

Development of a concept of compensatory measures: Revitalization of two places in the Aarebinnenkanal

1. Introduction

- KWO is developing ecological measures as part of acquisition of new concessions.
- Aarebinnenkanal is located in the region of Oberhasli and flows into the Lake of Brienz.
- The concept of revitalization is developed for two chosen places (zone 1 and 2 on the map) with two different options corresponding to the minimal and maximal intervention.



Google Earth

2. Objectives

- Improvement of biodiversity in restoring variability of habitat with the creation of new ones.
- Increase lateral and longitudinal connectivity inside the river and with surrounding ecosystems.
- Restore a semi-natural dynamic in the river to return to an almost natural river.
- Decrease the effects of discharge peaks.
- Introduce the aspect of feasibility in all domains: social, political and environmental.

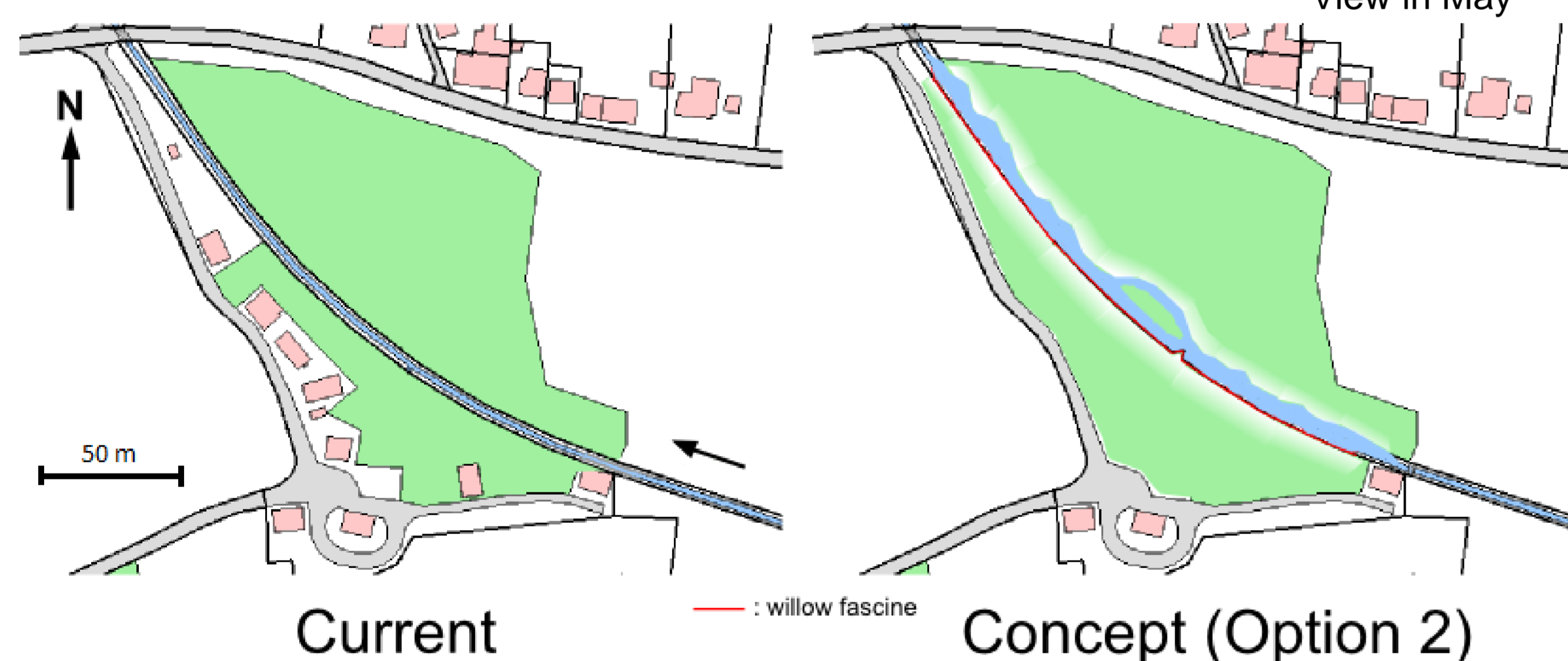
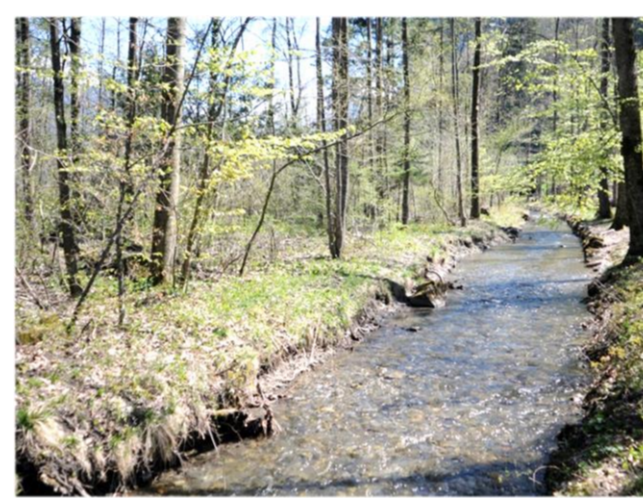
3. Analysis of river characteristics

