstorpsån stream method for wetland recreation and construction consists of measures to reach the original project objectives but also:

- to have a catchment systems perspective,
- to have a bottom-up perspective,
- that the farmer’s engagement is crucial for the project,
- to develop a legal/governance model for regulating the cooperation between landowners, and for the management of the green infrastructure along the watercourse, and
- to develop practical methods for joint administration and management.

A full final evaluation of the nutrient retention effects of wetland establishment, silt traps and stream structure changes is not possible until after the construction phase. However, in 2016, the Swedish Agency for Marine and Water Management evaluated, five large and three stand-alone projects for reducing water eutrophication. In this evaluation TSWP received the highest total sustainability index calculated from separate ecological, social and economical sustainability indexes (Franzén et al 2016).

TSWP has used several methods for wetland restoration: construction of wet-

land of different sizes, two-step-ditches along the stream to balance high water flows, restoring of water meadows, (re-)meandering of the stream and bed-load traps for retrieving nitrogen and phosphorous, see

<https://tullstorpsan.se/projektet/tullstorpsametoden>

An “outdoor showroom” on former grazing land, in the southern part of the catchment area, features several of the used methods and provide information about the project for stakeholders, authorities and the public, <https://tullstorpsan.se/bilder/visningstrackan>.

## 2.2 Project objectives

As stated, the main objective at the start of TSWP was to decrease the nutrient outflow to the Baltic Sea through wetland establishment. Soon a string of linked social-ecological objectives developed:

- to reduce the nutrient outflow, mainly nitrogen and phosphorus, to the Baltic Sea,
- to increase biodiversity,
- to recreate the fish populations through good ecological status in the stream,
- to counteract flooding and erosion,
- to decrease the need for biomass harvesting,
- to increase the possibilities for nature experiences, recreation and shooting, and
- to increase the public interest in, and understanding of, environmental problems as well as the importance of protecting natural and cultural values for the next generations.

## 2.3 The project organisation development

Before the start of the TSWP, a number of ditching enterprises were legally in force along the Tullstorpsån stream. To get subsidies for a restoration project, the legal





The southern wetland of Sillesjö. One of the first wetlands in the area. Photo: Johnny Carlsson

framework postulates some kind of common association. Therefore, TSWP was organised as an economical association, the Tullstorpsån Stream Economical Association (TEA), which is responsible for administration, funding and decision-making. The association was founded 2009 and the project was divided into two parts, owing to earlier regulation history conforming to drainage enterprises, the south and the north part of the catchment area.

The south part included two ditching enterprises, The Tullstorpsån Stream Ditching Association 1965 and Lilla och Stora Beddinge Ditching Association 1902. Owing to legal requirements, TEA needed to apply to the Swedish Environmental Court (Mark och Miljödomstolen) to replace the Ditching Associations with a new kind of joint property unit, the Tullstorpsån Stream Water Regulation Association. This association is legally able to allocate costs following the

landowners shares and the fundamental basis is environmental benefit and land drainage. Through an agreement between the Tullstorpsån Stream Water Regulation Association and TEA, the latter has assumed all rights and obligations from the former. In the southern part all the estates and owners are linked to TEA and the association is responsible for management and maintenance, i.e. establishing a water management area along the stream. Each landowner has made an agreement with TEA allowing the association to use the land for the decided purposes after economical compensation. The compensation was in total 2,4 million SEK for 25 ha inclusive the water surface. This compensation was an important driver for the establishment of TEA and in creating landowner involvement.

In the northern part, the landowners retained the existing ditching associations. They did this owing to: /. the fact that it was

not possible to receive compensation due to a later start of the wetland establishment, 2 that by only using the two-step ditching method, the stream channel could be left intact and therefore no new legal water verdict was required, and 3/ the landowners being comfortable with the existing drainage associations while, at the same time, being members in TEA.

To summarise the motivations for the choice of organisation, TEA, was:

- that it was a well-known type of organisation,
- that the organisation clearly regulated the relationship between the landowners and had explicit routines for the work and responsibilities of the board,
- that the quantitative and qualitative objectives, as well as the membership rules, were defined in the charter of the organisation,
- that the relationship between TEA and the individual landowner was regulated in agreements, adapted to local measures and conditions,
- that the members were mainly landowners, though a supportive memberships were possible, and with only voting rights restricted to landowners ,
- that it allowed for detailed project accounting as a basis for budgeting and monitoring is crucial,
- that the organisation could handle public funds with external accountants responsible for budget oversight, and
- as the TEA charter had no clause for profit share any surplus could be used for activities which are not directly funded, e.g information.

TEA has employed a full-time project manager. For the practical arrangements of wetland construction, contractors have been employed.

## 2.4. Project development over time

The idea to restore the catchment area was developed during 2008-2009 in discussions

between landowners and two consultants, one employed as wetland advisor within the agricultural initiative "Greppa näringen" (Hold the nutrients) and one employed as environmental consultant by Trelleborg Municipality. During these discussions, several of the landowners showed a great interest in restoring the stream water quality.

At the same time, the EU Water Directive entered into effect inspiring politicians in Trelleborg Municipality to a closed-loop project for biogas production. The Tullstorpsån stream catchment area was a part of the project and the municipality allocated 3 million. SEK, inclusive costs for planning wetland establishment in cooperation with the landowners. The two project consultants identified 50 potential wetland locations within the Tullstorpsån stream catchment area and their potential contribution to reducing the nutrient loads of the stream. Theoretically the wetlands were enough to reach "good ecological status" for the stream water. The initial plan was to establish 13 wetlands of different sizes during the first 6 months; and the TWSP started to build the first project wetlands 2008-2009 before the TEA was officially constituted. To secure the long-term project economy, additional funding was needed but Trelleborg municipality was not able to contribute other to other priorities. TEA then applied to the County Administration of Scania. and contacted the officer in charge of wetland issues. At the time, the County Administration's strategy was to promote very large wetlands but, in a dialogue with TEA, a string of wetlands of different size, was decided on for the catchment.

In the spring 2009 TWSP applied to the County Administration for funding to restore the part of the stream that became Visningssträckan (the Outdoor showroom) and the restoration work was finished during that summer. The funding came from the Local Water Protection Fund (LOVA) at the County Administration but without the requirement of co-funding , e.g money from the TSWP or the TEA members. TSWP got additional funding 2010, and in this case the



Sörby Kjöse. Photo: Johnny Carlsson

co-funding was arranged through the Rural Development Programme given to the individual landowner, which the landowners transferred to TSWP. The construction of new wetlands was swift due to the fact that TSWP continuously applied and got funding for new sub-projects. The project developed an economical model of cross linked project funding to fully finance its activities.

