

# LIFE SURE

## After LIFE Plan



Swedish Agency  
for Marine and  
Water Management



**KALMAR**

**Linnæus University**



The LIFE SURE project has received funding from the LIFE Programme of the European Union and the Swedish Agency for Marine and Water Management.

The project is carried out by Kalmar Municipality and Linnæus University.



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**Authors:** Johan Persson, Renate Foks

**Responsible partner:** Kalmar Municipality

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# INTRODUCTION

In LIFE SURE, an innovative, cost-effective and ecologically sustainable process to remove and remediate sediments from shallow waters has been developed. The project ended in July 2022. In this After Life Plan we described how Kalmar municipality (KLM) and Linnaeus University (LNU) are committed to continue to disseminate the results of the project and actively work for the further implementation of the results

The website for LIFE SURE is [www.life-sure.eu](http://www.life-sure.eu)

# THE LIFE SURE PROJECT

LIFE SURE was a partnership project, originally by Kalmar Municipality (KLM), Linnaeus University (LNU) and the company Techmarket (TM) that ran between 2016 and 2022. However, the latter left the project after just 2 years. The project was financed by the LIFE programme and the Swedish Agency for Marine and Water Management (HaV).

The overall objective of the LIFE SURE project was to show how to sustainably restore the ecological status and hydro morphology in a eutrophic sea bay and test methods for beneficial use of removed sediments. The LIFE SURE project had as the main objective to demonstrate an innovative, cost-effective, and ecologically sustainable process dredge sediments from shallow waters and to use it as a resource.

In the LIFE SURE project, a prototype for sediment removal was developed and tested. With this new solution, the project has been able to achieve almost all objectives above. LIFE SURE can be as cost effective as conventional techniques. The costs for running a sediment removal project with LIFE SURE was compared to costs in other projects where high demands were set for environmental disturbance.

The demonstration site of the project was Malmfjärden bay, a shallow bay of the Baltic Sea located centrally in the city of Kalmar, Sweden. In this bay, sediments with relatively high levels of metal and nutrients have accumulated over many years. The bay and the surrounding water bodies suffer from high level of nutrients in the Baltic Sea and therefore do not achieve good ecological status in the Water Framework Directive. Sediment removal from bays and lakes can attribute to a lower load of nutrients and contaminants to the water phase, but only if done without any disturbance to the water phase. The LIFE SURE the solution can be a possible measure to restore many lakes and bays throughout Europe.

The LIFE SURE solution has other advantages which were evaluated and confirmed during the project. It can remove soft sediment from shallow water bodies without causing environmental disturbances. The system of sediment removal and dewatering can run automatically, steered by remote control, is movable on trucks and easy to learn and use. The solution is quiet and can be run without fossil fuels. During the project, these parameters were monitored and evaluated. For example, the effects on the marine environment were evaluated by studies before, during and after the projects, using that the LIFE SURE solution does not cause turbidity and that plants and animals return to the dredged area within months. The conclusions are also confirmed by the Life Cycle Analysis, analysis of the environmental costs and an evaluation of the socio-economical aspects.

Another promising result of LIFE SURE is that the project has shown that soft sediments from shallow waters can be used beneficially. During the project, the removed sediments were used to final capping of landfills and well as in several pilot studies for innovative sediment uses.

The project tested the removal and reuse of both metals and nutrients from the sediments. These tests were first done on a lab scale, and later in field experiments. The results show that plant nutrients in the sediment can be taken up by amending the sediments with compost and biochar and other soil.

Of these, results from the greenhouse experiments are still under analysis, and a scientific publication is being prepared to be published in 2023.

Next to that, a pilot was run to use sediments in construction and infrastructure. The company NETICS has developed a technique to make blocks using a Geowall press. A recipe for the Malmfjärden sediment was made, to make for example pavement blocks. With higher dewatering rations, other applications could also be possible. Trials provided valuable information on how the Malmfjärden sediments can be used as soil remediation and provide the basis for follow-up projects for developing sediment used for Baltic Sea sediments.

The project shared its outcomes with public, politicians, companies, authorities, professionals in Sweden, Europe and even worldwide. Using existing networks, initiating a new network on low-flow dredging and participate in innovation workshops to discuss the possibilities and barriers for the scaling up of the life sure solution to other areas and to allow a wider spread knowledge and application of sediment uses. A business case for the use of the LIFE SURE solution in other areas have been made, as well as suggestions for project financing. This is an ongoing process, as the patent for the prototypes, that KLM has applied for, is pending (Nov 2022).

# THE AFTER LIFE OBJECTIVES AND NEEDS

To implement the use of the LIFE SURE solutions in a broader region, several steps need to be made in four different areas.

