

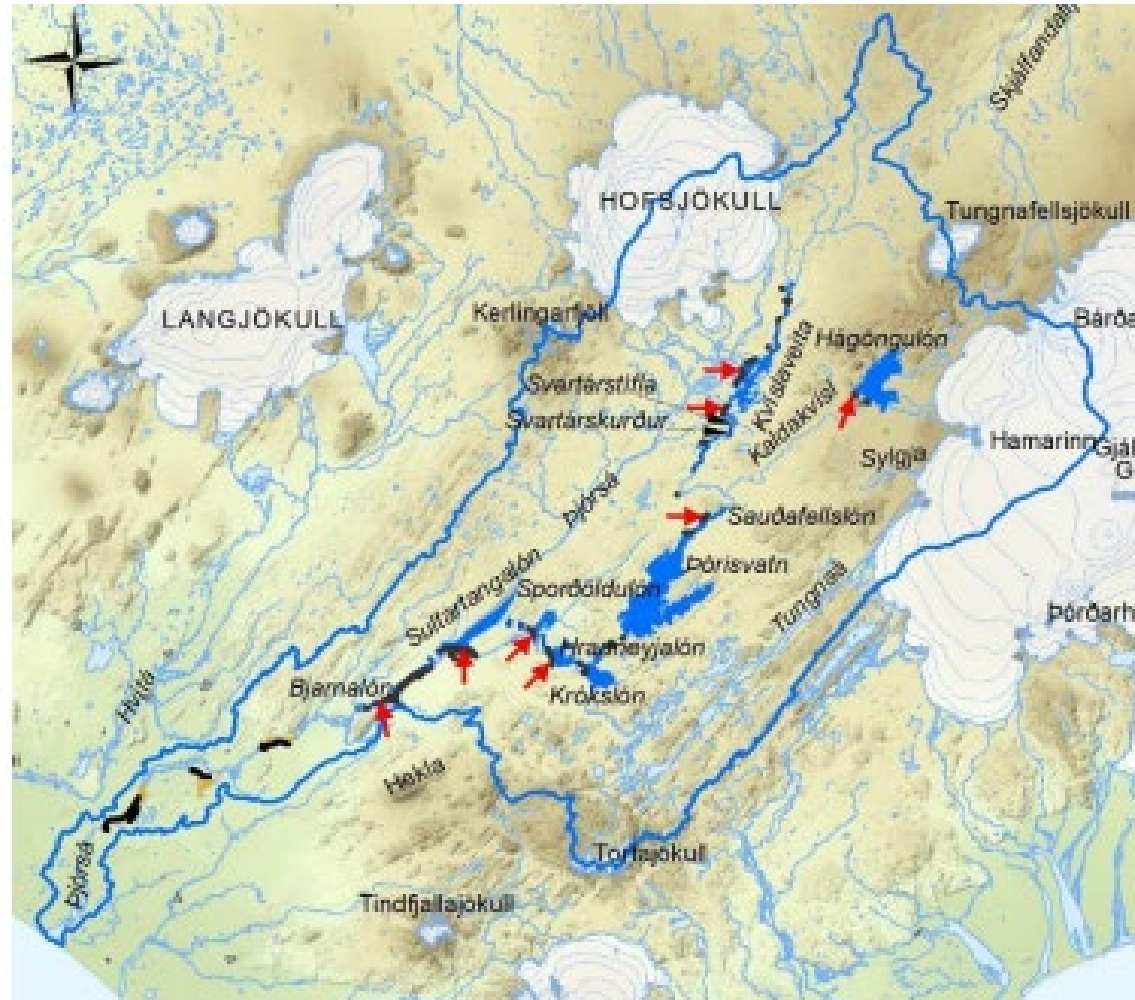
Fish passage facilities in a new hydropower plant at Hvammur in River Thjorsa , Iceland

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Thjorsa River

- Thjorsa is a large river in Iceland (225 km long and has 360 m³/s)
- It is partially glacier fed river having runoff from two of the largest glacier in Iceland
- It has already 7 power plant along with many reservoirs
- The first power plant was built in 1969 and the last one in 2014
- Due to flow regulation the water flow of Thjorsa is now more even
- As large part of the glacier silt stops in the reservoirs the river is not as turbid as before
- A new power plant (93 MW) is planned at Hvammur 55 km from the estuary