The decision by The County Administration decision on the Outdoor Showroom Stretch covered both funding and the permits for the work. The last sentence of the work permit stated: "This project may be of guidance to other catchment areas with similar needs (in the agricultural landscape)". This decision was time effective and allowed a quick start of works. The Outdoor Showroom establishment was crucial to demonstrate practical outcomes of the planned arrangements, and also the effect on water and landscape, for the landowners. The Outdoor Showroom has also been valuable for the County Administration as a demonstration area. One important factor in the TSWP success has been the systems perspective of the County Administration as well as the trust built between the project and the County Administration. The Admin-

istration officers' openness to discussions, and their lack of prestige as civil servants, as well as their long experiences of water issues were fundamental for trust building between the County Administration and the landowners/consultants. The high level of trust allowed the project to work most efficiently toward the defined objectives, and for the actors to jointly develop solutions to unexpected problems when they arose.

Both the TSWP's systems perspective and management plan for the whole catchment area can be seen as forerunners for handling complex environmental problems. During the project period, fundamental knowledge was gained, based on practical experiences, on how to run an extensive wetland project. That knowledge has been documented through generic guidelines. Method development, as well as technical cooperation, has been the basis for attaining the project objectives. Finally, team building is also very important for success; the expertise, experiences and roles of the team members should complement each other.

### 3. Evaluative framework

Environmental problems of today are diffuse, complex and often without a clear relationship between cause and effect. Owing to the resulting uncertainties suggested solutions are seldom well defined and often generating disagreements between experts, authorities and citizens. Thelander and Lundgren (1989) classified environmental problems in first and second generation type problems. The first generation represented easily identified problems with straightforward solutions. The second generation problems can be characterised as more complex, with multiple cause-effect relationships and delays, – and countermeasures to be difficult to delineate, potentially more disruptive or costly and thus more controversial from an environmental and societal perspectives.

Current environmental objectives and sustainability issues represent third generation problems where solutions must include ecological, economical and social dimensions and the effectiveness of the measures will be dependent on continuous learning, adaptive management and the transmitting of practical experiences. To reach the environmental policy objectives new modes of governance have been developed during the last 20 years operating on the EU, national and local levels (Bäckstrand et al 2010). Important components for success are transparency, participation and dialogue as well as bottom-up and deliberative perspectives.

In order to evaluate the driving forces for the long-term effects of the TSWP, the analysis needs to cover both:

a/drivers on the local level, and

b/ the official perspectives on what is required in order to obtain a long-term policy for a sustainable environmental strategy for water and landscape.

The importance of the latter can be illustrated by a comment by a HAV representative, with an extensive experience from EU projects, concerning why suggested solutions of complex environmental problems often fail: “You only consider *one* problem at the time and there is no understanding of

the system”.

#### 3.1. A systems perspective on complex environmental problems

##### 3.1.1. A systems perspective

The environmental problems are complex, non-linear, multi-dimensional, dynamic and multi-disciplinary. We tend to focus on symptoms, e.g. a nutrient inflow to the Baltic Sea, whereas the understanding of why the symptom has developed needs to be based on a holistic perspective identifying the systems structure and function in order to grasp the problem behind the symptom. To identify possible solutions we need to develop a systems understanding, i.e. an understanding about underlying cause-effect relationships, feedback loops and how these are connected and influence each other. In a dynamic model development over time may be identified (Sverdrup et al 2010, Ingelstam 2012). A holistic perspective allows us to identify important actors for change, which is not always evident with a top-down perspective. It also allows us to identify important or alternative leverage points for change. This is important as a small shift in one driver can generate disproportionate changes within the whole system (Meadows 1999). Without a systems view, the risk of using inefficient measures, which only have minor or short duration impacts will be great. Another risk is that unwanted side-effects will be both overlooked and generated.

##### 3.1.2 Boundary settings and scales

The boundary of a system defines our understanding of the problem as well as of possible measures and actions. A large catchment area is a good example as it often consists of multiple stakeholder estates and boundaries between the landowners as well as several administrative borders (municipalities and

counties). The streams are also affected by all kinds of activities within the catchment. If, for example, the objective is to contribute to improving the water quality of the Baltic Sea, the action of a single landowner will be marginal. If, on the other hand, the landowners in the area were to coordinate their actions then their contributions could be significant. This is exactly what the TSWP has done.

The various actors within the system have different degrees of control over the diverse components and factors affecting the outcome. With the example of TSWP, practical measures like remeandering of the stream and wetland construction assume willingness and actions by the landowners. Public actors are limited by legislation, guidelines, governance system and budget processes. Hence, the coordination processes between authorities tend to be difficult. Further challenges are information exchange, effecting staff continuity and continuity of policy defined commitments. The last challenge is central to the discussion about the importance of different time-scales.

Measures on the landscape scale to improve the water quality from a catchment area need to be long-term, and the effects are not immediately recognisable. Further, these kind of measures needs time for the development of a local organisation with joint objectives, filing of funding application and funding for planning and constructions. The time scale of authorities runs from a budget year to a term of office (4 year), a mismatch with the time scale of the landowner (decades- generations), physical constructions in the landscape (several years) or the time period before the effects are established. From a practical perspective, the mismatch of scales is a considerable barrier for initialising and realising wetland projects. Financial decisions and subsidies following a one-year budget period does not allow for long-term guarantees for landowners and other actors with regard to funding or other prerequisites for project implementation.

## **3.2 New modes of governance**

The nature of complex environmental and natural resource problems crosses boundaries between disciplines and competences, as well as over administrative boundaries and sector responsibilities. As discussed above, they also belong to different scales and need long-term measures for mitigation. Efficient handling of complex problems often require the use of new modes of governance. Management, and governance, by objective implies participation in both the definition of objective and measures (be they between authorities and between authorities, civil society and the market. Bäckstrand et al 2010 identified new modes of governance as a response to perceived legitimacy and output deficiencies in environmental governance. In a landscape perspective, a bottom-up perspective is crucial in order to engage all actors as well as for an effective action. The TSWP provide a good illustrative case.

### ***3.2.1 Importance of building trust***

Ostrom (1998) identified that the trust building process between two or more partners was dynamically linked to cooperation and credit, but also to cooperation for the common good. The identified feedback shows that more cooperation results in more credit between partners, which in turn results in more trust and more trust back to more cooperation. This reinforcing feedback need to develop over time in order to counteract effects of uncertainties and negative drivers, like change of officer at the regional authority or risk for negative changes in financial subsidies. Rothstein (2011) found that loss of trust may develop into a social trap, where it is hard for the actors to restore sufficient trust for cooperation for a common good even if they theoretical can identify this action as positive for the joint effort. In the renewable resource system, inequality between large and small actors may serve as a major driver for lost of trust (Gisladottir et al 2020).



### **3.3 TSWP and the development of the regional wetland strategy**

#### **3.3.1 A wetland landscape strategy**

The national Swedish wetland strategy is influenced and regulated by several national environmental objectives and EU directives, i.e. the Directive 2000/60/EG for water policy. Of the 16 Swedish Quality Environmental Objectives, six influence wetland establishment: Zero Eutrophication, Flourishing Lakes and Streams, Good Quality Groundwater, Thriving Wetlands, A varied Agricultural Landscape and A Rich Diversity of Plant and Animal Life. At the regional level, water strategies develop through joint consultation with regional actors, i.e. the Association of Swedish Municipalities, the Swedish Society for Nature Conservation and the Association of Recreational Anglers. The strategy's objectives are to adapt the National Environmental Objectives to the regional prerequisites (Karlsson et al 2009). The regional water strategies are also linked to other regional strategies and planning. In southern region of Scania, known for intense agriculture, the development of a regional water strategy started in 2007 (Länsstyrelsen i Skåne 2007). The former Director of the South Baltic Water District, Dea Carlsson, phrased the importance of such a strategy as "We water authorities have met requests and expectation about new ways of working, adapted to the Swedish context and requirements".

