Brežice Hydroelectric Power Plant – promises and reality

A review of the implementation of the promised replacement habitats and mitigating measures

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Ljubljana, December 2018

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Report title:

Brežice Hydroelectric Power Plant – promises and reality. A review of the implementation of the promised replacement habitats and mitigating measures

Research organization and report preparation:

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Front cover photo:

Artificial islands on Brežice reservoir as a mitigation measure, 22 May 2018 (Photo Tilen Basle)

Recommended citations:

Ploj, A. (2018): Brežice Hydroelectric Power Plant – promises and reality. A review of the implementation of the promised replacement habitats and mitigating measures. DOPPS – BirdLife Slovenia, Ljubljana. 83 pp.

Index

1. Summary

This report is a textual and pictorial presentation of 30 mitigating measures adopted in the Decree on the national spatial plan for the area of Brežice Hydroelectric Power Plant (HPP Brežice) relating to nature conservation. The project proposed establishment of 6 replacementhabitats (SH) and 24 other mitigating measures, which are associated with nature conservation and that should replace habitats lost during construction in the wider area of HPP Brežice. Inspection in the field revealed, however, that mitigating measures had not been implemented (e.g., extraction of gravel at the sites of SH1 and SH2 is still taking place) or were carried out very poorly and are not being maintained (e.g., most of the planting proved unsuccessful and must be done anew, nesting islands for terns are being gradually overgrown with vegetation, sandbanks for Kingfisher (*Alcedo atthis*) are absolutely unsuitable for this species, etc.). Monitoring of the populations that would reveal the efficiency of mitigating measures is not carried out, in spite of its mandatory implementation.

The Table below indicates in different colours the degree of implementation of individual measures. It has been ascertained that yellow colour prevails, which indicates that the measures have been inadequately carried out, as well as that they are only partially functional and, therefore, should be be thoroughly improved.

Measure No.	Measure/Operation	State of implementation
1	Construction of the bank, embankment and shoals	
2	Construction of small bays (dunes, pools)	
3	Passage for water dependent organisms, planting of shrubs and trees (left bank)	
4	Regulation of the outflowing parts of the tributaries of Močnik, Struga and Potočnica	
5	SH1 – gravel pit	
6	SH2 – gravel pits	
7	SH3 – forest and dry grasslands	
8	SH4 – ponds at the outflowing part of the Struga stream	
9	SH5 – Jevščina gravel pit	
10	SH6 – replacement habitat for European Pond Terrapin	
11	Shoals with reed beds	
12	Construction of the sandbank for Kingfishers	
13	Floating islands for terns and island as a habitat for birds	
14	Drainage channel on the right bank	
15	Setting-up of bat boxes	
16	Preservation of part of poplar plantations and eco-cells	
17	Sections of the banks for the passage of game	
18	Planting of autochthonous riparian trees and shrubs	
19	Regular monitoring of species and habitat type at the site of SH	
20	Regulation of the Močnik stream	
21	Regulation of the outflowing parts of the Sava tributaries (4 tributaries)	
22	Construction of the sandbank for Sand Martins	

23	Planting of the area's external boundaries with trees	
24	Planting of trees and shrubs on the banks of the Sava's tributaries	
25	Passage for water dependent organisms on the left bank, planting	
26	Physical relocation of dead trees and animal species	
27	Construction of embankments for the passage of amphibians	
28	regulation of the Sava's tributaries, enabling uninterrupted passage for water dependent organisms	
29	Monitoring	
30	Maintenance	

Table 1: Degrees of implementation of individual measures

Red colour – the measure was not implemented at all
Orange colour – the measure was implemented, but it is not functional
Yellow colour – the measure was implemented, but it is only partially functional and unmaintained and, therefore, it has to be improved
Green colour – the measure was implemented and it is functional
Light blue colour – under construction
Dark blue colour – no information on its implementation

Calculation of habitat type loss after the construction of HPP Brežice has also been made. The results showed that 5 habitat types had been completely destroyed, while 7 additional habitat types had been destroyed to the extent of 80% or more. Completely destroyed were habitat types such as reed beds and the abandoned gravel pits. Despite the urgency, the replacement habitats that were to replace habitat types lost during construction have not been implemented to this very day.

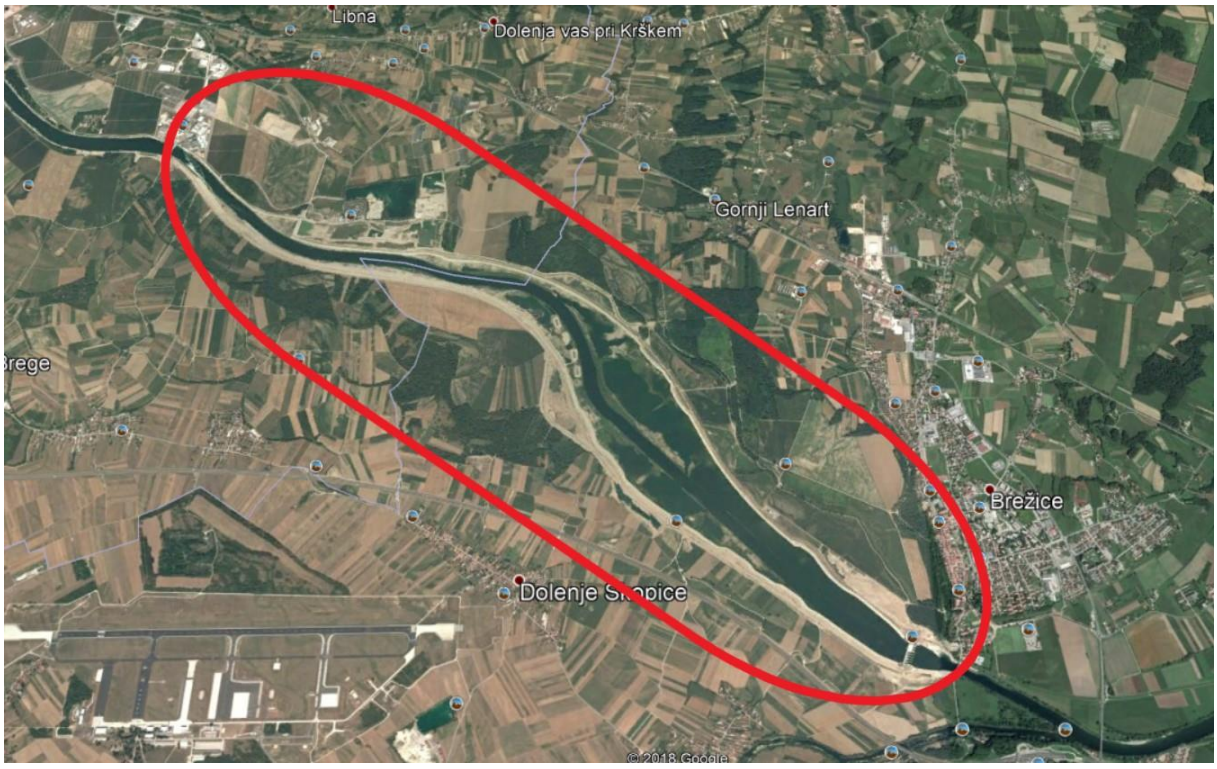

Figure 1: The area of construction of Brežice Hydroelectric Power Plant (source: GoogleEarth, 2018)

2. Introduction

DESCRIPTION OF THE AREA

The area of Brežice Hydroelectric Power Plant is situated in the Dolenjska region in the south-east part of Slovenia. The area covers 12 km long section of the Sava River from Krško Hydroelectric Power Plant to the confluence of the Sava and Krka Rivers at Brežice town. Some time ago, the Vrbina gravel pit and the Sava River constituted an area of exceptional significance for birds and other animal species in Slovenia. This was the only breeding site of Night Heron (*Nycticorax nycticorax*) colony in Slovenia, a very important feeding site for the White-tailed Eagle *(Haliaeetus albicilla)*, and a breeding site of one of the largest Sand Martin (*Riparia riparia*) colonies in Slovenia. With the construction of HPP Brežice, Slovenia thus lost its only known Night Heron breeding colony. Apart from the endangered bird species, important populations of the endangered European Pond Terrapin (*Emys orbicularis*) and European Otter (*Lutra lutra*) inhabited this area prior to the HPP Brežice construction.

BREŽICE HYDROELECTRIC POWER PLANT AND THE RESPECTIVE DECREE ARTICLES

Brežice Hydroelectric Power Plant is the fifth in the chain of six hydro plants on the Lower Sava River with the rated power of 47.4 MW. It is accumulation–type HPP with five flow fields and average annual production of 161 GWh. Currently it contributes with slightly more than 1% of electric energy to the Slovenian electric power system[1].

The investor for the energy infrastructure is the HESS d.o.o. company. Of crucial importance for the construction of the plant were three investors, i.e. the Government of the Republic of Slovenia, which built the accumulation pool and all of the necessary infrastructure, the firm Eles that built the power line connection, and Krško Nuclear Plant. Total investment amounted to 141,745,046 €.

Control over the implementation of the Decree articles is in the hands of the Ministry of Infrastructure and Spatial Planning – the Inspectorate of the Republic of Slovenia for Transport, Energetics and Spatial Planning, while the Institute of the Republic of Slovenia for Nature Conservation is responsible for the expert control in the establishment of replacement habitats.

The leading subject in the sphere of control and protection of nature and the environment (monitoring) is the supervisory (public) company INFRA d.o.o., whereas its subcontractors are Savaprojekt, Erico, Limnos, Irgo (external control of the engineer), Aquarius and IVD (current control of the contractor).

Facilities of the water and energy infrastructure in indivisible relationship: Investor Grantor MKO with funds: MKO-VS: Water Fund MKO-PS – Climate Fund	Owner of the RS regulations, by authorization of MKO-VS Manager: ARSO (Slovenian Environment Agency) Regular maintenance: HESS d.o.o.
Facilities and procedures	Accumulation pool with embankments with consolidations and sealing on the upstream and downstream sides of the barrier: embankments, protection of embankments, sealing of the pool, deepening of the downstream river-bed, facilities before flow fields and under the dam (protection of the Sava's banks downstream

[1] HES, http://www.he-ss.si/he-brezice-splosno.html 12.12.2018

	from the dam structure). Constructions for the reduction of impacts of the water level rise in accumulation pools on the groundwater level rise: drainage channels with all appertaining works (protection, bridging, planting), regulation of the Močnik and Struga streams as a drainage for the lowering of the groundwater level, protection of facilities against the impacts of groundwater rise (residential and commercial facilities, sealing of underpasses under the motorway), raising of plots of land to the appropriate height above the risen groundwater, replacement habitats, including passage for water dependent organisms, sustainable regulations in and along the plant's pool and drainage channels.
Water infrastructure facilities – flood safety: Investor Grantor MKO with funds: MKO-VS: Water Fund MKO-PS – Climate Fund	Owner of the RS regulations, By authorization of MKO-VS Manager: ARSO (Slovenian Environment Agency) Regular maintenance: INFRA d.o.o.
Facilities and procedures	High water embankments and other constructions for the protection against high waters and floods in the area of the concession, including purchase of the facilities, the protection of which would exceed their value, and anti-erosion protection of the facilities and tracts of land in the flood area, regulation of the Sava's tributaries

Table 2: Display of the ownership and management arrangement[2]

[2] Programme of the implementation of the water, national and local infrastructure and facilities of the water and energy infrastructure in indivisible relationship for the construction of Brežice Hydroelectric Power Plant, 2013. Prepared by Infra d.o.o. and Hidroelektrarne na Spodnji Savi d.o.o. http://www.mop.gov.si/fileadmin/mop.gov.si/pageuploads/pomembni_dokumenti/program_izvedbe_he_brezice_novelacija1.pdf

Ploj, A. (2018): Brežice Hydroelectric Power Plant – promises and reality. A review of the implementation of the promised replacement habitats and mitigating measures

PURPOSE OF THE STUDY

The study presents an estimate of the implementation of the mitigating measures, stipulated with the Decree on the National Spatial Plan for the area of Brežice Hydroelectric Power Plant[3] (hereinafter referred to as »Decree«). The report presents a comparison between all prescribed replacement habitats and other mitigating measures as well as their actual implementation. Surface area of the lost habitat types after the construction of the plant was calculated as well.

[3] Decree of the Republic of Slovenia (2012): Decree on the National Spatial Plan for the area of Brežice Hydroelectric Power Plant. Official Gazette of the RS No. 50/2012. http://www.pisrs.si/Pis.web/pregledPredpisa?id=URED6213

3. The planned measures and their implementation

Replacement habitats and mitigating measures for the Brežice Hydroelectric Power Plant were roughly proposed in the Environmental Report[4], then accepted in the Environmental Protection Consent[5] and finally legalized with the Decree.