River Thjorsa



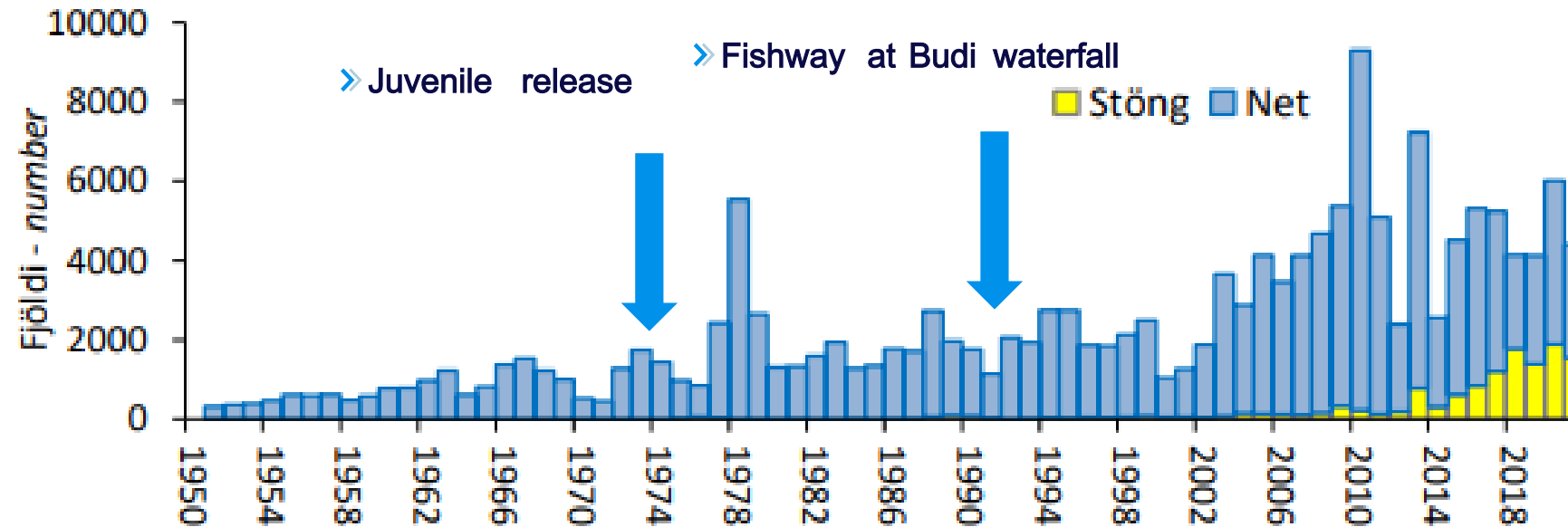
The salmon population in Thjorsa

- Atlantic salmon is the dominant fish species in River Thjorsa
- Brown trout and arctic char are also found in the river
- The total run of natural salmon has been measured since 2013 and is on average 10.436 (range 7.761 – 13.798)
- Net fishery is the main fishing method, but rod fishery is increasing
- The catch ratio has been 44 % on the average and the total catch reflects the total run as fishing effort is relatively constant
- The population was smaller earlier

The salmon population in River Thjorsa

- Annual monitoring of the biota has been carried on in the river system since 2004 and some studies earlier
- Physical and chemical parameters
- Benthic fauna
- Juvenile fish surveys
- Salmonids run and catch
- Research on migration time of smolts

Salmon catch in River Thjorsa



- Even flow and less turbidity have increased the biological production in the river
- The salmon population has increased 2x
- Fishway in Budi waterfall (1991) increased the run again 2x

Hvammur power plant



Hvammur power plant



Útgáfudagur: 18.11.2022 Teiknað af: E.D
Auðkenni teikningar: HVM_011_U001
Heimild: LMI



Minimum E-flow below dam (10 m³/s)