#### **3.3.2 The water strategy of Scania**

The first draft of the Water Strategy of Scania, developed by the County Administration of Scania in 2007, has several interesting links to the wetland establishment in The Tullstorpsån Stream catchment area. One of the most important starting points was that the multifunctionality of the wetlands and the planning of wetlands ought to have a landscape perspective. The idea was to create planning materials for the local actors as

well as develop cooperation with landowners, municipalities and other authorities. The aim of the County Administration was to identify large projects, however, problems were early noted owing to that the water responsibility was divided between many different authorities and planning levels. The road map to an improved interest in wetland establishment was to encourage landowners through an outreach programme. This strategy may be defined as top-down in relationship to the landowners.

The wetland strategy of Scania, with an attendant subsidy system, later developed more of a systems perspective on the catchment area. The development was supported by the experiences of the TSWP as well as by the cooperation between the county administration and TSWP. The history below is based on an interview with the county administration officer responsible for the wetland strategy.

At the start of the TSWP, 2009, the county administration had only a few civil servants responsible for wetland establishment, and the financial resources were small. Since then, the national authorities' wetland establishment objectives have changed. Initially the main problem was seen as the nitrogen and phosphorous content in the water even if biodiversity in the landscape and recreation values also were included. At the same time the knowledge about wetlands ability to reduce the phosphorous was incomplete.

Already before the Swedish EU membership in 1994, the Swedish Society for Nature Conservation carried out an information campaign focusing on the importance of wetlands in the landscape aimed at landowners. The national authorities also allocated subsidies for establishing smaller ponds but the landowner's traditional view of agriculture was hard to change. In 1993, the County Administration of Scania arranged a wetland conference about the importance of water in the landscape. The conference was aimed at landowners, the Federation of Swedish Farmers, municipal ecologists and academic researchers. As a consequence of the Swedish EU member-



Böringe mad. Grazing is an important management measure to increase the biodiversity and the quality of wetlands. Photo Hans Bergren

ship, funding for wetland measures became available. Funds were channelled to the areas with the highest water pollution, like Scania. The County Administration identified a requirement for more of a systems perspective, informing the national authorities about the need for a holistic view in order to increase the understanding about regional problems. The County Administration realised that the approach of template subsidies was inefficient for engaging landowners for wetland establishment. The approach was based on landowners paying half of the construction costs while at the same time the landowner would lose valuable agricul-



Böringe mad wetland. A paradise for birdwatchers. Photo Hans Bergren

ture land and, as a result, get a decrease in income.

As an effect of an increased application rate for wetland funding, the County Administration developed a model to evaluate and rank different projects. This model evaluated first the potential wetland contribution to nitrogen retention followed by effects on phosphorous retention, biodiversity and recreation. An algorithm was developed to calculate the benefits of the wetland based on the size of the catchment area and its location. At the time the TSWP was different compared to other wetland projects owing to its combination of several sub-projects within a larger catchment area. The County Administration accepted the design after a detailed discussions with TEA and a period of trust building between the partners. The landowners' strong interest in wetlands was seen as a guarantee for successful implementation.

At the project's start, neither the TSWP, nor the County Administration, had anticipated that the existing national subsidy system for wetlands would cause numerous financial and administrative problems. The time horizon and duration of the

subsidies caused operative problems where farmers had to balance crop production, ban on bulldozer use during the bird breeding period and seasonal variations in precipitation complicating the wetland construction. The overall problem, however, was budget regulations where funding, earmarked for one year, could not be transferred to the next year.

During the 2009-2020 period the County Administration worked holistically on wetland establishment. The wetlands' ecosystem services were identified to be of interest for several kinds of stakeholders, i.e. through biodiversity, recreation, water treatment, hydrology and the water storing possibilities (Våtmarksstrategi för Skåne 2007). The responsibility for these interests is divided between the Government and the municipalities. The Government is responsible for threatened species, water quality in the coastal sea and nature reserves whereas municipalities have a general planning responsibility for biodiversity, recreation and the beauty of nature. This mixed responsibility is the basis for the authorities willingness to pay, but for an effective use of local opportunities in a wetland project, a more holistic perspective is needed.

With the EU wetland subsidies for any given project period followed a legal framework, which should to be defined in a Swedish legal context, accepted by EU, and interpreted by the Swedish Board of Agriculture. The Government was aiming at a simple legal regulations and the results became a rather roughly designed framework. For example, wetland subsidies from the Swedish Board of Agriculture to the County Administration arrived at the Department of Agriculture, today "Department Nature and Rural Areas". In the beginning of the TSWP period, the Department did not prioritise the development of administrative routines to forward the funding to existing projects owing to the relatively small amounts as compared to other subsidy schemes within the Department's remit. Further, the Department of Agriculture had no contact with the Department responsible for wetland establishment. Subsequently, when the admini-

stration of the wetland subsidies was transferred to the Department of Environment and Water, information about the changes to the national wetland subsidy system was given to prospective applicants. Currently (2020), the County Administration has developed both a functional administrative model and good contacts with the relevant national authorities with regard to questions of substance and information support.

The EU wetland establishment subsidies were later on in the TSWP period administrated by the Department of Environment and Water, i.e. the department handling national funding for other water measures. Together with a improving water strategy competence this was an important factor for successful wetland operations in Scania. Additionally, the County Administration had, over the years, developed a knowledge about possible financing from other sources, i.e. local environmental funds, and developed a close cooperation with these funding institutions assisting TSWP in receiving extra funding to supplement financial gaps. However, TSWP received little financial support from the municipality in spite of municipalities being supposed to be key operators in the Swedish Water Strategy. The municipality plan for wetlands was also perceived as inadequately adapted to the landowners' contexts or the geographical characteristics of the landscape.

As a result of the cooperation with TSWP, the County Administration found that the best strategy for wetland establishment is to develop a plan for each catchment area in order to show landowners the potentials within the individual catchment area.

#### **4. Methods and interviews**

The data was collected from written project reports and semi-structured interviews with landowners, consultants and officer on the regional (the County Administration of Scania) and national (Swedish Agency for Marine and Water Management) level. Semi-structured interviews may help identify information that is important for the inter-



Stora Markie before and after the wetland establishment.  
Photo Johnny Carlsson

viewees but may be excluded with other kinds of methods (Kvale and Brinkman 2008, Gill et al 2008). In total 14 interviews were conducted in person with the exception of one, which was conducted via zoom. The 8 landowners were identified through the snowball sampling method, i.e. that an interviewed person suggests other key actors for further interviews (Robson 1993). All the persons involved in the TSWP were interviewed, i.e. 3 consultants, 2 County Administration officers and 1 officer from the Swedish Agency for Marine and Water Management.