The measures can be roughly divided into two groups – replacement habitats (SH) and mitigating measures. The first group includes the areas that are rearranged into such habitat types that can substitute degraded habitats destroyed during the plant's construction itself. As in the case of Brežice Hydroelectric Power Plant much of the specific wetland habitats was destroyed; thus gravel pits and ponds prevail among the replacement habitats. In spite of these habitats (which have to be suitably implemented and protected if they are to function in a satisfactory way), it is difficult to reinstate balance and biodiversity in the destroyed river ecosystem. The replacement wetland habitats established in the area of Brežice Hydroelectric Power Plant cover about 45 hectares.

Mitigating measures include all other measures that are not replacement habitats. With the aid of these measures, the consequences of rough encroachments upon nature should be mitigated. The same as replacement habitats, mitigating measures should be suitably implemented as well, if they are to function in a proper way. Mitigating measures are both physical (construction of the banks, planting of shrubs and trees, construction of passages for water dependent organisms, etc.) and non-physical (monitoring, reporting). Monitoring and reporting functions as a kind of concluding part which, however, is highly significant, given that the results of mitigating measures can be followed, and if necessary improved, with the very aid of monitoring.

The measures in the report are presented as written in the Decree. The Table below presents all measures referring to replacement habitats or mitigating measures associated with nature conservation that were constructed/applied in the area of Brežice Hydroelectric Power Plant.

[4] Environmental Report for the National Spatial Plan for the area of Brežice HE Plant, Geateh d.o.o. Ljubljana, 2011

[5] MKGP (2014) Environmental Protection Consent, Ljubljana, http://www.arso.gov.si/novice/datoteke/031637-Okoljevarstveno%20soglasje%20HE%20Bre%c5%beice.pdf

Measure No.	Measure/Operation	Article in the Decree
1	Construction of the bank, embankment and shoals	Article 7
2	Construction of small bays (dunes, pools)	Article 7
3	Passage for water dependent organisms, planting of shrubs and trees (left ba	Article 11
4	Regulation of the outflowing parts of the tributaries of Močnik, Struga and Potočnica	Article 11
5	SH1 – gravel pit	Article 12
6	SH2 – gravel pits	Article 12
7	SH3 – forest and dry grasslands	Article 12
8	SH4 – pools at the outflowing part of the Struga stream	Article 12
9	SH5 – Jevščina gravel pit	Article 12
10	SH6 – replacement habitat for European Pond Terrapins	Article 12
11	Shoals with reed beds	Article 12
12	Sandbanks for Kingfishers	Article 12
13	Floating islands for terns and island as a habitat for birds	Article 12
14	Drainage channel on the right bank	Article 12
15	Setting-up of bat boxes	Article 12
16	Preservation of part of poplar plantations and eco-cells	Article 12
17	Sections of the banks for the passage of game	Article 12
18	Planting of autochthonous riparian trees and shrubs	Article 12
19	Regular monitoring of species and habitat type at the site of SH	Article 12
20	Regulation of the Močnik stream	Article 14
21	Regulation of the outflowing parts of the Sava tributaries (4 tributaries)	Article 15
22	Construction of sandbank for Sand Martins	Article 26
23	Planting of the area's external borders with trees	Article 26
24	Planting of trees and shrubs on the banks of the Sava's tributaries …	Article 39
25	Passage for water dependent organisms on the left bank, planting	Article 39
26	Physical relocation of dead trees and animal species	Article 52
27	Construction of embankments for the passage of amphibians	Article 52
28	Regulation of the Sava's tributaries, enabling uninterrupted passage for	Article 52
29	Monitoring	Article 67
30	Maintenance	Article 68

Table 3: Table of mitigating measures and replacement habitats

The Environmental Protection Consent[6] states, under Item 2.7.25, the following Article that cannot be found in the Decree:

2. 7 Conditions for the protection of ecosystems, plants, animals and their habitats:
2.7.25 If the populations of species (Red-backed Shrike *Lanius collurio*, Nightingale *Luscinia megarhynchos*, Barred Warbler *Sylvia nisoria*, Whitethroat *Sylvia communis* and Turtle Dove *Streptopelia turtur* is reduced by more than 20%, the cultural landscape areas are to be substituted.

After the construction, the populations of the following species are to be monitored: Red-backed Shrike, Nightingale, Barred Warbler, Whitethroat and Turtle Dove. Monitoring is to be carried out by a biologist or ornithologist, who is to pass the obtained results to the Institute of the Republic of Slovenia for Nature Conservation.
It is not known whether the monitoring is being carried out, considering that no monitoring findings or results have been received by the Institute of the Republic of Slovenia for Nature Conservation so far.

[6] MKGP (2014) Environmental Protection Consent, Ljubljana, http://www.arso.gov.si/novice/datoteke/031637-Okoljevarstveno%20soglasje%20HE%20Bre%c5%beice.pdf

3.1 Construction of the bank, embankment and shoals

As defined by the Decree

The measure is defined as following in Article 7(3)[7] of the Decree:

(3) High water-energy embankments are to be implemented mainly with transverse compensation. For their construction, materials obtained in the area of the planned reservoir are to be used, as well as surpluses of the material occurring during the implementation of other facilities and works. The embankments are generally of trapezoidal profile with the crest width of 4 metres and mostly with bank gradient 1:2. Here and there, the embankments are implemented in tiers and at different gradients, in some places there are extensions on the crest intended for the establishment of manipulation surfaces at the planned accesses to water for the purpose of rescuing and planting, while in some other places shoals are to be implemented. On the back side of the embankments, 1.0 m to 3.5 m deep drainage channels are to be built along their entire length. Between drainage channel and the embankment's crest, one or two intermediate berms with multipurpose paths are to be constructed. The crest of the embankment is to be implemented as drivable surface for maintenance works.

Detailed description of the measure

The measure is described in the above Article (underlined).

Description of the implementation

"Here and there" a varied bank has already been implemented, the same as widenings of the flood protection embankment and shoals.

[7] Title of the Article: Accumulation pool, high water-energy embankments, drainage channels and deepening of the bed

Ploj, A. (2018): Brežice Hydroelectric Power Plant – promises and reality. A review of the implementation of the promised replacement habitats and mitigating measures

Figure 2: Widening of the flood protection embankment

Summary assessment of the suitability of the implementation

The measure has already been carried out.

3.2 Construction of small bays (dunes, pools)

Definition as per Decree

The measure was defined in Article 7(4)[8] of the Decree:

Article 7

(4) At the inner banks of the reservoir, from 2 to 10 m large bays (where hydraulically possible) with different water depths (dunes, pools) are to be constructed.

Detailed description of the measure

The measure is described in the above Article.

[8] Title of the Article: Accumulation pool, high water-energy embankments, drainage channels and deepening of the river bed

Ploj, A. (2018): Brežice Hydroelectric Power Plant – promises and reality. A review of the implementation of the promised replacement habitats and mitigating measures

Description of the implementation

Within the scope of works, bays were constructed on the left bank along the tract where a rowing course is envisaged as well. According to the instructions by ZZRS, dead trunks were placed in the bays for shelter. On the left bank, a shoal with the berm of 10 m has also been made.

Figure 3: Hither and thither varied bank

Summary assessment of the suitability of the implementation

The bays have already been constructed (Figure 3), although no guidance as to the hydro-morphological validity has been taken into consideration, due to which they do not provide for the actual function of dunes and pools.

3.3 Passage for water dependent organisms, planting of shrubs, trees (left bank)

Definition as per Decree

The measure is defined in Article 11(1)[9] of the Decree:

Article 11

[9] Title of the Article: Passage for water dependent organisms and spawning areas

(1) A passage for water dependent organisms in the shape of sustainably built river bed, the shading of which is to be provided with the planting of autochthonous tree species, is to be built near the dam structure. At the same time, the passage is to be created as a habitat for rheophilic species of fish. In the phase of acquiring the Environmental Protection Consent, conditions for the implementation of a combined passage for water dependent organisms of a wider significance that the maker of PVO is liable to prepare in cooperation with a fish expert, are to be checked and determined. The instigator or investor of the wider purpose of the passage for water dependent organisms is liable, while checking and determining conditions for the passage of this kind and in further phases of planning and acquiring the consent for the wider purpose of the passage for water dependent organisms, to cooperate with a fish expert.

Detailed description of the measure

Along the dam structure on the left bank of the Sava River, a passage for water dependent organisms, composed of two types of sections, is to be constructed: inflow chamber section with slots with falls of water level 6 cm between individual chambers and sustainable section with graded pools with 12 cm falls between individual pools. The flow in the passage is ca. 0.7-0.8 m3/s, while in the outflow part it increases for additional 2.5 m3/s to a total of ca. 3.2 m3/s, which should be the minimum required flow that provides a great opportunity for fish to find the entrance to the passage (attraction flow).

The inflow of water from the Sava River into the passage, which is at the same time an exit for the spawning migration of fish, will be located in the reservoir of HPP Brežice upstream from the barrier. The route of the passage runs at the section upstream from the dam facility on the plateau along the high water embankment with a longitudinal gradient of 2% and then over natural terrain. In the profile immediately under the axis of the dam facility, it joins the Močnik stream, thus enabling a passage to water mechanisms into the Močnik stream as well. Downstream from the outflow ramp of turbine outflows the passage flows into the Sava River. Within the framework of the passage, resting places for fish and a spawning site are also envisaged[10].

Attraction flow to the passage for water dependent organisms will be provided from the Hydroelectric Plant's pool with concrete pipeline with inflow in the upstream left wing wall and connection to the passage upstream from the access bridge to the dam structure[11].

Description of the implementation

The passage for water dependent organisms (= fish pass) has already been implemented, as well as all microstructures in the passage itself. However, the same as in all places where shrubs and trees were planted, everything proved abortive in this part as well. Everything should be urgently planted anew as well as favourable conditions provided at the site prior to it. It was also evident that in the tract of fish pass, which runs through the embankment, a large quantity of waste is accumulating.

[10] See p. 29, MKGP (2014) Environmental Protection Consent, Ljubljana, http://www.arso.gov.si/novice/datoteke/031637-Okoljevarstveno%20soglasje%20HE%20Bre%c5%beice.pdf

[11] See p. 30, MKGP (2014) Environmental Protection Consent, Ljubljana, http://www.arso.gov.si/novice/datoteke/031637-Okoljevarstveno%20soglasje%20HE%20Bre%c5%beice.pdf

Figure 4: Failed attempt at planting shrubs and trees along the fish pass

Figure 5: Failed attempt at planting shrubs and trees along the fish pass

Figure 6: Failed attempt at planting shrubs and trees, with passage for water dependent organisms in the background

Figure 7: Passage between the fish pass and reservoir, where waste is accumulating

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Figure 8: The outflowing part of the channel into the Sava River

Summary assessment of the suitability of the implementation

The passage has already been built, but shrubs and trees are to be planted completely anew. In order to prove the actual functionality of the passage for water dependent organisms, including strictly protected rheophilic fish species, monitoring should be carried out.

3.4 Regulation of the outflowing parts of the tributaries of Močnik, Struga and Potočnica

Definition as per Decree

The measure is defined in Article 11(3)[12] of the Decree:

Article 11

(3) The outflows of the Sava's tributaries are to be regulated in a manner to allow water dependent organisms a passage from the river into the tributaries. Spawning site in the Potočnica stream is to be preserved. A replacement spawning sites are to be created in the outflowing parts of the Močnik and Struga streams, or in the passage for water dependent organisms that would provide habitat for the rheophilic fish species as well, i.e. Mediterranean Barbel *(Barbus meridionalis)*, Danube Streber *(Zingel streber)* and Stargazer (*Uranoscopus scabe)*. The replacement spawning site is to be created with the

[12] Title of the article: Accumulation pool, high water-energy embankments, drainage channels and deepening of the river bed

depth smaller than 0.5 m, at the medium flow with natural substrate at the bottom. During the main spawning season from 1 March to 31 May, no recreation in the area of replacement spawning sites is to be allowed.

