Holistic Water management in Agricultural Areas, Improvements of implementation on national level

16.04.2016 NUTRINFLOW River Loviisa - Project 02.05.2017

Drainage basin activity model

Mikko Ortamala, 09.11.2018
Drainage Centre of Southern Finland

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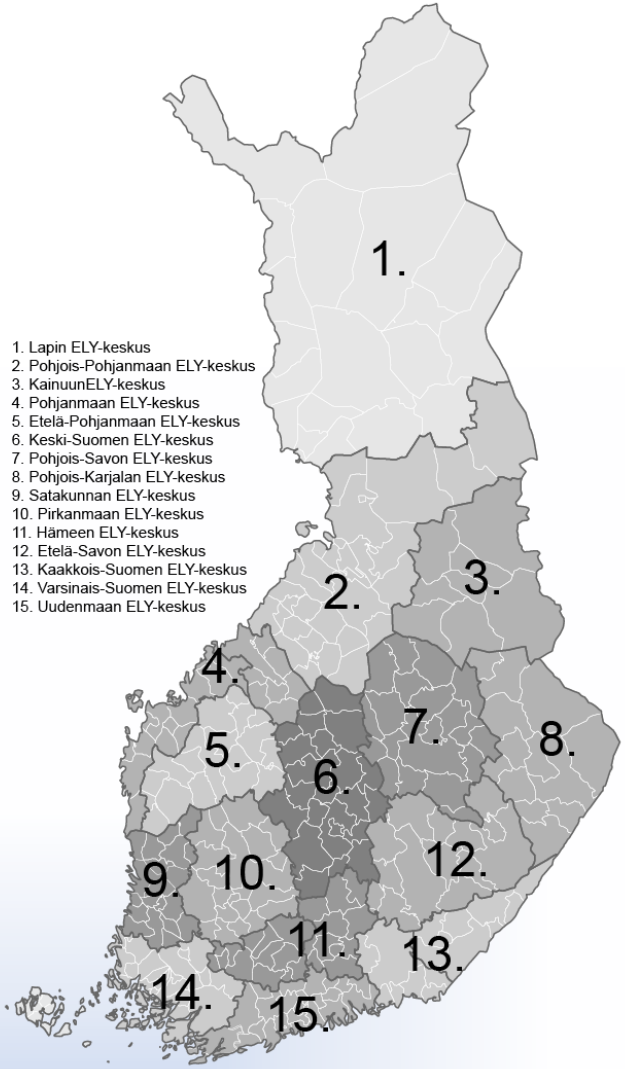
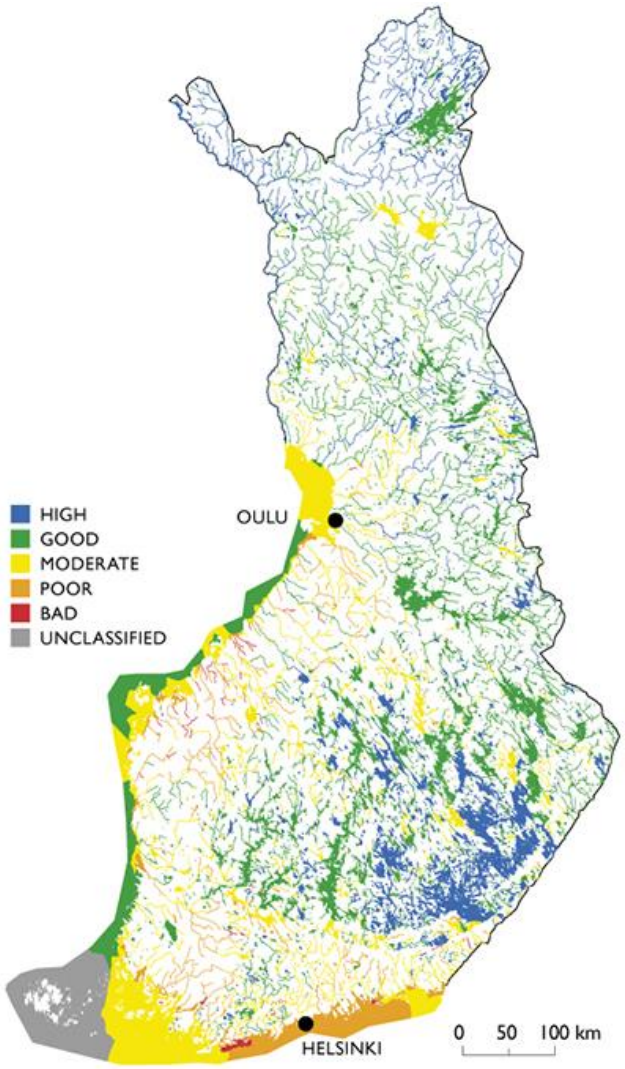
Productive agriculture, clear water and clean environment

Drainage corporate bodies are organizations witch consist of those land owners that gets benefit or profit of the drainage. Drainage corporate bodies have been established since 1883 for maintain the ditches.



Elinkeino, liikenne ja ympäristökeskus



Suomen ympäristökeskus, SYKE

The number of drainage corporate bodies and drainage areas is not accurate, but it is estimated to be tens of thousands. Each year 70 to 100 projects will be funded for basic drainage in Finland. The need for maintenance for basic drainage can be remarkable.

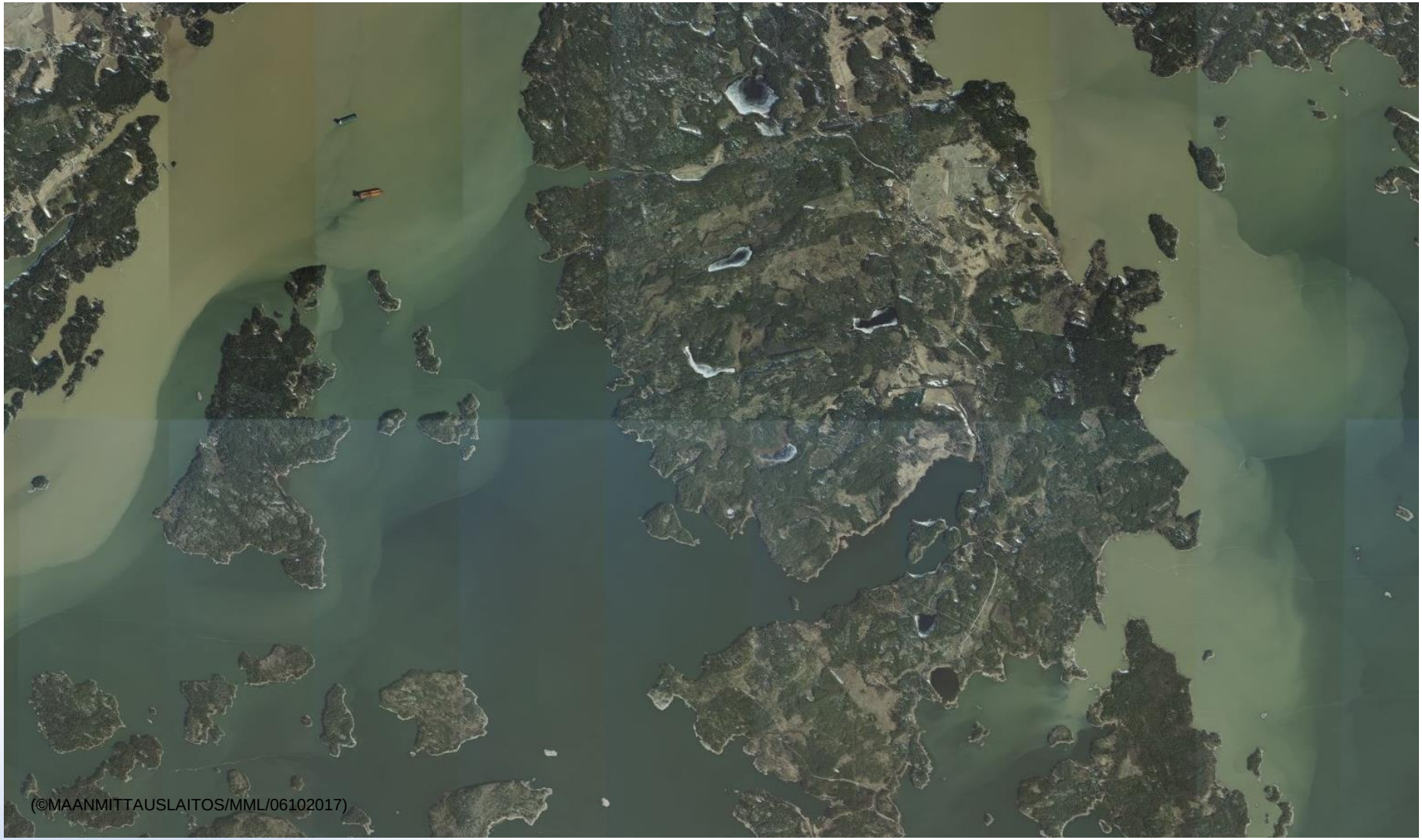
Wetness and flooding in agricultural areas

The most of drainage corporate bodies are not active and maintenance of the ditches has been delayed. Many cases drainage corporate body has not been active in 50 years. Farmers are trying to excavate small shots of the ditch in their own lands with locally-based contractors and the results are largely qualitatively weak.