The interviews lasted 1 – 1,5 hours and were based on a list of open questions. The rationale behind the questionnaire was to identify key drivers and barriers for wetland establishment. Consequently, the questions were classified into six categories,

drivers, barriers, regulatory system and policy, long-term motivation, innovations and approaches to natural values. The authority representatives were given an extra category: the authority engagement with TSWP.

Chapter 5 summarise the evaluation analysis and discussion. For detailed information of the results and the list of questions, see “Utvärdering av våtmarksprojektet i Tullstorpsåns avrinningsområde i Skåne, 2009-2020” (Stjernquist 2021).

## 5. Results and discussion

Long-term solutions of complex environmental problems linked to water ecosystems benefit from: 1/ a systems perspective for identifying leverage points, 2/ a local organisation developing practical solutions ,



Ängsslätt before and after the wetland restoration.  
Photo: Johnny Carlsson

3/ trust-building between actors, and 4/ a long-term perspective.

The result shows an unanimity between the interviewed categories that the crucial consideration in order to participate in TSWP, as well as for the long-term development of the project, were the systems perspective, a project plan with clear objectives, secured funding over the whole project period, the autonomous project manager, landowner participation by choice and a long-term project period allowing an analysis of the project work results step by step. Important drivers over time were the development of the cooperation model between TSWP and the county administration, the development of practical methods and the Outdoor Showroom.

The result and discussion chapter is structured following the criteria: organisation and leadership, social drivers, economical drivers, the landowner engagement in environmental issues and the landowner's participation in the goal formulation

## **5.1 Organisation and leadership**

### **5.1.1 A systems perspective**

The landowners' awareness of a systems perspective was evident in their answer to the question how to define "Good Ecological Status", which is a fundamental objective for the EU Water Directive. The landowners put forward that a good ecological status was to be reached through a holistic perspective on the catchment area including factors like decreased nutrient load, improved biodiversity and an efficient resource management. The basis for an efficient resource management is knowledge about the causal factors behind nutrient leakage over time. Cleaner water results in a larger fish population in the stream, and wetland construction in more game and bird species in the area.

The landowners' view on the future development of the TSWP (TSWP1) was that the project will (2020) transition into a management phase – and that the driver for continuity is a dynamic perspective which

allow the a development of new ideas, e.g. to test different irrigation methods to compensate for climate change (a new project called TSWP2) or to analyse if the agriculture production will increase as an effect of wetland biodiversity.

TEA has built up a resource of experience available for other Swedish wetland projects, for example the development of economic incentives to assist landowners to find ways for long-term wetland management.

Borgström et al (2016) has claims that in restoration projects, a systems perspective is crucial for the possibility to focus on ecosystem functions. The TSWP avoided the risk of fragmentation through individual minor projects by the initial plan to construct 50 wetlands in the catchment area developed already at the beginning of the project and followed during the whole construction phase. However, the system boundary and size must be chosen as close to optimal as possible in order to allow actor cooperation and project structure to be effective enough to reach the project objectives.

### **5.1.2 Organisation**

All interviewees highlighted that the chosen organisation, with an elected board, a chairman and an independent project manager was crucial for the project realisation and for its positive results. This type of organisation can be highly recommended to similar wetland projects. The project was landowner dominated and, from the outset, based on voluntarily participation which contributed to success. This type of organisation, as well as the project size and durability has helped building trust between actors and between the authorities and the project. The TSWP organisation also made it possible to focus on the project's objectives and to transfer these to practical results, i.e. wetlands. A democratic leadership and the landowner's competence have helped developing the project. The chairman and the project manager experience have contrib-





Digging activity, phase 2. Photo Johnny Carlsson

uted to trust building between the county administration and TSWP. The different roles of the various actors were clearly defined and contributed to smooth project running, e.g. the project manager's role as an independent and driving force helped in avoiding of potential conflicts (Olsson et al 2004).

The co-management as well as the discussions between the TSWP board and the landowners ensured that all members were active, that new initiatives were accepted and that the landowner ideas could be developed within the project framework.

### **5.1.3 A bottom-up perspective**

The bottom-up project management, describe above, is a suitable, and transferable, model for other wetland projects. This evaluation shows the strength of the working strategy. The size of the catchment area has, however, to be manageable and a functioning relationships between landowners need to be attainable. If working with large systems, the project need be divided into sub-areas, of suitable size for landowner cooperation. One of the advantages at the start of the TSWP was its manageable size.

## **5.2 The landowner interest in environmental issues.**

All the interviewed landowners were, before the project start, interested in nature and

environmental issues, like e.g. water habitats in the landscape, habitats for game as well as in fishing and shooting. They were also aware of the high nutrient load in the Tullstorpsån stream, which became the starting point for project. The project evaluation highlighted that the holistic view of the catchment area as well as the cooperation between actors had been parts in a social learning process where the landowners' local environmental and nature interest has developed towards a systems perspective on the landscape, ecosystem services and the connections between agriculture and the environment.

### **5.2.1 Objectives**

The landowners ranked a decrease of nitrogen and phosphorous concentration in the water as the most important objective. This objective was also the main focus of project from the start.

For 50% of the landowners an increase in biodiversity was seen as the second most ranked objective. The landowner expectations on the wetland development illustrate the long-term perspective of the actors, who emphasise that the resulting wetlands need continuous management for its long-term functionality. Sustainability can be created by compensating for earlier changes and by adaptive revisions and management.

The effect of the artificial wetlands on nutrient retention has, against the Water



A two-step ditch at Sillesjö. Photo Ingrid Stjernquist

Directive classification, been positive. A continuous analysis of nutrient in the Tullstorpsån stream outflow into the Baltic Sea has created a long and valuable sequence of measurements. It is, however, not possible to measure the final impact before the end of the construction phase. The same is true for the biodiversity effects, which depends on the future management strategies.

The interviews further highlighted that the management ought to be efficient and that use, especially through grazing, increases biodiversity in the high efficiency agricultural landscape of Scania. The Börringe mad wetland in the northern part of the catchment area and Beddinge mad meadows in the south exemplify this (Carlsson 2020). The rare black stork (*Ciconia nigra*) is now a not infrequent visitor at the Börringe wetland. The project's wetland management strategy identifies a potential to further increasing biodiversity (Nilsson 2017). In order to be able to reach this goal, a continuous dialogue between actors will be crucial, as well as a learning process during the whole of the future management phase. Solutions to increase biodiversity could often be simple, but a step-by-step approach will be needed. The first step is a coherent management for the area.

### **5.2.2. The relationship between agriculture, landowner interest and wetland development.**

The TSWP illustrate the importance of the strong relationship between agriculture, landowner interest and wetland development for reaching the desired objectives. None of the landowners felt that the wetlands have decreased the productive farmland area. Owing to the bottom-up perspective, the project has been able to make use of the landowners' detailed knowledge about the productivity of their agricultural land as well as the landscape history of the catchment area, so as to identify suitable sites for wetland establishment. As mentioned above, one foundations for the project has been the

landowners' interest in environmental issues, shooting, fishing and biodiversity. This is an interesting observation in light of the discussion in a joint study by the Swedish Agency for Marine and Water Management and the Swedish Board of Agriculture on how to balance agricultural and environmental measures (HAV Report 2015:10). Several of the suggested technical solution within the project, like the idea to use the so-called "two steps ditching" to avoid farmland flooding are part of the holistic perspective of TSWP.