Detailed description of the measure

In the outflowing parts of the Sava's tributaries of Žlapovec, Potočnica, Leskovški potok and Močnik, minor regulatory works are to be carried out, such as local protection, reconstruction of the beds and sanitary cuttings. The Močnik stream's water is to be enriched by connecting drainage channel to it, which is to be implemented behind the high water-energy embankment on the left bank along the reservoir. In the areas of the Močnik and Struga streams in the area of Vrbina near Brežice, the beds are to be cleaned and maintenance works carried out. Partially, the bed of the Struga stream is to be shifted and widened, as well as deepened for the needs of recreational rowing (boating). The banks are also to be consolidated, as well as the bed. With the regulation of the Struga stream, the groundwater level will be adjusted at the same time. The outflowing parts of the tributaries are to be regulated in a way to enable passage of fish from the pool or the Sava to the tributaries, and vice versa. The riparian overgrowth is to be preserved as much as possible, with the removed growth replaced by autochthonous tree species, where planting of as large seedlings as possible is to be provided for[13].

Description of the implementation

The implementation is still in progress, the necessary works have not been concluded as yet.

Summary assessment of the suitability of the implementation

Regulation of the outflowing parts of the Sava's tributaries is still in progress and not concluded as yet. As a consequence, neither passages for water dependent organisms nor spawning sites are functional.

3.5 SH1 – Gravel pit

Definition as per Decree

The measure is defined in Article 12(3, 4)[14] of the Decree:

Article 12

(3) In order to replace the important habitat types for nature conservation in Vrbina gravel pit as well as in forests and grasslands, which will be permanently lost owing to the construction of the reservoir and sediment dumps, replacement habitats are to be established, with which favourable conditions for the development of natural succession of species will be provided for. Replacement gravel pits

[13] See p. 28, Programme of the implementation of facilities of water, national and local infrastructure and facilities of water and energy infrastructure in indivisible relationship for the construction of Brežice Hydroelectric Power Plant, 2013. Prepared by: Infra d.o.o. and Hidroelektrarne na Spodnji Savi d.o.o. http://www.mop.gov.si/fileadmin/mop.gov.si/pageuploads/pomembni_dokumenti/program_izvedbe_he_brezice_novelacija1.pdf

[14] Title of the Articles: Replacement habitats, quiet areas and other habitats

(SH1, SH2, SH4 and SH5) are being created on approximately 45 ha of the water surfaces with groundwater supply, i.e. with gradual extraction of gravel in such a way that as large water surfaces with appropriate banks are acquired in as short time as possible. Autochthonous hydrophilous plants are to be planted, which will trigger natural succession in the shortest possible time at concurrent digging of gravel until the final foreseen limits of each replacement habitat. In the water along the south bank of SH1, along a little peninsula and along the eastern side of the islet between SH1 and SH2, islets are to be created of trunks and rocks that will be suitable for the European Pond Terrapin *(Emys orbicularis)*. On the west side of the islet between SH1 and SH2, a habitat suitable for Common Sandpipers *(Actitis hypoleucos)* is to be constructed; sand banks are to be built with a gentle slope of 1:5 with transition to the natural bank. At least a third of the newly made banks of SH2 are to be made in the upper dry part with a slope of 1:5 and transition to the natural bank.

(4) On the banks and on the embankments of SH1 and SH2, riparian Willow, Alder, Ash and Pedunculate Oak are to be planted. In the gravel pits, various water plants are to be planted: Hornwort *(Ceratophyllum demersum)*, Spiked Water-milfoil *(Myriophyllum spicatum)*, Whorled Water-milfoil *(Myriophyllum verticillatum)*, Brown Galingale *(Cyperus fuscus),* Galingale *(Cyperus longus)*, Shining Pondweed *(Potamogeton lucens)*, Narrow-leaved Water-plantain *(Alisma lanceolatum)*, Bearded Iris *(Iris germanica)*, Yellow Iris *(Iris pseudacorus)*, and similar plants.

Detailed description of the measure

Stari Grad gravel pit, located south of Raceland and the existing gravel pit, is to be constructed in such a way that it will be supplied by groundwater, including the riparian area (around 17 ha)[15].

In the creation of replacement habitats, the following requirements are to be taken into account:

- prior to the submersion of gravel pits, physical relocation of dead and felled old trees is to be provided in accordance with the provisions of Article 12 of the Decree, and of less mobile animal species, e.g. European Pond Terrapin *(Emys orbicularis)*, into replacement biotopes or temporarily into other biotopes, from which they will be returned after their final creation;
- prior to the submersion of Vrbina gravel pit, the dragonfly larvae and European Pond Terrapins *(Emys orbicularis)* are to be moved to SH1 and SH2;
- half of all planned replacement habitats are to be created prior to the filling of the reservoir, while other works should begin to be implemented after the first filling and gradually in the ensuing years, subject to the dynamics of gravel extraction from gravel pits;
- at the beginning of physical procedures in the area of Vrbina gravel pit, 50% of the water habitats should be functional. The area of Vrbina gravel pit encompasses the water surface and a 40 metres wide belt along the gravel pit;
- in the area of replacement habitats, access and educational trails are to be constructed in agreement with a nature conservation authority. Furthermore, bird viewing platforms are to be set up, as well as information boards and other facilities associated with the maintenance and promotion of habitats;
- in the area of replacement habitats, no angling and sports activities are allowed, except in the part of SH1, where rowing is permitted. The time table and types of activities in these areas and presentations are to be adapted to the ecological requirements of the present species and to other replacement habitat characteristics[16].

[15] Page 35, MKGP (2014) Environmental Protection Consent, Ljubljana, http://www.arso.gov.si/novice/datoteke/031637-Okoljevarstveno%20soglasje%20HE%20Bre%c5%beice.pdf

[16] See p. 131, Decree of the RS (2012): Decree on the National Spatial Plan for the area of Brežice Hydroelectric Power Plant. Official Gazette of the RS No. 50/2012. http://www.pisrs.si/Pis.web/pregledPredpisa?id=URED6213

Ploj, A. (2018): Brežice Hydroelectric Power Plant – promises and reality. A review of the implementation of the promised replacement habitats and mitigating measures

Description of the implementation

The replacement habitat SH1 has not been implemented as yet, as gravel extraction is still in progress. The implementation of the measure has been entrusted to the concessionaire Kostak d.d. who carries out primary mining activities (gravel extraction). The concession contract was recently extended until 2022/2023 and the works continue, although only in the area of SH2 in this moment. HESS CEO recently gave a statement, that replacement habitats won't be finished for sure, as long as the concession contract is valid[17].

The bottom of the gravel pit is very varied, with interchanging gravel islets and shallow water bodies. In the area of SH1, a high number of Sand Martins *(Ripaira ripaira)* bred this year (2018), whose breeding sandbank was formed by chance, i.e. owing to the collapse of the pit's wall, and was not created intentionally for this bird species. The northern part of SH1 is overgrown with the invasive Goldenrod (*Solidago sp.)*, which should be removed. Owing to the active gravel extraction, no riparian Willow, Alder, Ash and Pedunculate Oak have been planted as yet.

Figure 9: SH1, where gravel extraction is still taking place

[17] Jakše, L. (2019). Od društev, ki delujejo proti gradnji obnovljivih virov, ima koristi le fosilni lobi. Delo, sobotna priloga. 12.1.2019

Figure 10: SH1, where gravel extraction is still taking place

Figure 11: SH1, where gravel extraction is still taking place

Figure 11: Sand Martins' *(Ripaira ripaira)* breeding site in 2018, created owing to the spontaneous collapse of the gravel pit's wall

Figure 12: Sand Martins' *(Ripaira ripaira)* nest holes in gravel pit SH1

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Summary assessment of the suitability of the implementation

The replacement habitat has not been accomplished as yet, as gravel extraction is still in progress. Requirement that half of all planned replacement habitats should be created and functional prior to the filling of the reservoir is not achieved, and it is unclear if translocation of dragonfly larvae and European Pond Terrapins ever occurred.

3.6 SH2 – Gravel pits

Definition as per Decree

The measure is defined in Article 12(3, 4) [18] of the Decree:

Article 12

(3) In order to replace the important habitat types for nature conservation in Vrbina gravel pit as well as in forests and grasslands, which will be permanently lost owing to the construction of the pool and sediment dumps, replacement habitats are to be created, with which favourable conditions for the development of natural succession of species will be provided for. Replacement gravel pits (SH1, SH2, SH4 and SH5) are being created on approximately 45 ha of water surfaces with groundwater supply, i.e. with gradual digging of gravel in such a way that as large water surfaces with appropriate banks are acquired in as short time as possible. Autochthonous hydrophilous plants are to be planted, which will trigger natural succession in the shortest possible time at concurrent digging of gravel until the final foreseen limits of each replacement habitat. In the water along the south bank of SH1, along a little peninsula and along the eastern side of the islet between SH1 and SH2, islets with the application of trunks and rocks that will be suitable for the European Pond Terrapin *(Emys orbicularis)* are to be made. On the west side of the islet between SH1 and SH2, a habitat suitable for Common Sandpipers *(Actitis hypoleucos)* is to be created; sand banks are to be built with a gentle slope of 1:5 with continuous transition to the natural bank. At least a third of the newly made banks of SH2 are to be constructed in the upper dry part with a slope of 1:5 and continuous transition to the natural bank.

(4) On the banks and on the embankments of SH1 and SH2, riparian Willow, Alder, Ash and Pedunculate Oak are to be planted. In the gravel pits, various water plants are to be planted: Hornwort *(Ceratophyllum demersum)*, Spiked Water-milfoil *(Myriophyllum spicatum)*, Whorled Water-milfoil *(Myriophyllum verticillatum)*, Brown Galingale *(Cyperus fuscus),* Galingale *(Cyperus longus)*, Shining Pondweed *(Potamogeton lucens)*, Narrow-leaved Water-plantain *(Alisma lanceolatum)*, Bearded Iris *(Iris germanica)*, Yellow Iris *(Iris pseudacorus)*, and similar plants.

Detailed description of the measure

The complex of gravel pits Stari Grad-east of Raceland (around 22 ha) will be constructed as a replacement habitat east of Raceland and the existing gravel pit, partially in the area of the building plan and partially outside it (encroaching upon other farm lands); gravel pits will be constructed with the extraction of gravel down to the depth of 142 m a.s.l.; inundation with groundwater with the surface 146.50 m a.s.l. is planned. The edges of entrenchments on the circumference of the water

[18] Title of the Articles: Replacement habitats, quiet areas and other habitats

surfaces of the gravel pit will be constructed in such a way that the upper part of the banks will be implemented with the rounding off and continuous transition to the overgrown terrain[19].

Angling in the area of Stari Grad gravel pit is prohibited, the same as stocking of fish[20].

Along the entire northern bank of the gravel pit, a breeding wall for Sand Martins *(Ripaira ripaira)* is to be constructed, possibly also for Bee-eaters *(Merops apiaste*r) and Kingfishers *(Alcedo atthis)*. Annual monitoring of Sand Martins and other endangered bird species is to be implemented, too. The wall should be more or less horizontal and at least 2 metres high. If it is to be constructed near the existing Sand Martins' colony, necessary works cannot be carried out between 20 April and 30 August. The breeding wall is to be left bare and its yearly maintenance provided for. If the wall's inclination changes owing to the crumbling and falling sand, the original inclination is to be reinstated. Protective buoys are to be set 15 metres from the Sand Martins' breeding wall, in order to provide for a safe distance of the navigating route from the banks[21].

In the area of Stari Grad gravel pit, annual monitoring of Sand Martins and other endangered bird species is to be implemented. This has been entrusted to the company Pagrat[22].

Annual monitoring of species in SH1 and SH2 is carried out by the investor. The following species are to be monitored: Ferruginous Duck *(Aythya nyroca)*, Red-crested Pochard *(Netta rufina)*, Common Sandpiper *(Actitis hypoleucos)*, Night Heron *(Nycticorax nycticorax),* Eurasian Otter *(Lutra lutra),* European Pond Terrapin *(Emys orbicularis),* amphibians and dragonflies[23].

