

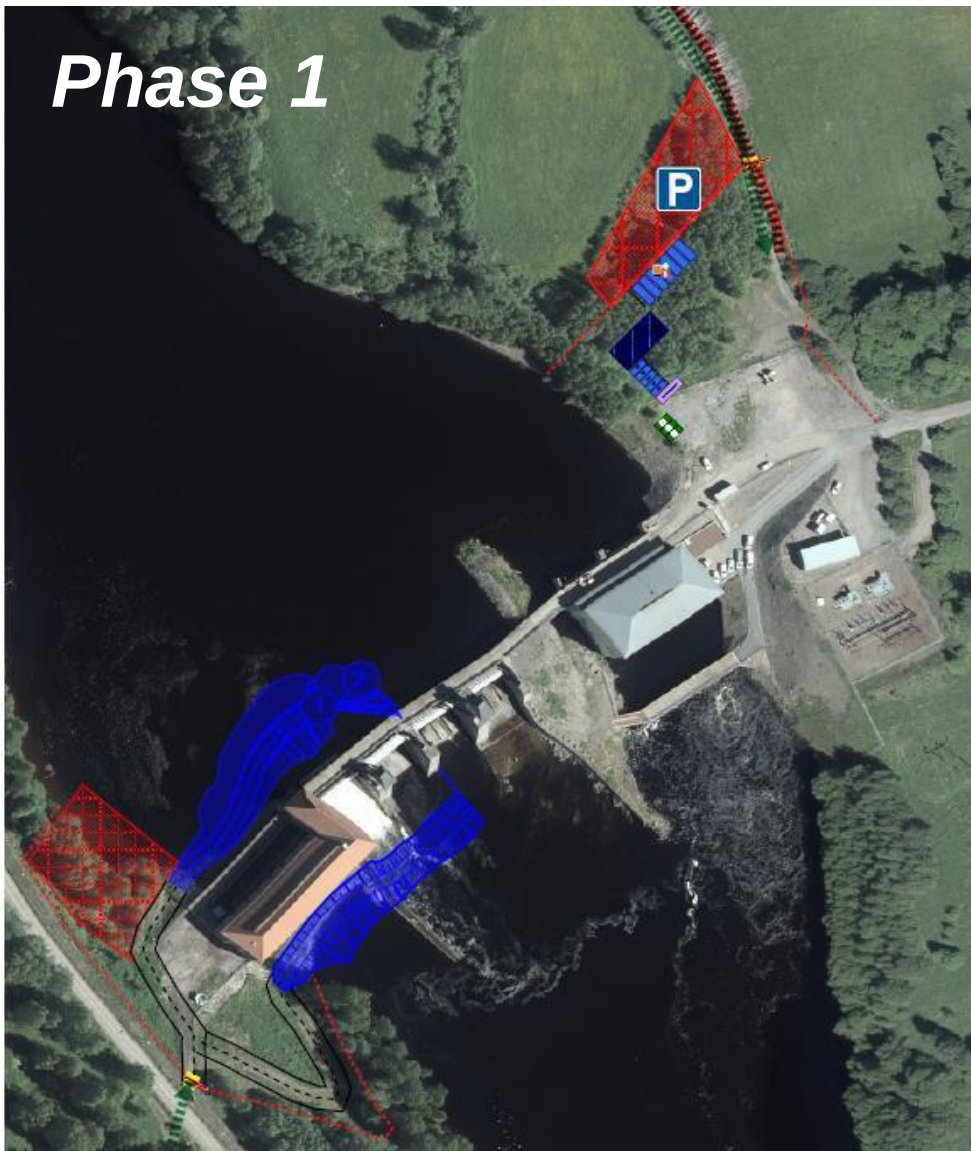
Dam safety project - rehabilitation of spillways



Type	Earthfill embankments, concrete dam and stone clad concrete core piers
Built	1920 (dam) 1990/1998 (HPP)
Reservoir size	20 Mm ³
Q _{Mean}	283,6 m ³ /s
Q ₁₀₀	1660 m ³ /s (SMHI revised calculations 2019)
Q _{design}	2047 m ³ /s
Spillway capacity	2047 m ³ /s (2425m ³ /s) 3185 m ³ /s (at core crest level)
Spillway gates	1: 720 m ³ /s (695m ³ /s) 2: 720 m ³ /s (695m ³ /s) 3: 420 m ³ /s (695m ³ /s) 4: 187 m ³ /s (340m ³ /s)
Minimum water level	+149,40m
Maximum water level	+150,39m
Core level	+153,00m
Crest level	+152,80m Spillway section
Crest length	271 m
Crest length	271 m
Turbines	2 x Kaplan (G1,G2)
Number of units	2
Maximum power output	44 MW
Average production	229,2 GWh/a
Head	10,7m
Nominal discharge	500 m ³ /s