These areas are:

**A1. Continued improvement of the process:**  
any further improvement before it can be commercialised.

- Sediment removal: Start collaborations to replicate Mudster and life sure solution to other areas. A part of this process is to secure the IP- rights.
- Sediment use: Further develop sediment use applications and larger scale implementation, through collaborations with researchers and companies

**A2. Management of storm water and sedimentation:** The reduction of storm water drain to the area was done during the scope of the project, building a sedimentation pond for one of the largest outlets of storm water. Kalmar Water will also make up plans for measures at the other smaller outlets to Malmfjärden bay.

Kalmar Municipality and Kalmar Water participate in a newly started project, "Waterman", to gain control over the rainwater systems and its outlets in Kalmar. The project is partly funded by the Interreg Baltic Sea region.

**A3. Long term monitoring of the eco system.**

The effects of the sediment removal need to be monitored under a longer period in order to evaluate the benefits and risks of LIFE SUREs sediment removal system

**A4. Future implementation in the EU by keeping contact with end users and execute pre-studies.**

These actions cannot be funded by commercial interests and local governments alone, therefore funding is needed to successfully do these steps. The steps /actions are described below.

# WHAT WILL HAPPEN AFTER THE LIFE SURE PROJECT?

- 1** Kalmar Municipality, KLM, will continue the eco-dredging in Malmfjärden using the Mudsters and its technique. KLM will also start up in other eco-dredging activities in nearby areas as a progress plan decided by the local politicians. While KLM is present at Malmfjärden we will continue to receive study visits at the site and present the progress in several networks: The effects on the sediment removal will continuously be monitored, also soil analysis will be carried out at infiltration area due to elevated values of oil index in the outlet water. (action A1, A3 and A4)
- 2** KLM has received fundings from The County Administrative Board through a LOVA-funded follow up project: Mudster – Eco dredging using SURE. This project will continue the research and development of using the Mudster technique and using sediment as a resource as stated in action A1. Some interesting examples where sediment can be used are building materials, soil, and compost components as well as when building with nature. The project ends in December 2024 and will deliver its final report in March 2025 (action A1 and A4). KLM will continue to apply for fundings to develop the building with sediment stones technique.
- 3** KLM and LNU will continue to cooperate with organizations who are interested in using the LIFE SURE solution in other areas. Business proposals has been initialized from both Swedish companies and from companies abroad. Among these, the city of Rio de Janeiro has shown interest in adapting the “Mudster technique” in some of their water bodies to help manage the sediment situation. Another possible new area is the estuary of Eems Dollard in the Netherlands (action A4)
- 4** KLM and LNU have applied for fundings for a development project in India. The scope is to use the “Mudster technique” and to perform further research regarding the best available technique regarding use of flocculants. (Action A1)
- 5** In order to find large scale commercial solutions for sediment use, KLM and LNU started to collaborate with a local company in an innovative project using sediment as a part of a compost soil recipe (Action A1) An application for fundings has been applied for and the project has a planned starting date in December 2022. The aim is to produce compost soil within 24 hours using sediment, food waste and minerals.

- 6** KLM will continue the collaboration with other municipalities and problem holders in Sweden. KLM will also continue the search for problem holders and potential business partners within the EU in accordance with action A4.
- 7** KLM will continue the R&D of the best available technique to improve the sediment uptake and dewatering as well as to find further applications for the sediment (Action A1). One of the focus areas will be to increase the dewatering from the geobags by testing other materials together with a local company.
- 8** KLM will update the webpage [www.life-sure.eu](http://www.life-sure.eu) continuously whenever something related to the project or its follow up projects occurs (action A4)
- 9** KLM will continue to spread the results of our project to others, via existing networks. For example, our project will be presented at the Eco-Tech conference at Linnaeus university in November 2022. (Action A4) LNU will publish a report based on the results from the different cultivation trials.
- 10** As a part of a Swedish low flow dredging network KLM will continue to spread our results while at the same time probe the outside world for any related techniques (action A4). KLM will ask the EU to write a report on Best available technique (BAT) based on the Mudster technology
- 11** KLM will discuss the commercialization of the IP rights with relevant companies when the IP rights are agreed through a patent. (Action A1)
- 12** KLM will within "Mudster – Eco dredging using SURE" and the project called "Climate Neutral City" investigate the long-term follow-up of the eco-dredging activities in Malmfjärden. This according to action A3
- 13** Also, KLM will make sure that materials left from the three "Swan" prototypes will be re-used to maintain existing Mudsters and build new Mudsters. These materials include wires and flotation devices as well as other available parts. In the meantime, the prototype Swan-1 and extra parts are stored in a storage facility indoors.

