

THE TULLSTORP STREAM PROJECT

"From source to estuary – the unique project"

Project description

The Tullstorp stream 2.0¹
Pilot project & development och methodology

2020 – 2023



PILOTPROJEKT



¹ The Tullstorp stream 2.0 Pilot project and development of methodology are part of the overall Project Tullstorp stream 2.0, which in turn is part of the Tullstorp stream project. Tullstorpsån 2.0 and the sub-project Tullstorpsån 2.0 Pilot project and development of methodology have their own project manager, budget, implementation, follow-up and final reporting.

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Project area

Tullstorp stream
Water
MS_CD: WA21240924
Category: Water
VISS EU_CD 614633-134828

Catchment area:
Kustområde- SE89090

Skåne – Baltic Sea

Nybro stream
Water
Category: Water
VISS EU_CD 614658-138072

Catchment area:
Kustområde- SE89090

Skåne – Baltic Sea

Partners

Tullstorp stream project
Jordberga Gård
Högstad & Christinehof

WWF
Region Skåne
Länsstyrelsen i Skåne

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1. INTRODUCTION

1.1. Background – Problem and challenges

Wetter and drier

The recent extreme weather, with the wet summer and autumn of 2017 and the dry summer of 2018 in fresh memory, presents Swedish agriculture with new challenges. Climate change means that Swedish agriculture has to rethink and think again. Large areas could not be sown in autumn 2017 when the fields were too wet to drive out machines. During the dry crisis summer of 2018, the possibility of using water stored in wetlands for irrigation was discussed, but this was not possible as existing wetlands (mostly designed with a focus on the ecological perspective) are shallow and dried entirely or partly in parallel with the fact that the legality of abstraction of water was unclear. Furthermore, some farmers who had water rods for groundwater abstraction realised that their water source was not sufficient, either because the groundwater supply was too small or because conditional groundwater abstraction was not sufficient to cover the irrigation needs.

More cultivation in northern Europe, increased need for irrigation and conflicts over water needs

EU Environment Agency EEA has issued a new report² assessing how food production and agriculture will be affected by climate change. The report reiterates that cultivation in parts of southern Europe can be made more difficult. In some cases, so much that land is abandoned and areas are depopulated. And the slightly warmer climate can instead provide benefits for cultivation in Northern Europe. For Sweden, animal husbandry can benefit from an extended growing season and increased harvests. As a joker in the game for all Europe's countries, there is extreme weather with heat waves, but also floods and hail, which can cause major crop damage. Drought will increase the need for irrigation and it will cause conflicts as a result of the need for water in other areas.

Overall grip on the water and smarter use

Sydvatten recently issued a report³ where it is stated that there is a very widespread understanding that we need to achieve change at several levels, in many areas and that it must be done urgently.

“It is becoming increasingly clear that there is no overall grip on the water issue, while the situation is rapidly becoming more and more acute. Climate change and extreme weather situations with drought and rainfall are becoming increasingly common, making the water resource permanently more vulnerable. Ignorance and conflicts of interest and goals can create irrational solutions. ”

“Through changing, more efficient and smarter use of water, the freshwater resource can last longer. Many measures within the municipality, agriculture and industry are relatively easy to implement, but are hindered by low awareness, the issue is undeveloped and the lack of insight into the value of water. Other measures require new forms of financing, a clearer priority in water use and a modernization of water legislation. Ecosystems must be a part of the whole and the risks of pollution are taken into account. Collaboration, partly across the value chain, partly in a river basin, and partly around issues such as irrigation, drainage and municipal water and gas activities need to grow and develop. ”

² Climate change adaptation in the agriculture sector in Europe , EEA report (European Environment Agency), No 04/2019

³ Klimatsäkert vatten, Sydvatten juni 2019

1.2. About the initiative / project Multifunctional wetlands and Recirculating irrigation

Using the above problem picture as background, the Tullstorp stream Project Board in spring 2019 decided to give the Project Manager the task of starting up, financing and running the overall project Tullstorp stream 2.0, and initially Tullstorp stream 2.0 - pre study Multifunctional wetlands and Recirculating irrigation. Financing was secured with WWF, LOVA and finally Region Skåne. In order to create a greater weight behind the project Högestad and Christinehof was connected which has a long history and knowledge on environmental and water conservation projects and Naturvårdsingenjörerna AB participated in the project with technical documentation.