Phase 1



The first phase starts from the right-hand side of the river

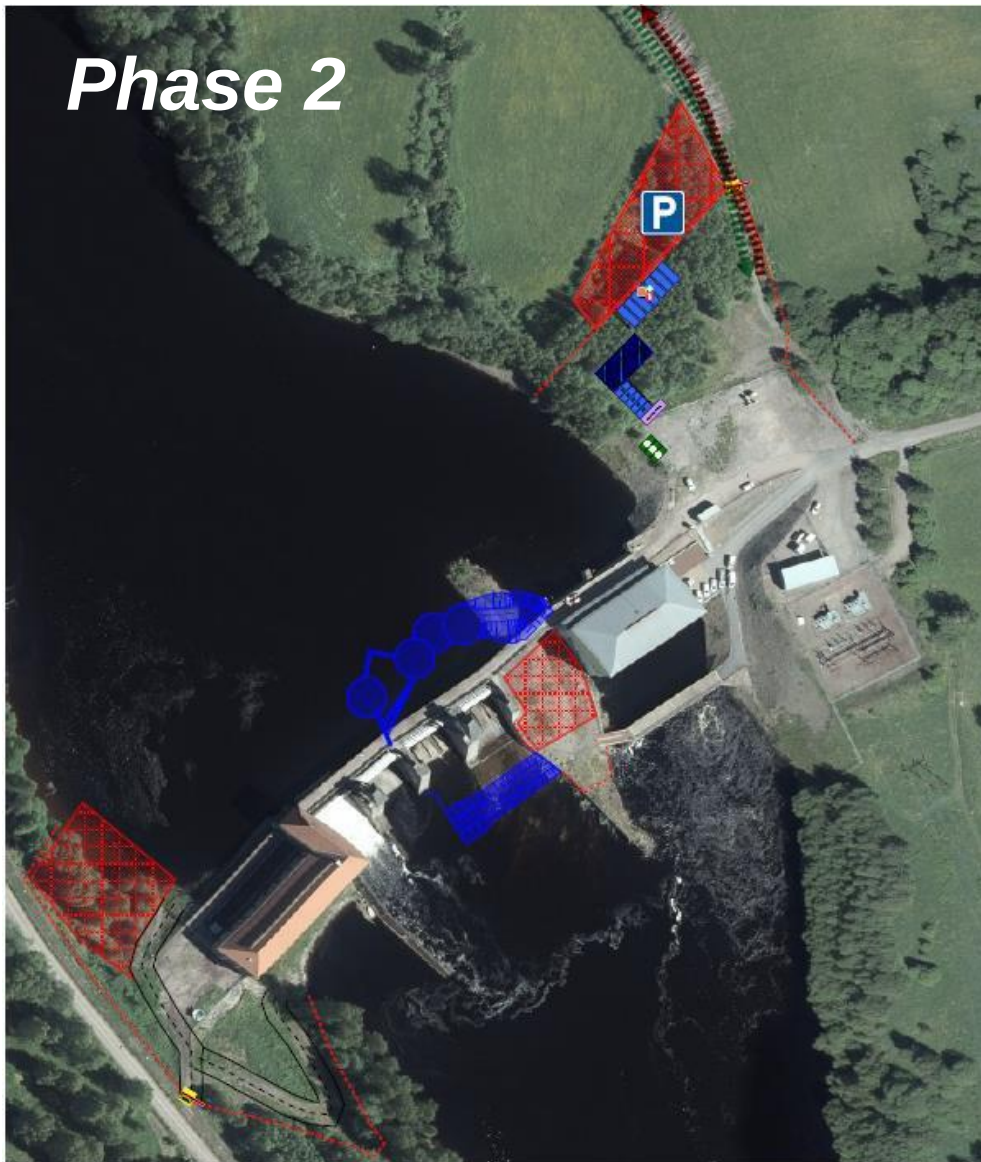
Total spill capacity $720+720\text{m}^3/\text{s}$

- Cofferdams upstream and downstream.
- Demolition of gatehouse 2, bridges, skibords and the front of the pier.
- Rock excavation upstream for new foundations for piers and skibords.
- Construction of new piers, skiboards, bridges and gate houses.
- Installation of new gates.
- Commissioning tests.
- Removal of cofferdams.

Start of Phase 2.



Phase 2



The second phase starts from the left- hand side of the river.

Total spill capacity 695+340m³/s

- Cofferdams upstream and downstream.
- Demolition of gatehouse 1, bridges, skibords and the front of the pier.
- Rock excavation upstream for new foundations for piers and skibords.
- Construction of new piers, skiboards, bridges and gate houses.
- Installation of new gates.
- Commissioning tests.
- Removal of cofferdams.