Hagalón

aðalstífla

Yriasker

tengivirki

stöðvarhús

Ölmóðsey

Þjórsárdalsvegur

frárennisskurður

aðkomuvegur

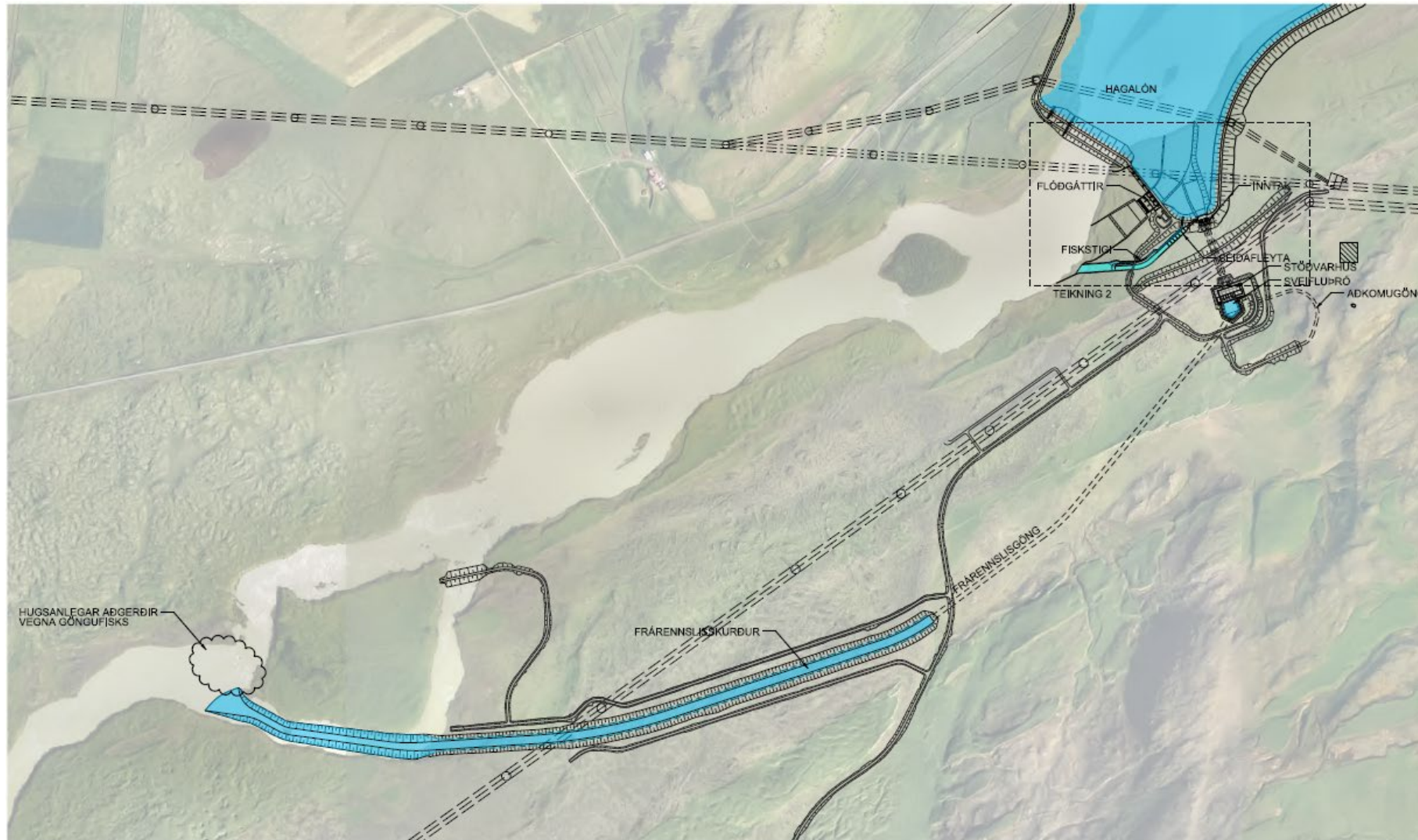
Average summer flow below dam (40 m³/s)