As a result of the close link between agriculture and wetland establishment, a new project (TSWP2) has been developed now with a focus on water issues in relation to ongoing climate change.

Ebernhard et al (2020) identified knowledge gaps of importance to reduce biodiversity loss. One important gap was methods to integrate science and local knowledge to assess appropriate measures. The work of TSWPis, in this context, a valuable contribution to reducing this the knowledge gap. In the interviews, the landowners emphasised the importance of a multifunctional landscape and the connections between agriculture and wetlands. One of the landowners defined multifunctionality as: "An ecological landscape with improved conditions for high yields and reduced inputs of herbicides".

### **5.2.3 The long-term perspective - a basis for results.**

TSWP has, compared to similar projects, run for a very long period, 2009-2020. This makes it possible to follow the environmental effects of different kinds of wetland constructions, as well as to develop new technical innovations as a response to practical challenges. New ideas developed during the project period have also been tested. The long-time project duration has been crucial for gradually building trust between the project and the County Administration. The County Administration representatives



The Outdoor room 2009 (left) and 2020 (right). Photo: Johnny Carlsson

estimate that TSWP has developed into one of the flagship wetland projects in southern Sweden.

### **5.2.4 Climate change**

The landowners are aware of expected effects of future of climate change on agriculture owing to experiences of the severe impacts of drought during the growing period 2018. Assisted by the water balancing characteristics of the artificial wetlands, the variations in water flow over the year could be buffered. In the future water from the wetlands may potentially be used for irrigation of agricultural crops., This idea may, however, result in water competition between farming and the wetland environments. The landowner awareness of future climate change is an important driver for TSWP2, a project focused on multifunctional water magazines, recycling of irrigation water and adapted drainage of farmland (Bonthron 2020, Wolsing 2020).

## **5.3. Social drivers**

The local social drivers for the implementation of TSWP are described under chapter 5.1.2, 5.1.3 and 5.2.2. The bottom-up approach allowed the members of the TEA to engage in joint discussions about goals, methods of wetland construction, management strategies etc. New initiatives and innovation were the result of the social learning process and the trust building between actors. The democratic organisation allowed

landowners who, at the beginning of the project, were hesitant to join as a member to see the advantages of the project. Additionally, the organisation made it possible to handle different approaches to the future wetland management. Important positive regional drivers are described in 5.3.1 and 5.3.2

### **5.3.1. Regional authorities**

The objectives of TSWP have been reached as it was organised as a joint project for all the landowners within the catchment area, a set up that generated trust-building between landowners and consultants as well as between the project and the County Administration. The system perspective on wetland functionality, well-defined objectives and clear boundaries provided the basis for the dialog with the County Administration resulting in a close cooperation. The project manager and consultants were most important for this development owing to their project roles, knowledge about regulations and the subsidy system, their knowledge about possible technical solutions as well as contacts with skilled entrepreneurs.

### **5.3.2 The cooperation model between TSWP and the county administration**

The cooperation model between TSWP and the County Administration, developed through a dynamic dialog over a 10-year pe-





View of the Tullstorpsån stream area at Sånarp before the wetland construction. Soil erosion is contributing to the sediment content in the water. Photo: Johnny Carlsson



View of the Tullstorpsån stream area at Sånarp directly after the wetland construction. For the 2020 view, look at the frontpage. Photo: Johnny Carlsson

riod, has contribute to the development of the regional wetland strategy (Länsstyrelsen i Skåne 2007). The TSWP has – through its bottom-up approach, well-defined organisation and cooperation between landowners as well as between landowners, consultants and regional authorities – turned out to a road model for large wetland projects. TSWP focus on its original objectives has been an active and dynamic actor for, in a broader sense, developing innovations and new ideas for wetlands. Compared to the Water Council's LEVA coordinator (local water engagement coordinator), TSWP has focused on a single catchment area, employed a full-time project leader and had landowners working together towards the project objectives of optimising environmental management and agriculture. (For the explanation of the Swedish water administration and water organisation, see 1.3)

### **5.3.3 Communications with society and other wetland stakeholders**

The Outdoor Showroom, the Börringe mad wetland and the southern part of the Tullstorpsån stream are used by the public as recreation areas. One component of the management plan is to create public footpaths with information. The interviews

highlighted the Outdoor Showroom as an excellent example for informing stakeholders, authorities, schools and the public about the vital role of wetlands in the landscape as well as for demonstrating useful methods for restoration. The County Administration officers claim that the will of the landowners and consultants to make the area available for the public has been fundamental for the design of the recreation areas. Information about TSWP has been available on the project homepage, through reports, newsletters as well as information about the TSWP approach and ecosystem services within the Tullstorpsån stream catchment area (<https://tullstorpsan.se/>, (Ekologgruppen 2017).

## **5.4 Economical drivers**

The TSWP evaluation showed that full recovery of costs through funding is fundamental for the long-term positive outcome of a wetland project. All the interviewees state that the subsidy system and the lack of funding continuity were barriers for wetland construction. The landowners are unwilling to directly fund public goods except as in kind land management activities, see 5.4.2 and 5.5.

### **5.4.1 Innovations**

All the interviewees state that TSWP has developed an economic model of how to combine various kinds of subsidies for reaching a continuity in financing. Innovations have likewise been important for the continuity and vitality of TSWP. The landowners' view that increased biodiversity can give positive economical effects on farming is, in a sense, a kind of innovation. The project has also developed a technical knowledge base about new ways to construct and manage different kinds of wetlands, e.g. two-step ditching and silt traps. The most important social innovation is the interaction, cooperation and social learning between landowners in the catchment area. These innovations are of general interest; showing how to reach a long-term sustainable soil management through the handling high water flows, decrease the erosion hazards and in estimating optimal use of farmland. Water resource innovations like using the wetlands for crop irrigation during drought periods are important in relation to climate change. The project has also developed knowledge about how to find functional balances between different measures.

### **5.4.2 Economical barriers for wetland establishment**

Economical barriers for wetland establishment are associated with the problems of coordination identified during the project period, e.g.:

- changes in economic terms from one year to another, as well as time gaps between different kinds of economic subsidies
- windows of opportunity for constructing wetlands are sometimes not matched with the funding periods
- a difficulties of matching the time frame formal approval of activities with those for using funding.

Another coordination problem connected to the issues above, identified in the interviews

with the authority representatives, was that the national and local/regional perspectives concerning wetlands needs to be better coordinated.

A general result from the interviews was that the subsidy system and the lack of funding continuity for long-time projects were barriers for wetland establishment. These barriers existed at the start of TSWP and remain the same today (2020). The recurrent uncertainty about if the project was to receive funding was perceived as a negative factor for realisation of the project. Uncertainty concerning future funding is also a barrier for the planning for and implementation of future wetland management.