Problems in the catchment area consist of:

- Erosion
- Outflow and sedimentation of solid matter
- Increased drainage network on drainage basin – lower water retention
- Water capacity in the rivers and ditches
- Subsidence of soil

Floods → Effects on agricultural production
(crop, soil, working efficiency, land value) → GDP



Floods → Outflow of solid matter and nutrients →
Effects to rives, lakes and Baltic sea

Nutrient load is not born evenly from all the field plots

Pasi Valkama, The Water Protection Association of the River Vantaa and Helsinki Region

Important observations of RaHa-projects water research on agricultural areas

“Measurements showed the significance of vegetation cover for decreasing the outflow of solids and phosphorous. An important notice was also that a substantial proportion of the load could be formed from very small areas and during a very short period. The problems of these risk areas were thought to be culminated in **poor soil structure, drainage problems and lack of vegetation cover**.”

“Nutrient load is not born evenly from all the field plots. Focusing the actions to problematic areas gives relatively large degrease also to total load.” (RaHa-project, Pasi Valkama, The Water Protection Association of the River Vantaa and Helsinki Region)

Pasi Valkama, The Water Protection Association of the River Vantaa and Helsinki Region

Floods → Effects to value and upkeep of the infrastructure

Loviisan sanomat, Arto Henriksson

Holistic water management

- Holistic water management consist of the actions on the fields, ditches and the rivers, lakes and sea.

- <u>Basic drainage, local drainage and environmental water management</u>

- Our priority is to prevent flooding and surface flow and outflow of solid matter and nutrients.

- Good soil structure and workable water management are basic requirements for productive agriculture and on the other hand to reduce the outflow.

Practical actions for holistic water management

Actions in outflow area

- Basic and local drainage
- Management of the soil structure
- Suitable land use (plants, cultivation, fertilization)
- Constructions for control of the water levels at summertime

Environmental water management

- Artificial wetlands, sedimentation ponds
- Bottom thresholds and dams
- Flood protection (embankments, pumping, flood ledges)
- Buffer zones
- Water management on farm areas (wastewater, washing waters, waters coming from stables and cowsheds)

Actions in rivers, lakes and the sea

- Reed cuttings, oxidizations, fishery restorations, excavations, control of water the level, (chemical restorations)

Possible actions in drainage basin

Basic drainage

- Maintenance of the ditches
- Reorganizations of drainage corporate bodies
- Constructions for control of the water levels at summertime
- Two-stage ditches

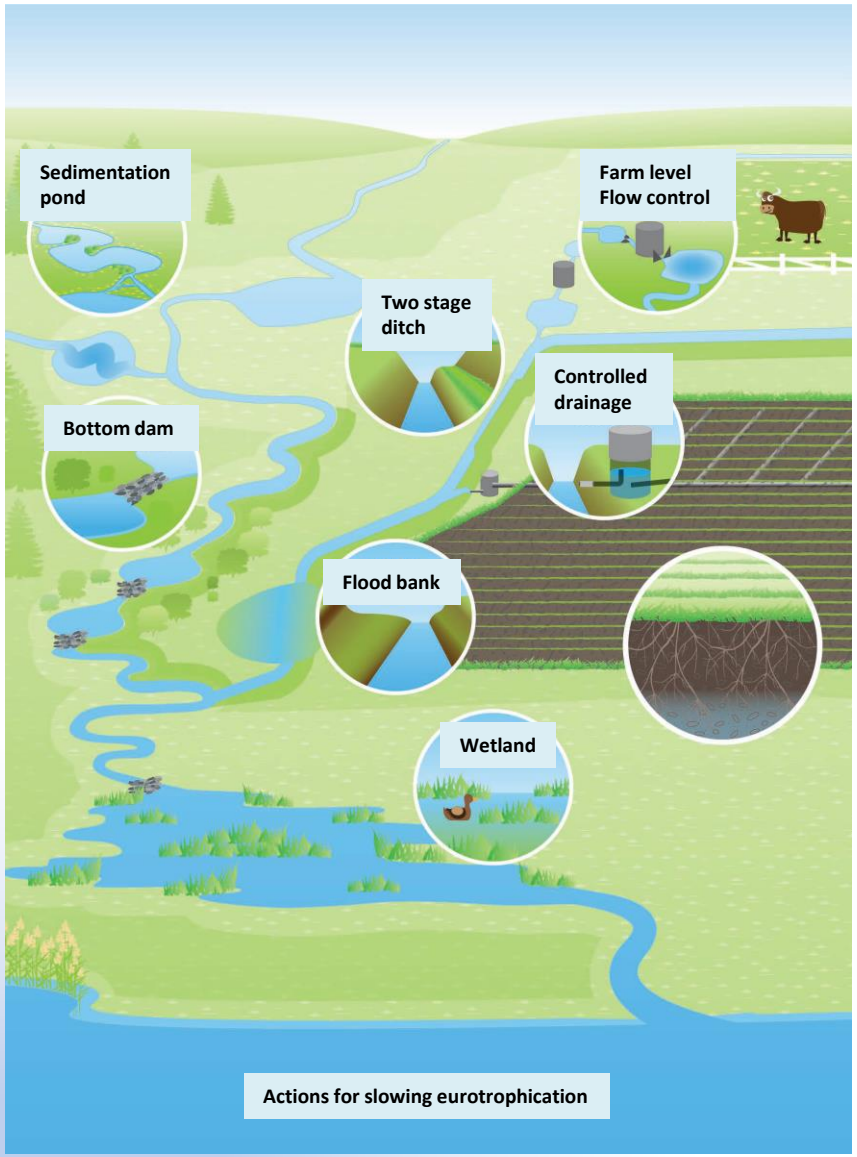
Local drainage

- Subsurface drainage systems
- Improved management of surface flow (lime filtration drainage)
- Drainage flow management, controlled drainage (control wells)
- Possibilities to subsurface irrigation (water reservoirs, ponds, pumping of additional water)
- Service and maintenance of underground drainage (flushing)
- Field levelling
- Soil structure improvements (mechanical, substrate additions)
- Farm level flow control of production premises (storage sites, outdoor paddocks, washing sites, etc.)

Environmental water management

- Artificial wetlands, sedimentation ponds (On field measurements and mapping,
- feasibility studies)
- Bottom thresholds, dams and adjustable dam constructions for controlled adjustment of summertime water level
- Flood protection (embankments, pumping, flood ledges)

Drainage basin activity model

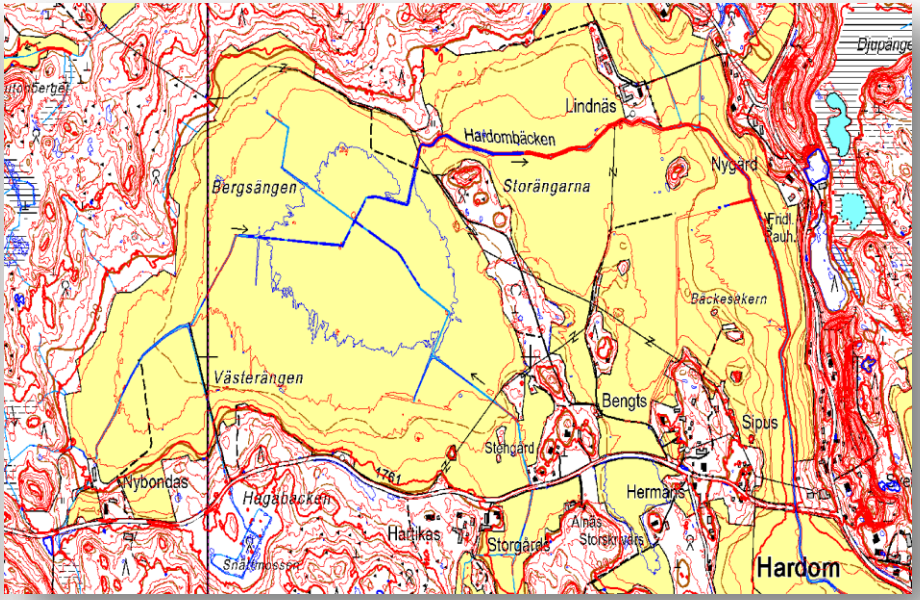


Mainostoimisto Kuke. Menetelmiä ravinteiden ja vedenpidättämiseksi osana kokonaisvaltaista pellonkuivatusta. Granholm, K., E. Lundström, H. Äijö, M. Ortamala, S. Manninen-Johansen & S. Mäkelä (2018)

