Key Issue:

10- Landscape & Cultural Heritage

1-Biological Diversity

6-Reservior Impoundment

Climate Zone:

Df : Severe

Subjects:

- Preservation of an old village and riverine habtat

Effects:

- Preservation of an old village with wooden houses and its landscape

Project Name: Kokkosniva Hydropower Plant

Country: Finland (Europe) (N 67° 13'22" , E 27° 19'33")

Implementing Party & Period

- Project: Kemijoki Oy
1987 -

- Good Practice: Kemijoki Oy
1987 -

Key Words:

Cultural Heritage, Landscape, Old Village, Lowering Head, Riverine Habitat

Abstract:

In order to preserve an old village which had survived World War II, together with its landscape, from reservior impoundment, the planned head of the power plant was lowered by additional dredging, and small islands were constructed to keep the landscape more river-like.

1. Outline of the Project

Kokkosniva is one of the seven run off river hydro power plants constructed on the River Kitinen, a tributary of the River Kemijoki. A large artificial lake was built on the upper parts of the River Kitinen. Artificial lake has also been constructed on the nearby tributary, River Luiro. The location of the project and its surroundings are shown in Fig.-1 and Fig.-2. These two reservoirs have been connected to each other with the Vuotso channel - thuspart of the waters from the Luiro catchment area have been diverted for the use of powerplants on the River Kitinen. The total volume of the reservoirs is more than double compared with their annual inflow.

Fig.-1 Location Map

The plants on the River Kitinen are mainly run for peak load production in the wintertime. The regulation height of upper reservoir of the Kokkosniva power plant is 0.6 m in the winter and 0.4 m in the summer. This creates good conditions for recreational use. The construction schedule of Kokkosniva hydropower plant is shown i

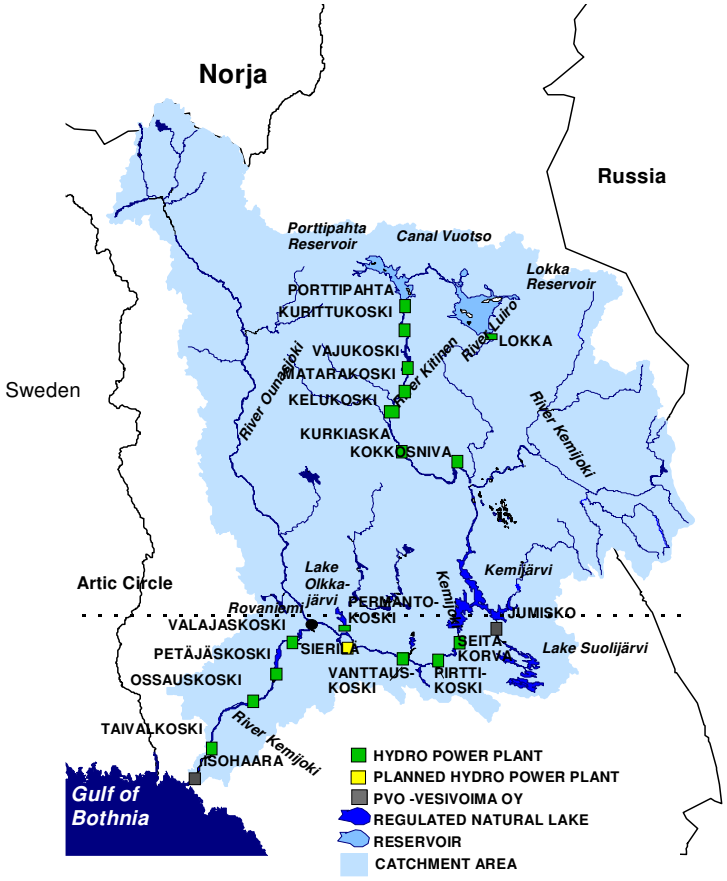
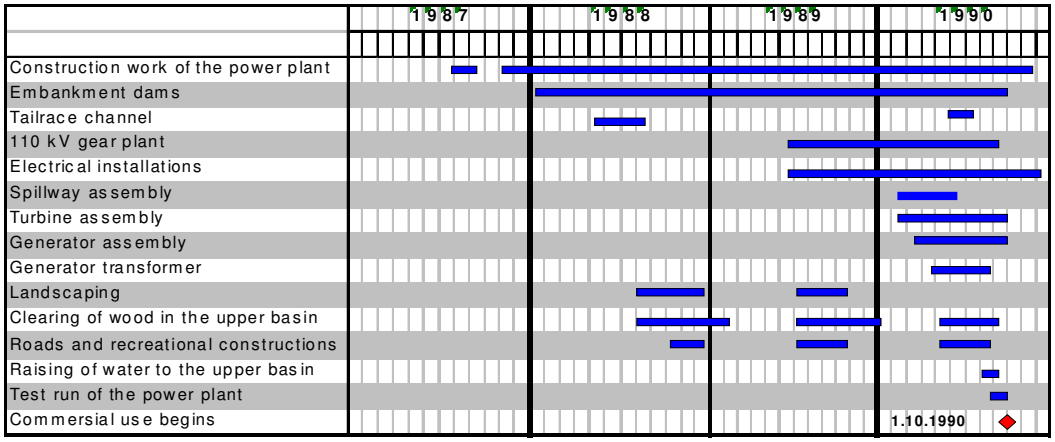