- Quality of the water at the two points is quite good.
- Morphology of the river is strongly degraded, far from natural.
- Calculations of sediment transport show there is none (gravel trap upstream).
- Calculations of breakout force show that vegetation can be used for stabilization.

4. Proposed revitalization concepts

Zone 1

Along 200m, the river crosses an unused forest. The idea is to use revitalization to reduce seasonal variations of water level due to snow melting and prevent flood risks.



Revitalization propositions:

Option 1: right edge changes

Option 2: both edges change

Modifications:

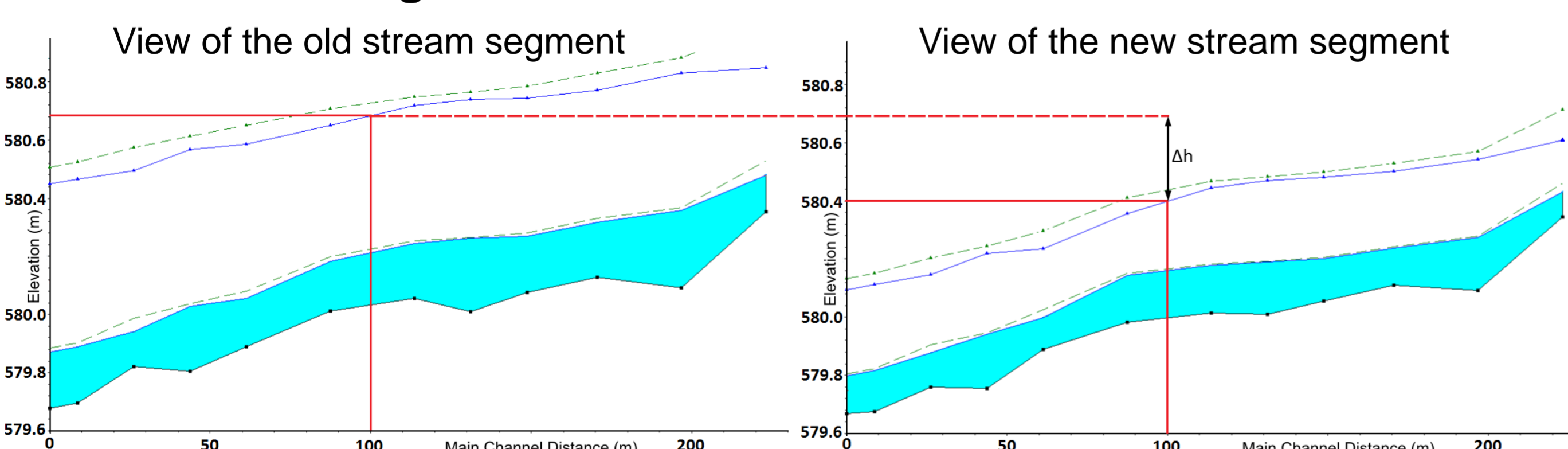
Right edge:

- Removal of rockfills and trees.
- Doubling of the river bed.
- Flattening of the bank.
- Nothing to protect: no bank stabilization.
- Planting of wetland species.
- New arm created.

Left edge:

- Removal of houses, rockfills and trees.
- Flattening of the bank.
- Stabilization to protect the road: willow fascine, willow cutting, and brushes and shrubs.
- Seeding of herbaceous species.
- Installing coconut biodegradable geotextile.
- Heap of rocks to orient the flow into the arm.