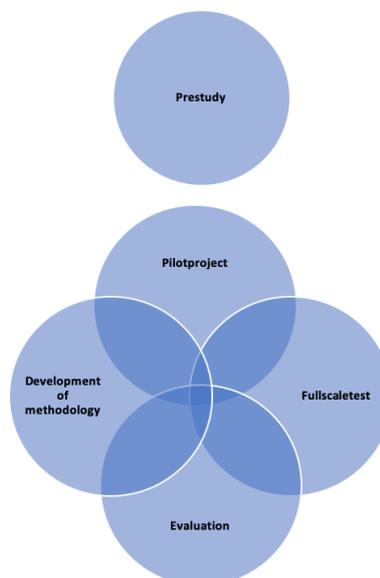
Overall project purpose

Historically executed and ongoing water projects (such as the Tullstorp stream project) have been created, designed, operated and followed up from a, largely, strictly ecological perspective with the goal of generating environmental benefits.

The pre study is a first step in a larger project on multifunctional wetlands and recirculating irrigation. The overall purpose of the entire project is to create the conditions for future water projects to be run in order to achieve both **ecological benefit** for the environment and **economic benefit** for the landowner as well as **community benefit**. This will be done by mapping, investigating and strengthening the possibilities of planting multifunctional wetlands and recirculating irrigation. This will increase the motivation of landowners to create wetlands with multiple functions and systems for recirculating irrigation.

Overall project plan

The project is based on a holistic view of a water body / watercourse - by studying the entire river basin around a river, a stream, or a ditch body - in this case the Tullstorp stream. The project consists of 4 phases in addition to the pre study (see figure below) and will be run by Tullstorp stream's economic association, together with a number of partners, as a further development of the successful Tullstorp stream project and the Tullstorp stream method. Most of the project will concentrate on Tullstorp stream and its river basin, while some parts are made at Högestad & Christinehof.



Pre study

Make it possible for the project idea to go from idea to reality.

Phase 1 - Pilot project

Construction of reference systems for multifunctional wetlands and recirculating irrigation in the catchment area of Tullstorp stream and at Högestad & Christinehof. The pilot project includes both newly constructed wetlands but also the development of existing wetlands as well as the construction of systems for recirculating irrigation.

Phase 2 - Method development

Development of a working method / process for creating a holistic view and enabling a holistic approach to a body of water / watercourses can be made. A guide / description for the design and construction of systems for multifunctional wetlands and recirculating irrigation is developed. The final result is compiled in a manual.

Phase 3 - Full scale test

The entire watercourse of the Tullstorp stream and its catchment areas are analyzed from a holistic perspective on water management. Existing measures (such as wetlands, two-stage ditches, overflow beds, etc.) are supplemented by the construction of multifunctional wetlands and recirculating irrigation.

Phase 4 - Evaluation

Overall analysis of how the measures implemented within the project have resulted in both ecological benefit for the environment and economic benefit for the landowner as well as social benefit. What trends and opportunities can be demonstrated? What conclusions can be drawn? The analysis should also point out if there are areas where continued need for in-depth analyzes and any research is needed.

The ambition of the entire project - Expected results

The impact of the project is estimated to be:

- Reduced nutrient supply to the Baltic Sea.
- Flooding, erosion, cleaning needs to a lesser extent.
- Increased biodiversity in and around the waterways and wetlands.
- Improved cultivation and higher yield on the land.
- Good ecological status in watercourses and coastal waters.

We also believe that this project will lead to more wetland projects being implemented as there is also a financial benefit to the projects and this in turn will lead to:

- Swedish agriculture gains better resistance to extreme periods of drought and drought.
- The water-holding, water-regulating and groundwater-forming opportunities in the landscape are being strengthened.
- More surface water is used for irrigation and the plant nutrients that are in circulation are reused by recycling nutrients and returning them to growing crops to reduce emissions to the Baltic Sea.
- The social benefits of wetland projects are strengthened by linking wetlands projects (which form a puzzle piece) with the County Administrative Board's action plan for regional green infrastructure (large puzzle).
- The regional environmental objectives, national environmental quality objectives and the EU Water Directive are achieved on a broader front.

- Swedish agriculture produces more food and also in an environmental way.
- A basis is created for discussion about new design of support for farmers linked to multifunctional wetlands and recirculating irrigation as a supplement to existing support for the planting and management of wetlands.

1.3. Ongoing pre study

The work with the pre study has been ongoing since July 2019 and is expected to be completed in beginning of 2020. Within the framework of the pre study, the project idea will be taken from idea to reality. This is done by anchoring the project plan, the pre study and the future project with several co-financiers and landowners who are interested in building multifunctional Wetlands and recirculating Irrigation. The following is included in the pre study.

At the final report it is presented:

- Project plan and budget plan for future work (next phases), ie. This document.

