Date: 1-Jun-21	Deliverable	luminus
Project: Life4Fish project	Luminus	
Version: V0	Rue du Pont du Val, 1 4100 Seraing ☎ + 32 (4) 330 47 80 - 🖷 + 32 (4) 338 24 03 pierre.theunissen@edfluminus.be	Contact name: Pierre Theunissen

DOWNSTREAM FISH MIGRATION ALONG THE LOW MEUSE RIVER

Action C1

Installation of second electrical barrier for smolts on the site of Grands-Malades

Deliverable – On site installation report

Révision				
Ind.	**Date**	**Published by**	**Checked by**	**Remarks**
0	23/11/20	Lorenz Leyssens	Philippe Wojeiechowski	First version

Table of contents

I. Introduction

Based on the extensive experimental findings available in the scientific literature and operational testing in the field and in the lab, the solution chosen for the LIFE4FISH project is an electrical barrier.

The barrier comprises a chain put at the bottom of the water and electrodes that float thanks to buoys. There are two fences, the first one is for the eel and the second one for the salmon. According to this selection and due to COVID situation, we installed the second barrier for smolts in end of October 2020.

The effectiveness of this technology, if demonstrated at the Meuse pilot site, could be harnessed for diverting fishes from the water intake channels at hydropower plants and any other waterways that have an impact on the migratory movements of the species in question (canals, industrial water intake channels, etc.).

The behavioral barriers will be placed upstream of the power plant at the entrance to the water supply channel in order to divert the fish toward a properly calibrated bypass.

II. SITE PREPARATION

1. Supplier Selection

The supplier selection was done on February 2019 according to several requirements:

- **Biotechnological criteria 45%:** barrier efficiency / barrier location / project compatibility.
- **Price criteria 40%:** purchasing price / purchasing conditions.
- **Technical aspect 5%:** specific design adapted to the site.
- **Project management 5%:** Site preparation and site follow-up.
- **Security aspect 5%:** Risk analysis / Material choice.

The electrical barrier chosen for the pilot site is the technology of Procom System, a polish society based in Wroclaw.

The Procom's barrier consist in two rows of electrodes, one for the anodes and the other one for the cathodes. The electrical field generate by the barrier creates a stress feeling for fish that prefer to go away from the barrier. It could led them to a properly calibrated pass. The barrier works by impulsion, the power is supplied by an electrical cabinet. And Procom can control the barrier from Poland thanks to an internet connection in the electrical cabinet.

The eel barrier has a row of anodes and cathodes and another row of anodes. The salmon barrier will have a row of anodes and a row of cathodes.

Under the biotech criterion, Fish pass was excluded. As regards the Fish guidance system, the price criterion was very unfavorable.

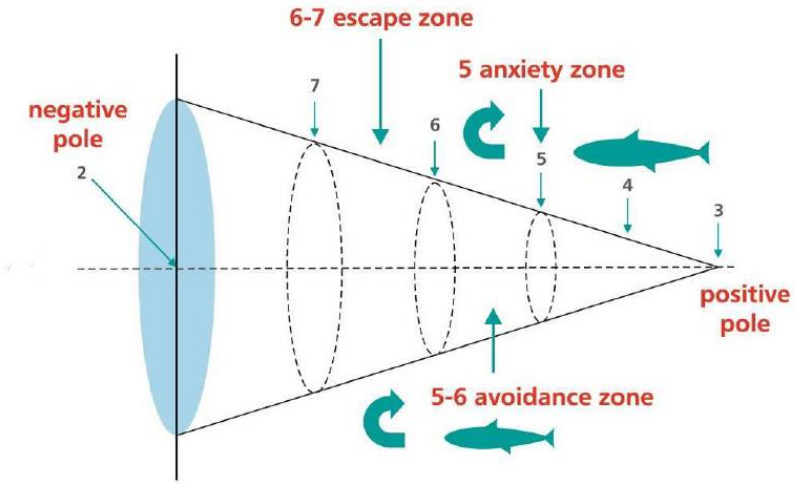

Figure 1 : Blueprint of the stress reaction of the fish near from the barrier.

2. Supplier Scope

Two suppliers worked for the electrical barrier project.

- Procom System : In charge of preparation of the electrical barrier, commissioning of the second barrier.
- Hydroscaph: In charge of underwater work: preparation and installation of anchorages (concrete bloc) – preparation and installation of the electrical barrier, cleaning of the first barrier for eels.

3. Projected Schedule and Actual Schedule

The installation begun at the scheduled date. Thursday, PROCOM asked us to check the first electrical barrier and to clean it with a special glove and a hammer. The divers did it on Friday.