How to prevent the floods and outflow of solid matter and nutrients in drainage basin nationally:

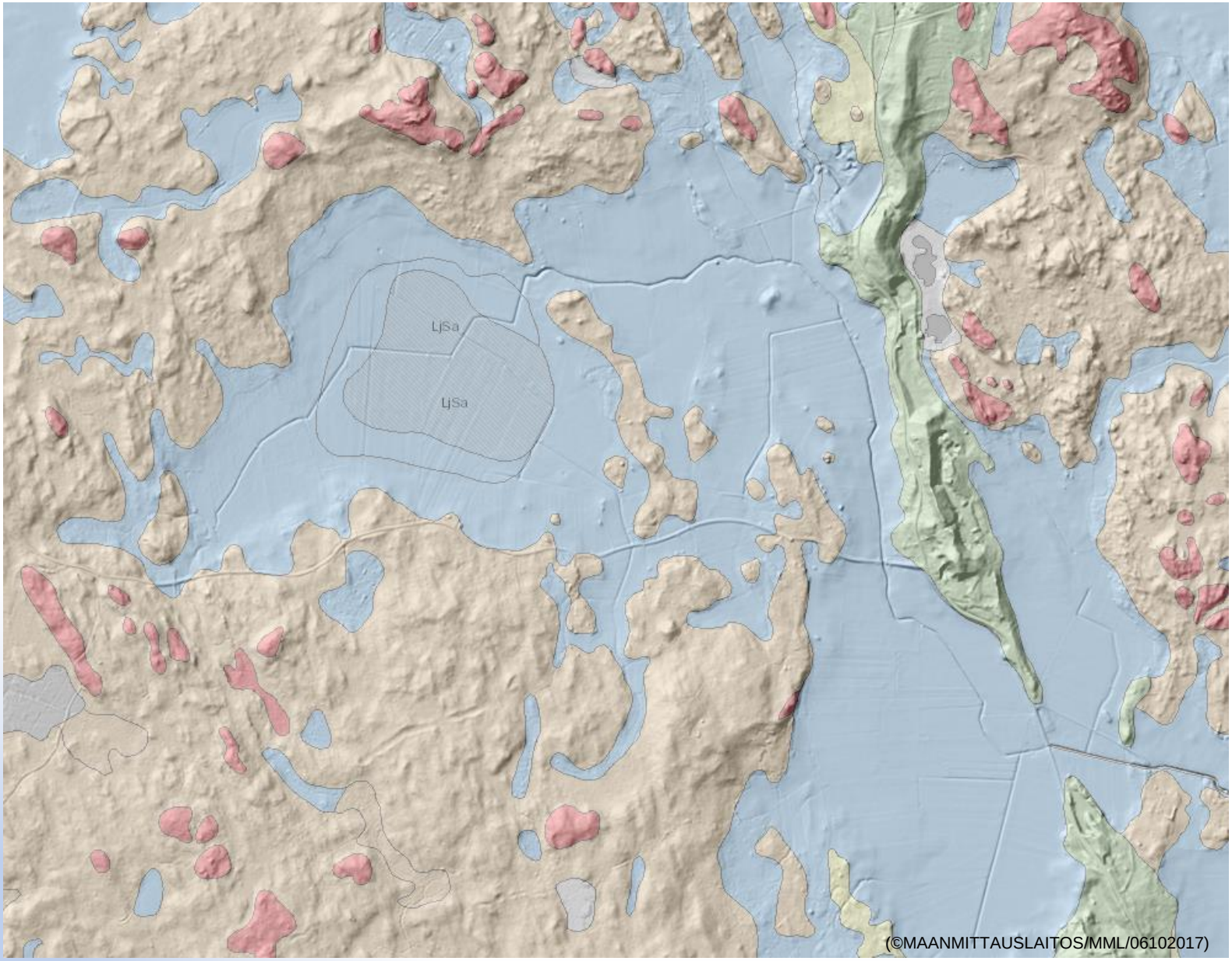
- National implementation strategy / plan
- Risk and flood areas analysis and measurements
- Information system to farmers → **Focus the actions to problematic areas systematically**
- Reorganizations of drainage corporate bodies
- Holistic actions from field level to ditches, the rivers, lakes and sea **systematically** → Basic drainage, local drainage and environmental water management
- Implementation committees = Cooperation with authorities, municipalities, foundations, associations, designers, contractors, researchers, advisers, farmers and landowners.

Preliminary studies / local problems on drainage basin

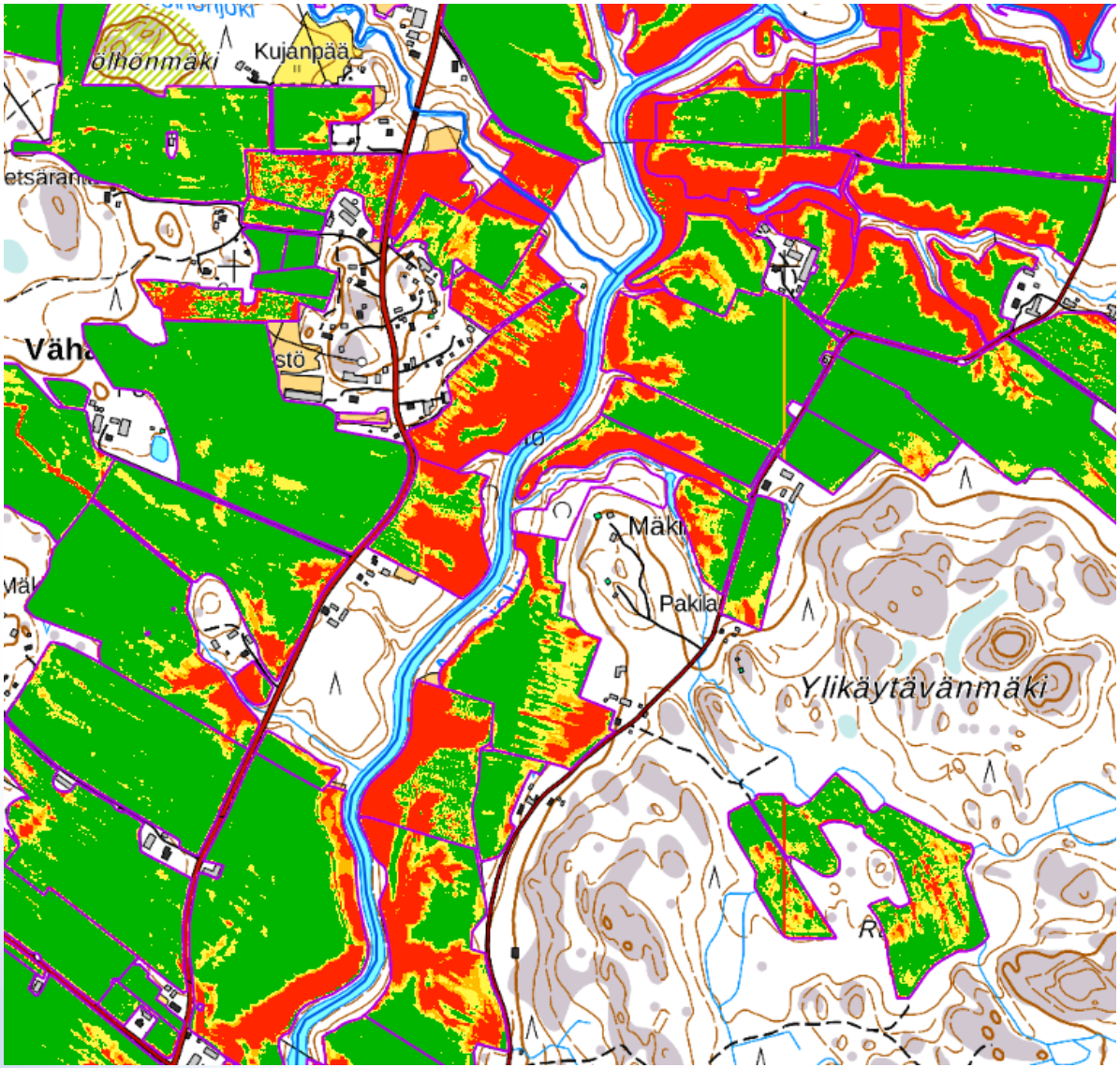


With airphotos and altitude models we can found the problematic areas!