Final report with the following content:

- Proposals for areas within the catchment area of the Tullstorp stream and within Högestad & Christinehof's fields with the right conditions for entering phase 1 - Pilot project.
- Discussion and, if possible, definition of multifunctional wetland, recirculating irrigation, adjustable drainage, irrigation technology (linked to the best possible technology), conservation considerations and society as the start of phase 2 - Method development.
- Description of the process for drawing up a water budget for the Tullstorp stream as the start of phase 2 - Method development.

2. Tullstorp stream 2.0 Pilot projects and Method Development

2.1. Summary description

Phase 1 - Pilot project

Construction of reference systems for multifunctional wetlands and recirculating irrigation.

- 12 ha multifunctional wetlands, for details see appendix
- 200 ha irrigation system
- 200 ha drainage system, adjustable drainage should be used where practicable

Phase 2 - Method development

Development of a working method / process for creating a holistic view and enabling a holistic approach to a body of water / watercourses can be made. A guide / description for the design and construction of systems for multifunctional wetlands and recirculating irrigation is developed.

2.2. Environmental quality objectives concerned

- Good quality groundwater
- No eutrophication
- Living lakes and streams
- Vibrant wetlands
- Sea in balance and living coast
- A rich plant and animal life

2.3. Compliance with the environmental quality standard for the water body concerned

Water

- The Nybro river will achieve good ecological status in 2027, today the status is moderate.
- The Tullstorp stream is to achieve good ecological status in 2027, today the status is moderate.
- ⇒ The multifunctional wetlands and recirculating irrigation purify the water from nutrients (nitrogen and phosphorus) and environmental toxins. The nutrient leakage to the watercourses is expected to decrease and the concentration of environmental toxins in the water is expected to decrease as this is bound to growth in low concentrations.

Groundwater occurrences

In general, all groundwater bodies should achieve good chemical groundwater status by 2021 and good quantitative status by 2021.

- Sv Skåne's limestones (down under the Tullstorp stream) today have good chemical groundwater status and good quantitative status.
- Krageholm (down under Högesta and Christinehof) today has a good chemical groundwater status and good quantitative status.
- ⇒ The multifunctional wetlands are considered to favor groundwater formation as they can store more water than traditional wetlands and then also "produce" more groundwater.
- ⇒ The multifunctional wetlands and recirculating irrigation purify the water from nutrients (nitrogen and phosphorus) and environmental toxins. Nutrients to the groundwater is estimated to decrease and the concentration of pollutants in basic water expected to decrease as this bound in vegetation in low concentrations.

3. PURPOSE – Tullstorp stream 2.0 Pilot project and Method development

The purpose of Phase 1 - Pilot et is to establish reference systems for multifunctional wetlands and recirculating irrigation that will serve as sources of inspiration / display items for others who want to do water projects and to build experience for Phase 3 - Full-scale test.

The purpose of Phase 2 - Development is to create conditions for a holistic approach and enable the e n holistic spirit process / methodology around a body of water / streams can be done in the future water projects.

4. OBJECTIVES – Tullstorp stream 2.0 Pilot project and Method development

In the final report, a Project plan and Budget plan are presented for the continued work in the project (next phases), presented in a separate document.

4.1. Phase 1 - Pilot project

Design and construction of 2 reference systems for multifunctional wetlands and recirculating irrigation in the catchment area of Tullstorpsån and at Högestad & Christinehof.

- 12 ha with multifunctional wetlands, for details see appendix
- 200 ha irrigation system
- 200 ha systems for drainage, controlled drainage should be used where it is practically possible

The above-mentioned part of the system shall, where possible, be designed and / or supplemented within the framework of the pilot project with equipment / technology that makes it possible to evaluate / follow up the benefit / effect of the systems, for example:

Groundwater

- recharge
- water level
- quality

Recycling of nutrients

- nitrogen
- phosphorus

Pesticides Leak

Water uptake in crops

Water content in soil

The County Administrative Board may provide input on the design and layout of evaluation systems.

4.2. Phase 2 - Method development

- A guide / description for the design and construction of systems for multifunctional wetlands and recirculating irrigation is developed.
- Development of working method / process to create a holistic view and enable a holistic approach to a body of water / watercourses to be made.
- The final result is compiled in a manual.

5. IMPLEMENTATION – Tullstorps stream 2.0 Pilot project and Method development

5.1. Phase 1 - Pilot project

Design and construction of reference systems for multifunctional wetlands and recirculating irrigation as shown below:

	Pilot project 1 Tullstorps stream - Jordberga Sugar mill ponds	Pilot project 2 Högesta Christinehof - Högestad
description	Renovation existing treatment ponds and cooling ponds (9 pieces) , to a multifunctional wetland system	Construction of a multifunctional wetland system
wetland area, ha	To be determined within the project	To be determined within the project
water surface, ha	6.5	5.6
average water depth, m	2-2.5	1.5
volumes, m³	97 000	87 000
water resources (drainage, storm water, river water)	drainage water, storm water and water	drainage water
basin, ha	To be determined within the project	250 of which 150 arable land
irrigation system	To be determined within the project	To be determined within the project
ha irrigated arable land	100	100
drainage	To be determined within the project	To be determined within the project
ha drained arable land	100	100
Other	The project includes a landscaping of the area - restoring to the industry and creating a beautiful environment	To get to a wetland that becomes natural in the landscape, obtain biological values, work for nutrient purification and at the same time get a good volume of water so it is proposed to make a plant on two levels.

