Constructed wetland within Kråkstadelva catchment (A-G.B.Blankenberg)

Small constructed wetland (挪威)

Fangdam

描述

A small constructed wetland is a combination of ponds and vegetation filters, designed mainly to remove sediment and nutrients from streams. It is usually located in first and second order streams in agricultural landscapes.

Purpose/aim: Small constructed wetlands (CWs) are designed to improve water quality in streams and thus downstream water quality as well. The shape of the constructed wetlands can differ and include different components. Generally, they include a deeper sedimentation pond at the inlet (depth 1.5-2 m), followed by one or more shallow vegetated zones (depth 0.5 m). The sedimentation pond decreases the water velocity to allow particles to settle, while the vegetated, shallower zones act as filters for particles passing the sedimentation pond and protect trapped sediments from re-suspension by stabilizing them with their roots.

Small constructed wetlands treating agricultural runoff have been in operation in Norway since the early 1990s. From 1994-2020, more than 1200 CWs have been established across the country, with the aim of reducing sediment, nutrients, pesticides and other pollutants in agricultural runoff.

Establishment/maintenance: Norwegian CW are designed mainly to remove phosphorus and particles (suspended sediment) with main removal mechanism being sedimentation and filtration, and (to a lesser extent) plant uptake. The CWs treating agricultural runoff are usually constructed by expanding the width of natural streams. At the inlet of the CW, the stream water flows into a sedimentation pond. From the sedimentation pond, water passes through a sprinkling zone, and then through one or more vegetated wetland filters. Due to the typical small-scale Norwegian agriculture and the landscape with rough topography, CWs are often quite small (<0.1 % of the catchment area). The size of CWs is one of the crucial factors limiting overall treatment efficiency.

Over the years, the CW will fill up with sediments, and to maintain good treatment efficiency, it is necessary to empty the CWs periodically (Blankenberg et al. 2013).

Benefits/impacts: Norwegian studies show that retention of total phosphorus (TP), both particulate P and dissolved P, increase with increasing area of the CW (Braskerud et al. 2005). The retention of sediments, nutrients and pesticides in different CWs also varies due to other factors like design principles, soil types in the catchment, hydraulic loads, and locations along the streams (Braskerud and Blankenberg 2005 ; Blankenberg et al. 2007 , 2008 ; Elsaesser et al. 2011). Braskerud (2001) showed that average retention in six CWs in Norway varied from 45% to 74% for soil particles and 21%–44% for TP. For CW in Skuterud catchment Krzeminska et al (2021) showed that average efficiency of removal was 36% of sediment, 19% of phosphorus and 3% of nitrogen .

Natural / human environment: The information presented here is based on the investigations and/or reports from different part of Norway. For the purpose of OPTAIN project, the technology is further presented in the natural and human environment context of the Kråkstad River catchment - a Norwegian Case Study catchment within OPTAIN project.

The Kråkstad River is mainly situated in Ski commune in South-Eastern parts of Norway. The river catchment is a western tributary of the Vannsjø-Hobøl watercourse, also known as the Morsa watercourse. The Kråkstad River catchment area is c.a 51 km^2, 43% of which is agricultural land, where mostly cereals are produced on heavy clays soils. The main environmental challenge in the area is water quality (incl. high phosphorus pollution) and soil erosion (incl. riverbank erosion and quick-clay landslides).

地点

地点: The Vansø - Hobøl catchment, Viken county, 挪威

分析的技术场所数量: 10-100个场所

选定地点的地理参考

- 10.8312, 59.68394
- 10.90641, 59.70117
- 10.90062, 59.68605
- 10.85956, 59.65484
- 10.85956, 59.65484
- 10.85956, 59.65484

技术传播: 适用于特定场所/集中在较小区域

在永久保护区？: 否

实施日期: 10-50年前

介绍类型

- ☐ 通过土地使用者的创新
- ☐ 作为传统系统的一部分（> 50 年）
- ☑ 在实验/研究期间
- ☐ 通过项目/外部干预
- ☑ SMIL (Special Environmental measures in agriculture)

Small constructed wetland within the Kråkstad catchment (Anne-Grete Busetch Blankenberg)

Small constructed wetland in the Skuterud catchment (Dominika Krzeminska)

技术分类

主要目的

- [ ] 改良生产
- [ ] 减少、预防、恢复土地退化
- [ ] 保护生态系统
- [x] 结合其他技术保护流域/下游区域
- [ ] 保持/提高生物多样性
- [ ] 降低灾害风险
- [x] 适应气候变化/极端天气及其影响
- [x] 减缓气候变化及其影响
- [ ] 创造有益的经济影响
- [ ] 创造有益的社会影响