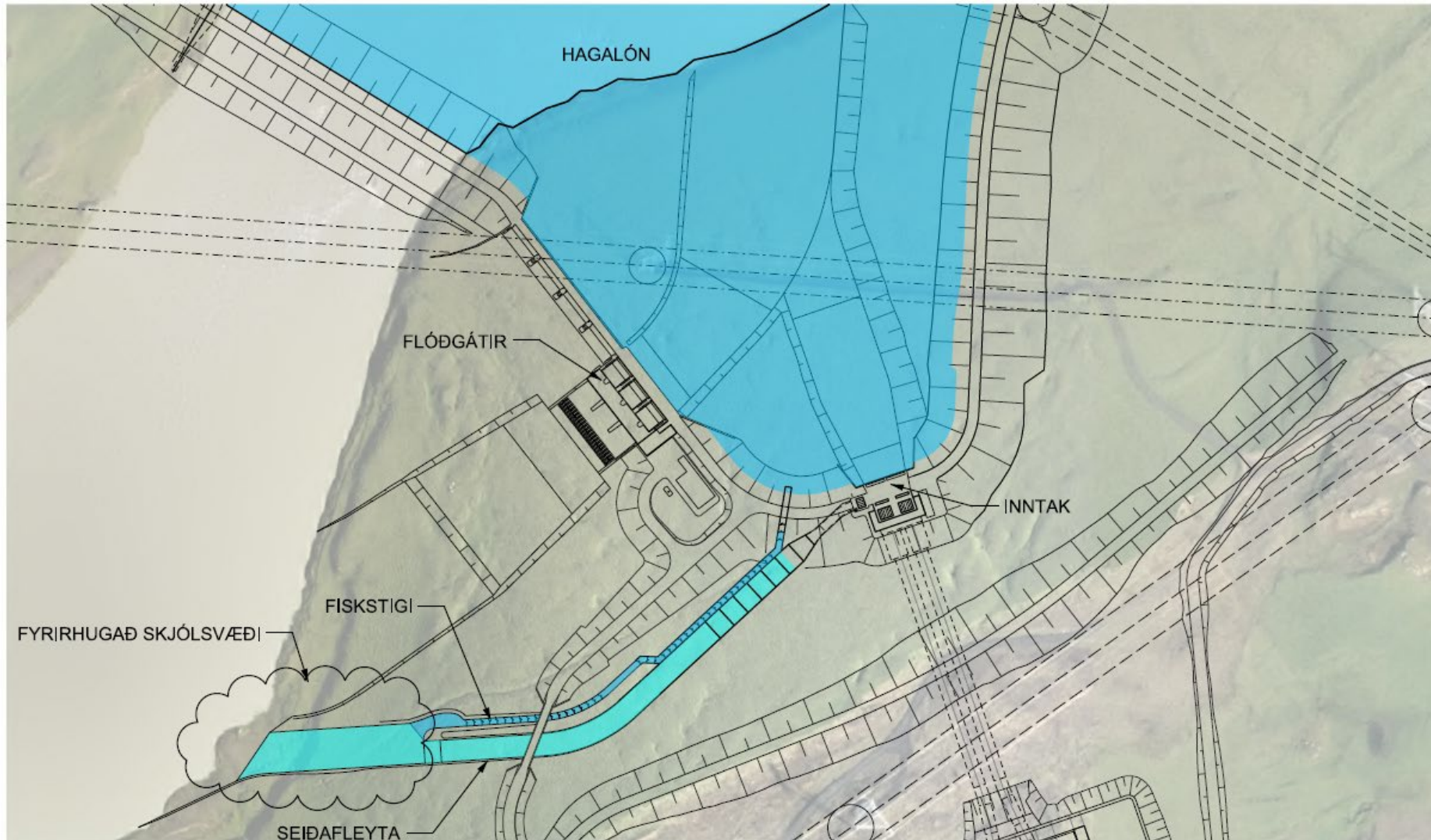
E-flow below dam

- Minimum flow of $10 \text{ m}^3/\text{s}$ will be secured below the dam to the outflow of the power plant
- This is to endure upstream migration and
- To maintain the biota and juvenile fish in this part of the river
- Only riverbed at less than 1 m depth produce in the turbid water
- Discharge of $10 \text{ m}^3/\text{s}$ have a riverbed under 1 m of similar size as the river in summer discharge today.