Site : Grands-Malades		October					
Project : electrical barrier smolts		26	27	28	29	30	31
Task		Week 44					
Unloading of PROCOM materials on the site	Projected						
	Actual						
Preparation of the electrodes (stretch the chains with cables, connect the electrodes, install floats on the electrodes, isolate the electrodes, attach firefighter's hoses to the chains,…)	Projected						
	Actual						
Checking the anchors							
Launching individualdly the electrodes and installation under water	Projected						
	Actual						
Laying the cables in the existing cable tray and connect them to the cabinet	Projected						
	Actual						
Commissioning the system and take measurements of the electric field in the water from the boat	Projected						
	Actual						
Checking and cleaning the first electrical barrier (not scheduled)	Projected						
	Actual						
Presence of the divers team	Projected						
	Actual						

Figure 2: Schedule timeline

4. Financial aspect

Société	**Prix HTVA**
TOTAL (HTVA) €	65 410,00€

Figure 3: Financial table

III. Project Realization

1. Security aspect

At Luminus, security is the most important. The safety rules must be applied by employees, suppliers, subcontractors. To ensure the safety of the site, the worksite manager provided the necessary documentation for the good progress of the works: work permit and risk analysis. The risk analysis is written by the company performing work. This document is approved or completed by the worksite manager, the work permit is written afterwards.

The main risks are related to the fall of a person into the water, a risk increased during the short period when the fence was down to let us put the electrodes in the water. Several solutions were implemented to make the workers as safe as possible. All work areas are marked out. Wearing the lifejacket is mandatory close to the water.

On one step of the work, Procom System had to use a CMR product (Carcinogenic, Mutagenic and Reprotoxic), so before this use, we checked that no one was on the working area, and the user was protected with a mask with cartridge.
Every morning, the site manager gives the safety instruction and signs the work permits. To ensure maximum safety, the Grands-Malades' hydropower plant is shut down during the works.

Due to COVID period, the risk analysis was made in consequence. During the work we often checked if all the workers were wearing a facial mask as mandatory.

On the site we were also construction the fish path and we had to share the area with on other company. We clearly separated the site to be sure that we couldn't create any accident.

We had to deal with the platform of Artes, which was the other company on site, because PROCOM wanted to switch on the eels barrier to check if everything work. But the employees of the powerplant told us that two pipes of this barrier were probably touching the platform. To avoid any accident due to electricity we decided to make the test after the end of work day od Artes.

Figure 4 : Artes Plateforme

The second day, our HSE coordinator Christian Collin warned them about a product they didn't tell us about. PROCOM had immediately change it.

2. Power Supply

Electrodes are powered by an electrical cabinet installed by Procom system next to the concrete pills of the bridge. They connected the second barrier to the electrical cabinet already present.
We asked them to provide us a signal to allow us to have a state of the three sections of the barrier in distance. They showed us how to connect a cable at the electrical cabinet. They are preparing for us a program that will enable us to remotely switch off and on the barriers.

Figure 5 : Section where we have to connect our cable

3. Checking the anchors

Thursday, Hydroscaph checked the anchors that have been installed during the first intervention in 2019. They had some difficulties to find them because a lot of trash accumulated on the bottom. They had dig to find two of the anchors but all of it were present.

4. Electrodes preparation

The barrier was already present on the site because PROCOM brought it when they installed the eel barrier. we were worried about the depth of the water where the barrier has to be fixed. We asked PROCOM to bring extensions. Due to the slope the depth was increased and the top of pipes were no long enough to be on the surface. The pipes present on the site had a length of 7m but the deep of the water on some areas was until 9.7m (figure3).

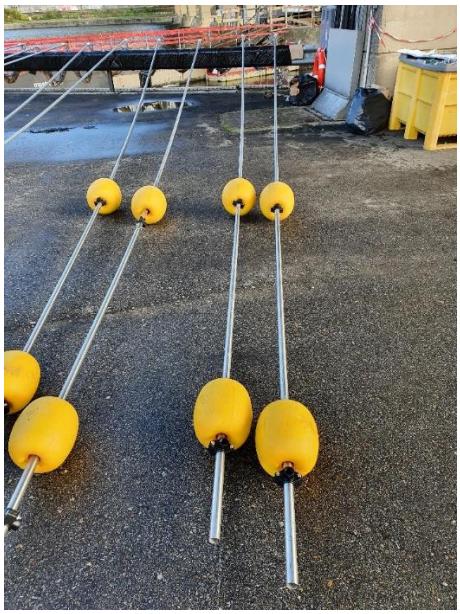

Figure 6: Pipes of 9.7m

The electrodes are made in stainless steel pipe (figure 4). The shackles are fixed to the electrodes via a plastic part made for the isolation. The standard length of pipe was 7 meters so where the electrodes needed to be longer, they were extended. To proceed, they drilled holes and installed the extensions then fixed them with bolts (figures 4 and 5).