土地利用

同一土地单元内混合使用的土地： 否

农田

- 一年一作: 谷类 - 其他, small grains

每年的生长季节数: 1
采用间作制度了吗？: 否
采用轮作制度了吗？: 否

森林/林地

水道、水体、湿地 - 排水管道、水道

供水

- [x] 雨养
- [ ] 混合雨水灌溉
- [ ] 充分灌溉

土地退化相关的目的

- [x] 防止土地退化
- [x] 减少土地退化
- [ ] 修复/恢复严重退化的土地
- [ ] 适应土地退化
- [ ] 不适用

解决的退化问题

水质恶化 - Hp：地表水水质下降

SLM组

- 地表水管理（泉、河、湖、海）
- 湿地保护/管理

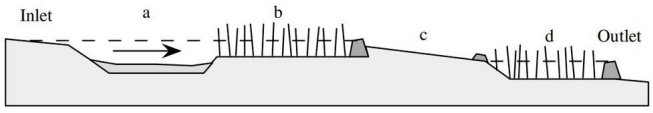
SLM措施

结构措施 - S5：大坝、集水斗、水池

技术图纸

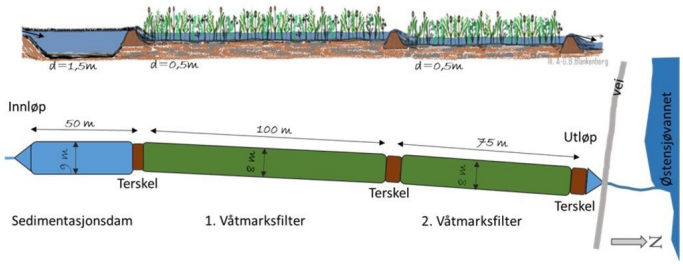
技术规范

Components of typical constructed wetland in Norway: (a) sedimentation pond, (b) wetland filter, (c) overflow zone covered with vegetation or stones and (d) outlet basin.



Author: B.C. Braskerud (2002)

Schematic representation of constructed wetland in Skuterud catchment.



Author: Anne-Grete Buseth Blankenberg (e.g. in the report from 2021)

技术建立与维护：活动、投入和费用

投入和成本的计算

- 计算的成本为：每个技术单元 (单位：**constructed wetland - area of water surface** volume, length: **<0.1 % of the catchment area. For Skuterud wetland it is 2300 m2**)
- 成本计算使用的货币：**NOK**
- 汇率（换算为美元）：1 美元 = 8.89 NOK
- 雇用劳工的每日平均工资成本：1440

影响成本的最重要因素

The most important factor affecting the costs of constructed wetland is the size. Larger constructed wetlands have lower establishment costs per m2 of water surface area. In terms of operating costs for capture ponds - mainly emptying the sedimentation pond - it is assumed that the cost per emptying is more or less independent of the size of the sedimentation pond. This is because a large component in the emptying cost is assumed to be the transport of the machinery and the removal of the excavated mass. The landowners can apply for subsidies to establish and maintenance constructed wetland (70% support of the cost), within SMIL system (Special Environmental measures in Agriculture). Local county authorities are responsible for the administration of these schemes.

技术建立活动

1. Construction of the wetland (时间/频率: None)

总技术建立成本（估算）

87500.0

技术维护活动

1. Maintenance - emptying the ponds (时间/频率: every 5-20 years depending on dimensions of the ponds.)
2. Maintenance of the damming/barriers (时间/频率: when needed)
3. Maintenance of stream banks (时间/频率: when needed)

总技术维护成本（估算）

41000.0

自然环境

年平均降雨量

- [ ] < 250毫米
- [ ] 251-500毫米
- [ ] 501-750毫米
- [x] 751-1,000毫米
- [x] 1,001-1,500毫米
- [ ] 1,501-2,000毫米
- [ ] 2,001-3,000毫米
- [ ] 3,001-4,000毫米
- [ ] > 4,000毫米

农业气候带

- [ ] 潮湿的
- [x] 半湿润
- [x] 半干旱
- [ ] 干旱

关于气候的规范

不适用

斜坡

- [ ] 水平（0-2%）
- [x] 缓降（3-5%）
- [x] 平缓（6-10%）
- [ ] 滚坡（11-15%）
- [ ] 崎岖（16-30%）
- [ ] 陡峭（31-60%）
- [ ] 非常陡峭（>60%）

地形

- [ ] 高原/平原
- [ ] 山脊
- [ ] 山坡
- [ ] 山地斜坡
- [ ] 麓坡
- [x] 谷底

海拔

- [ ] 0-100 m a.s.l.
- [x] 101-500 m a.s.l.
- [ ] 501-1,000 m a.s.l.
- [ ] 1,001-1,500 m a.s.l.
- [ ] 1,501-2,000 m a.s.l.
- [ ] 2,001-2,500 m a.s.l.
- [ ] 2,501-3,000 m a.s.l.
- [ ] 3,001-4,000 m a.s.l.
- [ ] > 4,000 m a.s.l.