[19] See p. 36, MKGP (2014) Environmental Protection Consent, Ljubljana, http://www.arso.gov.si/novice/datoteke/031637-Okoljevarstveno%20soglasje%20HE%20Bre%c5%beice.pdf

[20] See p. 22, Programme of the implementation of the facilities of water, national and local infrastructure and the facilities of water and energy infrastructure in indivisible relationship for the construction of Brežice HE Power Plant, 2013. Prepared by Infra d.o.o. and Hidroelektrarne na Spodnji Savi d.o.o. http://www.mop.gov.si/fileadmin/mop.gov.si/pageuploads/pomembni_dokumenti/program_izvedbe_he_brezice_novelacija1.pdf

[21] See p. 22, Programme of the implementation of the facilities of water, national and local infrastructure and the facilities of water and energy infrastructure in indivisible relationship for the construction of Brežice HE Power Plant, 2013. Prepared by Infra d.o.o. and Hidroelektrarne na Spodnji Savi d.o.o. http://www.mop.gov.si/fileadmin/mop.gov.si/pageuploads/pomembni_dokumenti/program_izvedbe_he_brezice_novelacija1.pdf

[22] See p. 413, Environmental Report for DNP for the area of Brežice Hydroelectric Power Plant, Geateh d.o.o. Ljubljana, 2011

[23] See p. 413, Environmental Report for DNP for the area of Brežice Hydroelectric Power Plant, Geateh d.o.o. Ljubljana, 2011

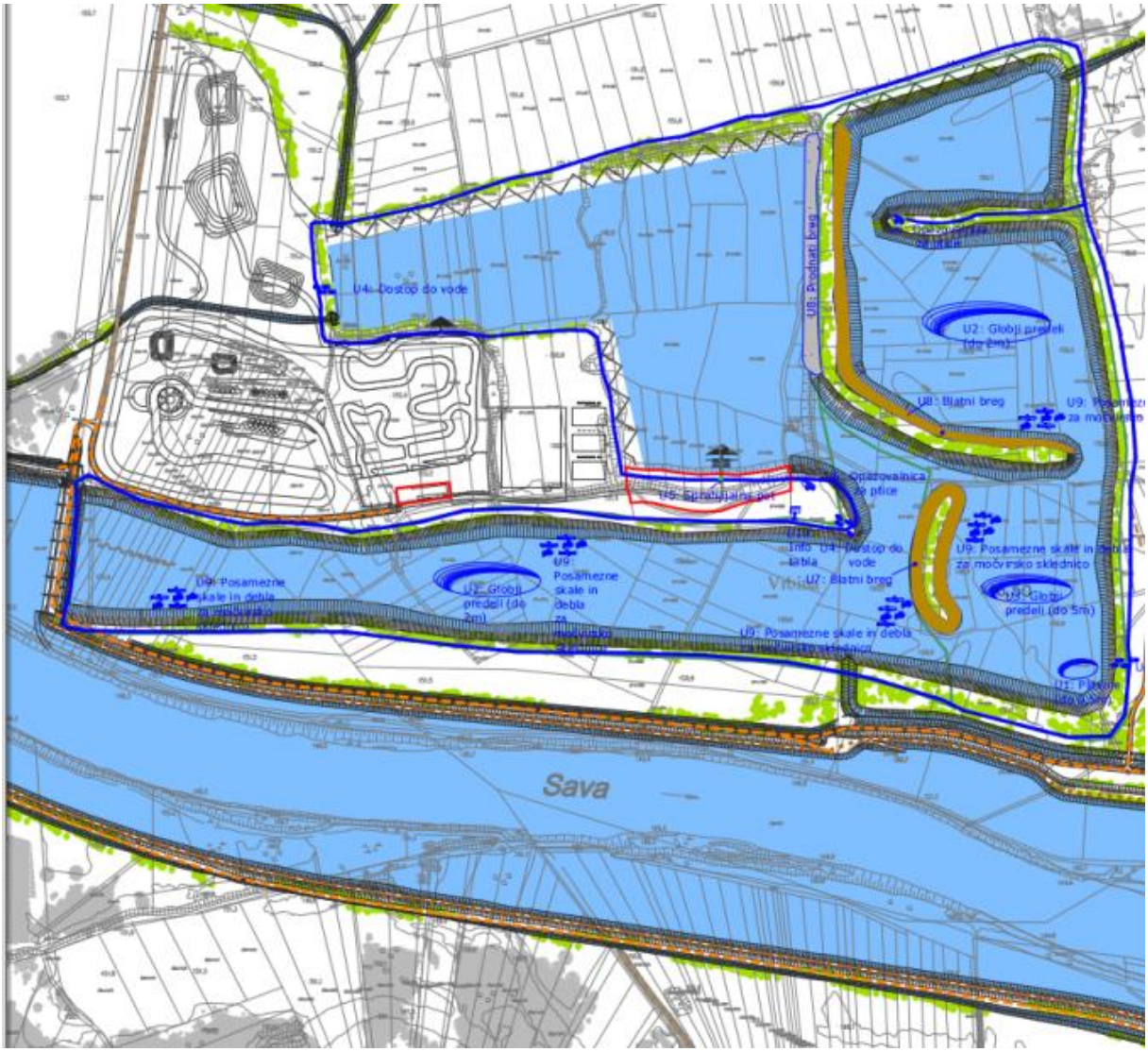

Figure 14: SH1 and SH2 construction plan[24]

Description of the implementation

In the SH2 gravel pit, gravel extraction is taking place, which is the reason why it has still not acquired its planned shape, with the entire area displaying the character of a construction site. Here, gravel is dug intensely. Numerous working machines can be seen here, the frequency of trucks in this area is high. Around the area, large areas of the invasive Goldenrod *(Solidago sp.)* can be noted.

The sand walls for Sand Martins *(Ripaira ripaira)* in the northern part of the gravel pit have not been fully completed and are unmaintained. The edges of pits where gravel is dug already run on the borders of plots, which means that no further adaptations or diggings are possible.

Annual monitoring of Sand Martins *(Ripaira ripaira)* and other endangered bird species is not being implemented. Furthermore, not a single report on the status of this species in this area has been presented or sent by the investor till this day.

[24] Kink, B., Hudoklin A., Danev G. & Rebernik K. (2014). SH implementation projects and other mitigating measures within the scope of the National Spatial Plan for the area of Brežice Hydroelectric Power Plant. PPT presentation.

Figure 13: Intensive gravel extraction in SH2

Figure 14: SH2

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Summary assessment of the suitability of the implementation

The replacement habitat has not been constructed as yet. Gravel extraction continues, monitoring is not carried out.

3.7 SH3 – Forest and dry grasslands

Definition as per Decree

The measure is defined in Article 12(9)[25] of the Decree:

Article 12

(9) Replacement forests and grasslands (SH3) are to be established with such management method that would enable development of habitat characteristic of the extensively farmed grasslands; any other land use is inadmissible. In places foreseen for the establishment of dry grasslands, the upper layer of soil is to be replaced with the turf and underground parts of individual species (e.g. orchids (*Orchidaceae*)) brought from the existing dry grasslands. Measures for the prevention of groundwater rise above 2 metres below the surface of the terrain are to be taken. If necessary, measures for draining the possible water quantities (e.g. drainage channels) that could cause changes in these habitats are also to be taken. Works should not be carried out across dry grasslands in order for their surface area to remain unreduced.

Detailed description of the measure

Replacement habitat SH3 (forest and dry grasslands): on the left bank of the reservoir, downstream from Stari Grad gravel pit along the existing forest area, the existing extensively farmed grasslands and overgrown tracts of land are to be preserved as dry grasslands and forest (app. 10 ha), with initial planting of autochthonous tree species (alders (*Alnus sp.*), Pedunculate Oak *(Quercus robur)*, maples (*Acer sp.*)) and relocation of individual fully grown trees from the area of the planned accumulation. Suitable conditions for the establishment of the water regime in the ground are to be also provided, i.e. of such a kind that will enable survival and development of dry grasslands. If necessary, measures for draining the possible water quantities (e.g. drainage channels) that could cause changes in these habitats are also to be taken[26].

[25] Title of the Article: Replacement habitats, quiet areas and other habitats

[26] See p. 36, MKGP (2014) Environmental Protection Consent, Ljubljana, http://www.arso.gov.si/novice/datoteke/031637-Okoljevarstveno%20soglasje%20HE%20Bre%c5%beice.pdf

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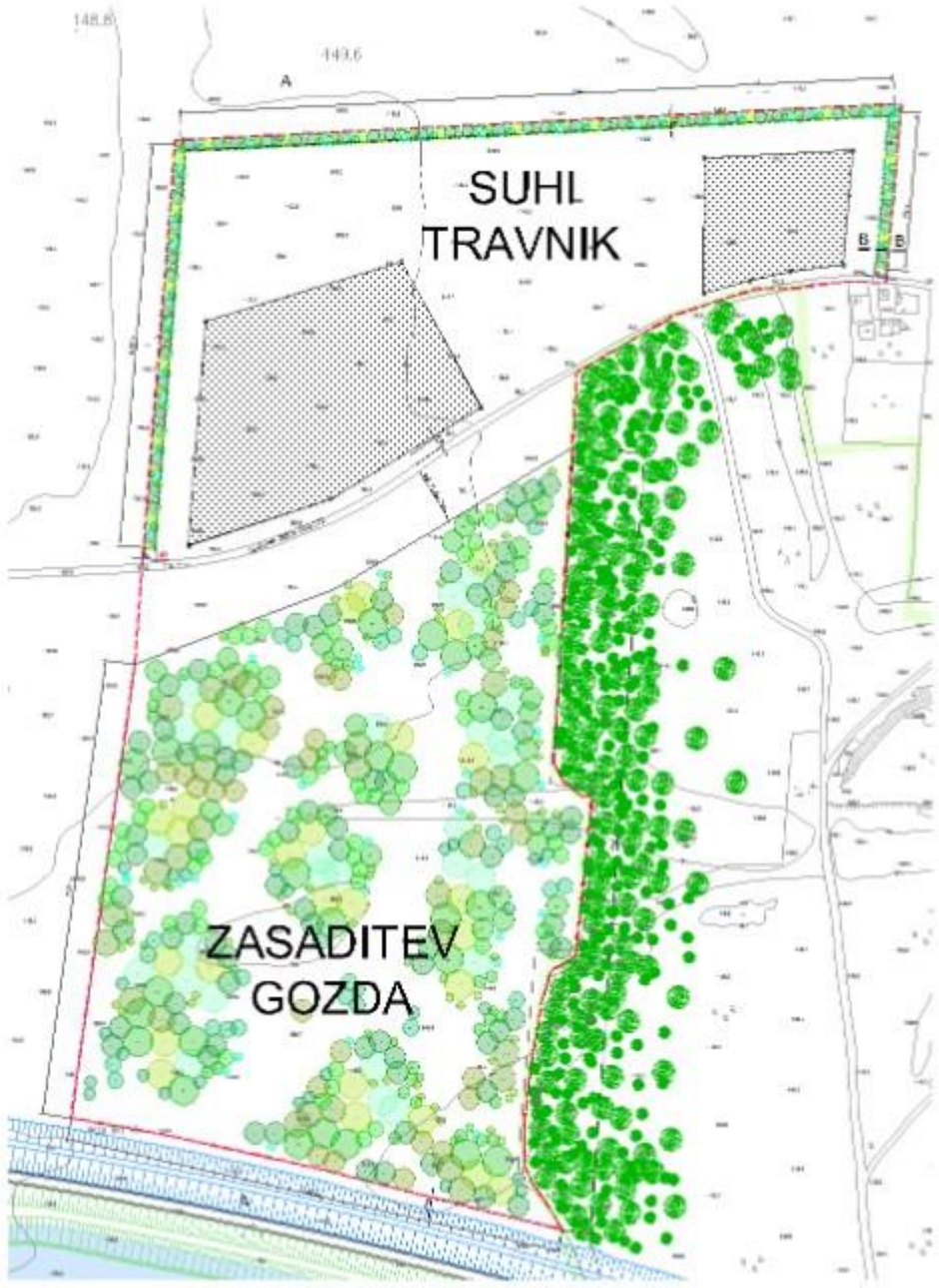

Figure 15: SH3 construction plan[27]

Description of the implementation

The implementation of SH3 was extremely poor, which could actually be perceived already at first sight. The attempt to plant the forest with autochthonous tree species proved to be completely abortive. The same as in other planting attempts, here, too, the majority of plants dried up and did not develop into a forest.

[27] Vanič, N. (2016). Nature-conservancy measures within the framework of Brežice Hydroelectric Power Plant and their implementation. http://slocold.si/prezentacije/Z16_Pred_05_Vanic.pdf

The grassland as a replacement habitat is conventionally intensively farmed. In it, predominantly only the annual Fleabane (*Erigeron annuus*) and the invasive Goldenrod *(Solidago sp.)* are thriving.
There are no data as to the functioning of the water regime. Physically, only a few willows were relocated to the site south of the Močnik stream.

Figure 16: Abortive attempt at tree planting (in the foreground)

Figure 17: Abortive attempt at tree planting (in the foreground)

Figure 18: The area of abortive planting

Figure 19: The area with autochthonous tree planting attempt is already being overgrown by the invasive Goldenrod *(Solidago sp.)*.