Soil type maps and altitude models

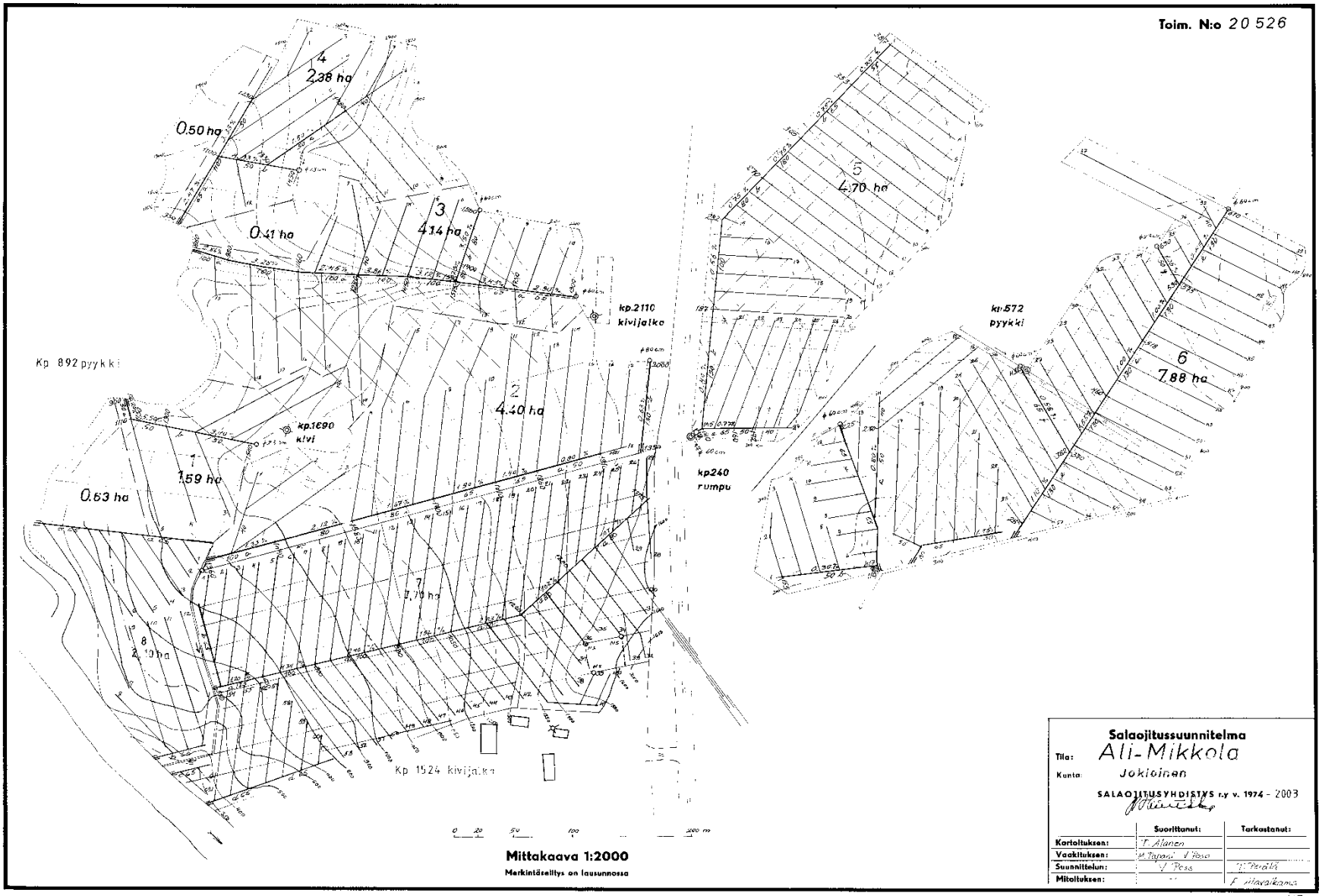


Erosion and outflow models



RUSLE 2015 - eroosiomallinnus, Lähde: Luonnonvarakeskus
Peltolohkorekisteri, Lähde: © Maaseutuvirasto
Vipu-vesistöt, Lähde: SYKE, MML
Vipu-vesistön uomat, Lähde: SYKE
Vipu-vesistön järvet, Lähde: MML
KUTOMA-hanke

Old drainage maps



Gradients, set up levels, soil types, altitudes

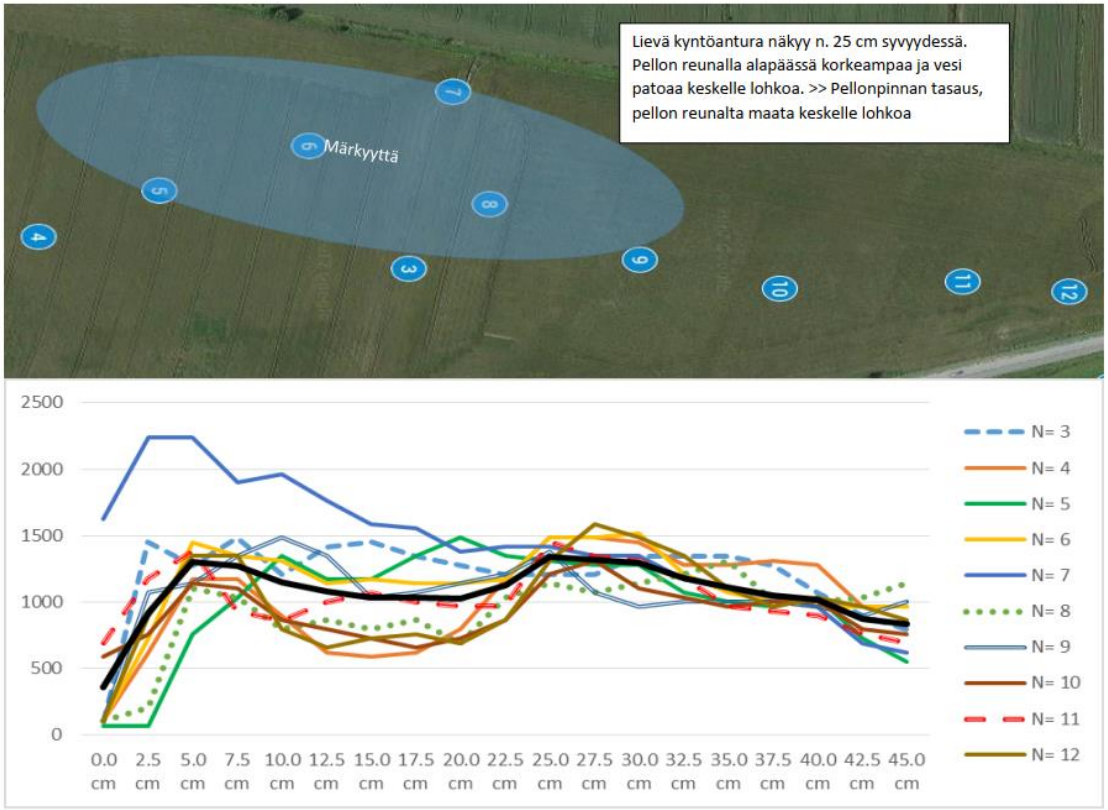
Field measurements identify the possibilities for implement the actions.

Studies for drainage (basic and local drainage)

Examinations:

- Difference between water level and field surface
- The discharges
- Wells
- Ditches
- Drums
- Difference between drainage pipes and field surface
- Distance between drainage pipes
- Gradients
- Maintenance (flushing)
- Possibilities for water protection structures

In some areas of the target area, a penetration test was performed to determine the structure



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Euroopan aluekehitysrahasto

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Focusing the actions to problematic areas and informing these areas drainage corporate bodies we can implement the holistic water management actions nationally.