# TABLE OF PLANNED AFTER LIFE ACTIONS

Funding need: € under 100.000 euro, €€ between 100.000 euro and 1.000.000 euro

Funding source: **bold:** secured funding, other: application in progress or planned

Nr	Objective and actions	who	when	Funding need	Funding source
1	Continue eco-dredging in Malmfjärden and other water bodies in Kalmar.	KLM	2022-2024	€€	KLM
2	Continue R&D using the Mudster technique and using sediment as a resource.	KLM and LNU	2022-2025	€€	National fund (LOVA)
3	Cooperation with businesses for implementation of the LIFE SURE solution in other areas	KLM and LNU	2022- 2025	Minor costs	As part of project budget above
4	Research regarding the best available technique regarding use of flocculants.	KLM and LNU	2023-2025	€	National funds
5	Collaborate with local companies in order to find large scale commercial solutions for sediment use as a part of a compost soil recipe.	KLM and LNU	2023-2025	€€	National funds Private funds Commercial investments
6	Continue the collaboration with other municipalities and problem holders in Sweden and EU.	KLM	2022-	Minor costs	KLM
7	R&D of the best available technique with focus on increase the dewatering	KLM	2023-2025	€	KLM National funds Private funds
8	Website update	KLM	2022-2027	Minor costs	KLM
9	Spreading results	KLM and LNU	2022-	Minor costs	KLM and LNU
10	Advocate for the LIFE SURE solution as a BAT	KLM	2023-2025	Minor costs	KLM
11	Utilize the IP rights	KLM	2023-	Minor costs	KLM
12	Monitoring long term effects in Malmfjärden bay	KLM and LNU	2023-2025	€	KLM National fund (LOVA)
13	Reusing materials for making new Mudsters	KLM	2023-	€	KLM Commercial investments

## Sammanfattning (swedish summary)

# INTRODUKTION

I projektet LIFE SURE en innovativ, kostnadseffektiv och ekologiskt hållbar lösning har tagits fram för att ta upp och återanvända sediment från grunda vatten, såsom sjöar och vikar. Projektet avslutades i juli 2022. I denna After LIFE plan beskriver vi hur Kalmar kommun (KLM) och Linnéuniversitetet (LNU) kommer att fortsätta sprida projektets resultat och aktivt arbeta för ett fortsatt genomförande av resultaten.

Projektets hemsida heter <http://www.life-sure.eu>

För att implementera användningen av LIFE SURE-lösningarna i en bredare region måste flera steg tas inom fyra olika områden. Dessa är:

**A1. Fortsatt förbättring av processen:** ytterligare förbättringar innan den kan kommersialiseras inom sedimentupptagning och sedimenthantering

**A2. Hantering av regnvatten och sedimentation:** Minskning av dagvatten av dagvattenavloppet till området gjordes under projektets omfattning genom att anlägga en sedimenteringsdamm för en av de största utsläppspunkterna. Kalmar vatten kommer även upprätta en åtgärdsplan för resterande mindre utsläppspunkter. Kalmar kommun samt Kalmar vatten medverkar i ett nystartat projekt som heter "Waterman" för att få kontroll över regnvattensystemet och dess utsläppspunkter i Kalmar. Projektet delfinansieras av Interreg Baltic Sea region

**A3. Långsiktig övervakning av ekosystemet:** Effekterna av LIFE SUREs sedimenthantering måste följas upp under en längre tid för att kunna utvärdera för- och nackdelar med processen.

**A4. Framtida impementering inom EU Future implementation in the EU genom att upprätthålla kontakterna med slutanvändare och genomföra förstudier**

Detta kan inte enbart finansieras av privata aktörer eller lokala myndigheter. Därför behövs extern finansiering för att framgångsrikt genomföra dessa steg.

# VAD KOMMER ATT HÄNDA EFTER LIFE SURE PROJEKTET?

- 1** Kalmar kommun kommer att fortsätta eko-muddringen i Malmfjärden genom att använda Mudsters. Kommunen kommer även att starta upp eko-muddring i andra intilliggande områden enligt en plan som de lokala politikerna beslutat
- 2** Kalmar kommun har beviljats medel från Länsstyrelsen i Kalmar län genom LOVA, Lokala Vattenvårdsprojekt. I detta uppföljningsprojekt kommer man att forska vidare på samt vidareutveckla tekniken med Mudster enligt Action A1. Några intressanta exempel på användningsområden för sedimentet är byggnadsblock, odlingsjord, kompostjord och anläggande av nya naturområden. Projektet pågår till december 2024 och skall klarrapporteras i mars 2025.  
Kalmar kommun kommer att om möjligt, söka ytterligare medel för att utveckla möjligheterna att tillverka byggstenar av sediment.
- 3** Flera olika affärsförslag har presenterats för Kalmar kommun, både från svenska och från utländska företag. Bland annat har en organisation i Rio de Janeiro med liknande förutsättningar som Malmfjärden visat intresse för att kunna använda Mudsters.
- 4** Linnéuniversitetet har tillsammans med lokala företagare samt Kalmar kommun lämnat in en forskningsansökan gällande användandet av Mudsters i Indien och samtidigt fortsätta forskningen kring bästa möjliga flockningsmedel.
- 5** Kalmar kommun är en del av ett mycket intressant utvecklingsprojekt som har som mål att tillsammans med LNU och en lokal entreprenör och innovatör tillverka kompostjord på 24 timmar av sediment, matrester och mineraler. Planen är att starta projektet i december 2022.
- 6** Kalmar kommun kommer att fortsätta samarbetet med andra kommuner och problemägare i Sverige. Kommunen kommer även att söka efter problemägare och potentiella samarbetspartners inom EU enligt Action A4
- 7** Kalmar kommun kommer att fortsätta forskning och utveckling av bästa möjliga teknik för att hitta möjliga applikationer där sedimentet kan användas. (Action A1) Ett fokusområde kommer att vara att öka avvattningen genom att testa andra typer av geosäckar tillsammans med en lokal entreprenör.