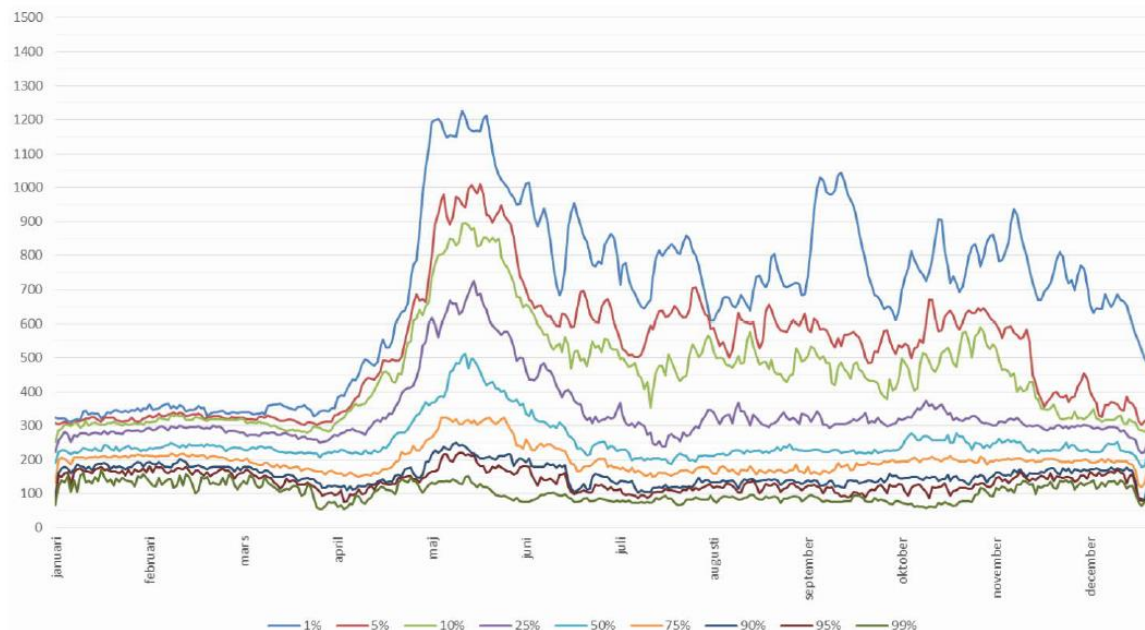
Works completed

May 30th, 2022



Pre-Engineering

- Historical data
- Risk and consequence analysis
- Available spillway capacity at different stages
- Water management plan
- Emergency plan for discharging water thru construction site

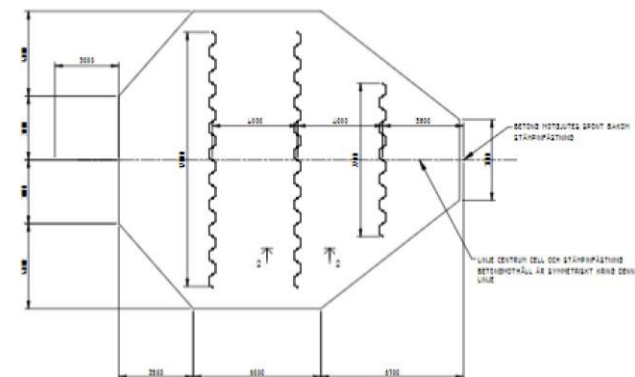
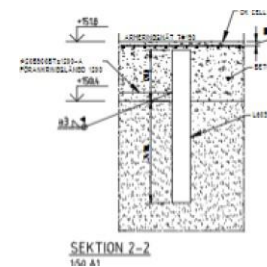
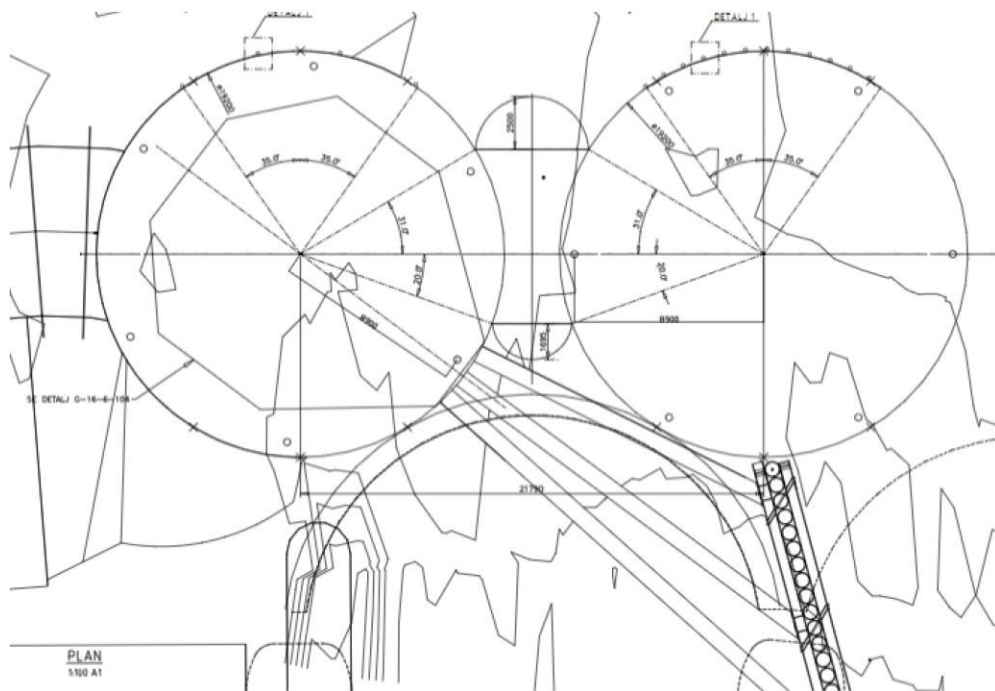