Backround for NUTRINFLOW- project in Hardombäcken ditches drainage basin

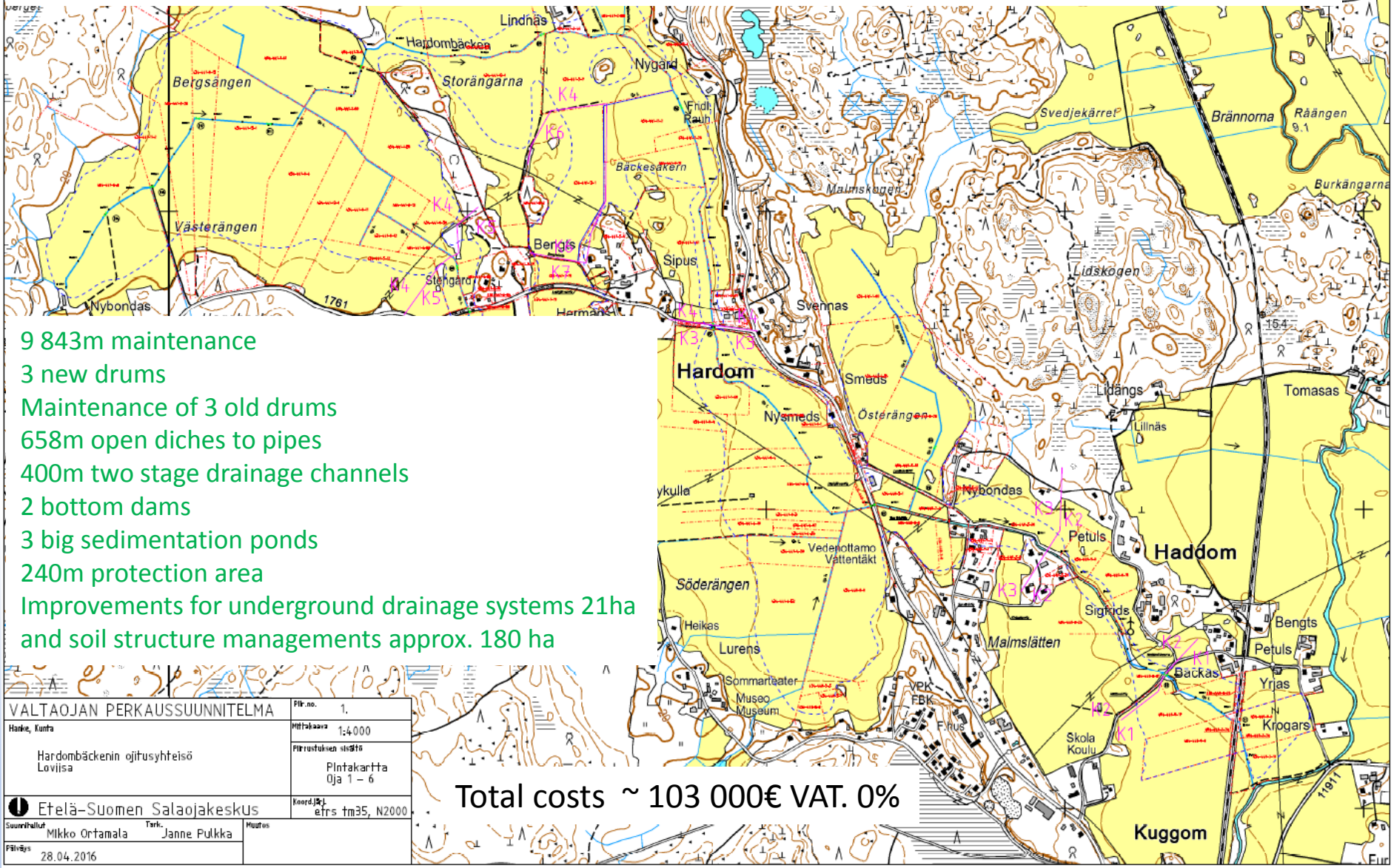
Hardombäkens water capacity was not enough for the waters from the drainage basin. The floods existed on area of 60 - 80 hectares round the year.

Problems consisted of:

- Erosion
- Outflow and sedimentation of solid matter
- Increased drainage network on drainage basin – lower water retention
- Water capacity of Hardombäcken ditch
- Subsidence of soil

Hardombäcken ditch, Loviisa, Holistic water management pilot area

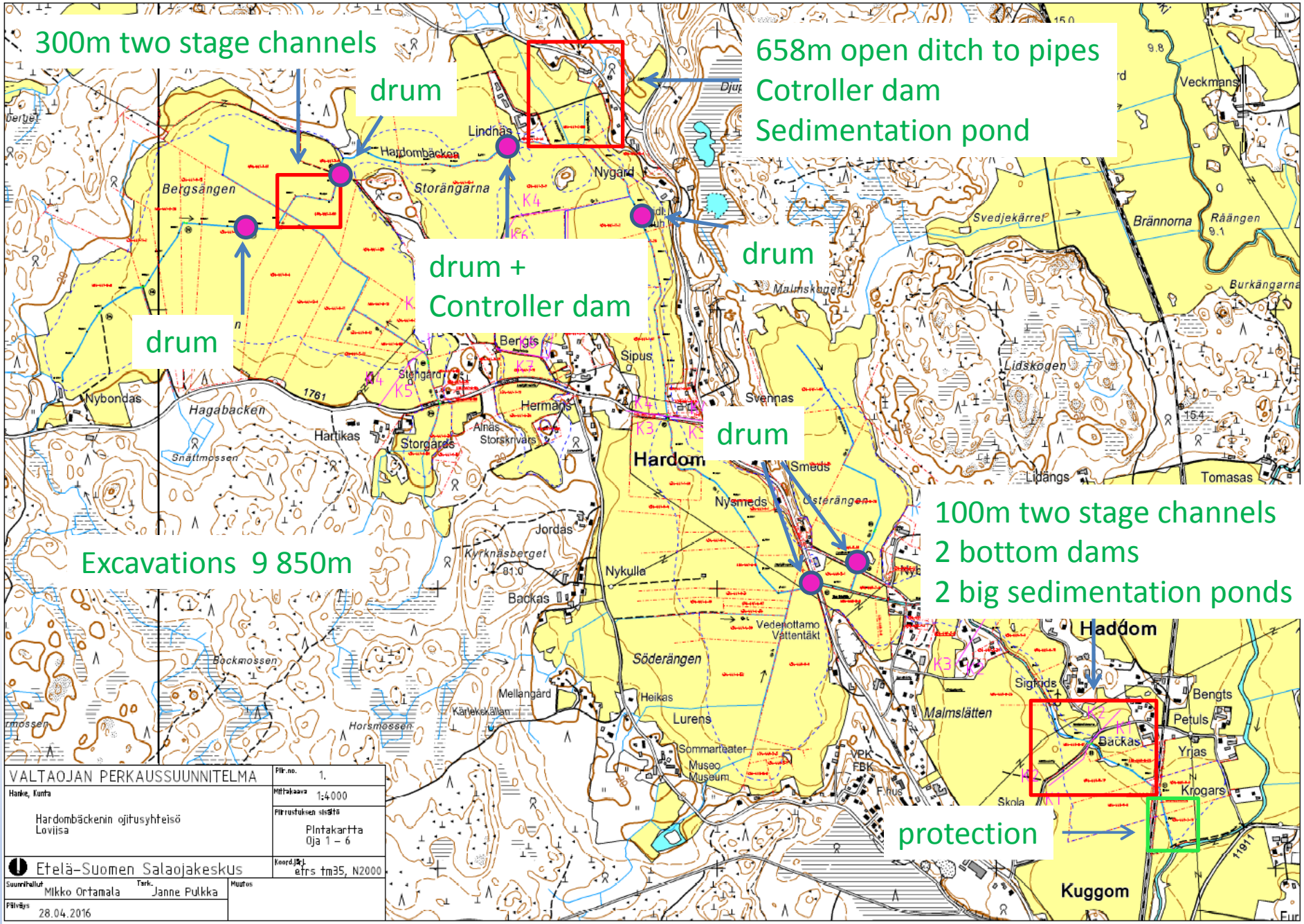
Catchment area 12.3 km²



9 843m maintenance
3 new drums
Maintenance of 3 old drums
658m open diches to pipes
400m two stage drainage channels
2 bottom dams
3 big sedimentation ponds
240m protection area
Improvements for underground drainage systems 21ha
and soil structure managements approx. 180 ha

VALTAOJAN PERKAUSSUUNNITELMA	Piir.no. 1.
Hanke, Kunta Hardombäckenin ojitusyhteisö Loviisa	Mittakaava 1:4000 Piirrustuksen sisältö Pintakartta Oja 1 – 6
Etelä-Suomen Salaojakeskus	Koord.järj. etrs tm35, N2000
Suunnittelut Mikko Ortamala Tark. Janne Pulkka Päiväys 28.04.2016	Muutos