On the national level, while several authorities are involved in water protection measures the cooperation between them is frequently inadequate – as opposed to the cooperation between TSWP, the County Administration and the Swedish Agency for Marine and Water Management. Even conflicts between national authorities exist, which adds to the already existing uncertainties around the realisation of wetland projects. Another identified barrier at the national level is the complex Swedish water legislation with its associated regulations. The EU wetland subsidy system and uncertainties due to potential change in future agriculture policy represent yet additional uncertainties, which contribute to a vague picture of future economical opportunities and constraints.

## **5.5 Structural barriers - economy and regulations**

### **5.5.1 Lack of cooperation between authorities**

The officers at the regional level emphasised that wetland initiatives must come from the landowners as ideas and action plans are place specific within a catchment area. However, the current national water management organisation has a top-down perspective and the members of the existing Water Councils often lack practical knowl-



Wetland management at Ådala 2020.  
Photo: Ingrid Stjernquist

edge or a systems perspective on catchment areas. The development and functioning of wetland projects are highly dependent on the full time coordinator employed by the Water Council to assure the continuity and focus of the individual projects. However, this type of employment is not always the case. The role of the regional authority ought to be general planning, support with map materials and knowledge about various kinds of subsidies. To put together sufficient funding was hard work for TSWP, owing to a lack of systems perspectives on behalf of the national authorities and as the application system was ill adjusted to practical realities. In order to reach a better results, viz. the national wetland strategy, the authorities need to change praxis and procedures.

The ability of the County Administration officers to take initiatives by their own was significant during the 2009-2020 period resulting in the development of a favourable cooperation model, see 5.3.2. The continuous dialogue with TSWP about new ideas for wetlands constructions, allowed the

authorities a possibility to identify different ways for project funding covering the whole project period. TSWP was also able to directly contact the County Administration if the project needed exemption for a planned measure. The work of TSWP has been an important inspiration for the Swedish Agency for Marine and Water Management in developing a national guidance for wetland establishment.

To summarise, it will be of a great advantage for society if the national authorities developed a better integrated wetland policy. The existing top-down strategy causes leading actors, who often are the first to recognise local problems and solutions, to be neglected. Different national authorities have different kinds of funding, which are poorly coordinated. The result is that the County Administrations have to work with three different kinds of funding, three different national regulations and, on top of that, the the EU regulations. One of the interviewed officers summarised the problem as: "There is a lack of a comprehensive view of what actor will pay for what activity, what kind of subsidy you may use for what and, if you can combine subsidies as well as if these subsidies can co-finance each other and, if so, in what way".

### **5.5.2 Insufficient municipal interest**

The evaluation shows that the municipality level has demonstrated little interest in TSWP. The Trelleborg municipality was initially engaged in the project, funding the project manager but later focused the politicised Water Council. A poor municipal interest is problematic and indicates a weakness in the proposal for new water legislation, which identify the municipalities as central actors at the local level (SOU 2019:66). Currently the wetland and wetland establishment expertise is located at the County Administration, the private sector and the universities. The wetland competence of the municipalities is highly dependent of the



size of the municipality, staffing policies and the fragmentation of tasks and priorities. Municipalities need to employ competent and enthusiastic wetland managers. In spite of the low municipality interest for TSWP, the project has created a wetland infrastructure that has increased the public's possibilities for birdwatching and recreation; as well as the public knowledge about wetlands and their importance in the landscape. The landowners need to be included if the municipalities are to realise their wetland strategies.

### 5.6 Measures to decrease barriers for establishing wetlands at the landscape level.

Landowners, consultants and the interviewed representatives from the County Administration of Scania and the Swedish

Agency for Marine and Water Management identified the following barriers for wetland development:

- insufficient system perspectives where different authorities are responsible for different wetland aspects owing to that wetlands are part of several, un-synchronised, national environmental objectives,
- the set-up of the funding systems for wetland establishment, including both the regulations and the guidelines, are lacking a systems perspective on wetlands and on the balance between agriculture and wetland establishment,
- the and political cycle's short-time span and as a consequence the politician's limited span of interest causes uncertainties with regard to funding and subsidies,
- uncertainties concerning funding for long-term wetland management,



A time series showing the Outdoor room south of Jordberga, construction period (upper left), after the meandering of the stream (upper right) and today 2020 (lower left). The Out-door room is used by schools for education (lower right). Photo: Johnny Carlsson

- the Swedish authorities understanding of the EU system for subsidies for wetlands.

The list barriers above indicate that the national authorities and regional/local actors diverge on their views on systems perspectives, long-term planning, continuity of funding, revision of regulations and guidelines. The new modes of governance suitable for mitigating complex environmental problems requires stakeholder participation, legitimacy in the sense that the means are proportional to objectives and bottom-up perspectives not at the forefront of the current water strategy. Some studies have suggested a strategy where landowners are paid by society for the production of ecosystem services like wetlands (Hansson et al 2012, Gren et al 2021).

## 5.7 An effective wetland strategy - further analysis

The TSWP evaluation indicates that the current top-down regulation of water related environmental issues through the Swedish Water Authority has limited effects on wetland establishment as well as on environmental problems and nature resources in a landscape scale. Bäckstrand (2010) discuss a in built conflict in participatory governance between the demand for an increased democratic participation and the delivery of effective solutions, e.g. of environmental problems. At the same time Sverdrup et al (2010), in a study of the Swedish Environmental Objective “Magnificent Mountains” show that an inadequate coordination between national authorities and failure in coordinated and consistent advise and decisions reduces the trust of the local society in national authorities. These multiple governance challenges are reflected in TSWP interviews, not the least the inadequate coordination as a problem for efficient wetland establishment and perceived legitimacy.

The report of the Water Management Commission (SOU 2019:66) recommends changes towards a more explicit manage-

ment on both national and local level though the outcomes on the local level remains rather vague. The catchment area is highlighted as an important platform but the role of the local reference group, responsible for wetland realisation, seems mainly to be as an information exchange between stakeholders. The report also addresses the importance of the landowner knowledge and interest to ensure effective action but without any plan on how to transform the information to effective drivers for wetlands.

The interviews highlighted that this suggested strategy has functional shortcomings at the landscape scale. Without landowner initiatives there will be no tools for implementations, and without a systems perspective on the catchment area there will be few possibilities to safeguard wetland ecosystem services. The comprehensive plans of the municipalities are not legally binding and, as such, not an effective tool for action. To identify effective, long-term and scale-adapted solutions, a more detailed investigation is needed, including on the landowners’ significance as key drivers for change on the ground.

There is a need to develop a better adapted strategy for long-term, and transparent, funding for wetlands in order to reduce the current uncertainties. These uncertainties are an effect of administrative problems, deficits in the cooperation and coordination between authorities and that several authorities are concurrently involved, while poorly coordinated, in the wetland funding processes. An additional but important factor is the weak understanding of how decisions on different time-scales effect stakeholder actions. One interviewed landowner summarised the situation as:” There is a lack of a holistic perspective on who is to pay for what, what kind of subsidy we can use for what and whether it is possible to combine the subsidies”.