 1. Huvuddel 4: Fångdamm uppströms utskov 3 och 4. Ansluter runt pelare 3. Fångdamm nedströms utskov 3 och 4 (juni -21). $Q_{utskov} = \text{ca } 1355 \text{ m}^3/\text{s}$ $Q_{fångdamm} = 300 \text{ m}^3/\text{s}$ $Q_{totalt} = 1655 \text{ m}^3/\text{s}$	 2. Valslucka 3 och 4 tas bort. Utskov 3 och 4 byggs om (juni -21 – april -22). $Q_{utskov} = \text{ca } 1355 \text{ m}^3/\text{s}$ $Q_{fångdamm} = 300 \text{ m}^3/\text{s}$ $Q_{totalt} = 1655 \text{ m}^3/\text{s}$	 3. Fångdammar vid utskov 3 och 4 rivs. Utskov 3 och 4 tas i drift (april -22). Huvuddel 3: Ny fångdamm uppströms och nedströms utskov 1 och 2 (juni -22). $Q_{utskov} = 1053 \text{ m}^3/\text{s}$ $Q_{fångdamm} = 2 \times 300 \text{ m}^3/\text{s}$ $Q_{totalt} = 1653 \text{ m}^3/\text{s}$	 4. Valslucka 2 tas bort. Utskov 2 byggs om (juni -22 – april -23). $Q_{utskov} = 1053 \text{ m}^3/\text{s}$ $Q_{fångdamm} = 2 \times 300 \text{ m}^3/\text{s}$ $Q_{totalt} = 1653 \text{ m}^3/\text{s}$	 5. Fångdammar kompletteras uppströms och nedströms mellan utskov 1 och 2 (april -23). $Q_{utskov} = 1053 \text{ m}^3/\text{s}$ $Q_{fångdamm} = 2 \times 300 \text{ m}^3/\text{s}$ $Q_{totalt} = 1653 \text{ m}^3/\text{s}$	 6. Fångdammar vid utskov 2 rivs. Utskov 2 tas i drift (april -23). $Q_{utskov} = \text{ca } 1748 \text{ m}^3/\text{s}$ $Q_{fångdamm} = 300 \text{ m}^3/\text{s}$ $Q_{totalt} = 2048 \text{ m}^3/\text{s}$
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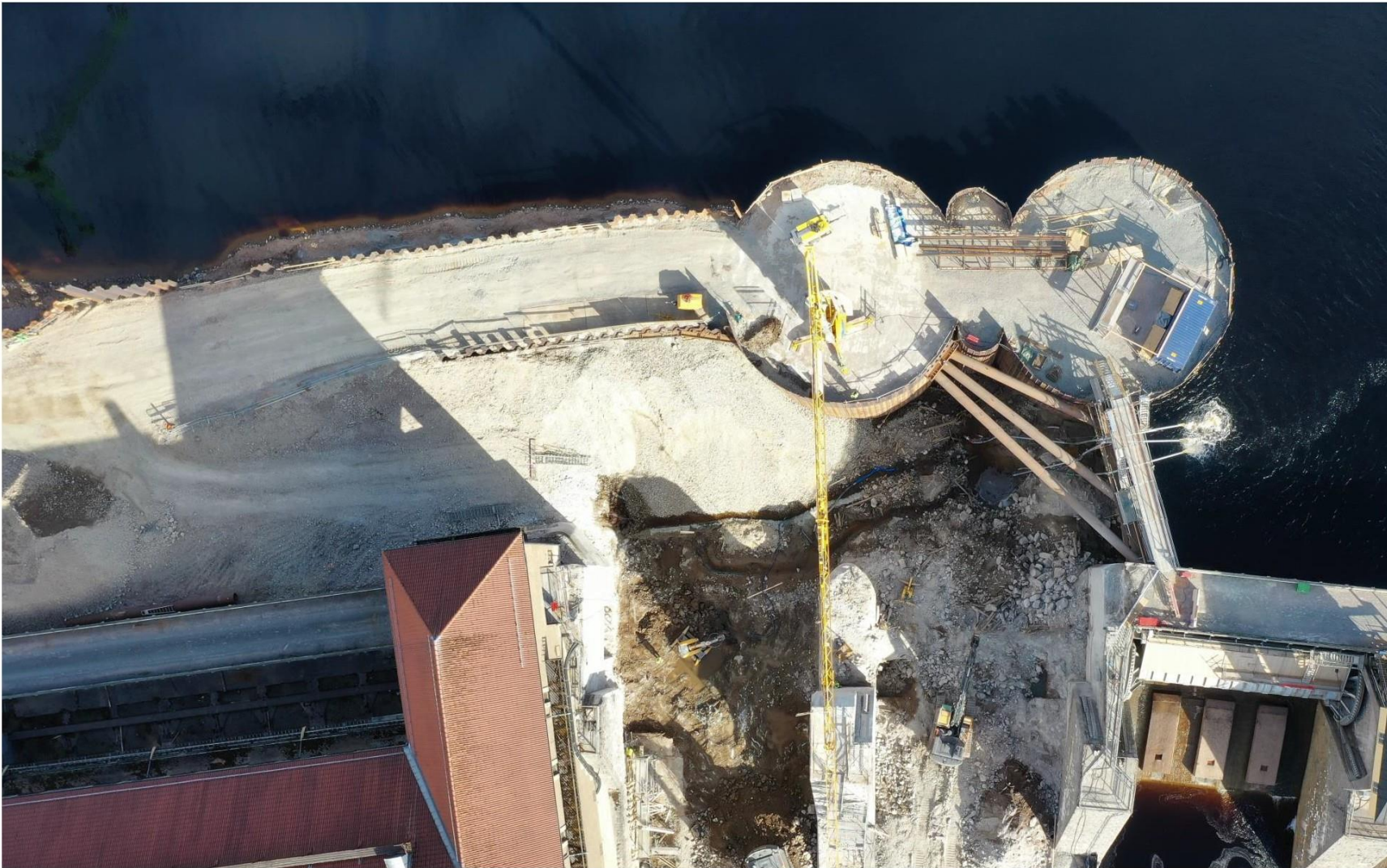