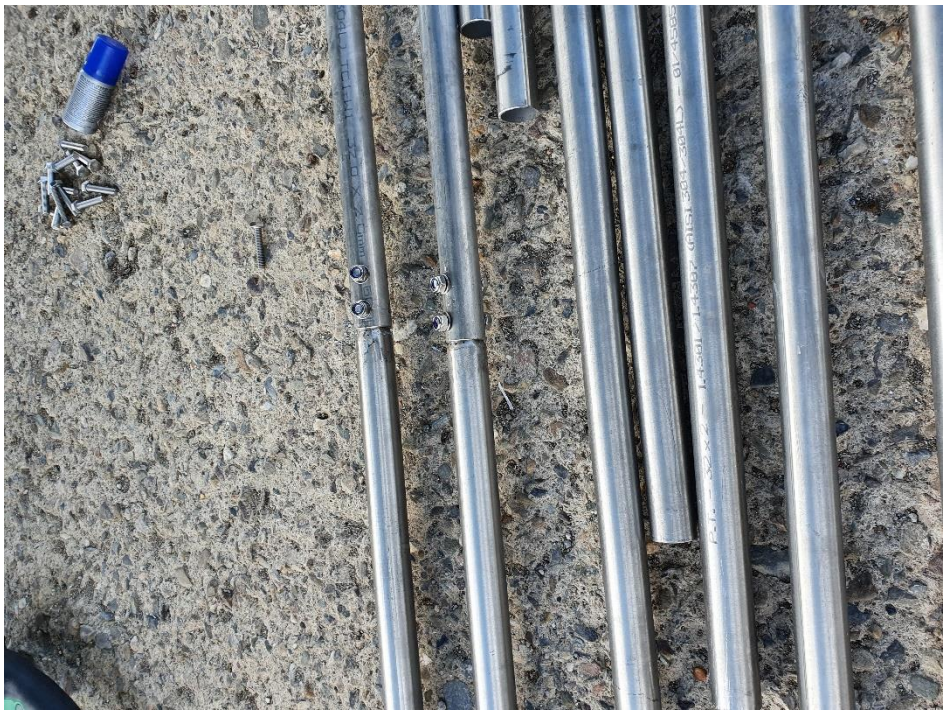

Figure 7 : Installation of extensions part 1

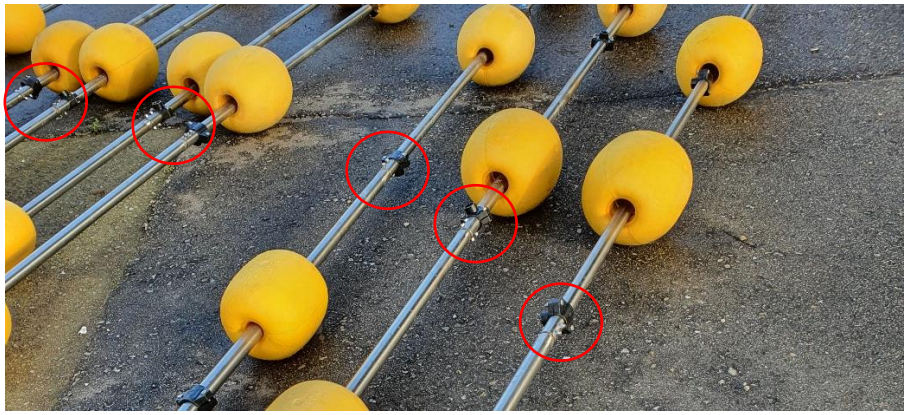

Figure 8 : Installation of extensions part 2

Procom drilled the lower extremity of each electrode to put the plastic part that isolate and fix the electrode on the chain (Figure 5). Then for the floatability, some buoys are fixed to the electrodes. Three buoys for the longer electrodes, two or one for the other ones.

Thanks to a galvanized shackle electrodes are fixed to the chain. The electrical connection between the cable is a physical connection, the extremity is locked on a threaded shaft with a screw. A metal cover is ad on the connection to protect the system and in addition to the physical protection, the PUH-255 (sealant) is put inside the metal cover.