Fig.-2 Kokkosniva Hydropower Plant and Its Surroundings

Table-1 Specifications of the Kokkosniva power plant

Item		Specification
Catchment area	Kitinen (+Lokka)	4,930 km^2 2,360 km^2
Power plant	Max. capacity	25 MW
	Annual output	79 GWh
	Effective head	11.5 m
	Max. discharge, turbine	260 m^3/s
	Discharge past flood gates	2*730 m^3/s
	Area of the upperreservoir	1,684.32 ha.
Dams	Total length	12,500 m
	Length of concrete dams	100 m
	Volume of concrete dams	27,000 m^3
	Volume of earth dams	785,000 m^3

Table-2 Construction Schedule of Kokkosniva Hydropower Plant



2. Features of the Project Area

The Kokkosniva power plant is located in Lapland, the northernmost province of Finland. The differences of altitude are minimal in Central Lapland and there are many bogs in the region. The area is very sparsely populated, the population density in the whole Lapland being only 2 people/km^2. Small villages have usually been established on the riverside. Fishing, hunting and berry-picking still represent an important role in the food economy of the local households. The Suvanto village - situated in the sphere of influence of the power plant - is a typical village community developed on the riverside. Nearly all other old Lappish villages were burnt down during the Second World War.

The mean temperature of the area is about 0 ℃. In January the mean temperature is -13 ℃ but the coldest measured temperatures have been approximately -50 ℃. In July the mean temperature is 14 ℃ and the annual precipitation 500 mm.

3. Major Impacts

Kokkosniva is a run off river hydro power plant. Although the embankment area is not large, the river-like landscape changes into lake scene near the power plant. During the embankment, there was a danger that historically valuable buildings would have been flooded. The Suvanto village is a typical riverside village, so the landscape would have radically changed. The flooded area was carefully investigated by measuring the elevation of the buildings and by the hydraulic calculation.

The change of the fish habitat was known by the experience of the monitoring results of the similar project. The change of the riverine habitat from a fast running river bed to a slow running reservoir has also implied changes in the habitat of fishes. This has resulted in changes between fish species. Rheophil species have decreased while species favouring limnic conditions have increased. Of individual species, grayling has significantly declined whereas pike has strengthened.

4. Mitigation Measures

As a result of careful planning, the upper water level was lowered by one metre compared to the original plan, ie. the head was lowered from 12.5 m to 11.5 m. This, combined with other large measures, was enough to save the buildings.

The shores of the village area were shaped so that the new shore - formed 3 metres higher than the original water level - did not contain any shallow areas. There was 100 ha. to be shaped, of which 60 ha. was

excavated for water area and 40 ha. was used for land fill. There was 790,000 m^3 land to excavate. Nine barns were lifted to the filled land area in their former locations; at the same time shingle roofs were renewed. Two cottages were relocated and road network and a reception building constructed in the new holiday village. Five swimming beaches and eleven boat harbours were made. In addition, a local road network of 10 km was built in the surroundings of the village. Several small islands were made near the village in order to maintain the landscape as river-like as possible (see Fig.-3).