- Survey with trigger levels
- Water management meetings
- Alarm system
- Emergency plan for dam failure

Phase 1 Upstream Cofferdam

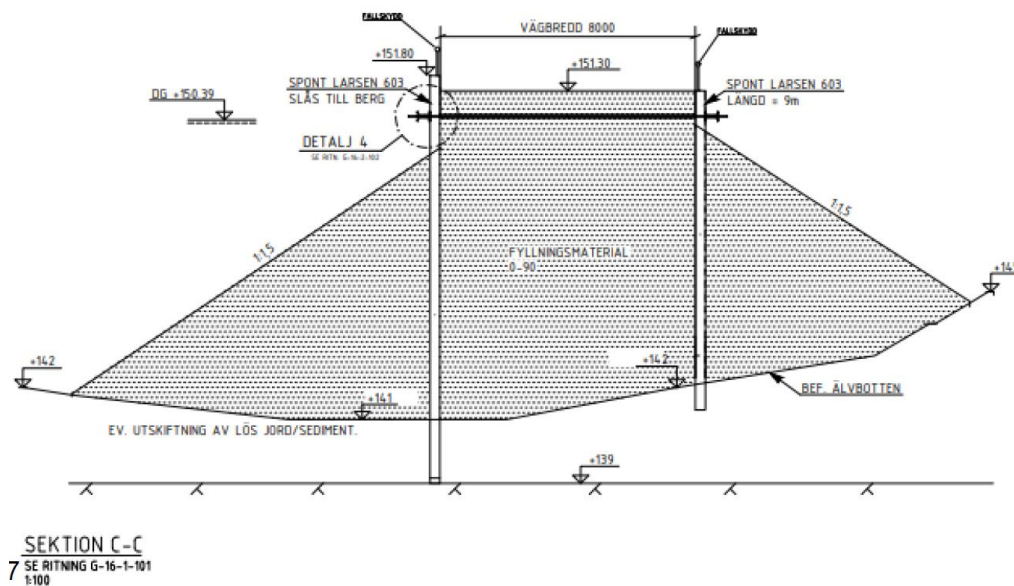
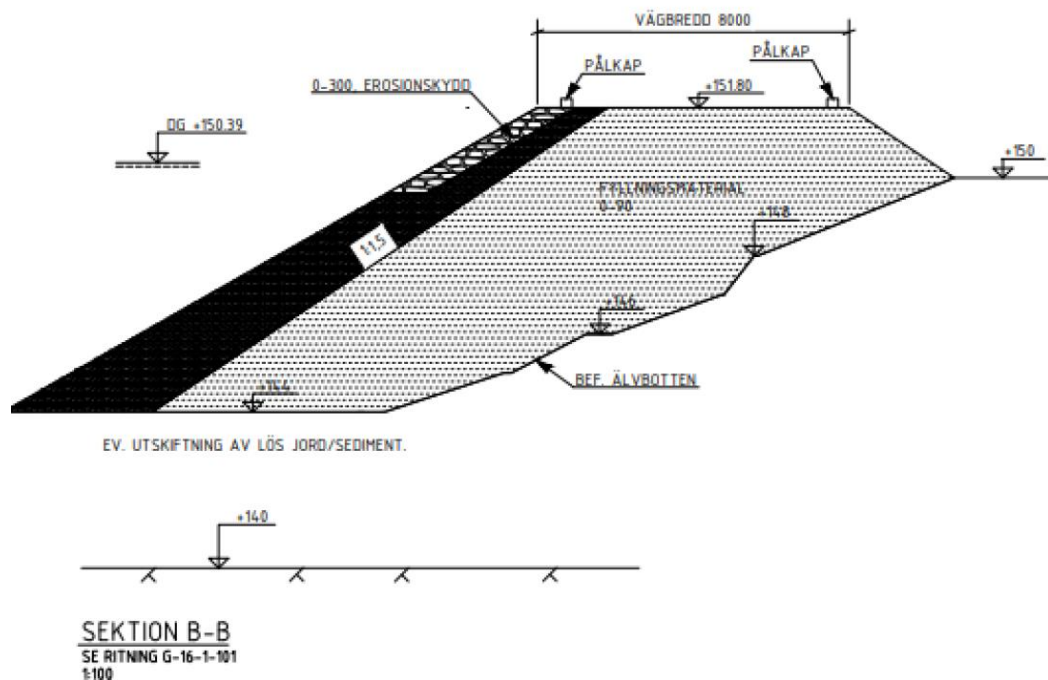