Total costs ~ 103 000€ VAT. 0%


300m two stage channels
drum
658m open ditch to pipes
Cotroller dam
Sedimentation pond
drum +
Controller dam
drum
drum
drum
Excavations 9 850m
100m two stage channels
2 bottom dams
2 big sedimentation ponds
protection
Hardombäcken
Lindhäs
Nygård
Storängarna
Bergsängen
Hagabacken
Nybondas
Hartikas
Storgårds
Alnäs
Storskrivars
Hermans
Stengård
Bengts
Sipus
Svennas
Hardom
Smeds
Nysmeds
Österängen
Jordas
Kyrknäsberget
Nykulla
Backas
Vedenottamo
Vattentäkt
Söderängen
Mellangård
Heikas
Lurens
Sommarteater
Museo
Museum
Bockmossen
Horsmossen
Snättmossen
Malmskogen
Svedjekärret
Brännorna
Råängen
Burkängarna
Lidskogen
Lidängs
Tomasas
Veckmans
Hadom
Sigrids
Bengts
Petuls
Backas
Yrjas
Krogars
Malmslätten
Kuggom
VALTAOJAN PERKAUSSUUNNITELMA
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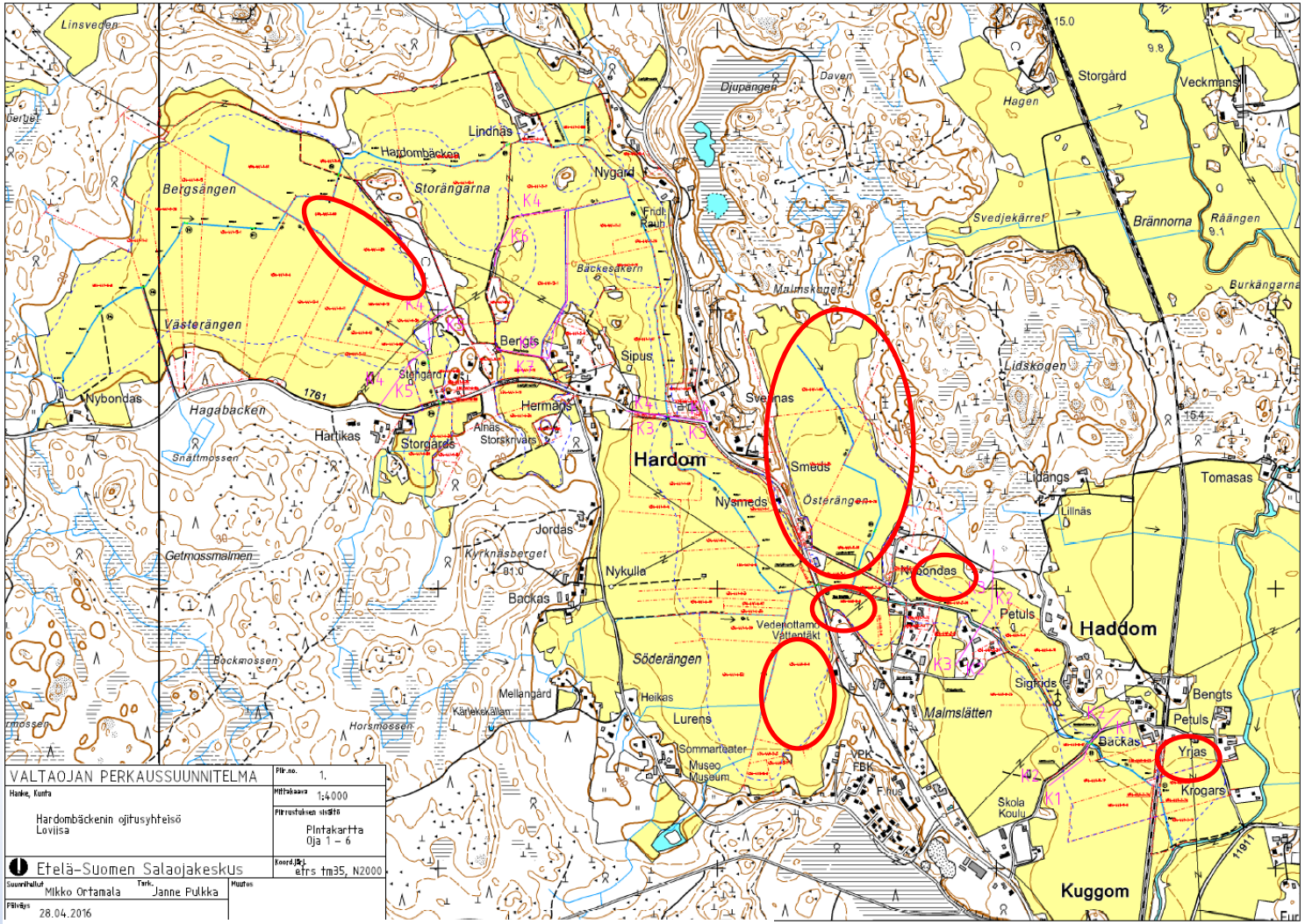


Total costs ~ 75 000€ VAT. 0%

Underground drainage systems n. 17 000m

New drainage 13ha

Supplement drainage 8ha

Soil fertility observations based on soil fertility analyzes in the target area

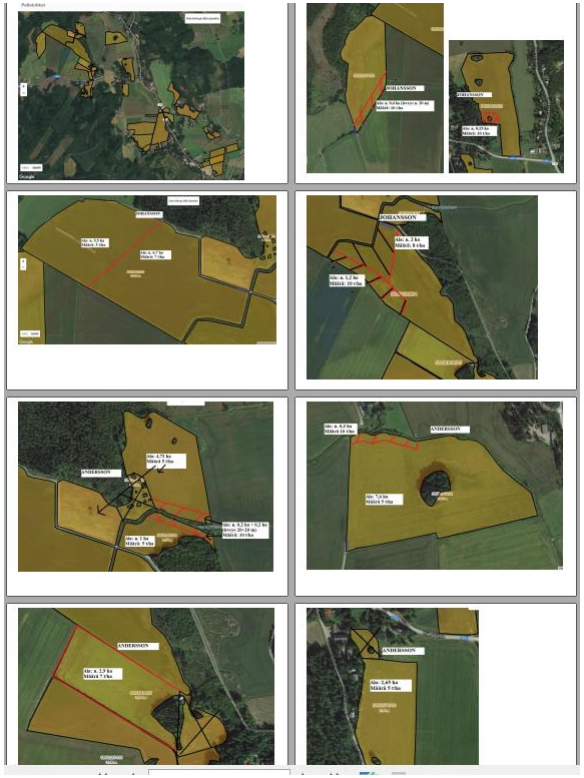
Liming

The need was varying according to need

- About 4-10 tn/ha calcite
- About 5 tn/ha structural lime

- **Calcite (NORDKALK) in total** 810 tn
  =approx. 115 ha
  - Spring/winter spreading 625 tn
  - Autumn spreading 185 tn

- **Structural lime (NORDKALK FOSTOP) in total** 20 ha
  - Autumn spreading 89 tn



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Soil improvers

- fibers from paper industry (Soilfood)
  - Improvers can effectively increase the amount of organic matter in a low-content soils. The soil with high organic content has a good structure, a well-functioning water management and an active micro-organism, and is easy to cultivate.
  - In total 1635 tn was spread in the pilot area (35 tn/ha)

Tyynelän tila Rokua 20.2.2014

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02.05.2016

16.08.2017

Traditional excavation
3,5€/mtr VAT. 0%

15€/mtr VAT. 0%

70 €/h VAT. 0%

Price = soil type, which side?, excavation **<u>mass m3</u>**

Water level set down 1.2m (on average) because the maintenance.

02.05.2016

12.10.2016

Water level set down 0.7m (on average)

Before

After

Constructions for control of the water levels at summertime

Fishery, landscape, recreational values, game management

Kaatuva rapid before and after renovation (River Kaatuvanjoki Hartola)

Before

After

Fishery Centre of Häme region

It is important to focus the actions on suitable areas with limited resources.

Results of NUTRINFLOW-project in Hardombäcken ditch, national exemplary pilot area of holistic water management:

- According to the landowners opinion sprouting and vegetation was more uniform in many fields. Year 2017 was not representative for comparison due to heavy rains and year 2018 due to exceptional drought. **Autumn flood 2017 were caught to control and water did not enter to the fields on the entire renovation area!**

- Operational basic drainage enables measures for soil structure and local drainage improvement. The renovation of the worst problematic objects has been continuing and renovation is almost completed.

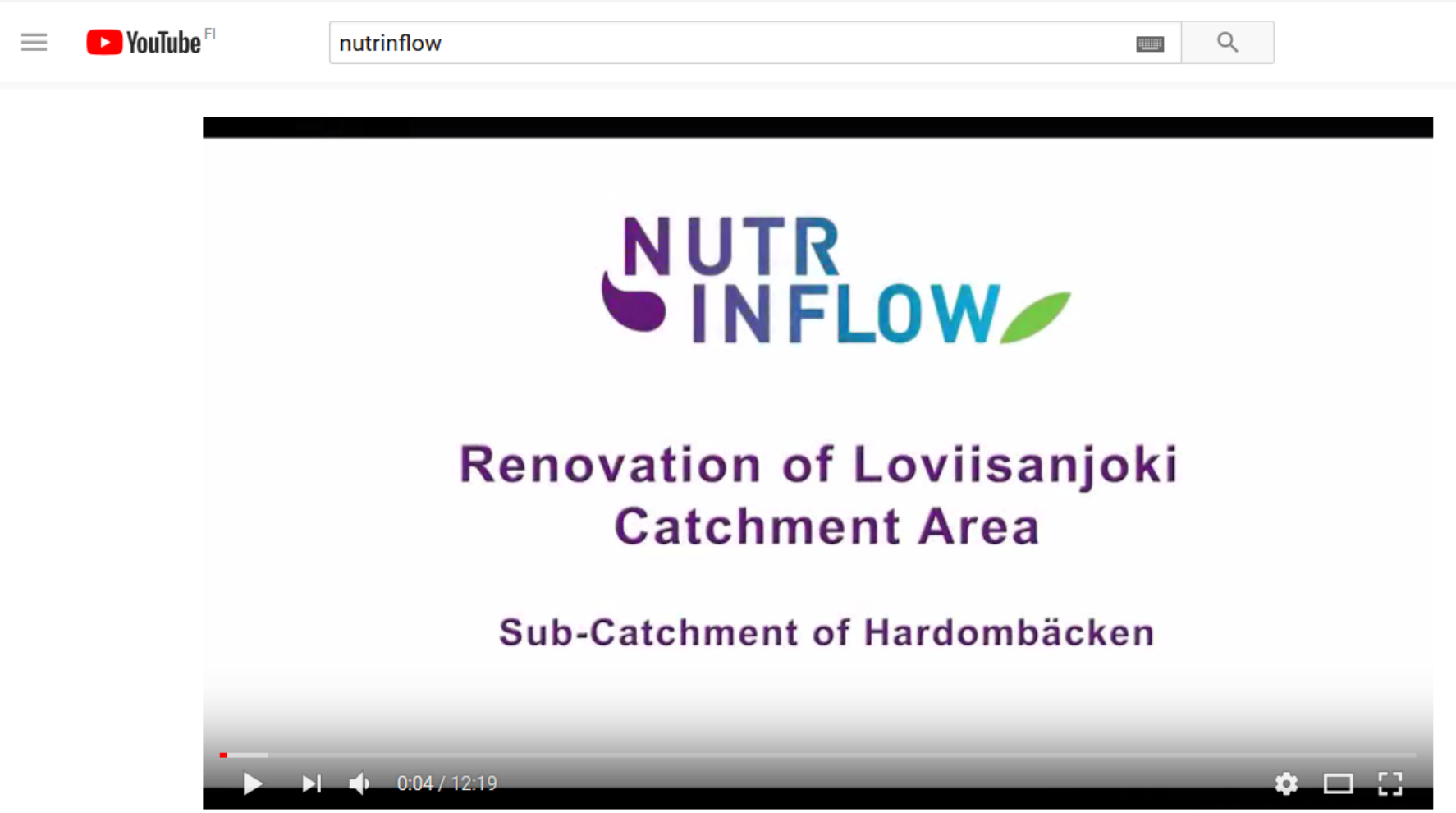
- Turbidity of Hardombäcken waters has decreased, because the sediment on ditch bottom does not flush out. This decreases the solid matter loading of the river Loviisanjoki.