Figure 20: Conventional intensively farmed grassland as a replacement habitat

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Figure 21: Conventional intensively farmed grassland as a replacement habitat

Summary assessment of the suitability of the implementation

The works carried out in the forest and dry grassland replacement habitats have not been suitably implemented. The habitats are deteriorating and they do not serve its purpose.

3.8 SH4 – Ponds in the outflowing part of the Struga stream

Definition as per Decree

The measure is defined in Article 12(7)[28] of the Decree:

Article 12

(7) The replacement habitat SH4 is to be established on the left bank, just below the dam structure, partially as shallow water surfaces and partially as deepening in the terrain with the surface of groundwater immediately under the surface of the terrain, with initial planting of hygrophilous plant species.

[28] Title of the Article: Replacement habitats, quiet areas and other habitats

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Detailed description of the measure

SH4 replacement habitat (ponds at the outflowing part of the Struga stream): wetland with small ponds (around 0.5 ha) is to be established, also as habitats for amphibians. Sealing of the ponds will be executed with bentonite foil. Inflow of minor quantities of water from the fish pass or the Močnik stream (few litres/s) will be also provided in order to secure constant water in the ponds and to prevent them from drying[29].

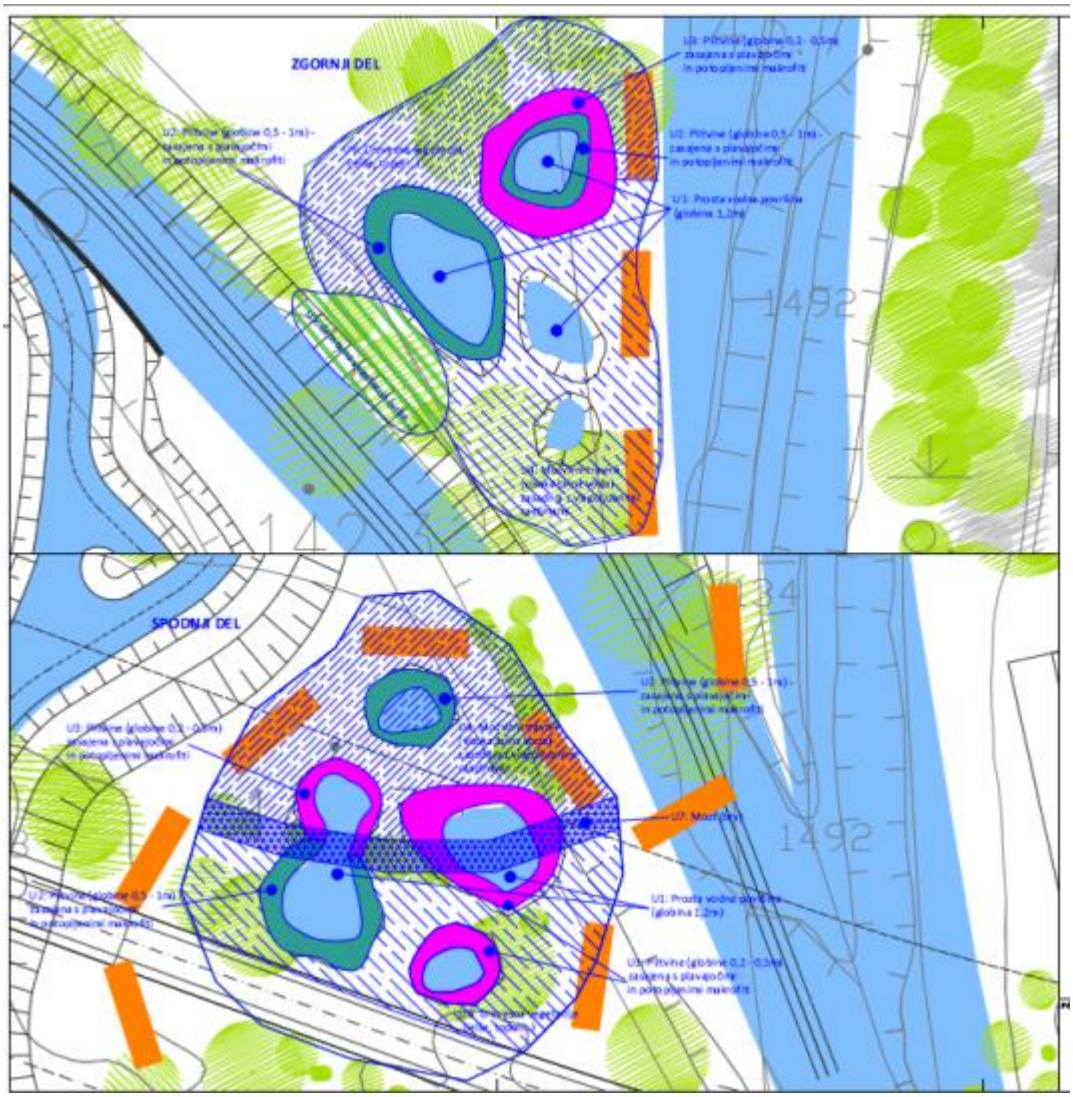

Figure 22: SH4 construction plan[30]

[29] See p. 36, MKGP (2014) Environmental Protection Consent, Ljubljana, http://www.arso.gov.si/novice/datoteke/031637-Okoljevarstveno%20soglasje%20HE%20Bre%c5%beice.pdf

[30] Kink, B., Hudoklin A., Danev G. & Rebernik K. (2014). See p. 36, MKGP (2014) SH implementation projects and other mitigating measures within the scope of National Spatial Plan for the area of Brežice Hydroelectric Power Plant. PPT presentation.

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Description of the implementation

Not carried out.

Summary assessment of the suitability of the implementation

SH4 replacement habitat is in the phase of construction. Thus it does not exists or serve the planned purpose for the protection of water dependent plants and animals.

3.9 SH5 – Jevščina gravel pit

Definition as per Decree

The measure is defined in Article 12(3)[31] of the Decree:

Article 12

(3) In order to replace the important habitat types for nature conservation in Vrbina gravel pit as well as in forests and grasslands, which will be permanently lost owing to the construction of the reservoir and sediment dumps, replacement habitats are to be created, with which favourable conditions for the development of natural succession of species will be provided for. Replacement gravel pits (SH1, SH2, SH4 and SH5) are being constructed on approximately 45 ha of water surfaces with groundwater supply, i.e. with gradual extraction of gravel in such a way that as large water surfaces as possible with appropriate banks are acquired in as short time as possible. Autochthonous hydrophilous plants are to be planted, which will trigger natural succession in the shortest possible time at concurrent gravel extraction until the final foreseen limits of each replacement habitat. In the water along the south bank of SH1, along a little peninsula and along the eastern side of the islet between SH1 and SH2, islets are to be made of trunks and rocks, which will be suitable for the European Pond Terrapin *(Emys orbicularis)*. On the western side of the islet between SH1 and SH2, habitat suitable for the Common Sandpiper (*Actitis hypoleucos)* is to be established; sand banks are to be built with a gentle slope of 1:5 with continuous transition to the natural bank. At least a third of the newly constructed banks of SH2 are to be made in the upper dry part with a slope of 1:5 and continuous transition to the natural bank.

Detailed description of the measure

SH5 replacement habitat (Jevščina gravel pit – on the right bank): a gravel pit (around 5 ha) will be established with extraction of gravel down to the depth of ca. 140 m a.s.l. Inundation with groundwater with the surface at 144.30 m a.s.l. is planned as well as formation of the pit's walls with the greatest possible slope enabled by the material. The edges of entrenchments on the circumference of water surfaces of the gravel pit will be constructed in such a way that the upper part of the banks will be implemented with the rounding off and continuous transition to the overgrown terrain[32].

[31] Title of the Article: Replacement habitats, quiet areas and other habitats

[32] See p. 36, MKGP (2014) Environmental Protection Consent, Ljubljana, http://www.arso.gov.si/novice/datoteke/031637-Okoljevarstveno%20soglasje%20HE%20Bre%c5%beice.pdf

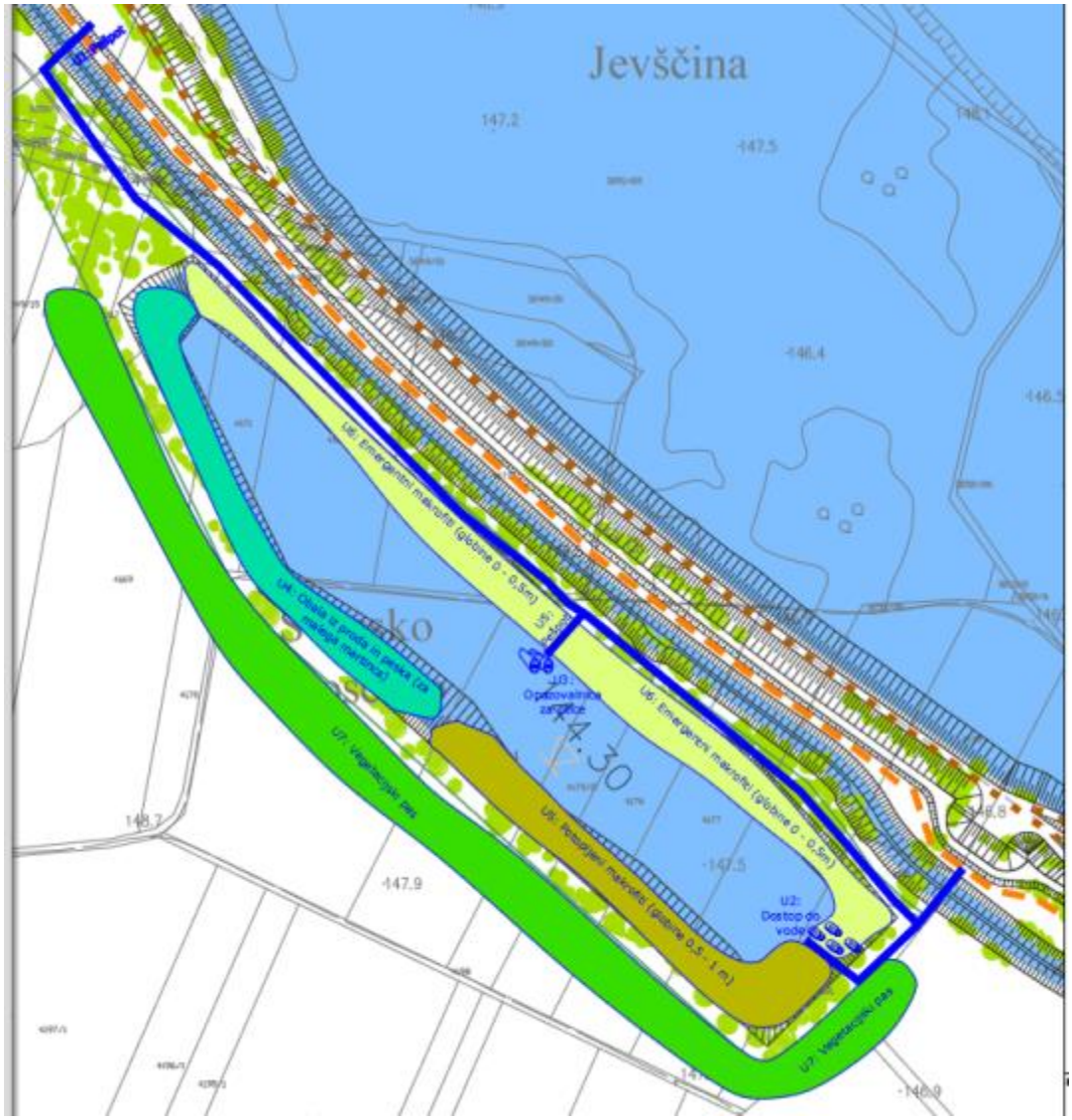

Figure 23: SH construction plan[33]

Description of the implementation

In the gravel pit, a bird watching platform has been constructed for visitors. The platform, however, has no special function, considering that there are no other screens all around the gravel pit that would prevent interferences between visitors and animals. The walls and banks in the pit are in a total mess, demolished and overgrown. Planting of trees has not been implemented either, and there is a vegetation belt missing. The walls should be regularly (annually) renewed and cleaned, or they will become overgrown or will collapse due to their crumbling itself.

[33] Kink, B., Hudoklin A., Danev G. & Rebernik K. (2014). Kink, B., Hudoklin A., Danev G. & Rebernik K. (2014). See p. 36, MKGP (2014) SH implementation projects and other mitigating measures within the scope of National Spatial Plan for the area of Brežice Hydroelectric Power Plant. PPT presentation.