For planning, sub-consultants will be used and for construction contractors.

5.2. Phase 2 - Method development

A guide / description for the design and construction of systems for multifunctional wetlands and recirculating irrigation is developed.

Focus on **technical** aspects

- ⇒ planning and project
- ⇒ design
- ⇒ operation and maintenance

Development of working method / process to create a holistic view and enable a holistic approach to a body of water / watercourses to be made.

Focus on **process-related** aspects

- ⇒ regulations affecting wetland construction and the use of water in recirculating systems
- ⇒ methodology for establishing a "water budget" for the water body / water body
- ⇒ links and collaboration with other processes / plans involving the water body / watercourse
- ⇒ environmental economic calculation or "production" of ecosystem services linked to monetary valuation - ecological benefit to the environment
- ⇒ socio-economic calculation - "economic" benefit to society
- ⇒ business-economic-calculation - economic benefit for the landowner

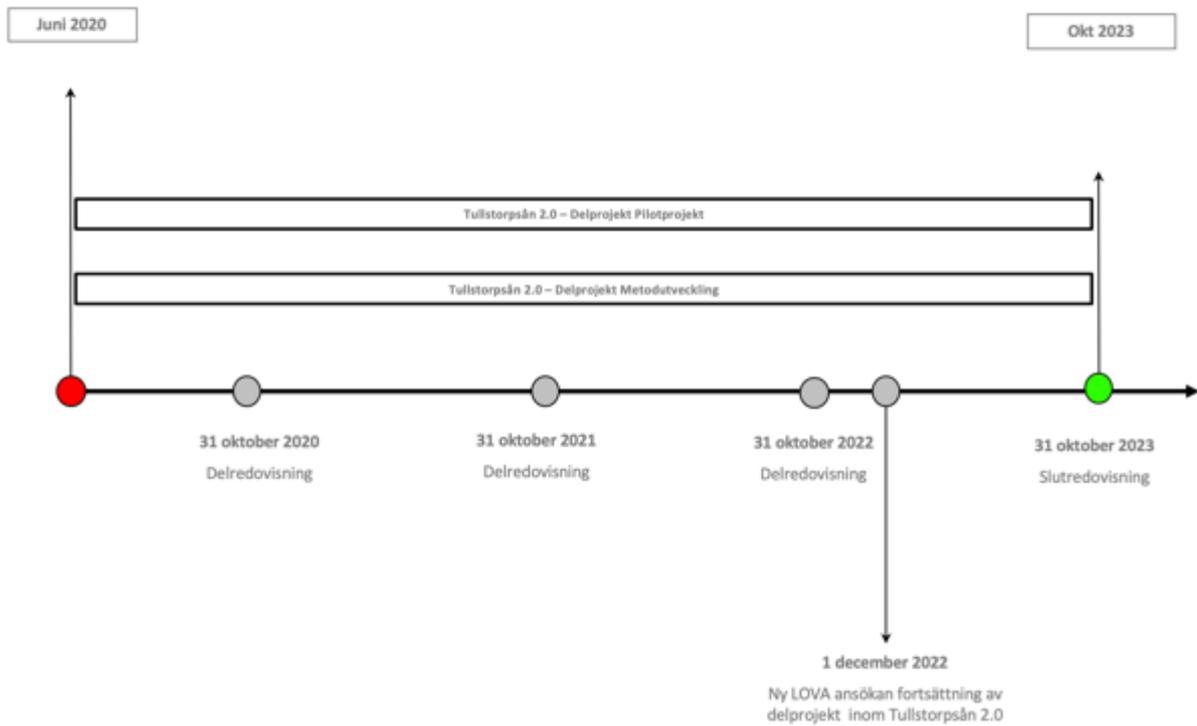
The work is carried out as literature studies, workshops, interviews and with the help of sub-consultants. The final result is compiled in a manual.

