

Gold Corner Pumping Station

Eel Bypass System

Description of Operation

General

Coastal rivers are very important living environment for eels. For the conservation of the unique species of the European eel (*aquilla anguilla*) it is very important, that adult eels reach the ocean in a fit and string condition. Thus, the downstream migration of full-grown eels is a very important part of the life cycle. Many lowland rivers have no natural run-off capability. The water has to be drained by pumping stations. The migration path of the eels follows the main current and thus the eels appear in front of the screens protecting the pumps from debris. To offer the eels a chance to continue their way eel bypasses are used, which consist of a collecting pipe and a bypass duct. Under usual conditions, for example at hydropower sites, the flow is driven by gravitation and the eels can follow the water current through the system. If the main current is pumped, the transport of the eels is more difficult.

Concept

Fortunately it is not a problem for eels to be caught and kept in a pool for a short time. So, the key-feature of the concept is to collect the eels during the night and carry them to the downstream but higher tailwater in two phases.

System components

The eel bypass system consists of the following components:

- eel collection pipe (zig-zag-pipe)
- tank with an inner well
- air-lift pipe
- conveyor pipe from tank to tailwater
- 2 pinch valves, both as normal-open version (full passage without pressure)
- air supply for air lift, consisting of lateral channel compressor and air hose
- supply of compressed air for pinch valves (compressor and pressure vessel)
- rotary pump

The outfall of the conveyor pipe should be located over deep water.

Phase 1: Collection of eels

Period of operation: during the night from dawn to daybreak

Both pinch valves are open; the lateral channel air pump is switched on and the air lift conveys the water from inside the tank to the headwater. The level difference is adjusted to

the requirements of the zig-zag-pipe (10 – 20 cm). There is no reverse flow through the conveyor pipe because this pipe is empty or is equipped with a stop valve at the outfall.

The eels are entering the zig-zag-pipe and traveling with a moderate flow to the tank. Only few of the eels will go back against the flow because the zig-zag-pipe is connected at a certain height over the bottom of the tank where the eels are not likely to find the possible exit. The way through the air-lift is barred by the inner well in the tank. The eels will gather inside the tank. There is no flow through the conveyor pipe.

Phase 2: Transport of eels to the tailwater

In the early morning hours the travelling period of the eels ends and the transport phase can be started. To do this, the pinch valves are shut, the air-lift (lateral channel pump) is switched off and the rotary pump is started. This pump fills up the tank until the inside water level is as high as the peak section of the conveyor pipe. This peak section should be above maximum water level of the tailwater. If the water level in the tank exceeds the peak section of the pipe, flow starts running. The eels swimming around in the tank reach the outflow section and follow the current. This can be assisted by guiding vanes in front of the exit hole.

The eels will follow the current in the conveyor pipe and reach the tailwater after a short time. The duration of this phase of operation can be set according to experience (approx. 0,5 to 2 hours).

Phase 3: Flushing of zig-zag-pipe

At the end of phase 2 the pinch valve between zig-zag-pipe and tank is opened. The rotary pump continues running for a few minutes. The content of the upper part of the tank (approx. equal to pumping head of rotary pump) is running back as flushing current through the zig-zag-pipe. The holes are flushed and the debris in front of it is jetted away. The rotary pump is supporting this process by adding some more water to the tank. After a few minutes the water level in the tank is dropped to the outside water level and the flow stops. Then the rotary pump is switched off and all pinch valves are opened.

Then the system is reaching the stand-by phase without any action and energy consumption. In the evening operation starts again with phase 1.