Figure 24: SH5 Jevščina gravel pit

Figure 25: Ruined and overgrown banks of Jevščina gravel pit

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Figure 26: Bird watching platform and overgrown banks at Jevščina gravel pit

Summary assessment of the suitability of the implementation

SH5 replacement habitat has been poorly implemented, there is a vegetation belt missing, and the walls are crumbling. The habitats are deteriorating and they do not serve its purpose for nature protection.

3.10 SH6 – Replacement habitat for the European Pond Terrapin

Definition as per Decree

The measure is defined in Article 12(8)[34] of the Decree:

Article 12

(8) Replacement habitat Mlake for the European Pond Terrapin *(Emys oribcularis)* (SH6) is to be constructed at the site of existing ponds, which are to be sanitized. At the same time, places for egg laying are to be created.

[34] Title of the Article: Replacement habitats, quiet areas and other habitats

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Detailed description of the measure

In the area of SH6, islets with dry trees are to be constructed for the European Pond Terrapin *(Emys orbicularis)* as its sunbathing sites. Places for egg laying are to be adapted as well[35].

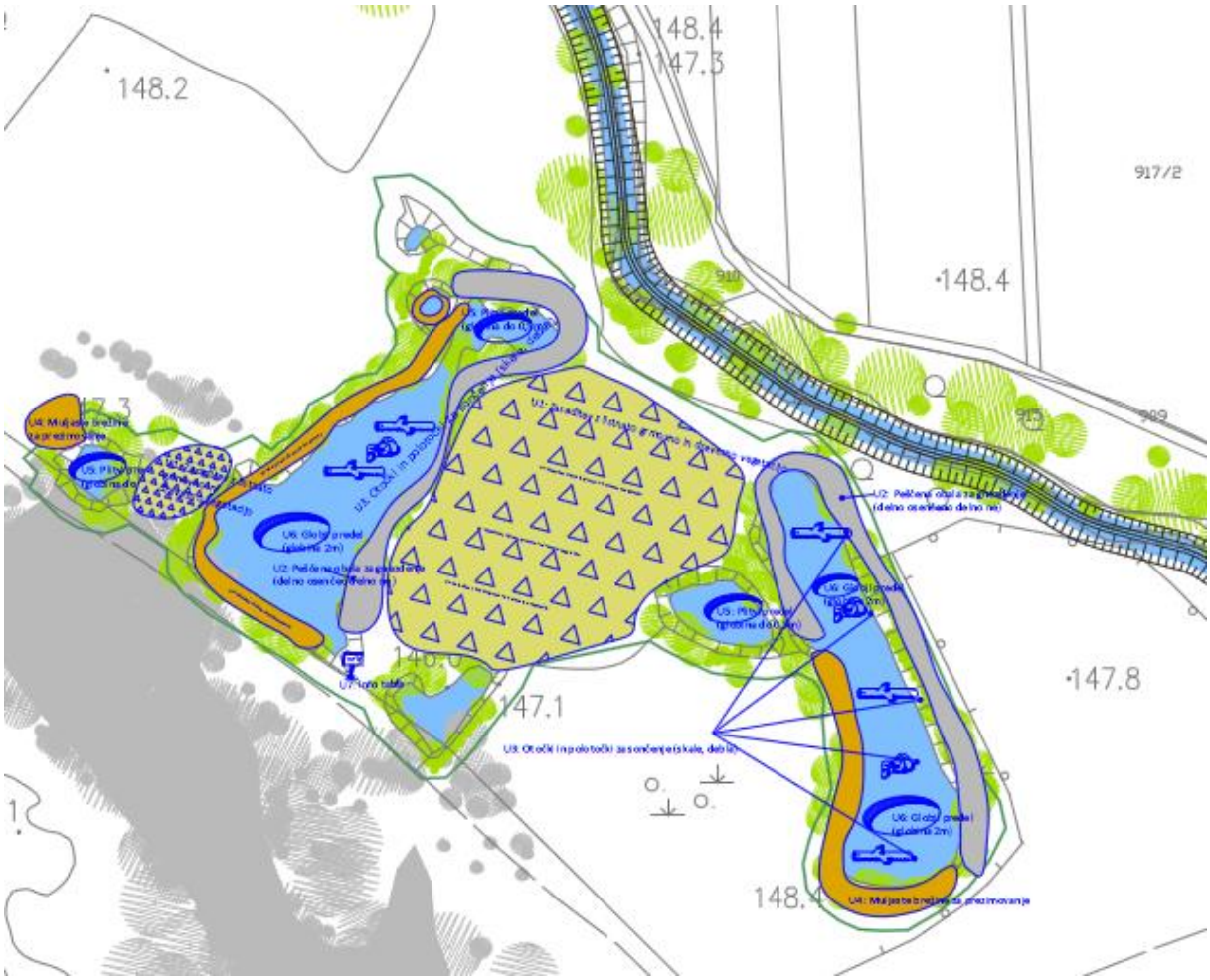

Figure 27: SH6 constriction plan[36]

Description of the implementation

The replacement habitat was implemented, but has not been maintained. The habitat is being increasingly covered with herbage, which includes the invasive Goldenrod *(Solidago sp.)*. If overgrowing continues, the habitat will no longer be suitable for the European Pond Terrapin (*Emys orbicularis*). In SH5, traces of the Beaver *(Castor fiber)* have been noted. Only monitoring would show whether the Terrapin's relocation to SH6 was successful.

[35] See p. 36, MKGP (2014) Environmental Protection Consent, Ljubljana, http://www.arso.gov.si/novice/datoteke/031637-Okoljevarstveno%20soglasje%20HE%20Bre%c5%beice.pdf

[36] Kink, B., Hudoklin A., Danev G. & Rebernik K. (2014). SH implementation projects and other mitigating measures within the scope of National Spatial Plan for the area of Brežice Hydroelectric Power Plant. PPT presentation.

Figure28: Beaver's *(Castor fiber)* traces in SH5

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Summary assessment of the suitability of the implementation

The replacement habitat has been established, but is losing functionality owing to its non-maintenance.

3.11 Shoals with reed beds

Definition as per Decree

The measure is defined in Article 12(11)[37] of the Decree:

Article 12

(11) Shoals with reed beds are to be implemented in the pool along the right bank, roughly between km 744-330 and km 745-130, and along the left bank between km 745-120 and km 745-640. Partially, they are to be planted with shrubs, to enable Common Sandpiper *(Actitis hypoleucos)* to breed.

Detailed description of the measure

It has been estimated that Common Sandpipers *(Actitis hypoleucos)* and Kingfishers *(Alcedo atthis)* will be totally banished from the area owing to the works carried out on the river banks. The latter are used by both species as breeding sites; the Kingfisher *(Alcedo atthis)* requires steep, sandy, eroded walls and overgrown banks continuing down to the river. All breeding sites in the area will be submersed or physically destroyed (direct permanent impacts) [38].

Breeding sites for the Common Sandpiper *(Actitis hypoleucos)* are to be set up in the reed belt area, where gravel should be tipped in the belt of fluctuating water and various autochthonous shrub species planted (Hazelnut *(Corylus avellana)*, Cornelian Cherry *(Cornus mas),* Common Dogwood *(Cornus sanguinea*), Hawthorn *(Crataegus),* Viburnum *(Viburnum), Viburnum lantana, Euonymus*)[39].

[37] Title of the Article: Replacement habitats, quiet areas and other habitats

[38] See p. 55, MKGP (2014) Environmetal Protection Concent, Ljubljana, http://www.arso.gov.si/novice/datoteke/031637-Okoljevarstveno%20soglasje%20HE%20Bre%c5%beice.pdf

[39] See p. 55, MKGP (2014) Environmetal Protection Concent, Ljubljana, http://www.arso.gov.si/novice/datoteke/031637-Okoljevarstveno%20soglasje%20HE%20Bre%c5%beice.pdf

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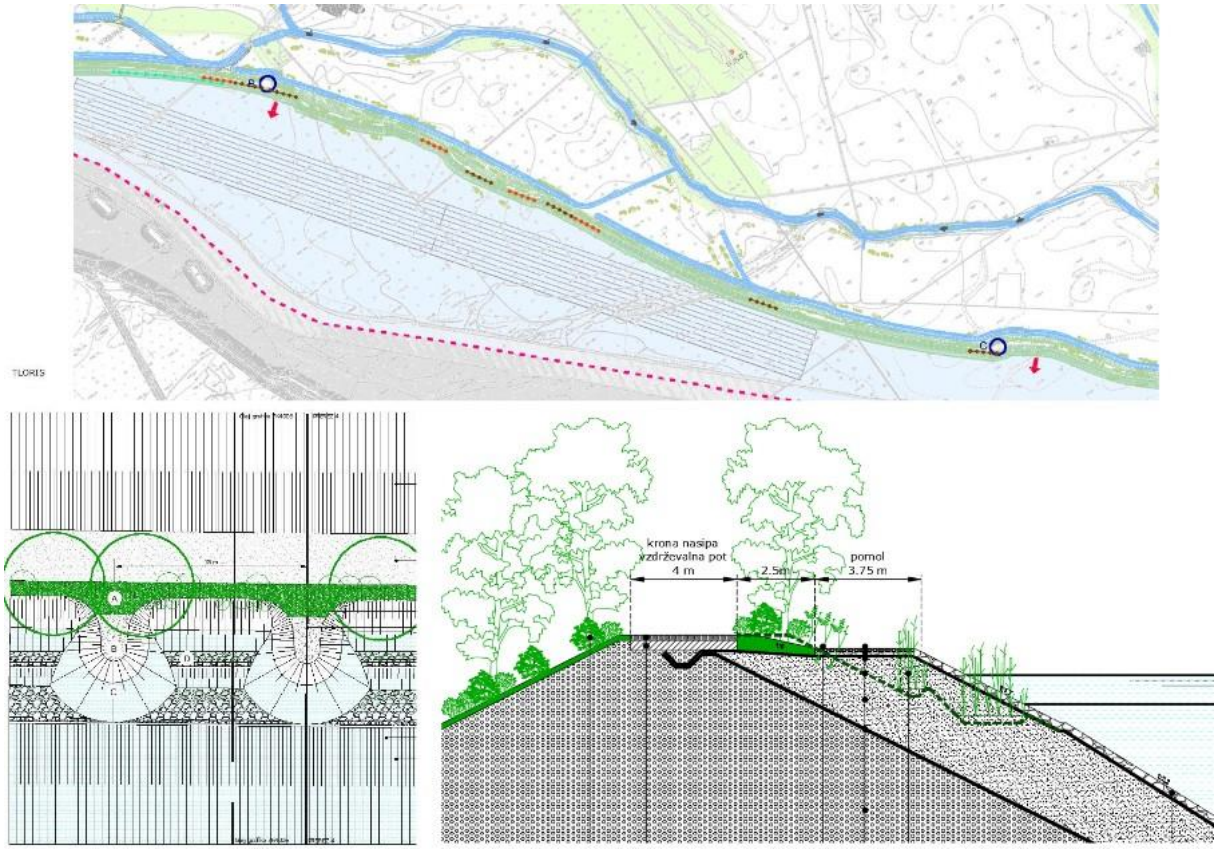

Figure 29: The area of reed beds and their construction plan[40]

[40] Vanič, N. (2016). Nature-conservancy measures within the framework of Brežice Hydroelectric Power Plant and their implementation. http://slocold.si/prezentacije/Z16_Pred_05_Vanic.pdf

Ploj, A. (2018): Brežice Hydroelectric Power Plant – promises and reality. A review of the implementation of the promised replacement habitats and mitigating measures