6. BUDGET – Tullstorps stream 2.0 Pilot project and Method

Beskrivning		Totalt	Plan 2020 (7 månader)	Plan 2021 (12 månader)	Plan 2022 (12 månader)	Plan 2023 (10 månader)	
	Projektledning och Projektadministration Pilotprojekt	600 000	150 000	150 000	150 000	150 000	
	Övrig administration	300 000	75 000	75 000	75 000	75 000	
	TOTALT Projektledning och administration	900 000	225 000	225 000	225 000	225 000	
Pilotprojekt	Analys av hur tillskottsvatten från vattensystemet påverkar Tullstorpsån	50 000	50 000				
	Multifunktionellt våtmarkssystem i Sockerbruksdammarna enligt beskrivning från Naturvårdsingenjörerna	5 800 000	2 400 000	3 400 000			
	Anläggningar för att flytta dagvatten	200 000			100 000	100 000	
	Anmälan om bevattningsuttag/miljödom	200 000	100 000	100 000			
	Projektering bevattningssystem, pumpar och ledningsnät	250 000	250 000				
	Anläggning bevattningssystem, pumpar och ledningsnät	2 500 000			1 250 000	1 250 000	
	Projektering system för dränering (täckdikning och reglerbar dränering)	250 000	250 000				
	Anläggning system för dränering (täckdikning och reglerbar dränering)	3 500 000		1 750 000	1 750 000		
	Miljö- och naturförstärkande åtgärder kring Sockerbruksdammarna - trädplantering, gångstigar, bro mm.	400 000				400 000	
	Utrustning/teknik som gör det möjligt att utvärdera nyttan/effekten av systemen - multifunktionell våtmark och recirkulerade bevattning. Installeras i respektive system vid anläggning och på lämpliga platser längs Tullstorpsån	400 000	100 000	100 000	100 000	100 000	
	TOTALT SYSTEM 1	13 550 000	3 150 000	5 350 000	3 200 000	1 850 000	
	Multifunktionell våtmark o Recirkulerande bevattning 2 Högestad o Christinehof – Högestad	Multifunktionellt våtmarkssystem på Högestad enligt beskrivning från Naturvårdsingenjörerna	3 665 000	1 832 500	1 832 500		
		Anmälan om bevattningsuttag/miljödom	200 000	100 000	100 000		
Projektering bevattningssystem, pumpar och ledningsnät		200 000	200 000				
Anläggning bevattningssystem, pumpar och ledningsnät		2 500 000			1 250 000	1 250 000	
Projektering system för dränering (täckdikning och reglerbar dränering)		250 000	250 000				
Anläggning system för dränering (täckdikning och reglerbar dränering)		4 000 000		2 000 000	2 000 000		
Utrustning/teknik som gör det möjligt att utvärdera nyttan/effekten av systemen - multifunktionell våtmark och recirkulerade bevattning. Installeras i respektive system vid anläggning och på lämpliga platser i närområdet		400 000	100 000	100 000	100 000	100 000	
TOTALT SYSTEM 2	11 215 000	2 482 500	4 032 500	3 350 000	1 350 000		
Totalt Pilotprojekt		25 665 000	5 857 500	9 607 500	6 775 000	3 425 000	
Metodutveckling							
Beskrivning		Totalt	Plan 2020 (7 månader)	Plan 2021 (12 månader)	Plan 2022 (12 månader)	Plan 2023 (10 månader)	
Metodutveckling	Projektledning och Projektadministration Metodutveckling	450 000	150 000	150 000	150 000		
	Litteraturstudier	150 000	50 000	50 000	50 000		
	Workshops och intervjuer	225 000	75 000	75 000	75 000		
	Underkonsulter	450 000	150 000	150 000	150 000		
	Övrig administration	75 000	25 000	25 000	25 000		
Totalt Metodutveckling		1 350 000	450 000	450 000	450 000	0	
Totalt		27 015 000	6 307 500	10 057 500	7 225 000	3 425 000	

7. TIMETABLE – Tullstorpså stream 2.0 Pilot project and Method development

Tidplan – Pilotprojekt och Metodutveckling



8. EXPECTED RESULTS AND EFFECTS – Tullstorp stream 2.0 Pilot project and Method development

8.1. Expected result of the action

Construction of reference systems for multifunctional wetlands and recirculating irrigation in the catchment area of Tullstorpsån and at Högestad & Christinehof.

Development of a handbook for the construction of multifunctional wetlands and recirculating irrigation as well as a comprehensive process / methodology regarding a water body / water feature in future water projects.