.....应用的技术

- [ ] 凸形情况
- [ ] 凹陷情况
- [x] 不相关

土壤深度

- [ ] 非常浅（0-20厘米）
- [ ] 浅（21-50厘米）
- [ ] 中等深度（51-80厘米）
- [x] 深（81-120厘米）
- [x] 非常深（> 120厘米）

土壤质地（表土）

- [ ] 粗粒/轻（砂质）
- [x] 中粒（壤土、粉土）
- [x] 细粒/重质（粘土）

土壤质地（地表以下>20厘米）

- [ ] 粗粒/轻（砂质）
- [x] 中粒（壤土、粉土）
- [x] 细粒/重质（粘土）

表土有机质含量

- [ ] 高（>3%）
- [x] 中（1-3%）
- [ ] 低（<1%）

地下水位

- [ ] 表面上
- [x] < 5米
- [ ] 5-50米

地表水的可用性

- [ ] 过量
- [x] 好
- [ ] 中等

水质（未处理）

- [ ] 良好饮用水
- [ ] 不良饮用水（需要处理）
- [x] 仅供农业使用（灌溉）

盐度是个问题吗？

- [ ] 是
- [x] 否

- [ ] > 50米

- [ ] 匮乏/没有

- [ ] 不可用

水质请参考： 地下水和地表水

洪水发生
- [x] 是
- [ ] 否

物种多样性
- [ ] 高
- [ ] 中等
- [x] 低

栖息地多样性
- [ ] 高
- [ ] 中等
- [x] 低

应用该技术的土地使用者的特征

市场定位
- [ ] 生计（自给）
- [x] 混合（生计/商业）
- [x] 商业/市场

非农收入
- [ ] 低于全部收入的10%
- [x] 收入的10-50%
- [x] > 收入的50%

相对财富水平
- [ ] 非常贫瘠
- [ ] 贫瘠
- [x] 平均水平
- [x] 丰富
- [ ] 非常丰富

机械化水平
- [ ] 手工作业
- [ ] 畜力牵引
- [x] 机械化/电动

定栖或游牧
- [x] 定栖的
- [ ] 半游牧的
- [ ] 游牧的

个人或集体
- [x] 个人/家庭
- [ ] 团体/社区
- [ ] 合作社
- [ ] 员工（公司、政府）

性别
- [x] 女人
- [x] 男人

年龄
- [ ] 儿童
- [x] 青年人
- [x] 中年人
- [ ] 老年人

每户使用面积
- [ ] < 0.5 公顷
- [ ] 0.5-1 公顷
- [ ] 1-2 公顷
- [ ] 2-5公顷
- [ ] 5-15公顷
- [x] 15-50公顷
- [ ] 50-100公顷
- [ ] 100-500公顷
- [ ] 500-1,000公顷
- [ ] 1,000-10,000公顷
- [ ] > 10,000公顷

规模
- [ ] 小规模的
- [x] 中等规模的
- [ ] 大规模的

土地所有权
- [ ] 州
- [ ] 公司
- [ ] 社区/村庄
- [ ] 团体
- [ ] 个人，未命名
- [x] 个人，有命名

土地使用权
- [ ] 自由进入（无组织）
- [x] 社区（有组织）
- [ ] 租赁
- [x] 个人

用水权
- [x] 自由进入（无组织）
- [ ] 社区（有组织）
- [ ] 租赁
- [ ] 个人

进入服务和基础设施的通道

健康	贫瘠	好
教育	贫瘠	好
技术援助	贫瘠	好
就业（例如非农）	贫瘠	好
市场	贫瘠	好
能源	贫瘠	好
道路和交通	贫瘠	好
饮用水和卫生设施	贫瘠	好
金融服务	贫瘠	好