Phase 1 Upstream Cofferdam

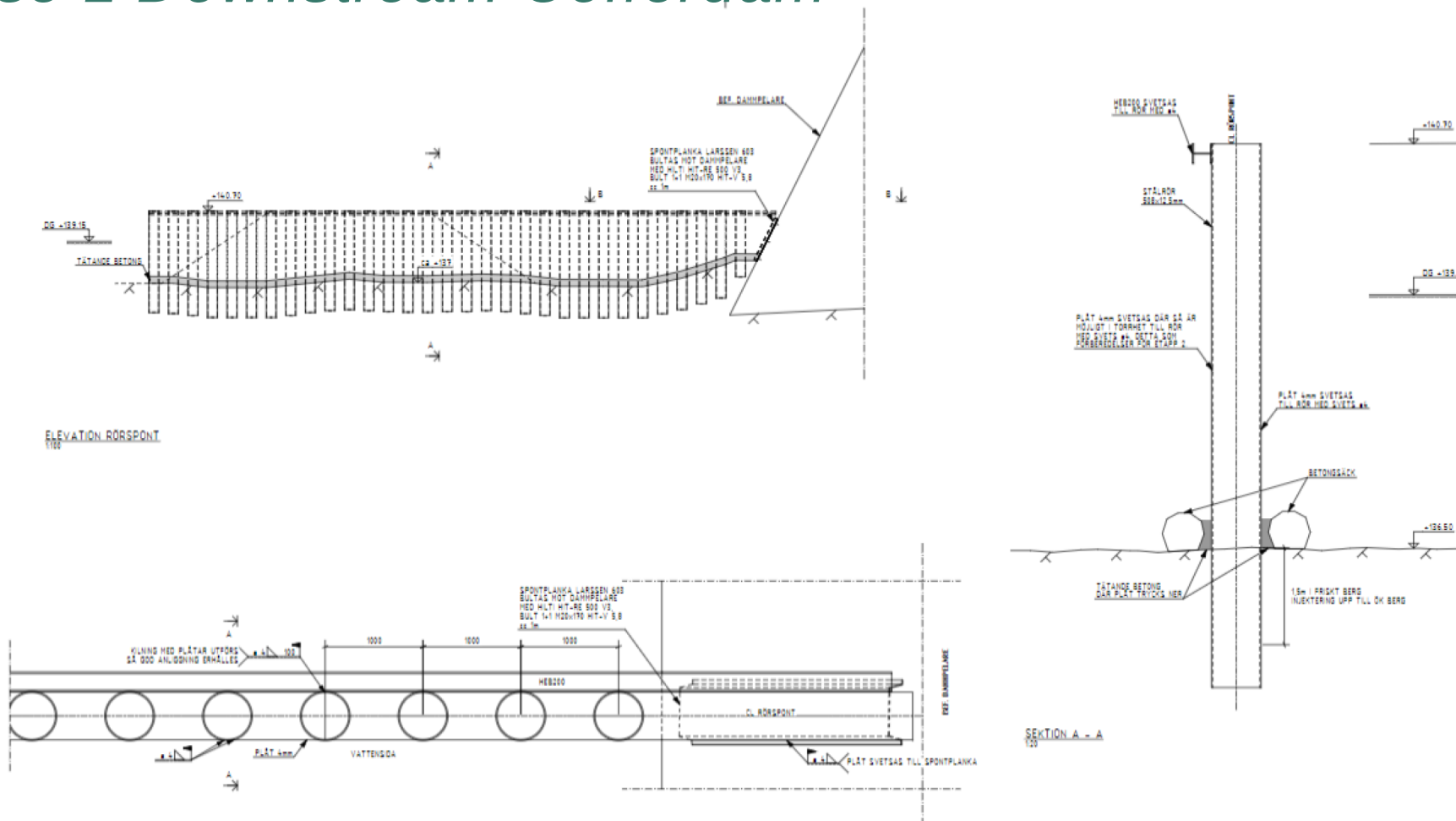




Phase 1 Downstream Cofferdam



Phase 1 Downstream Cofferdam







Conclusions

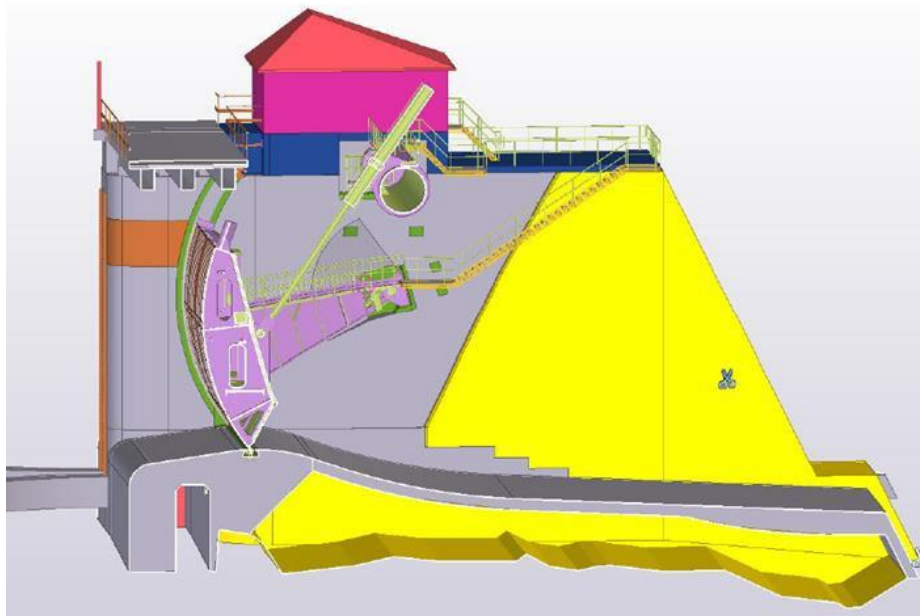
- An example of how different cofferdam techniques can be combined
- Connections between different types of cofferdams

Thank you for your attention

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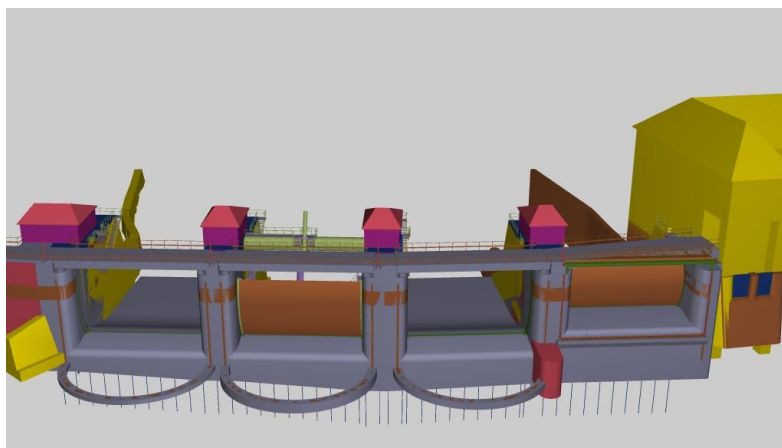