8.2. Action effect of the sub-project

For wetlands that are positioned and optimally designed for nutrient purification, the separation can amount to 1,000 kg N / ha and year and 50 kg P / ha. This project has several purposes of the multifunctional wetlands and can not be adopted constructed entirely optimal for nutrient reduction and therefore as e n appreciated severing the following be reasonable, 200 kg N / ha years and 5 kg P / ha and year. In total, approximately 12 hectares of multifunctional wetlands are planted and the nutritional treatment is estimated at 24 000 kg N / year and 60 kg P / year

Total N: 2 400 kg Total P: 60 kg

8.3. Expected environmental impact of the measure

The sub-project is expected to entail:

- Favorable groundwater formation
- Protection against drought
- Reduced flood risk
- Increased biodiversity
- Reduced eutrophication
- Reduced climate impact

8.4. Methods for measuring and calculating environmental effects

The Tullstorp stream project conducts water surveys, both flow proportional and with sampling, in accordance with the developed control program for water quality in the Tullstorpsån. This is done at the project's own sampling station in the lower part of the project area to give an overall picture of the impact of various activities and the effect of measures. Investigations of water chemistry, silica, bottom fauna, water supply and transport are carried out annually for agrohydrological years. In addition, fish surveys (electric fishing) are conducted annually on 5-7 premises along the river.

Within the framework of the Pilot projects, part systems, where possible, should be designed and / or supplemented with equipment / technology that makes it possible to evaluate / follow up the benefit / effect of the systems.

The action effects of the recirculation irrigation will also be determined as part of the future phase 4 - Evaluation of the project.

8.5. Expected Social benefit of the measure

Competence enhancement among project participants, increased public awareness of water projects, increased public participation in water related issues, new or strengthened collaboration on water projects, establishment of innovative tools and processes, increased food supply from aquatic environments, increased recreational values, conservation of natural heritage and conservation. for science and education. Climate adaptation of water systems to mitigate the consequences of periods of more intense rainfall and drought.

8.6. Dissemination and presentation of results and conclusions

The results will be disseminated on the project's website and through information material, excursions, seminars and conferences, etc.

9. FOLLOW-UP AND EVALUATION – Tullstorp stream 2.0 Pilot project and Method development

Within the framework of the Pilot projects, part systems, where possible, should be designed and / or supplemented with equipment / technology that makes it possible to evaluate / follow up the benefit / effect of the systems.

The action effects of the recirculation irrigation will also be determined as part of the future phase 4 - Evaluation of the project. Future follow-up is dependent on funding. The result will be disseminated to others through the dissemination of the Tullstorp sowing method.

10. OTHER – Tullstorp stream 2.0 Pilot project and Method development

The two sub-projects are important in order to be able to continue the work started in the sub-project Tullstorpsån 2.0 - Pre-study. Since the entire project Tullstorpsån 2.0 comprises a series of stages / sub-project it is important that the timed text sub implemented so that the next phases can be carried out and finally the entire project linked together.

11. ANNEX



PM 1 – Tullstorps stream 2.0

Calculation of construction costs for
wetlands / dam plants at Jordberga and
Högestad



2019-11-13

Technical overview

The 9 different ponds are slightly different in size and are in quite varying condition. The following table is an overview of size and condition that gives an idea of the current status.

Pond number	Size in m ²	Sediment, estimated volume m ³	Remaining material from the sugar mill	Other
1	14 000	No sediment	Yes, scrap and plastic hoses	Slope slope 1: 1 to 1: 2
2	1 700	About 2,500	No	Slope slope 1: 1 to 1: 2
3	7 300	About 500	Yes, sheet metal, scrap and concrete	Slope slope 1: 1 to 1: 2
4	4,200	No sediment	Yes, scrap and concrete	Slope slope 1: 1 to 1: 2
5	2 300	About 4,000	Yes, both scrap and concrete	Slope slope 1: 1 to 1: 2
6	5 800	About 2,000	No	Slope slope 1: 1 to 1: 2
7	4,200	About 3,000	No	Slope slope 1: 1 to 1: 2
8	8 800	About 1,700	Yes, concrete inlet from the river and on to pond 9	Biologically interesting for both amphibians and birds
9	17 000	About 3,400	Yes, concrete outlet	Biologically interesting for both amphibians and birds
Totally	65 300	About 17,000		

Proposal for a multifunctional facility

Restoration of ponds 1 to 7

For all dams, you first need to remove all scrap, plastic, concrete, electrical materials, etc. Everything must be sorted and removed from the area.

Then all the ponds should be emptied of sediment. This sediment can be laid out in the area to shape and restore after the industry. Laying out the masses within the area allows you to adapt the landscape image and create a beautiful environment that can also be used such as for example pasture. There are large volumes of sediment to be moved around. These volumes should not be a problem, as the area is large.

Since all the ridges are about 4-4.5 meters high and very steep, these should be lowered and the slope reversed. It is suggested that the embankments are lowered to about 2.5 - 3 meters in height and the slope is converted to a variation between 1: 3 to 1: 6. This means that the possible water volume will be about 2 - 2.5 meters average depth. Between the dams are made pits or pipes that allow the water to circulate throughout the system. This should be done so that the water goes from pond 1 to 9 and then possibly, surplus drain into the Tullstorps stream. If you want to keep a larger volume of water, you should not lower the embankments so much, but adjust to the desired volume of water.