The County Administration has, in the revised Wetland Strategy of Scania identified the same need for changes at the national level, i.e to:

- simplifying the wetland legislation and transfer the permit process to the

- County Administrations,
- revise the water legislation concerning ditching enterprises,
- develop the administration of subsidies and clarify the allocation of responsibility between the involved authorities.

There is a basic problem with the Swedish use of EU wetland subsidies. It is not allowed to use them if the result in a competitive advantage for the Swedish agriculture. To use wetlands established with EU funding for irrigation as an adaptation to climate change may be in conflict with competitive neutrality. In other cases, it may be difficult to sort out what costs the subsidies are allowed to cover in relation to the landowners' contributions. The Pollution Pay Principle is used within EU but for agricultural pollutants there is an unclear balance between the government and the landowner responsibilities. The Swedish Environmental Objectives have increased the requirements on the landowners to reduce environmental problems within the forestry and agricultural sectors, and to produce ecosystem services for the public, often without economical compensation. The interviews raised the possibility to introduce a system where the consumers would pay for ecosystem services, or environmental measures, through the food price. Currently, the links between individual consumption and related environmental problems remains relatively unclear for the consumer. An increased willingness to pay may open new ways for funding for a more sustainable environment.

This evaluation identify needs for further studies within the following fields:

- legislation and regulations as outdated or inefficient regulations cause an uneven application of these between county administrations,
- the relationship between the EU wetland regulations, incl. the Swedish understanding of these regulations and the effects at local and regional level,
- the design of the permits processes,
- the subsidy system and financial compensations for producing ecosystem services,
- structural problems related to the involvement of several authorities in the wetland administrative processes,
- a framework for guidance on wetland measures by results.

## 6. The Tullstorpsån Stream Wetland project as a road map for wetland establishment

The TSWP is a unique wetland project owing to its system perspective on wetland functionality, the high level of ambition and the positive results. The close connection between agriculture, land ownership and wetland establishment has developed through the multifunctionality approach of the project. The TSWP can be used as a model for wetland establishment and management, as well as a positive example to follow for other landowners and stakeholders. The challenge to the success for similar wetland projects is the existence of important drivers outside the project boundaries, which are difficult to influence. The TSWP has managed to fully finance its wetland activities through identifying and combining several different subsidies and funding sources. It has also been lucky in that weather conditions allowed "windows of opportunity" for wetland construction when short-time funding and permits were in place. The TSWP has developed a funding model combining different kinds of funding for a good result.

### *The models basic conditions*

- A wetland project ought to be driven by the landowners and to be voluntary and having a systems perspective on the catchment area and the surrounding landscape. Nutrient retention, biodiversity and other ecosystem services are important parts of the project.
- Joint developed objectives.
- A full time employed project leader.
- A continuous dialogue between the project and the County Administration

- An adopted plan in place before the start of the project, based on objectives and local conditions and with clearly-defined system boundaries.
- A long-term perspective for construction and management.

### ***A wetland systems perspective***

A long-term cooperation and dialogue between landowners, the project leader and the County Administration in order:

- to build trust over time between landowners, the project leader, project consultants and the County Administration,
- to identify aspects of importance for a multifunctional landscape in order to create ecosystem services of value to the public.

### ***Project characteristics***

- A joint organisation to ensure cooperation, democratic decisions on wetland establishment and future measures for the wetland,
- A democratic leadership as the project needs to build on the stakeholder's interests, knowledge and ideas,
- Accumulation knowledge and experiences is secured by a continuous employment of a project leader.
- An understanding of that the use of landowner knowledge on the relationships, and optimal balance, between farming and environment will ensure

that the production of the surrounding arable land will be maintained or increase while promoting the environment.

- A long-term landowner participation and multi-generational perspective on actions.
- An understanding of that the management phase and it's funding in the longterm are as important as the construction phase.
- A circular economy approach, where silt traps are use to allow nutrient recirculation to the farmland.
- A development of a legal framework to regulate the cooperation between the landowners as well as the long-term management of the green infrastructure along the stream.
- A project homepage in Swedish and English to communicate results and to allow the public to follow the wetland environmental actions.

### ***Model bonuses directly transferable to other wetland projects***

- A landowner learning process resulting in a holistic view of the ecosystem services of the catchment area.
- A development of practical methods of wetland construction and joint management adapted to local conditions, wetland in question and the wetland establishment objectives.
- An awareness of that project innova-



The Outdoor showroom, Oct 2020. Photo: Peter Schlyter



tions and environmental change are drivers for developing new side-projects.

- An awareness that the historical ditching enterprises in a formal sense can be transformed into wetland organisations.
- The outdoor showroom initiative. This initiative has been an inspiration for other actors and a opportunity to demonstrate different measures within a catchment area. Another important outcome is the opportunity to inform schools and the public about the value of wetlands for nutrient retention and the creation of a multi-functional landscapes. Regional, national and international visitors can *in situ* study wetland construction, management and innovations.
- The creation of a green infrastructure for tourism, recreation and bird-watching.



Bedding meadows, pastures surface irrigated and fertilized by flooding in spring. Photo Johnny Carlsson



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Project information in the northern part of the Outdoor showroom. Photo: Peter Schlyter

## 8. Appendix

### Environmental quality data

The objectives of the TSWP are good ecological and chemical status, increased biodiversity and production of relevant ecosystem services. The conclusion below is a summary of published reports

#### **Water quality**

##### *Phosphorus*

The phosphorus content in the Tullstorpsån stream was compared with the levels in the Scanian streams within the national environmental monitoring programme called "Representative county farmland areas". The programme investigation areas are chosen to be representative for the agricultural conditions in each county (Carlsson et al 2003). For the period 2009/2010 - 2017/2018, the P content in one of the Scanian areas, M36, follows the same pattern over time as the Tullstorpsån stream. However, the P content in the Tullstorpsån stream has significantly decreased over time compared to the M36 and M42 results, showing an increased P content. This indicates a positive development in the Tullstrop stream compared to other agricultural areas in Scania.

##### *Nitrogen*

The nitrogen content in the Tullstorpsån stream has followed the same pattern 2009/2010 - 2017/2018 as the Skivarp and Kävlinge streams, included in the monitoring programme "Estuaries" (<http://miljodata.slu.se/mvm/>), but the nitrogen content has not changed. However, the tendency for the Råå stream, another stream in the national monitoring programme, shows a 40% increase. A Danish evaluation of the wetland effects on water nitrogen content indicates a 15-year period before significant changes can be measured  
[https://tullstorpsan.se/rappporter/extra\\_rappporter/Arsrapport-Tullstorpsan-2017-2018-2018-12-11.pdf](https://tullstorpsan.se/rappporter/extra_rappporter/Arsrapport-Tullstorpsan-2017-2018-2018-12-11.pdf).