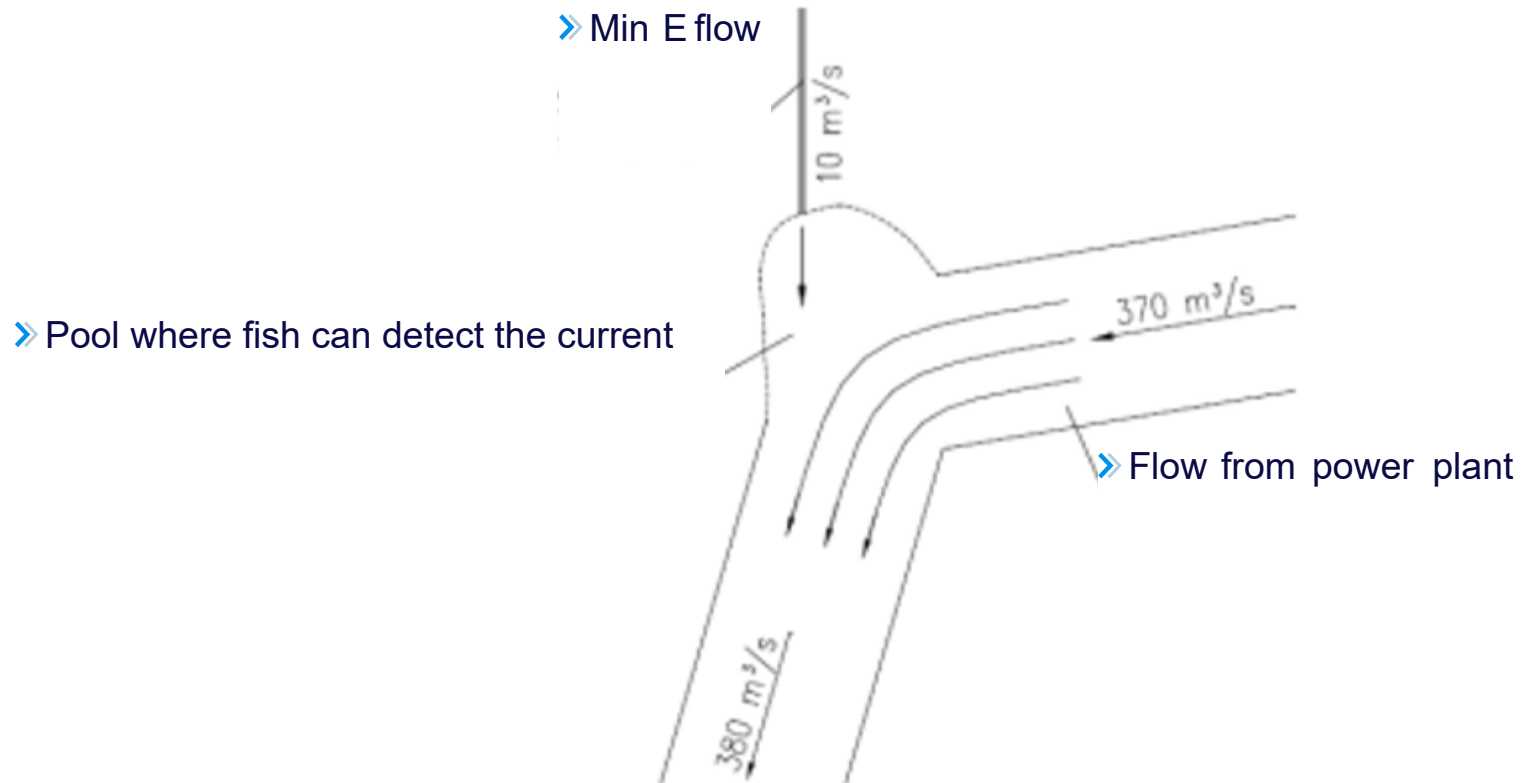
Fishways at Hvammur



Fishway and smolt overflow bypass at Hvammur



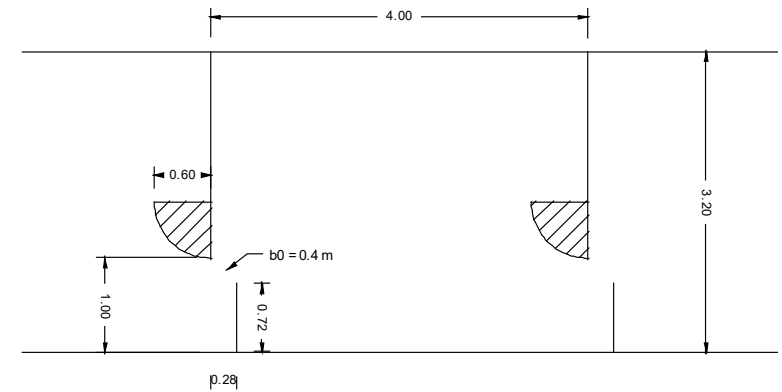
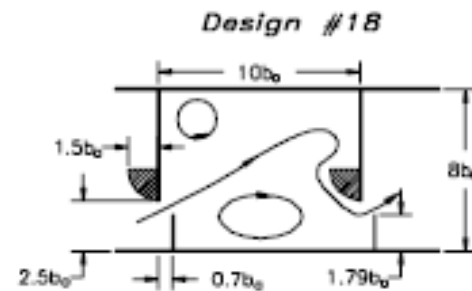
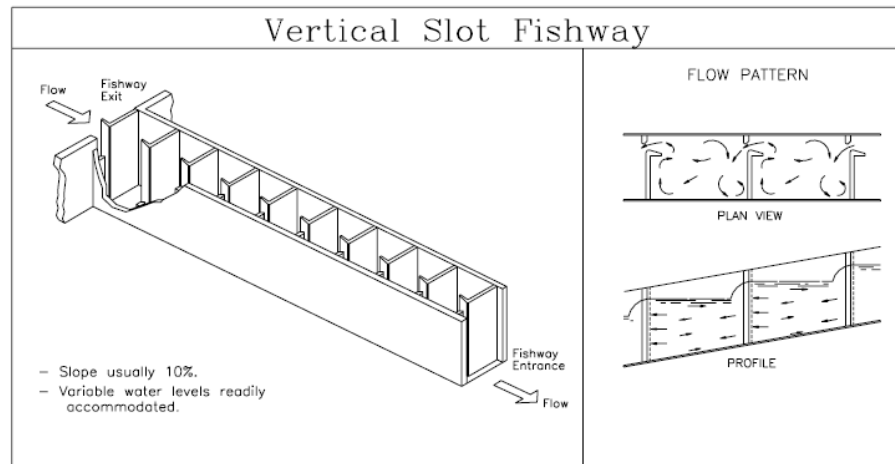
Fish guidance where two waterways join one large and another one small.



- » Examples are in River Blanda, North Iceland
- » and at the lower end of many fishways

Fishway

- Vertical slot fishway
- The slope is 1:13
- The height between pools 0,3 m
- The total height of the fishway is 13 m



The reservoir „ Hagalon “

- The water level in the reservoir is constant
- That is better for its biota
- The average water current velocity in the reservoir is 0.15 m/s and the retention time is 11:43 hours compared to 1:45 hours today
- Fish can find the current, but this might delay the upstream migration through the reservoir
- Salmon will not grow up in the reservoir, but brown trout and char will

Surface flow smolt bypass

- Located over all the powerplant intake
- The surface current flows to the surface flow outlet (SFO) and the salmon smolts follow that current
- About 10 % of the water flow to the SFO ($35 \text{ m}^3/\text{s}$)
- The uppermost 1 m of the flow goes to the SFO
- The waterway from the SFO to the river is designed to carry the smolts gently to the river below
- No sharp corners or rough walls
- Current velocity is 2 -4 m/s and no large current changes
- Designed in a way that water will not be supersaturated with air
- It will be operated during the smolt migration early in summer (mid -May to mid June)
- The flow through the surface smolt bypass was tested both with numerical models and a scaled model built in laboratory and based on the result the design was improved

Monitoring and evaluation after the power plant has been built

1. Fish counter will be in the fishway at Hvammur
2. Up migrating salmon will be radio tagged to monitor their upstream migration
3. Down migrating smolts will be radio tagged to monitor their downstream migration

Acknowledgements

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