- Ensured the secure traffic on the road from Loviisa to Lapinjärvi.

- The water protection structures built have improved landscape values and solid matter retention. Along the channel has been several wild duck litters, thanks to the larger open water parts.

- Positive feedback from the landowners. Information has been disseminated both nationally and internationally. Hardombäcken is a reference object for holistic drainage management.

Check out our latest project video in Youtube!



Renovation of Loviisanjoki Catchment Area - Hardombäcken (2018)

Waterdrive-project 2019-2021

Having national dialogue for creating a water management procedure.
Practical development of **Drainage basin activity model** with the pilot area **River Porvoonjoki** drainage basin. Activity model improves the implementation of actions and methods of holistic water management (**the production of agriculture, fisheries and biodiversity**) in drainage basins of watersheds in agricultural areas (national level).

Case studies / Karjalaiskylä & Gammelbacka

Rapala-rahaston avustama Gammelbackan puron kunnostus on edennyt lupaavasti

Gammelbackan puro laskee Porvoonjoen suistoon. Puro virtaa noin kahden ja puolen kilometrin matkan läpi Gammelbackan kaupunginosaan. Ylempänä puro jakautuu useammaksi haaraojaksi. Puroena virtaa weitä vuosien ympärä ja se muodostaa Gammelbackaanka keskeisen maisemaketjun virratessaan rakennusten välisinä ja puistojen halki.

Puron kunnostusprojekti käynnistettiin vuonna 2014

Kunnostusta jaksottiin vuosina 2015. Tulevan kesän aikana pyrittiin kaivamaan puron suu auki ja rantaosuudet suunnikkaita edellisellä syksyllä. Kunnostusprojektin tarkoituksena on ehkäistävä, rehoittaa ja parantaa puron kunnostamisen kasvamaankatkeket puolesta, jossa taimen hattuvaja ja poyntaisi kas ehkäisyyyttä suotuisuutta.

Muun taksen yhteistyötä

Käynnistäjä on kosteikostoisa hankeita yhdessä Gammelbackan asukasyhdistyksen kanssa vapaaehtoistyöstä. Keskeiset yhteistyökumppanit ovat Jokiriikkiset hanke, Porvoon kaupunki ja Porvoon-Sipoon kalastusalue. Rahoitusta hanke on saanut Porvoon kaupungilta (kiistaan, kone- ym. apua), Porvoon-Sipoon kalastusalueelta, Rapala rahastolta ja Uudenmaan ELY-keskukselta.

Tekstit ja kuvat EERO LEHTO

Gammelbackan puron kunnostuksen vähäisimmät kiinnyttämät ennen ja kunnostuksen.

Kesällä 2014 kaivettiin kaksi kertaa ehkäisemätöntä pyrmantoaiset.

Kesäpäivän kaksi kertaa ehkäisemätöntä pyrmantoaiset.

Kunnostusta kunnostamaa ja talkoita

Vuosina 2015 kunnostuksia tehtiin noin 450 metrin pituisilla puro-osuuksilla, joista selkä 300 metrin oli suoritettava kunnostamisten kohteena. Kunnostuksiaiseta oliva: Tuvaipolun ja Vistentien viliseen matoiahan ankt Vistentien alkaa alapuolella Niittypolun alkaa ankt edellisen pohjaskaella. Tiiliaiseen poistetaksen tarvittiin neljän talkoot, 48 kuntyttiaatta, 300 tonnia kiviaineen, 13 000 euroa rahoitusta ja 400 talkoontuntia.

Yliset osaa kunnostetiin kivelmällä tenkeksuna uudkaapiluhtyksen talkoilla. Samalla eitoeiitin puroosuus ja rantaeiitin riuspaaja ja syöstikkiä kunnostamaharika. Niittypolun alapuolella puroosuus oli eiin pahoin umpeenkasvanut, eiä eiä rantaeiitin ankt myös kaupungin metsäreiden istuneta.

Tuvaiksen maalpaalkan projektit talkoilla

Tuupolpaalat ja maalahat puroisen puroosuuman ielalyällä kiesykällä maakaiitin puroosuuma mosipaalmen yrpitesti, joka tarjoa suosuat suojaa ja elinpaikkoja eri iktiaalle taimenen poikaaille. Kiesykällä maalaan hanna vahaeka uomaa kesyysen, vedin ayyyysen ja virtaamapaisen. Saatin sukaisa kunnostaakella on alkeis, kun puroua virtaa nain eiikin vetä. Kiesykällä maipaiita myös uomaa suuraja sorasella ja eraasiaka. Sorella iehtiin suuaaat katupaikkoja ja ankakaiaella kiesiaaaella saatiin ankatoka aaapaaikkoja kaiella. Tuupolpaalat poraisen puroua oli taiaaiaaa vain ahaa hoosa vesii ja jäätyneen napaisa liihea polpia myöten. Kunnostaiken aaaiesta puroon maaakaaa heikeaaaia aaapaaa jäätaaat ja aea alla jää eiiaiekat vesii kalojen selettaaiaa vartea.

Vi yhdessäaiheessa-aiaiiiita töiesä ja aaraa

Kiiaiaea maiita Porvoon kaupungiita. Rekaella maaia kiiaiaea haiaiiia iraksesta pertikiesyys ja kalpeiiiita edellisen paella. Valiaaa kiiaiaekaaia ejaiiaiita paikallisen kaiaiksaaella. Kaaaiyte kaaiesii selji pätä ja maalta rahoitapiia (ELY, Rapala säätiö) saaha eraa käyiaiiia tiiiia iarkaiaaen. Kaikiaella ei kaiaiksaaella jäiayi ja aea kaaaaaiaaaia ankt eiaaaiaelyä iehiia talkoaytäaä kiiaia.

Talaaaiaiaiaaaa aaaiaaaaiia

Kesällä 2014 iaiaiaiiia kokeilliaaia kaksi aaiiaraaiiaa taiaaaaa aaiiyyeii oli aaia 1700 kpl. Laiikai iaiaaiiia aaia 200 kpl aaiiaaaaaaaiyaaikaaia oli aaia kaksea aaaiia aaiiaaia piraaykaaia, jaika jaaai eraa aiaaiiaaia.

PAIKALLISET

Puroa maisemoidaan kodiksi taimenille

Gammelbackan asukkaat pääsevät lapsiaiden lauantaina

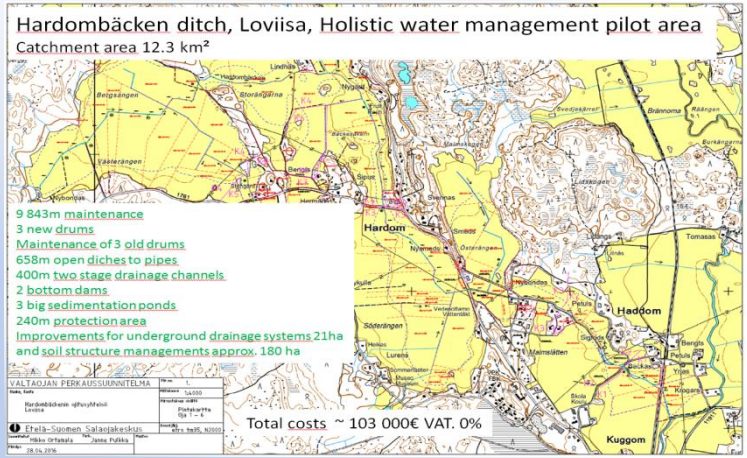
Kuvat 24-26. Purokunnostus oli hyvin esillä paikallisissa sanomalehdissä, mikä auttoi tuomaan runsaasti väkeä talkoisiin ja herättämään yhteishengen puron ja asuinympäristön puolesta.