影响

社会经济影响

生产区域（耕种/使用中的新土地）	降低	增加

社会文化影响

生态影响

水质	降低	增加	
土壤流失	增加	降低	The sediment taken out from the sedimentation pond can be distributed on the agricultural field - soil recovery.
养分循环/补给	降低	增加	The sediment taken out from the sedimentation pond can be distributed on the agricultural field - nutrient recovery.
植物多样性	降低	增加	
动物多样性	降低	增加	
栖息地多样性	降低	增加	

场外影响

下游淤积	增加	降低	Better water quality downstream
缓冲/过滤能力（按土壤、植被、湿地划分）	减少	改良	

成本效益分析

与技术建立成本相比的效益

短期回报 非常消极 ✓ 非常积极

长期回报 非常消极 ✓ 非常积极

与技术维护成本相比的效益

短期回报 非常消极 ✓ 非常积极

长期回报 非常消极 ✓ 非常积极

气候变化

渐变气候

年温度 增加 非常不好 ✓ 非常好

年降雨量 增加 非常不好 ✓ 非常好

气候有关的极端情况（灾害）

比较和缓的（河道）洪水 非常不好 ✓ 非常好

采用和适应

采用该技术的地区内土地使用者的百分比

- 单例/实验
- ✓ 1-10%
- 11-50%
- > 50%

在所有采用这种技术的人当中，有多少人在没有获得物质奖励的情况下采用了这种技术?

- ✓ 0-10%
- 11-50%
- 51-90%
- 91-100%

最近是否对该技术进行了修改以适应不断变化的条件？

- 是
- ✓ 否

什么样的变化条件？

- 气候变化/极端气候
- 不断变化的市场
- 劳动力可用性（例如，由于迁移）

结论和吸取的教训

长处: 土地使用者的观点

- Improvement of water quality downstream

长处: 编制者或其他关键资源人员的观点

- Improve of water quality downstream
- Resource recovery

弱点/缺点/风险: 土地使用者的观点如何克服

- Loss of productive cropland
- Need for maintenance

弱点/缺点/风险: 编制者或其他关键资源人员的观点如何克服

参考文献

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WOCAT数据库中的完整描述
https://qcat.wocat.net/zh/wocat/technologies/view/technologies_5940/

链接的SLM数据
Approaches: Regional Environmental program https://qcat.wocat.net/zh/wocat/approaches/view/approaches_2596/

文件编制者

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项目
- OPtimal strategies to retAIN and re-use water and nutrients in small agricultural catchments across different soil-climatic regions in Europe (OPTAIN)

主要参考文献

- Hauge A., Blankenberg A-G. B., Hanserud O.H. 2008. Evaluering av fangdammer som miljøtiltak i SMIL. Bioforsk Rapport Vol. 3 Nr. 140 2008.: https://evalueringsportalen.no/
- Blankenberg A-G.B., Paruch A.M., Paruch L., Deelstra J., Haarstad K. 2016. Nutrients tracking and removal in constructed wetlands treating catchment runoff in Norway. In: Vymazal J. (ed) Natural and Constructed Wetlands. Springer International Publishing Switzerland, pp. 23-40. DOI 10.1007/978-3-319-38927-1_2: Springer Book
- Krzeminska D., Blankenberg A-G., Bechmann M. Deelstra J. 2021. Effekt av fangdam i et endret klima. NIBIO-rapport;7(101)2021: NIBIO website
- Greipsland I.2016. Norwegian policy and practices regarding mitigation measures in agriculture.: NIBIO website

链接到网络上可用的相关信息

- Hauge A., Blankenberg A-G. B., Hanserud O.H. 2008. Evaluering av fangdammer som miljøtiltak i SMIL. Bioforsk Rapport Vol. 3 Nr. 140 2008.: https://evalueringsportalen.no/evaluering/evalueringen-av-fangdammer-som-miljotiltak-i-smil/Rapport%20Evaluering%20av%20fangdammer%20-%20Bioforsk%20Jord%20og%20Milj%C3%B8.pdf/@@inline
- Krzeminska D., Blankenberg A-G., Bechmann M. Deelstra J. 2021. Effekt av fangdam i et endret klima. NIBIO-rapport;7(101)2021: https://nibio.brage.unit.no/nibio-xmlui/bitstream/handle/11250/2757116/NIBIO_RAPPORT_2021_7_101.pdf?sequence=4&isAllowed=y
- Greipsland I.2016. Norwegian policy and practices regarding mitigation measures in agriculture.: https://nibio.brage.unit.no/nibio-xmlui/bitstream/handle/11250/2387569/NIBIO_POP_2016_2_21.pdf?sequence=3&isAllowed=y