

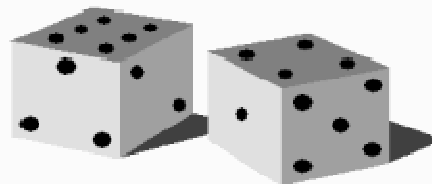


Rehabilitation of the Horten Channel

FORSVARETS BYGNINGSTJENESTE

Harald Bjørnstad
Senior Engineer

Clean up Project at the Horten Channel



Environmental Section



Rehabilitation of the Horten Channel

FORSVARETS BYGNINGSTJENESTE

The Horten Channel

- **A Historical Landmark built by the Norwegian Defence in 1854-1867.**
- **Purpose: Provide quick access to the sea with small vessels armed with missiles.**
- **The Channel is 830 m long, 3 m in depth and 10 m wide.**
- **Used for leisure activities by the public, and it forms a naturally dividing line between military and civilian areas.**


Environmental Section



Rehabilitation of the Horten Channel

FORSVARETS BYGNINGSTJENESTE

Status before rehabilitation program started

- **The Channel was in poor condition due to erosion and landslides. It was also bombed during the second world war.** 
- **The Channel was polluted with Pb (worst), PCB, PAH, and other heavy metals such as Cd and Hg. Main cause of heavy metals due to nearby battery factory.**
- **Pb(Lead) pollution: Up to 1.500 mg/kg dry weight, worst at the ends of the Channel, and in the upper 0,5 m of the sediments.**
- **PCB pollution: Up to 300 mg/kg dry weight in the top layers.**

Environmental Section

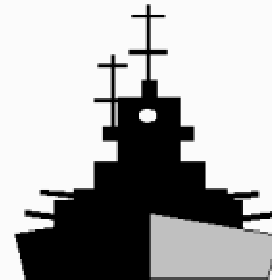


Rehabilitation of the Horten Channel

FORSVARETS BYGNINGSTJENESTE

Status before rehabilitation program started

- **Cd pollution: Up to 5 mg/kg dry weight**
- **Hg pollution: Up to 3 mg/kg dry weight and**
- **PAH pollution: up to 6 mg/kg dry weight**



Environmental Section



Rehabilitation of the Horten Channel

FORSVARETS BYGNINGSTJENESTE

Clean up process

- **Started in January 1998 and all polluted sediments were decided to be taken up by dredging and deposited on land**
- **Clearance for dredging given by the Norwegian State pollution Control authority**
- **Siltskirts were established in each end of the Channel to prevent dispersion and focus on program for controlling and monitoring samples**
- **Goal for the project was to reach classification II (moderately polluted sediments, lead <120 mg/kg)**

Environmental Section



Rehabilitation of the Horten Channel

FORSVARETS BYGNINGSTJENESTE

Challenges during the clean up process

- **Some sample values for turbidity and lead were exceeded due to extreme conditons like dredging very close to the siltskirt or a stretched siltskirt**
- **A worst case study concluded that up to 200 g lead pr. day could leak out of the Channel during the dredging**
- **Postdredging cause of unexpected earthslides from channel-wall, approximately 1.500 m³ extra, applied the local pollution Control authority for seadeposit**



Environmental Section

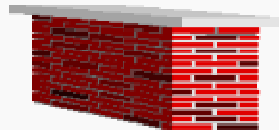


Rehabilitation of the Horten Channel

FORSVARETS BYGNINGSTJENESTE

Deposit of the sediments

- **5000 m³ of polluted sediments were sent for deposit in the mines of Mo i Rana in North Norway (the cheapest offer)**
- **Reconstruction of the polluted sediments with mixing of concrete and cemented in the mines 50-60 m below sealevel**



Environmental Section



Rehabilitation of the Horten Channel

FORSVARETS BYGNINGSTJENESTE

Costs of the project

- About 25 mill Nkr (~3 mill US \$) used in the project
the financing parties:
 - The Norwegian Defence
 - The Norwegian EPA
 - The local municipal (Borre)

- The Channel opened for local traffic on 17th of September 1998





Rehabilitation of the Horten Channel

FORSVARETS BYGNINGSTJENESTE



In 1999 the Norwegian Defence got the local municipal environmental award for the rehabilitation of the Horten Channel

Environmental Section