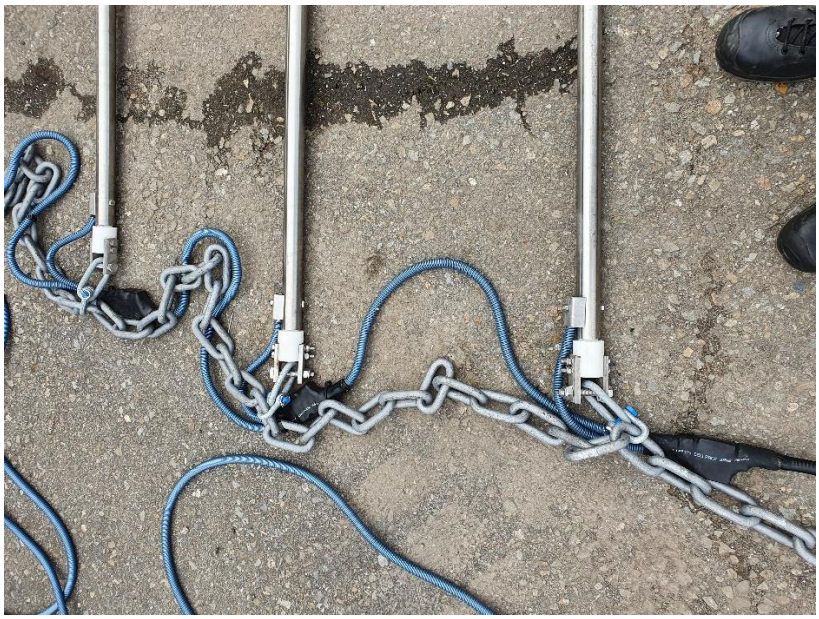

Figure 9 : Pipes with the chain and the electrical cable

5. Barrier installation

The fence near the water has been kept this time to prevent the risks of falling into the water. Protection has been installed along the barrier to protect it (in black on the figure 6).

Figure 10 : the first barrier ready to be launch

Thanks to a water hose fixed in a lot of point on the chain, the whole system was able to float. The water hose is inflated by a small compressor. It make the system easier to move and put in the right position. One extremity was hold with a rope from the other side of the water. Then electrode after electrode we put the system into the water, paying attention that no one is between electrodes in

case of a fall in the water of the whole chain carried away by its weight. Once the barrier is on position, divers cut the rope to make the system drown.

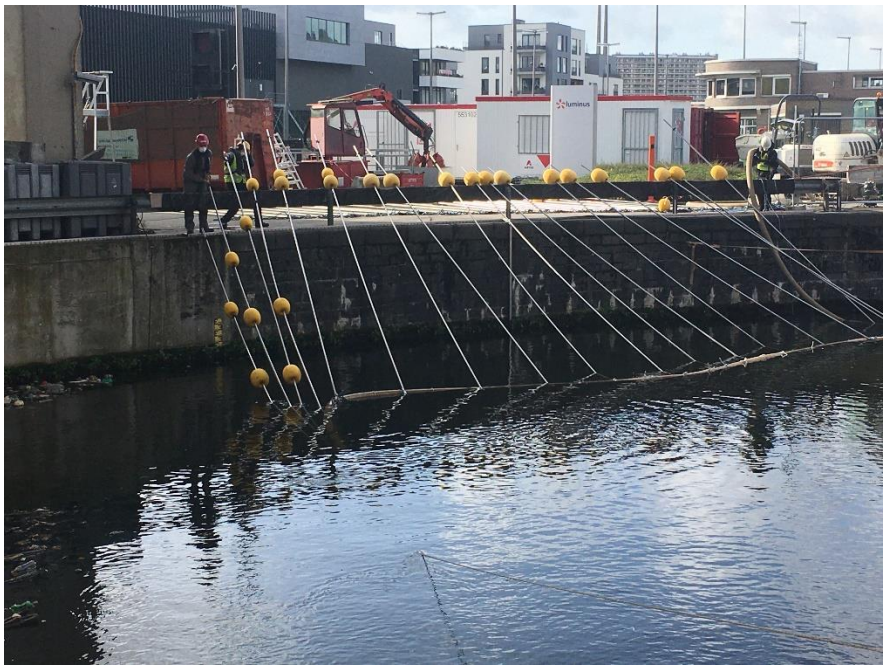

Figure 11 : Launching of the first barrier

The first barrier, the one with the cathodes was set up without any delay. Divers put shackles to fix the chain to the anchors.

For the second barrier, even with the extensions, the ones closest to the fish path were still too short. The divers had to add chain links. Then we put a boat into the water and Procom has adjusted the height of the buoys to be at the correct height.

Figure 12: PROCOM are correcting the height of the buoys

6. Modifications due to the proximity fences of the powerplant

After installing the first barrier on Wednesday 28th and restarting the installations, we were worried about the inclination of the electrodes due to the operation of the turbines.