Referring to Fig.-3, there was the narrow River Kitnen (white area) before project implementation. The flooding of the area made a new lake (blue area). To keep the landscape more river-like and to avoid formless shore lines several small islands were constructed on the flat bank.

Because of the lowering of the head of Kokkosniva hydro power plant, the tailwater level at the upper Kurkiaska power plant was to be lower. This caused frazil-ice problems and loss of energy production. Due to this, a dredging project between the two power plants was executed after the construction of Kurkiaska power plant. The costs of the dredging were 3 million € and the volume of the excavation material was 500,000 m^3 . After the dredging these problems significantly decreased. The dredging the river decreases the velocity of flow thus helping to cover the river by ice. When the river has ice cover, frazil ice problems will not exist.

In accordance with the licence decisions, the fish population is managed by the stockings of whitefish, brown trout and grayling. In recent years also catch-sized rainbow trout has been stocked. Part of the stockings has been carried out on the tributaries.

The culculation results of ”Head Loss” and ”Frazil Ice Thickness” are shown in Fig.-4.

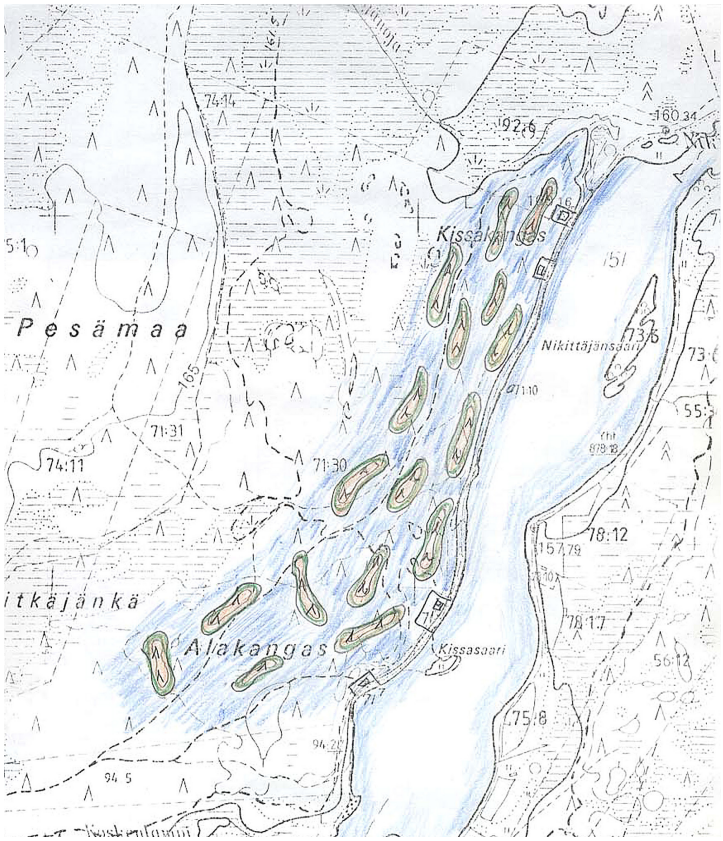


Fig.-3 Several small islands having been constructed

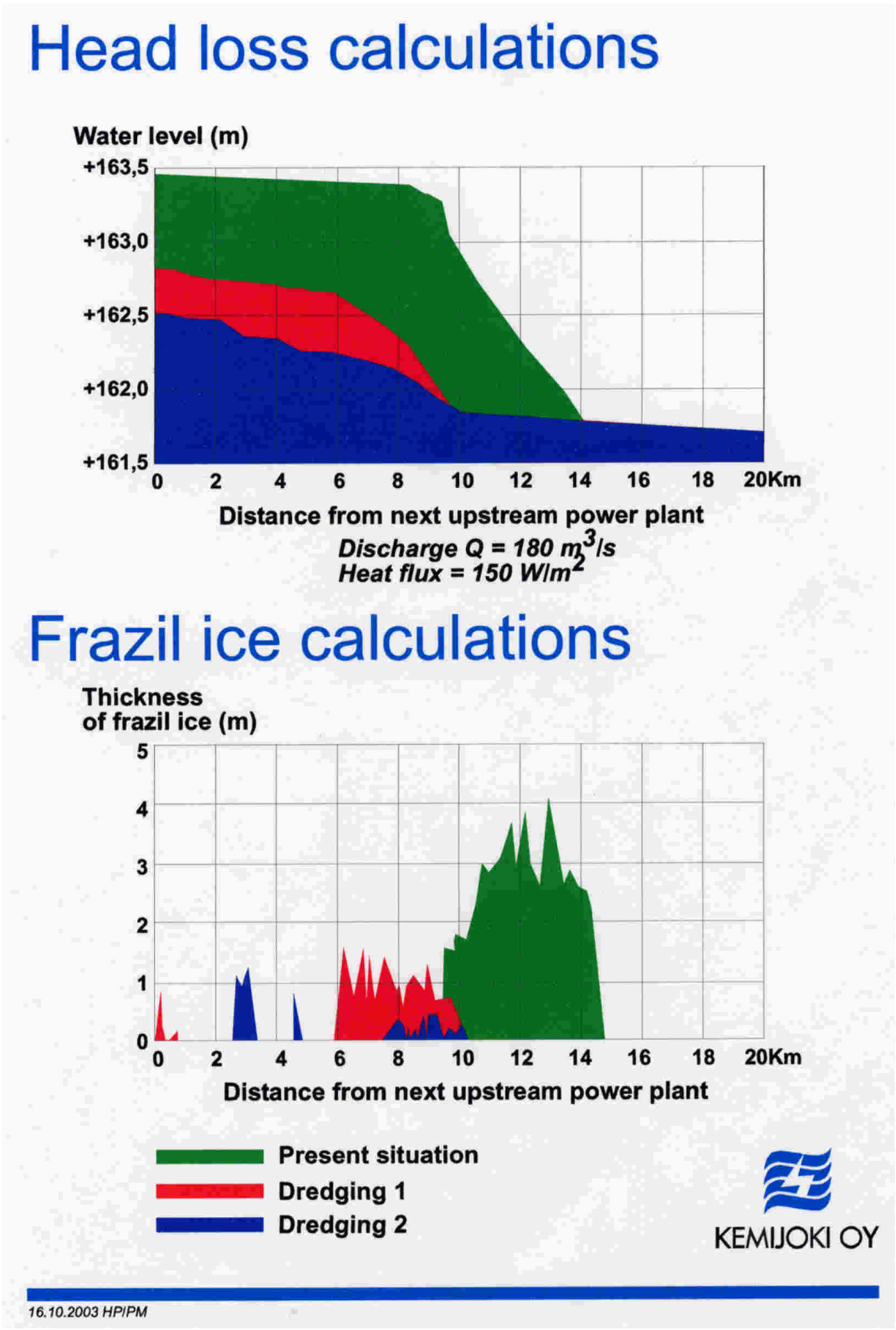


Fig.-4 Head Loss and Frazil Ice Thickness

5. Results of the Mitigation Measures

The project was completed in 1990. The total costs of landscaping were 1.2 million €. Almost every single building in the village could be kept in their old locations. The village is still very lively and eg. artists have spent a lot of time there. Although the landscape near the power plant changed from river scene into a lake scene, the scenery by the village of Suvanto could be preserved very close to the original, mainly due to construction of islands and shaping of shores (refer to the photo of heading information and Fig.-5).

Fig.-5 Suvanto Village beforeimplementing project

Fig.-6 shows water level and flow rate in mean discharge of 76 m^3/sec. before and after construction of Kokkosniva hydropower plant.