HEC-RAS Modeling:



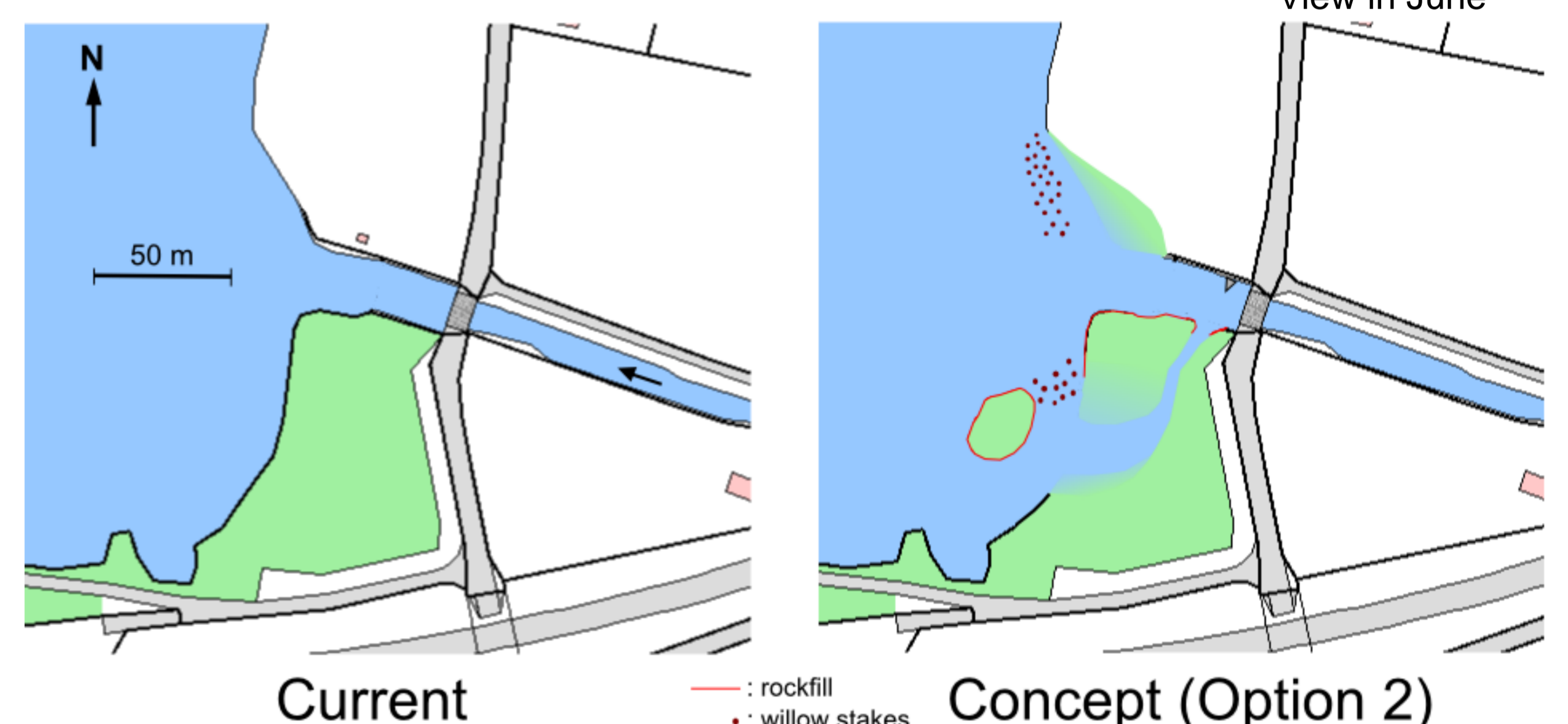
Legend:

- summer energy grade line
- summer water level
- winter energy grade line
- winter water level
- ground level

- Difference of $\Delta h = 25\text{cm}$ between the old and new stream summer water level.
- Less risk of flooding into the forest.

Zone 2

At the delta, the idea is to create new shallow places to make ideal habitats for fish. A small unused forest is available for revitalization.