#### **Biodiversity**

##### *Birds*

The development of the bird populations has been investigated 2014. Both the amount of species and individuals has increased,  
[https://tullstorpsan.se/rappporter/extra\\_rappporter/Fagelrapport2014.pdf](https://tullstorpsan.se/rappporter/extra_rappporter/Fagelrapport2014.pdf)

##### *Fish*

The fish population has been investigated 2019.

The trout population has increased. "The ongoing TSWP resulting in restoration of natural environments in and around the stream will probably have positive effects on the water quality and indirectly on the fish population",  
[https://tullstorpsan.se/rappporter/extra\\_rappporter/Fiskundersokningar\\_2019.pdf](https://tullstorpsan.se/rappporter/extra_rappporter/Fiskundersokningar_2019.pdf).

##### *Ecosystem services*

A report from 2017 states that 15 ecosystem services is the result of the water protection measures by the TSWP. Of these, five have been investigated and classified, biodiversity, water regulation, nutrient retention, tourism and recreation. The total value over a 50-year period is about 280 million SEK compared to the construction costs of 70 million. SEK.  
[https://tullstorpsan.se/rappporter/extra\\_rappporter/Ekosystemtjanster-i-Tullstorpsan-2017.pdf](https://tullstorpsan.se/rappporter/extra_rappporter/Ekosystemtjanster-i-Tullstorpsan-2017.pdf)

#### **Green infrastructure**

Trees and bushes have been planted along the stream with the objective to catch nutrients and shadow the water. About 5000 individuals of oak, cherry, alder and several bush species have been planted over a 10-year period.

##### *Summary of the Action plan 2015: Building green infrastructure in the southern part of the Tullstorpsån stream*

The restoration of the green infrastructure will preserve and improve the key habitats along the stream. It is also considered possible to create new habitats for the game species in the agricultural landscape. A good quality water status, fish repopulation and habitat quality measures will together create high biodiversity with a wide range of species. The plan is connected with other parts of the catchment area creating a green corridor in the landscape.

##### *Plan for planting measures*

###### *Future management*

Trim some of the untouched areas, preparing them for seeding with a mixture of low growing grass species and clover, 1-3 times over the vegetation period. Areas seeding with a mixture of higher plants are trimmed when needed.

###### *The plan*

1. Area, 310 m<sup>2</sup> will be even planted with oak (*Quercus robur*)
2. Area 200 m<sup>2</sup>, planted with alder (*Alnus glutinosa*), spacing 2x2 m.
3. Area 200 m<sup>2</sup>, planted with 3 rows of edge species
4. Area 240 m<sup>2</sup>, is left as a flooding area. Estab-



lishment of natural vegetation.

5. Area 520 m<sup>2</sup>, planted with mixed deciduous tree species, spacing 2 x 2m.
6. Area 260 m<sup>2</sup>, plant with oak and alder, even spacing. The alders are planted close to the stream.
7. Area 220 m<sup>2</sup>, plant willow (*Salix*) in a row close to the steam
8. Area 640 m<sup>2</sup>, plant willow evenly. Plant edge species between the willow trees
9. Area 350 m<sup>2</sup>, leave unplanted and allow the natural vegetation to establish.
10. Area 250 m<sup>2</sup>, plant a mixed stand with deciduous tree species
11. Area 360 m<sup>2</sup>, plant trees along the stream and edge species on the other part. Plant several species together
12. Area 250 m<sup>2</sup>, plant trees along the stream and edge species on the other part of the area. Plant several species together
13. Area 700 m<sup>2</sup>, plant a mixed stand of deciduous trees species. Alder contribute to the landscape quality.
14. Area 560 m<sup>2</sup>, plant a mixed stand of deciduous trees species. Alder contribute to the landscape quality.
15. Area 200 m<sup>2</sup>, oak, evenly planted over the area.
16. Area 420 m<sup>2</sup>, oak, evenly planted over the area.
17. Area 200 m<sup>2</sup> plant edge species, plant several species together.
18. Area 180 m<sup>2</sup> plant edge species, plant several species together

*The border area on the east side of the stream, 565m*

To strengthen the impression of a meandering stream, an edge habitat of mixed bush species and of different thickness will be planted. The edge habitat will have some openings as wind protecting structures for the wildlife. The edge vegetation will be mixed with, apple, cherry, plums and damson. Between the stream and the edge vegetation a footpath with build seats may be constructed. The border between the green infrastructure and the arable land is will be marked with poles.

*The border area on the west side of the stream, 565m*

The suggested vegetation design on the west side of the stream will be the same as on the eastern side



The Tullstorpsån stream at Ådala, spring 2020. Photo Hans Berggren

Tabell 1. Established wetlands and restored parts of the stream, area and year

Nr	Våtmark	Yta ha	År
1	Stora Markie	1,84	2010
2,3	Skönadal	4,46	2010
4,5	Sillesjö	13,5	2009
6	Hönsinge	2,85	2009
7	Ådala N + slingrande bäck till ån	2,11	2010
8	Sotemosse	6,08	2010
9,10	Jordberga N 101	2,67	2009
11,12	Visningssträckan	0,64	2009
13	Gudmundtorp	1,47	2009
14	Tullstorps boställe	0,85	2009
15,16	Sånarp	2,35	2011
17,18	Vassadal & Älmvik	7,89	2011
19	Brunsbo	1,83	2012
20	Sjöslätt	0,79	2012
21	Böringe mad	21,25	2012
22,23	Kronodal	1,04	2012
24	Köset	7,05	2013
25	Sillesjö Åleskiftet N	1,91	2012
26	Sillesjö Åleskiftet S	10,01	2012
27,28	Stora Markie våtmarker 1 & 2+3 samt 4 & 5	2,17	2014
29,30	Assartorp 1 prod.våtmark & ref.våtmark	1,68	2014
31	Skateholmsvåtmarken	1,46	2014
32	Assartorp VM 1 Nordväst	2,58	2014
33	Assartorp VM 2 Nord	1,16	2014
34	Assartorp VM 3 Väst	1,36	2014
35	Assartorp VM 4 Öst	2,13	2014
36	Ängelholmsgården	0,5	2019
37	Beddinge ångar, översilningsångarna	41,4	2019
38	Assartorp 1:4	0,8	2020
39	Ådala S Assartorp 4:6	0,6	2020
<b>Totalt våtmarker</b>		<b>146,4</b>	

Nr	Restaurerad åsträcka	Yta ha	År
1	Etapp 1 Visningssträckan	7,49	2009
2	Etapp 1 A+B Källstorp-Lilla Beddinge	13,40	2015
3	Etapp 1 C delsträcka 2+3	1,60	2016
4	Etapp 1 C delsträcka 4 genom Beddinge ångar	1,30	2017
5	Etapp 3 Stora Markie + Stävesjö (Ålholmen)	2,14	2014
6	Etapp 2 Jordberga-Stävesjö 2020	14	2020-2021
<b>Totalt årestaurering</b>		<b>39,9</b>	

<b>Total våtmarksyta</b>		<b>186,4</b>	
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Planting the Outdoor showroom 2010. Species are oak, Swedish whitebeam, crab apple, damson, willow, alder, hawthorn, blackthorn, guelder rose, sweet briar and mountain currant. Photo Johnny Carlsson