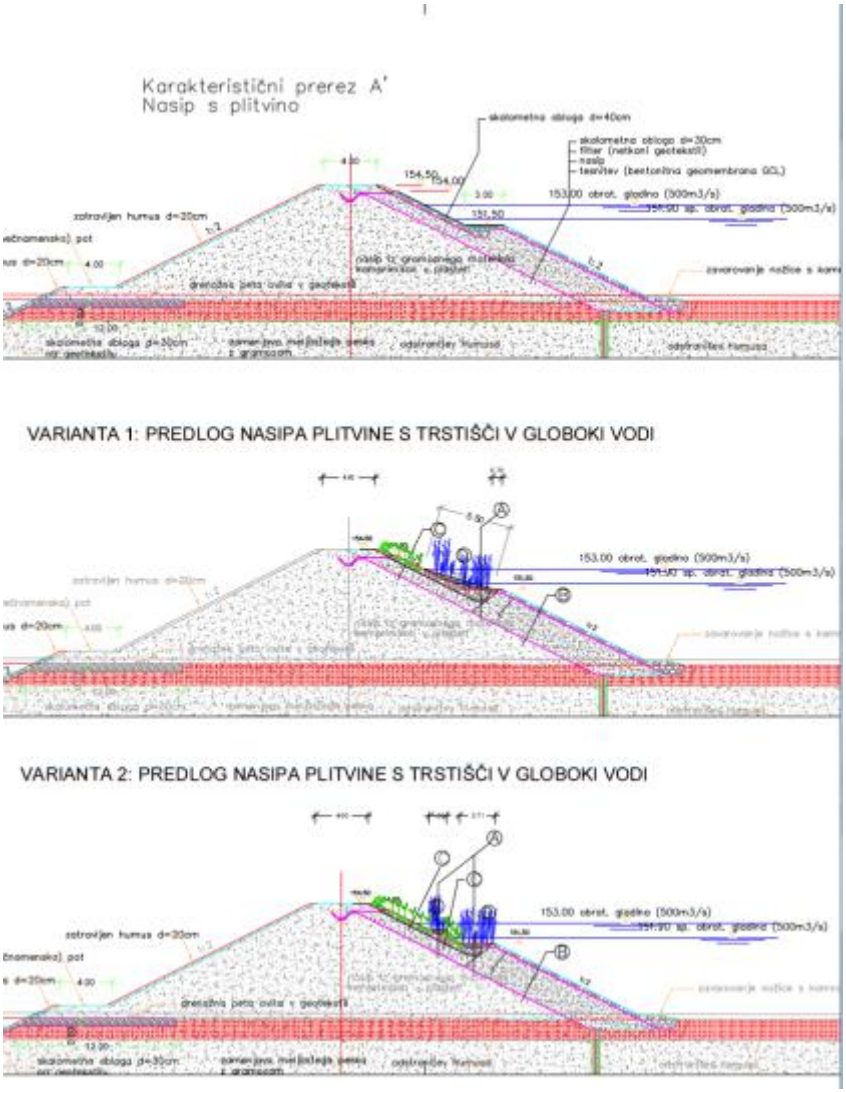

Figure 30: Proposal for the Setting-up of the right part of the banks[41]

Description of the implementation

The shoals along the right bank have been implemented, but not in a suitable way. Reed beds are missing, and no shrubs have been planted. Dunes are in early succession stage and are overgrown with Fleabane (*Erigeron annuus*). As no autochthonous species have been planted here, the place has given way to the expansion of invasive species.

[41] Kink, B., Hudoklin A., Danev G. & Rebernik K. (2014). SH implementation projects and other mitigating measures within the scope of National Spatial Plan for the area of Brežice Hydroelectric Power Plant. PPT presentation.

Figure 31: Breeding sites for the Common Sandpiper (*Actitis hypoleucos*) have not been planted with reeds and autochthonous shrub species.

Figure 32: Breeding sites for the Common Sandpiper (*Actitis hypoleucos*) have not been planted with reeds and autochthonous shrub species and are being overgrown by nonindigenous invasive species.

Ploj, A. (2018): Brežice Hydroelectric Power Plant – promises and reality. A review of the implementation of the promised replacement habitats and mitigating measures

Summary assessment of the suitability of the implementation

Shoals have been implemented, but are inadequate for the planned purpose. Furthermore, no planting and maintenance has been carried out. As a result, habitats do not serve its purpose for nature protection.

3.12 Construction of sandbanks to be utilized by Kingfishers

Definition as per Decree

The measure is defined in Article 12(12)[42] of the Decree:

Article 12

(12) At least ten sites in the widened parts of the embankments, sandbanks are to be constructed from alternating layers of sand and silt with an almost vertical bank on the water-side for the Kingfisher (*Alcedo atthis)* to breed there.

Detailed description of the measure

Natural breeding banks in which Kingfisher *(Alcedo atthis)* breeds are usually at least 1 metre high, at least 3 metres long and not more than 1 metre away from the water. Furthermore, they have to be deep enough, given that these birds dig their breeding holes more than half a metre deep. They are particularly fond of well beaten sand or clay banks with particles of about 1 mm in them. Kingfishers usually breed along larger rivers, occasionally along standing waters as well. The sites for replacement habitats are therefore to be looked for on the banks of the Sava River and along gravel pits. Owing to the works being carried out at a quite long stretch of the Sava, it is estimated that at least ten artificial banks imitating natural breeding walls should be made. In the planning of replacement nest sites (reconstruction of natural banks is also possible), an ornithologist must obligatorily take part[43].

[42] Title of the Article: Replacement habitats, quiet areas and other habitats

[43] See p. 302, Environmetal report for the National Spatial Plan for the area of Brežice Hdroelectric Power Plant, Geateh d.o.o. Ljubljana, 2011

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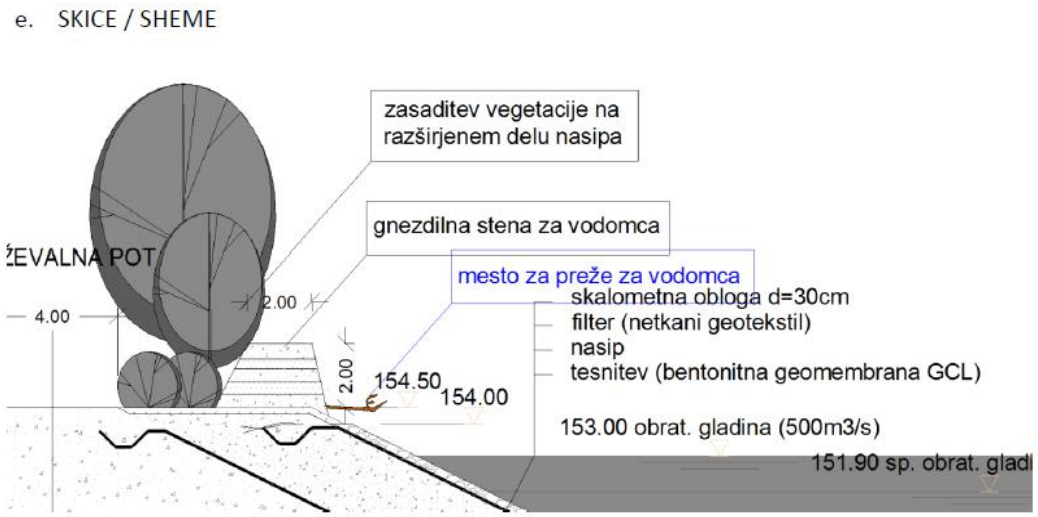

Figure 33: Kingfisher's breeding wall construction plan[44]

Description of the implementation

The banks intended for Kingfishers (*Alcedo atthis*) have been implemented, although not in a way as planned. Only eight of the ten planned breeding banks were constructed, six on the embankment and two on the island. The banks are utterly unsuitable for breeding, as they are too far from the water, built of unsuitable material (with too much gravel) and exuberantly overgrown owing to the lack of their maintenance. The implementation highly deviates from the plan, as perches are also lacking and no shrubs have been planted on the widened part of the embankment. The banks are, in short, completely non-functional and they do not serve its purpose for nature protection.

[44] Kink, B., Hudoklin A., Danev G. & Rebernik K. (2014). SH implementation projects and other mitigating measures within the scope of the National Spatial Plan for the area of Brežice Hydroelectric Power Plant. PPT presentation.

Figure 34: Replacement breeding bank for the Kingfisher (*Alcedo atthis*)

Figure 35: No shrubs have been planted behind the banks.

Figure 36: The banks have been built of unsuitable material.

Figure 37: The banks are not maintained and are, in turn, covered by overgrowth.

Ploj, A. (2018): Brežice Hydroelectric Power Plant – promises and reality. A review of the implementation of the promised replacement habitats and mitigating measures

Summary assessment of the suitability of the implementation

The measure has indeed been implemented, although totally inappropriately and is utterly non-functional.

3.13 Floating islands for terns and island as a bird habitat

Definition as per Decree

The measure is defined in Article 12(13)[45] of the Decree:

Article 12

(13) The floating islands, intended for breeding terns, are to be implemented as rafts fixed to the bank or to the bottom of the reservoir. The island as a habitat for birds is to be constructed in the reservoir close to the newly reconstructed bank; gently sloping banks of the island are to be made, but no fences are allowed on the island itself.

Detailed description of the measure

Approximately in the middle of the accumulation reservoir, an island that is to serve as a habitat for birds is to be constructed at the existing right bank. The island is also to direct part of the water flow during high waters towards the convex bank of the pool, to prevent creation of possible return currents in this area of the pool. The island is to be implemented using the material dug in the area of the pool, where deepening of the bottom is envisaged. The island's banks are to be protected against erosion by considering the same principles of protection as for the reservoir's banks. The island is expected to cover ca. 0.5 ha[46].

The island in the accumulation is to be constructed in such a way that will also be suitable as a rest area for wild animals crossing the accumulation (the shore should be gently sloping, the island is not to be fenced). In the implementation of this measure, an expert biologist is to take part (condition 2.7.23 Item 2 of the Environmental Protection Consent)[47].

The floating islands, intended for breeding terns, are to be implemented as rafts fixed to the bank or to the bottom of the reservoir. The island as a habitat for birds is to be constructed in the reservoir close to the newly reconstructed bank; gently sloping banks of the island are to be made, but no fences are allowed on the island itself[48].

[45] Title of the Article: Replacement habitats, quiet areas and other habitats

[46] See p. 30, MKGP (2014) Environmental Protection Consent, Ljubljana, http://www.arso.gov.si/novice/datoteke/031637-Okoljevarstveno%20soglasje%20HE%20Bre%c5%beice.pdf

[47] See p. 55, MKGP (2014) Environmental Protection Consent, Ljubljana, http://www.arso.gov.si/novice/datoteke/031637-Okoljevarstveno%20soglasje%20HE%20Bre%c5%beice.pdf

[48] See p. 45, Programme of the implementation of the water, national and local infrastructure and facilities of the water and energy infrastructure in indivisible relationship for the construction of Brežice Hydroelectric Power Plant, 2013. Prepared by Infra d.o.o. and Hydroelectric Power Plants on the Lower Sava d.o.o.

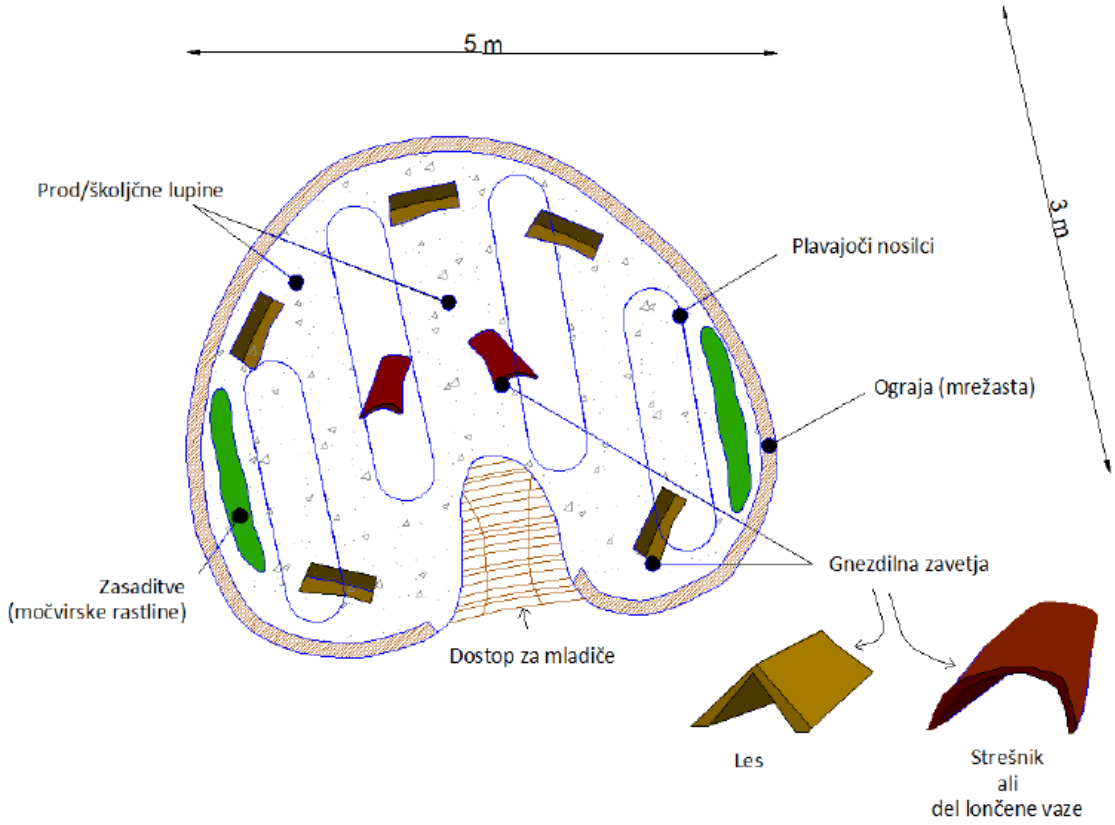

Figure 38: Breeding rafts construction plan[49]