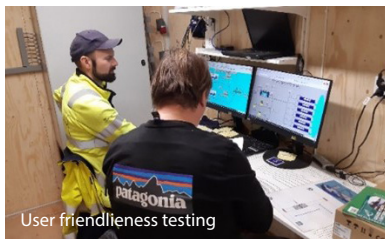
- 8** Hemsidan, [www.life-sure.eu](http://www.life-sure.eu) kommer att uppdateras kontinuerligt och i samband med att information relaterad till projektet eller uppföljande projekt framkommer.
- 9** Kalmar Kommun kommer att fortsätta att sprida resultaten från projektet. Till exempel kommer projektet presenteras på "Linnaeus Eco-Tech" i november 2022 (Action A4). LNU kommer att publicera en rapport baserad på resultaten från de olika växtodlingsförsöken.
- 10** Som deltagare i ett svenskt lågflödesmuddringsnätverk kommer Kalmar kommun att fortsätta sprida resultaten från projektet samtidigt som omvärldsbevakning gällande olika muddringstekniker pågår. Kalmar kommun kommer att uppmana EU att skriva en rapport om "Best available technique" (BAT) baserad på Mudsters teknik.
- 11** Kalmar kommun kommer att utveckla de kommersiella möjligheterna med relevanta företag när patentansökan blivit accepterad.
- 12** Inom projekten "Mudster – Ekomuddring genom SURE" samt "Klimatneutrala Kalmar" kommer de långsiktiga effekterna av Mudsters eko-muddring att följas upp. Detta enligt Action A3
- 13** Dessutom kommer Kalmar kommun dra nytta av material från de tre "Svanprototyperna" t.ex. vinschar, flytkroppar och andra delar och använda dem till att komplettera och konstruera nya Mudsters. Under tiden förvaras prototyper samt extra delar i en lagerlokal.



Dredging workshop

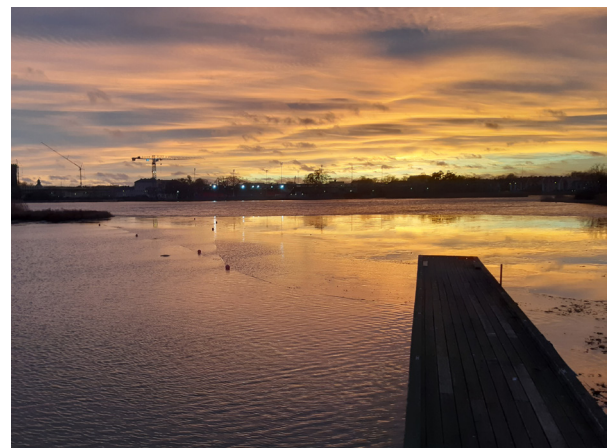
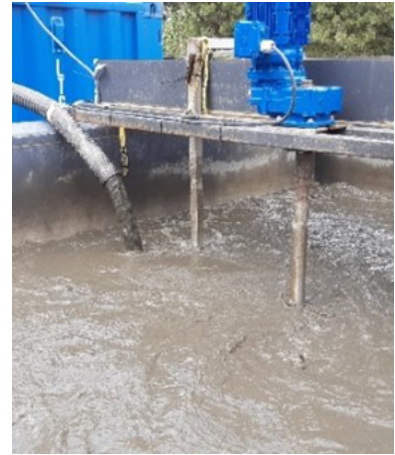


Site visit at biochar production site in Emmaboda



User friendliness testing





**Kalmar kommun**  
0480-45 00 00  
kommun@kalmar.se  
*lifasure.kalmar.se*

**Postadress:**  
Kalmar kommun  
Box 611  
391 26 Kalmar

**Linnaeus University**  
0772-28 80 00  
info@lnu.se

**Postadress:**  
Linnaeus University  
391 82 Kalmar

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