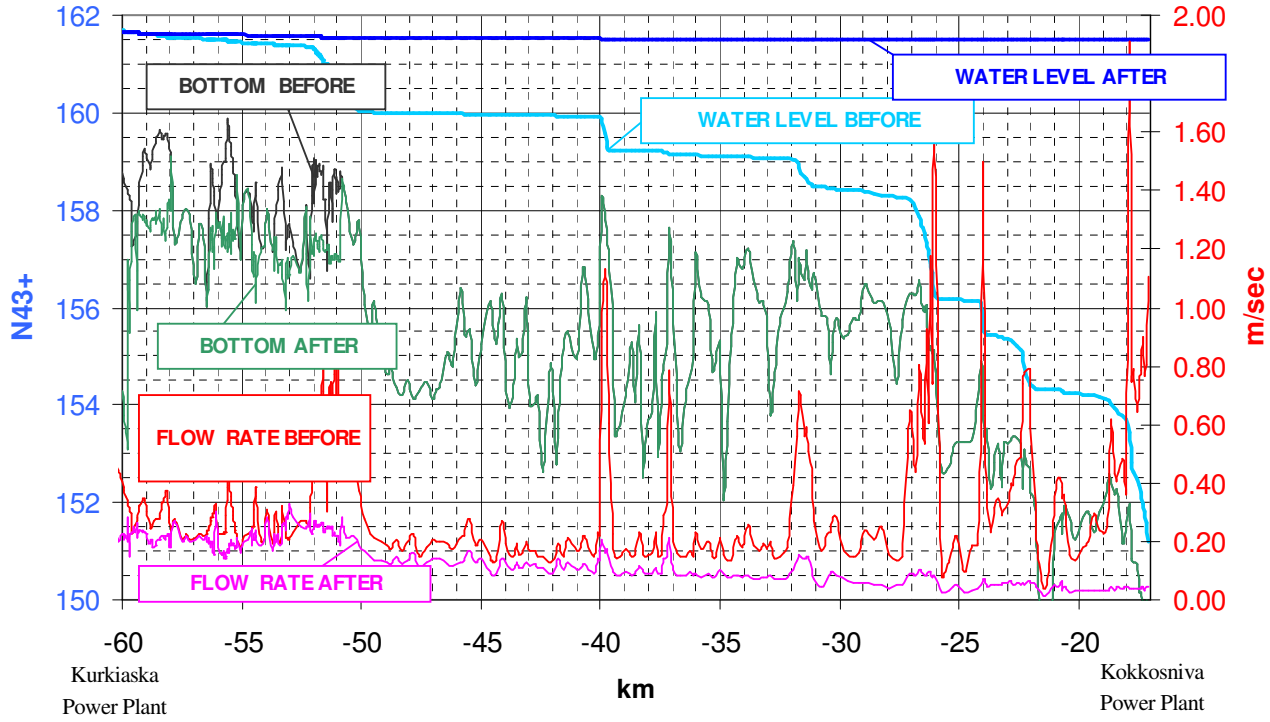


Fig.-6 Kurkiaska – Kokkosniva water level and flow rate in mean discharge 76 m^3/sec before and after construction of Kokkosniva Power Plant

After the construction of Kokkosniva hydropower plant, the spawn of grayling was expected to happen poorly. The monitoring of the fish and stocking (planting) has been implemented continuously after the construction. Fishing in the reservoir is mainly carried out by the local residents for domestic use by gillnetting and trolling. The most important catch species are pike, burbot and whitefish. The catches of brown trout and rainbow trout have in recent years increased mainly on account of the stockings.

6. Reasons for Success

The actual basis for the environmental planning in the project was the preservation of the origin of the village. Both the National Board of Antiquities and Historical Monuments and the local residents were involved in the planning. Although the final result was a compromise, all parties were satisfied enough with it.

7. Outside Comments

1) Lapin Kansa* : Suvannon kulttuurikylä säilyi (The cultural village of Suvanto was preserved), 8 August,1990
2) Lapin Kansa*: Maisemointi Suvannossa todettiin onnistuneeksi (The landscaping in Suvanto was successful), 18 November, 1999

8. Further Information

8.1 References

1) Kemijoki Oy & Suunnittelukeskus Oy: Suvanto, ranta-alueiden maisemanhoitosuunnitelma (The management plan for the bank areas in the Suvanto village), report in Finnish, 1985

8.2 Inquiries

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