Revitalization propositions:

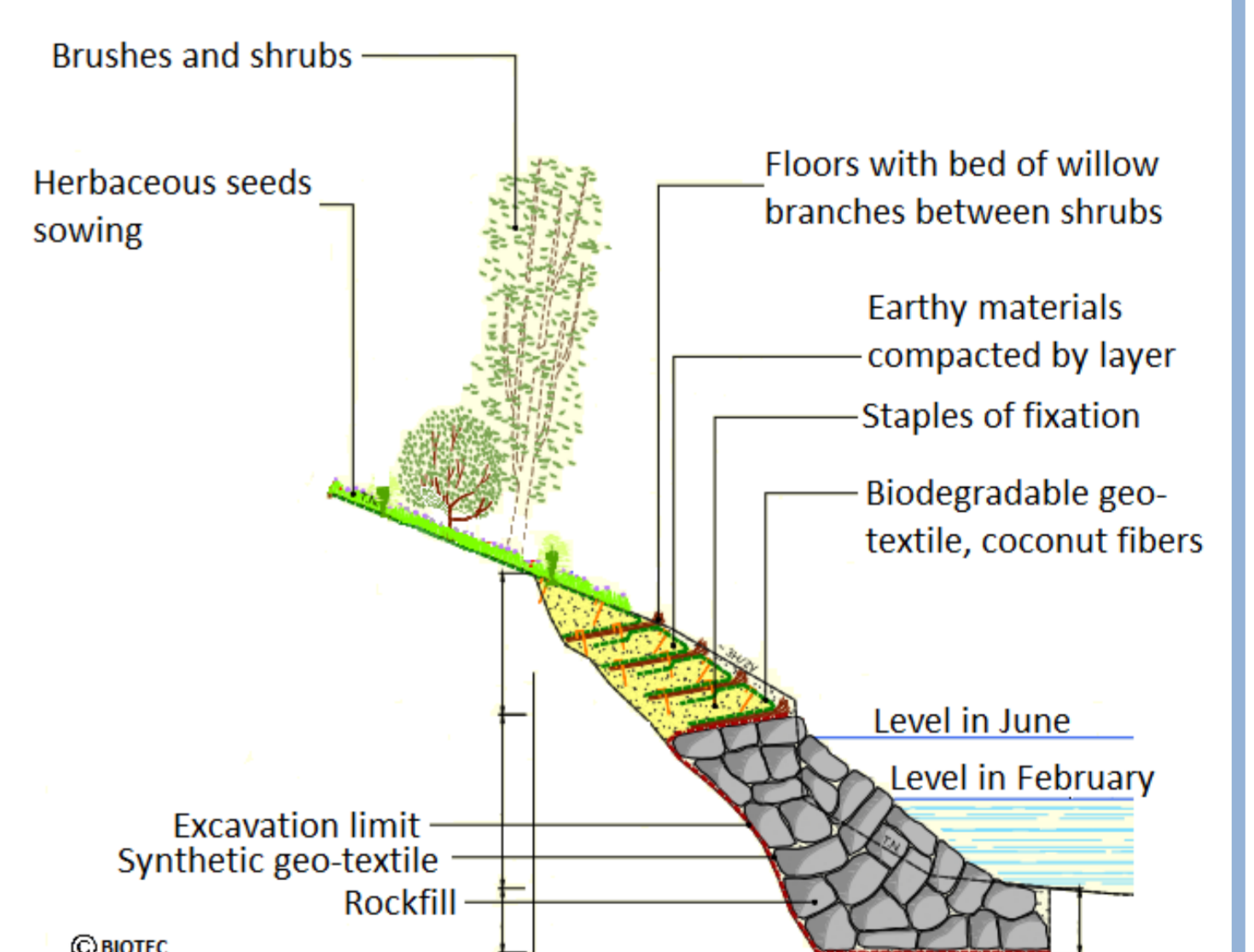
Option 1: left edge changes

Option 2: both edges change

Modifications:

Left edge:

- Removal of rockfills and trees.
- Flattening of the banks.
- Protection against waves: A combination of civil engineering and vegetation techniques is used because of the seasonal variations (see schema).
- New arm created without bank stabilization.
- Planting of wetland species into the arm.
- Creation of an island with the materials removed and stabilization of it.
- Planting of willow stakes to protect the shallow area against dead wood.



Right edge:

- Removal of rockfills and trees.
- Flattening of the bank.
- Nothing to protect: no bank stabilization.
- Planting of wetland species.
- Planting of willow stakes to protect from the dead wood.
- Heap of rocks to orient the flow into the arm.

5. Managing

- Remove biggest wood trunks around the willow stakes.
- Cut and maintain bioengineering constructions.
- Survey proliferation of invasive plants.

6. Conclusion

- Concepts allow to improve biodiversity and connectivity of the river, limit the risk of flooding and the effect of discharge peaks and recover an almost natural state and dynamic.
- Chosen areas are available and have low value, different options are proposed, allowing social and political feasibility.
- Limitation of environmental impact with the improvement of ecological state of the zones.