Water supply can only be made by pumping because the ponds 1 to 7 are at an altitude.

Pumping can be done from the Tullstorps stream and possibly from any drainage system that is

nearby. The water is pumped through electric pumps that are powered by solar cells or possibly regular mains power. This may be investigated in more detail. Withdrawal of water can only take place during periods of higher flows in the Tullstorp stream. This needs to be mapped to control how much water can be withdrawn and during wet periods.

Restoration of ponds 8 and 9

These ponds have a fairly good design. The embankment located between the ponds and the Tullstorp stream is very high and should be lowered to get a better landscape adjustment. Otherwise, the technical structures should be replaced when in poor condition. Remove the old inlet from the river because it does not perform any function.

One possibility is to make an open stream as a transfer of water between ponds 7 and 8. This will create a varied and pleasant environment.

Possible water volumes for irrigation

To know how much water is available, an initial calculation of volumes has been made. In the ponds 1 to 7 all volume is removed except about 30 cm. In ponds 8 and 9, a maximum outlet of half a meter is proposed so as not to jeopardize the biological values.

Pond	Volume
1	30 000
2	4 000
3	15 000
4	8 000
5	5 000
6	13 000
7	8 000
8	6 000
9	10 000
Totally	Approximately 97 000 m³

Costs

Type	Volume	Estimated cost excluding VAT
Mapping drainage system for water supply	1	50 000
Testing water activities, incl. design	1	600 000
Demolition of past operations	1	500 000
Sediment removal	17 000	850 000
Lowering of embankments	40 000	1 600 000
Inlets, regulations	1	800 000
Pumping station	1	600 000
Socket for irrigation	3	150 000
Electricity, solar cells	1	300 000
Project management, construction management, final inspection	1	200 000
Investigation of sediment quality	1	100 000
Investigation of biological values	1	50 000
Totally		About 5 800 000

There are no costs in this documentation for irrigation pumps, hydrants and sockets, irrigation machines, etc.

Högestad

Description

Högestad & Christinehofs Förvaltnings AB has pointed out an area where one would like to plant a wetland for irrigation. The irrigation should provide about 100 ha of arable land. At present it is divided into three evenly sized shifts where the plant sequence is cereal, whey and protein crops. In the future, 15 may be relevant for special crops. The property where the wetland is to be built is called Högestad 36: 1, Ystad municipality.



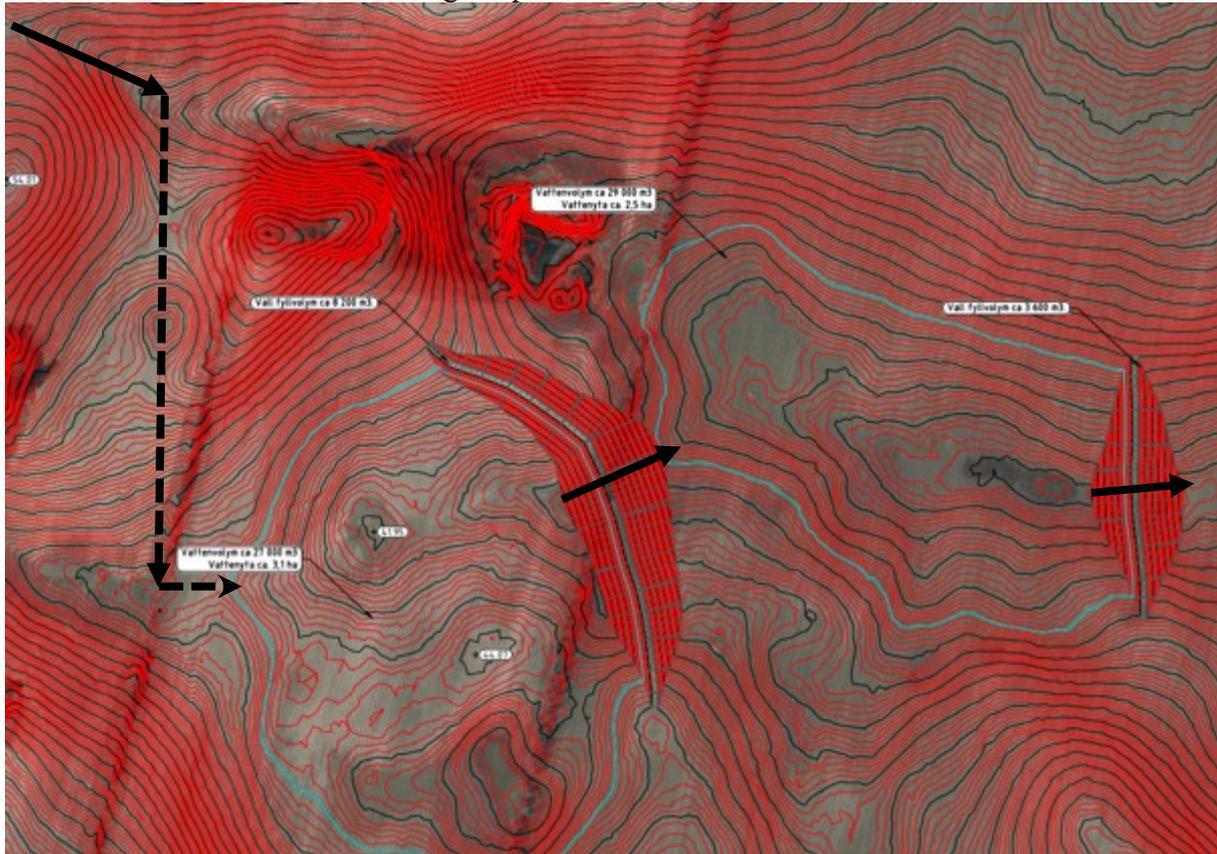
Overview Högestad. Brown dash shows delimitation for irrigated area. Red ring shows the location of the wetland.