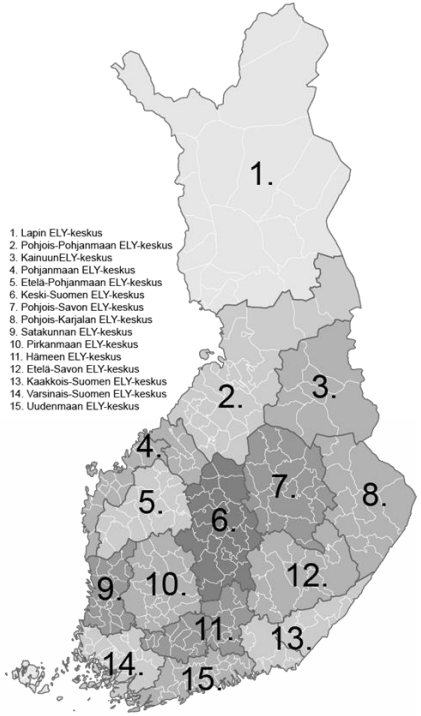
Kuva 18. Mustijokeen syksyllä 2012 noussut meritaimen.

Itä-Uudenmaan ja Porvoonjoen vesien- ja ilmansuojeluyhdistys r.y.
Runebergintie 17, 06100 PORVOO

Föreningen vatten- och luftvård för Östra Nyland och Borgå å r.f.
Runebergsgatan 17, 06100 BORGÅ

National level / case studies





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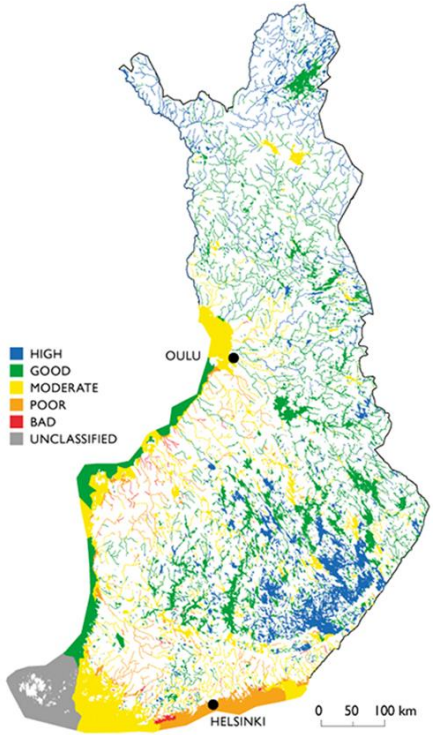
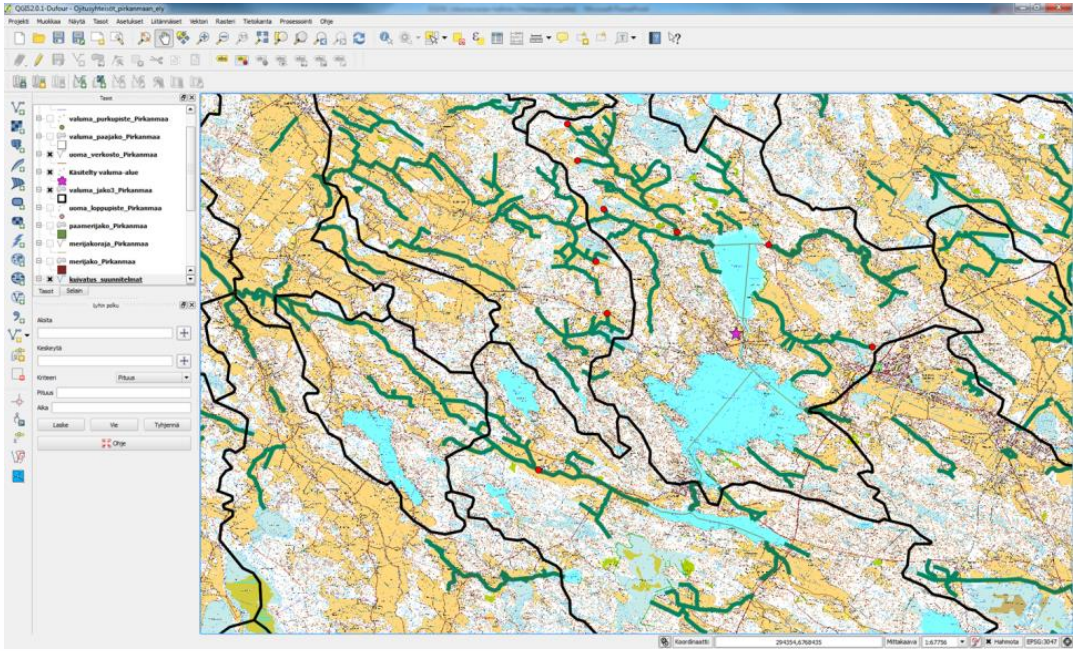
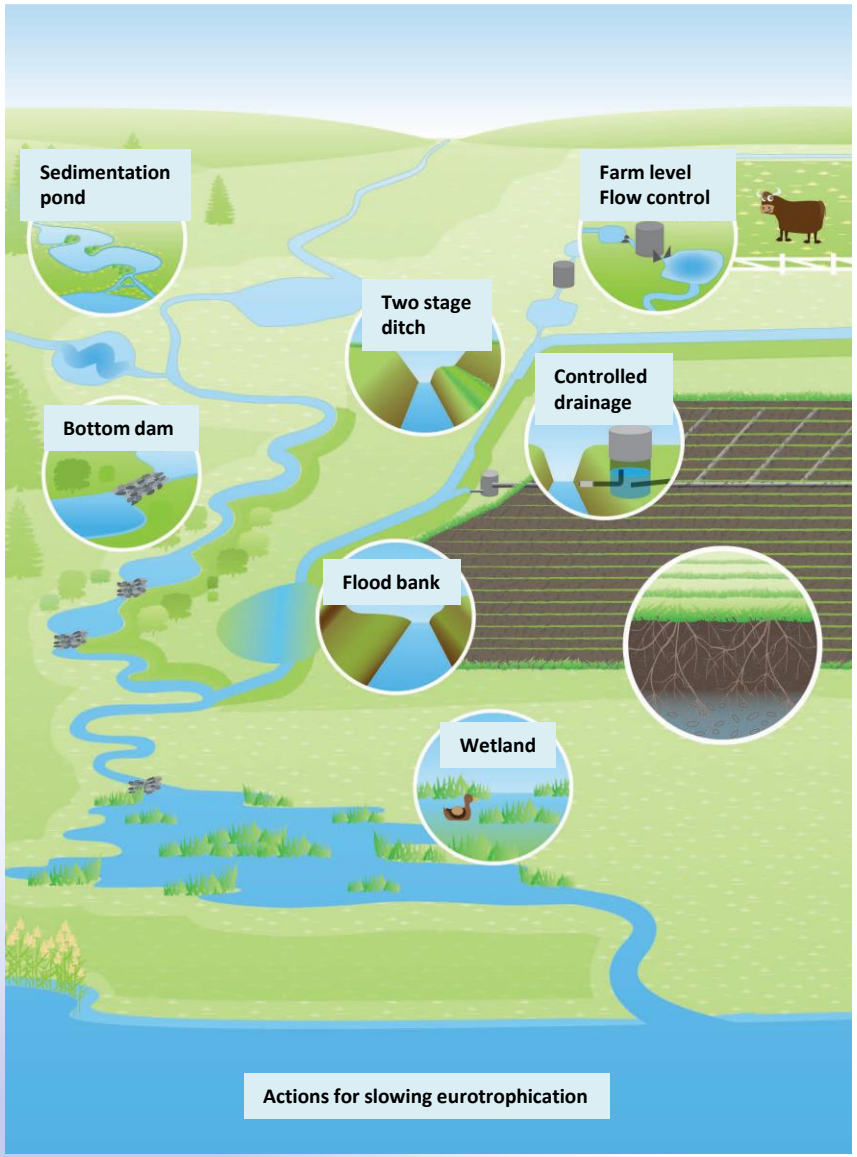


Suomen ympäristökeskus, SYKE



Drainage basin activity model



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- National implementation strategy / plan
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PRO Agria Etelä-Suomi

Nylands Svenska Lantbrukssällskap

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Thank you!

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