On Thursday 29th when we arrived three electrodes were no longer visible after having stopped the turbines and a member of the staff of the power station told us that he heard a metallic noise.

We sent the divers to find the missing pipes. Two were lying down and stucked in the grid. After moved both we decided to cut the nearest pipes to prevent that happen again.

We calculated the inclination of the pipes and cut accordingly the new longer to be sure it will be no stuck anymore in the fence. We were worried because without these pipes the barrier will not have the same impact but we decided to not risk any damage on the power plant.

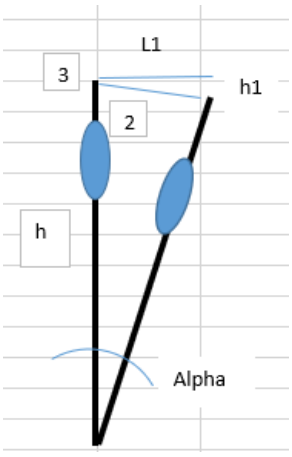

Figure 13 : Inclination of the pipes due to the operation of the turbines

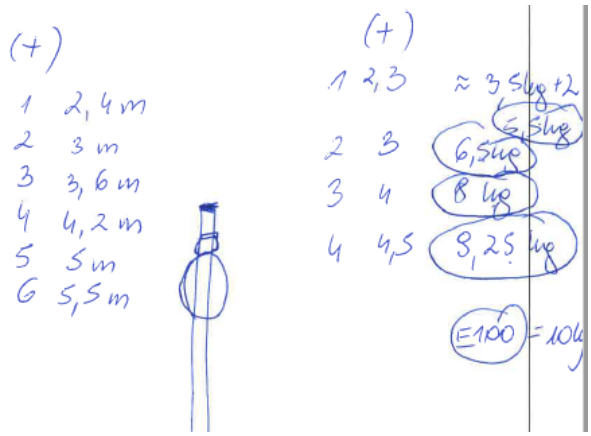

Figure 14: Height of cuts

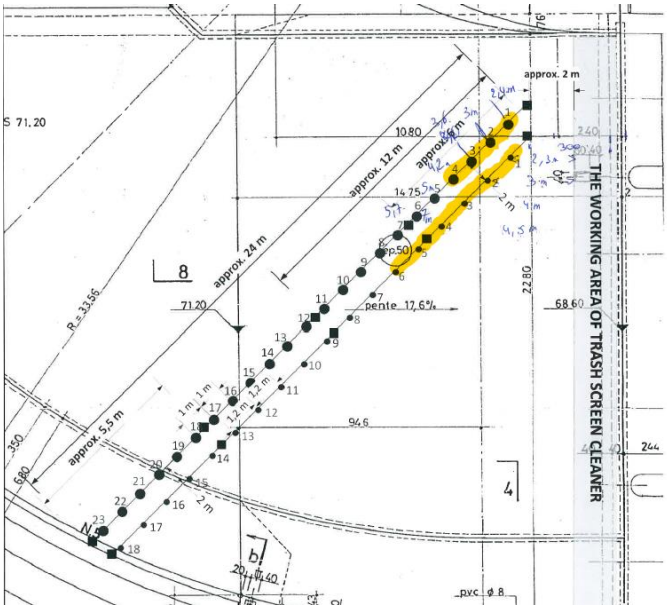

Figure 15 : Plan fo the ionstallation and in yellow the pipes cut

7. Procom measurement of the electrical field

The last step was to measure the potential of the electrical field along the barrier. Procom used an oscilloscope to check in the water if all was clear.

This time we asked to PROCOM to come with their own boat.

The measures were good and the insulation finalized without any problem.

Figure 16 : Boat of PROCOM

8. Cleaning of the eels barrier

The October 29th, PROCOM asked if the divers could inspect the eels barrier and clean it if necessary. They told us that we could easily clean the pipes with some hammer blow and abrasive glove. The 30th, the divers made video of the eels barrier. We can see on this that the pipes and chains was very dirty.

Figure 17 : Trash on the pipe

They also saw that the last pipe, the nearest close to the mole, was detached. The shackle of the pipe was missing and it only was connected by the electrical cable. The divers put on a new shackle.

They cleaned the pipes under the water with a hammer and those on the surface with a glove.

9. Commissioning of both barriers

The last day as planned PROCOM connect the barriers to the electrical cabinet and switch it on to verify the electrical fields which was correct.

Because Artes were still working and that the platform was in place, we decided to switch it off to avoid any electrical risk because the pipes of eel barrier might touch the platform.