Technical condition

Water intended to be used comes from a closed drainage system with a catchment area of about 250 ha, of which 150 ha is arable land. The drainage system is not a diving company and is wholly owned by Högestad & Christinehof Fideikommiss AB. The drainage system opens in Nybroån about 1.5 km from the planned wetland. Planned wetland is located in an area that is of national interest for the cultural environment.

Proposal for a multifunctional facility

To get to a wetland that becomes natural in the landscape, obtain biological values, work for nutrient purification and at the same time get a good volume of water so it is proposed to make a plant on two levels. To get to these water surfaces it is necessary to make two fairly large ponds with a maximum height of about 3.5 meters. These ponds are made with a slope of about 1: 6 and the material is taken within the area to be water surface to increase the volume of water. The shaft volume is about 12,000 m³ needed for the embankments. To increase the volume, the soil of about 30 cm is laid off, which is laid out around the wetland on the arable land. Then some shafts are required for pipes, wells, electricity, etc. The volume of water will be about 87,000 m³ and the size will be 3.1 + 2.5 = 5.6 ha of water surface. This means that the average depth will be about 1.5 meters.



Proposal sketch showing diversion of water (dashed line), embankments, water surfaces and placement.

Possible water volumes for irrigation

In order to cover the irrigation needs that exist, about 130,000 m³ is needed in the worst case (dry year). The calculations are based on this volume.

In this project, there are two parts that are important for managing the supply of irrigation. On the one hand, it is the volume that exists in the wetlands that can be used for irrigation and partly the water that flows into the irrigation period.

When calculating the annual runoff to the wetland it is approximately 880,000 m³ of water. The average flow rate (MQ) is 28 l / s and average low flow (MLQ) is 3 l / s. The irrigation period is June, July and August on the crop distribution that exists today. In some years, there may be irrigation in May and September as well. Assuming that the entire volume is to be withdrawn for three months evenly distributed over the period, the withdrawal will be approximately 1,500 m³ per day. Assuming that the inflow is 5 l / s (just above MLQ), the inflow is about 450 m³ per day. This means that about 1000 m³ of water is needed in addition

from the wetland to meet the irrigation needs. This means that about 90,000 m³ of storage volume is needed in the wetland. The flow in the culvert system has not been clarified and this can vary greatly between different river basins. The calculation made is in a normal case and the calculation is based on standard values.

With the proposal above, the water volume becomes about 57,000 m³ by dam, 12,000 m³ by taking the material to the dams in the area and about 18,000 m³ by paving off the soil. This means that the volume of water will be 87,000 m³. This means that you reach the volume of water required for a full donor during a dry year.

Costs

Type	Volume	Estimated cost excluding VAT
Testing water activities, incl. design	1	600 000
Diversion of pipe systems	1	300 000
Shaft dams	12 000	600 000
Demolition of food soil 30 cm on 6 ha	18 000	540 000
Other shaft	5 000	250 000
Pipelines, wells	300	600 000
Socket for irrigation outlet	1	75 000
Wells	2	200 000
electrical wiring	1	300 000
Project management, construction management, final inspection	1	200 000
Totally		About 3 665 000

There are no costs in this documentation for irrigation pumps, hydrants and sockets, irrigation machines, etc.