Cross section of spillway 2



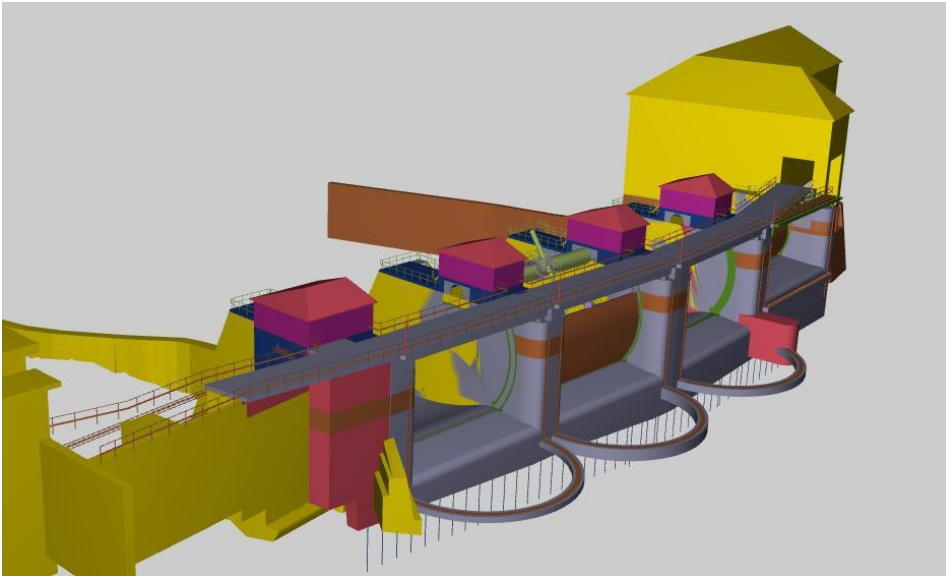
Cross section of spillway 4



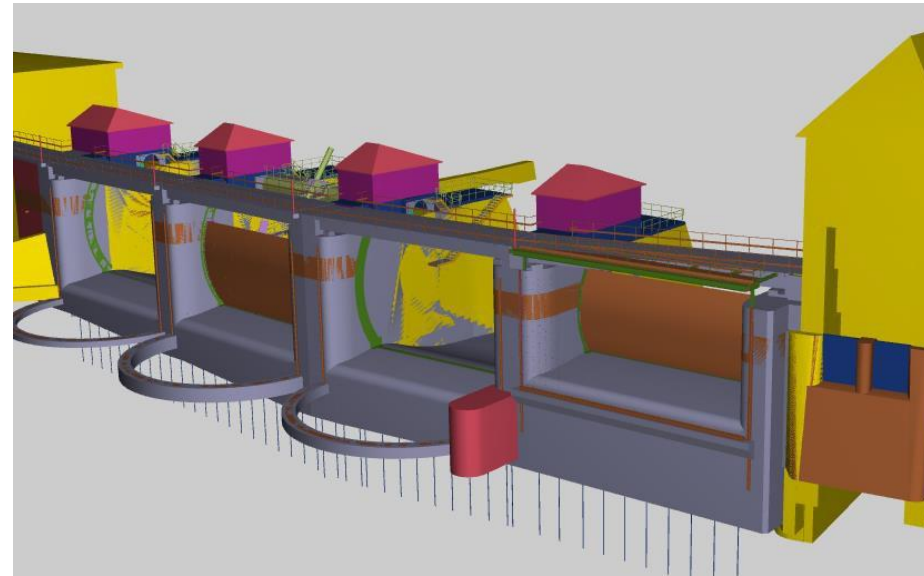
View from up stream

Yellow are old parts that are kept,
gray is new construction, brown
are steel structures.

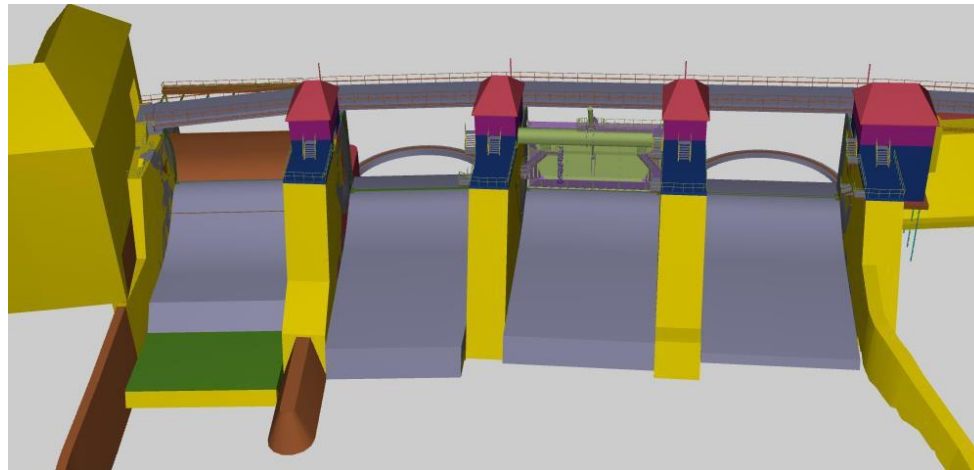




View from upstream of the new powerplant (Left side)



View from upstream of the old powerplant (Right side)



View from down stream

May 30th, 2022