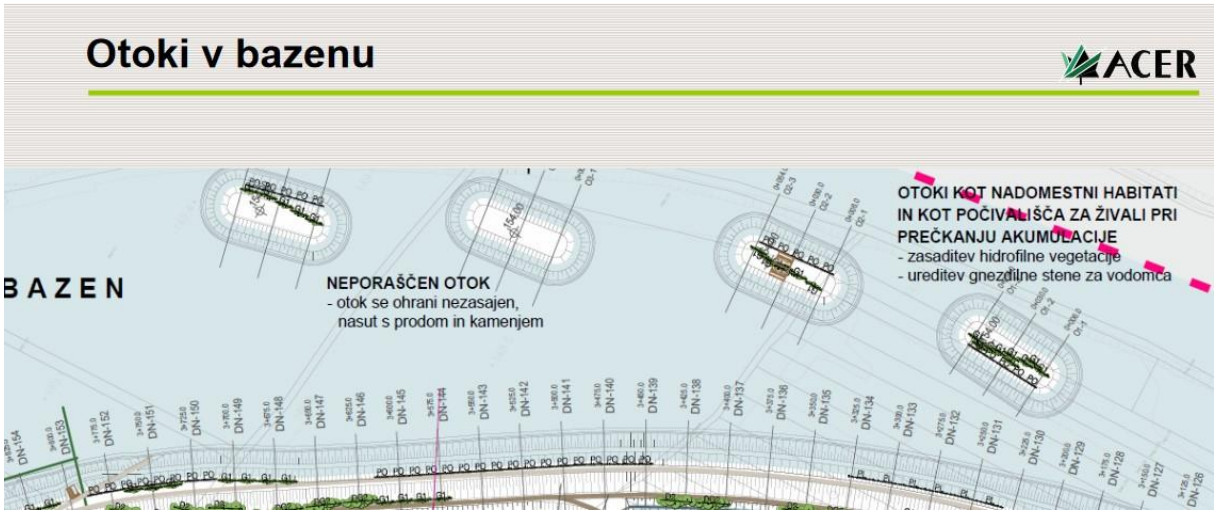

Figure 39: Construction plan for the islands[50]

http://www.mop.gov.si/fileadmin/mop.gov.si/pageuploads/pomembni_dokumenti/program_izvedbe_he_brezice_novelacija1.pdf

[49] Kink, B., Hudoklin A., Danev G. & Rebernik K. (2014). SH implementation projects and other mitigating measures within the scope of the National Spatial Plan for the area of Brežice Hydroelectric Power Plant. PPT presentation.
[50] Hudoklin, J., 2016. Landscape architectural treatments on the nright bank of the pool of Brežice Hydroelectric Power plant. http://www.slocold.si/prezentacije/Z16_Pred_04_Hudoklin.pdf

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Description of the implementation

Within the framework of constructing floating islands for the breeding terns, 3 floating rafts were constructed. They are functionally placed, but will sooner or later become overgrown if not maintained – particularly if overgrowth is not removed. From the reservoir bank, plants overgrowing the floating rafts can already be seen. If they get completely overgrown, they will become unsuitable for the breeding terns. Although the rafts were suitably implemented, not a single pair of Common Tern *(Sterna hirundo)* has bred on the rafts this year (2018). As the reasons for such state of affairs are not known, they should be identified as soon as possible and the rafts made functional.

Three islands as wildlife resting areas and one island as a breeding site for terns were also built. Common Terns require clean and herbage-free sites for breeding. As the island for the terns is not maintained, it has already become overgrown (by the invasive Goldenrod (*Solidago sp.*), willows etc.) and will be almost completely unsuitable for the breeding terns in the ensuing breeding season. The banks of all four islands were implemented without gentle slopes as they should be. They are covered by large stones and thus hardly passable for animals. Access to the islands should be implicitly limited, considering that people (anglers, hunters, strollers, boatmen etc.) are regularly visiting them and disturbing birds and other animals on the islands. As terns require peace and quiet in the breeding season, a quiet no-go zone should be urgently reinstated in the vicinity of the islands and breeding rafts.

In direct vicinity of the islands (on the southern side of the right embankment), a motocross course has been built, which certainly has no positive effect on the breeding birds nearby. On the motocross course itself, a few pairs of Bee-eater *(Merops apiaster)* and Sand Martin *(Ripaira ripaira)* bred last year; their nests, however, were destroyed or went to ruin.

The Programme of the implementation of the water, national and local infrastructure and facilities of the water and energy infrastructure in indivisible relationship for the construction[51] clearly states that replacement habitats, rafts and other facilities for the breeding of birds as well as shoals in the pool should be regularly maintained in order to preserve favourable conservation status of species. Any changes as far as maintenance of these facilities is concerned are admissible only on the basis of monitoring results and previous compliance with authorized nature conservation service.

[51] Programme of the implementation of the water, national and local infrastructure and facilities of the water and energy infrastructure in indivisible relationship for the construction of Brežice Hydroelectric Power Plant, 2013. Prepared by Infra d.o.o. and Hidroelektrarne na Spodnji Savi d.o.o.

Figure 40: On the rafts, first signs of overgrowth can already be seen.

Figure 41: On the rafts, first signs of overgrowth can already be seen.

Figure 42: For breeding terns, 3 floating rafts were constructed

Figure 43: The islands intended for resting and breeding of birds and wildlife

Figure 44: The island intended for breeding of terns

Figure 45: Overgrowth on the island intended for breeding of terns

Ploj, A. (2018): Brežice Hydroelectric Power Plant – promises and reality. A review of the implementation of the promised replacement habitats and mitigating measures

Figure 46: Overgrowth on the island intended for breeding of terns

Summary assessment of the suitability of the measure

The islands and rafts were constructed, but the latter turned out to be completely non-functional. This year (2018) all terns bred on the island. Regular maintenance is required as well as establishment of no-go zone that would prevent disturbance by the other users.

3.14 Drainage channels on the right bank

Definition as per Decree

The measure is defined in Article 12(14)[52] of the Decree:

Article 12

(14) Approximately 3.5 km long drainage channel is to be constructed along the right bank in sustainable manner to ensure suitable living conditions for rheophilic fish species. In the planning of the channel, the area of dry grasslands is to be left untouched. The drainage channel is to be of such dimensions that will convey 0.8 m^3/s of water during medium groundwater influx at its discharge into the Sava River. The bottom of the drainage channel is to be constructed with general inclination of 0.05-0.12%. Rapids with the depth of flow from 0.2 to 0.5 m and with the flow speed of up to 1m/s will be made, as well as pools with the depth of flow from 0.25 to 1.00 m. To this, the width and inclinations

[52] Title of the Article: Surroigate habitats, quiet areas and other habitats

of the channel floor are to be adapted. The sustainably made drainage channel is to be built parallel to other parts in order to function immediately upon the filling of the accumulation. Until the report on the impacts on the environment is made, expertise for a more detailed construction of this channel is to be provided.

Detailed description of the measure

The measure is described in the above Article.

Description of the implementation

The drainage channel has already been constructed, but it is still to be established as a fish habitat, because its current functioning and flow rate are not suitable for the rheophilic fish species. A quick survey in the field has shown that the water in the channel is probably too cold for fish (although this was not specified in the Decree). To prove the functionality of the channel, fish monitoring should be carried out and analysis of physical-chemical parameters of water made. Trees and shrubs are still to be planted there.

Figure 49: The drainage channel on the right bank has not been constructed sustainably as habitat for rheophilic fish species.

Ploj, A. (2018): Brežice Hydroelectric Power Plant – promises and reality. A review of the implementation of the promised replacement habitats and mitigating measures

Figure 47: The drainage channel on the right bank has not been constructed sustainably as habitat for rheophilic fish species.

Summary assessment of the suitability of the measure

The drainage channel has already been constructed, but not in the way to serve as habitat for rheophilic fish species. Thus it does not fit the planned purpose for the protection of endangered fish species.

3.15 Setting-up of bat boxes

Definition as per Decree

The measure is defined in Article 12(16)[53] of the Decree:

Article 12

(16) Bat boxes are to be set up, the detailed locations of which are to be stipulated in project documentation for the acquisition of the building permit.

[53] Title of the Article: Replacement habitats, quiet areas and other habitats

Ploj, A. (2018): Brežice Hydroelectric Power Plant – promises and reality. A review of the implementation of the promised replacement habitats and mitigating measures

Detailed description of the measure

Cracks and crevices in trees are key shelters for numerous endangered or vulnerable bat species. Apart from setting-up of bat boxes, fallen trees with cavities can be relocated to different locations, thus enabling the cavities to serve their purpose. Their number can be determined upon a previous field visit and inventory of the potential tree cavities in the forests that will be destroyed during construction works[54].

Description of the implementation

70 wooden and 16 concrete bat boxes have been set up in accordance with the plan. To determine their functionality, monitoring of bat box occupancy should be carried out.

Summary assessment of the suitability of the measure

Bat boxes were set up in accordance with the plan. Monitoring of bat box occupancy should be carried out to prove their planned purpose.

3.16 Preservation of part of poplar plantations and eco-cells

Definition as per Decree

The measure is defined in Article 12(17)[55] of the Decree:

Article 12

(17) In the area between SH2 replacement habitat and the town of Brežice, the following is to be preserved for the purpose of conserving biodiversity and protecting valuable natural features: part of poplar plantations and riverine forests as well as the existing and envisaged vegetation along the Močnik and Struga streams in the total area of 101 ha, in order to create a habitat of floodplain softwood forest that would provide for long-term survival of the saproxylic beetle *Cucujus cinnaberinus* population. At least ten evenly distributed 1-2 ha large eco-cells (at least 13% of the entire area of 13.13 ha) are to be determined. In the ensuing ten years, annual monitoring of the beetle's population and reporting on its status is to be implemented in the area of 101 ha.

Detailed description of the measure

In the area of poplar plantations, which are to be transformed into a natural forest with a combination of natural succession and planting of autochthonous and for the site appropriate tree species, the dead and dying trees are to be preserved (willows *(Salix),* poplars *(Populus),* ash trees *(Fraxinus),* oaks

[54] See p. 55, MKGP (2014) Environmental Protection Concent, Ljubljana, http://www.arso.gov.si/novice/datoteke/031637-Okoljevarstveno%20soglasje%20HE%20Bre%c5%beice.pdf

[55] Title of the Article: Replacement habitats, quiet areas and other habitats

(Quercus)) with a minimum diameter of 20 cm and emphasis on trees thicker than 50 cm in order to preserve at least 5% of dead mass relative to the entire growing stock[56].

Description of the implementation

The poplar plantations have been preserved, the eco-cells have been implemented, the monitoring of beetles is in progress. In the eco-cells, 400 trees were implemented.

Summary assessment of the suitability of the measure

The measure has been implemented, the monitoring results are to be examined.

3.17 Elevations along the motorway for the retreat of animals

Definition as per Decree

The measure is defined in Article 12(22)[57] of the Decree:

Article 12

(22) Along the motorway fencing, three ground elevations are to be implemented in about 100 m long and 10 m wide belts above the water surface with the return flood period of 100 years with a very gentle slope, which will enable agricultural use. On the upper part, trees and shrubs are to be planted in order to provide additional terrain for the retreat of animals during floods.

Detailed description of the measure

Along the embankment of the motorway between Skopice and Krška vas, three elevations are to be implemented for animals to retreat during the Sava flooding. The 100 m long and ca. 10 wide elevations (5 m outside the motorway fencing) above the surface of high water with the return flood period of 100 years will be constructed from fertile soil, which will be removed from the area of the HPP Brežice reservoir, or some other suitable material with the slope of 1:10 to enable use of the banks of the elevation for agricultural purposes. On the upper part, trees and shrubs will be planted as animal shelter[58].

[56] See p. 415, Environmental Report for the National Spatial Plan for the area of Brežice HE Plant, Geateh d.o.o. Ljubljana, 2011

[57] Title of the Article: Replacement habitats, quiet areas and other habitats

[58] See p. 36, MKGP (2014) Environmental Protection Consent, Ljubljana, http://www.arso.gov.si/novice/datoteke/031637-Okoljevarstveno%20soglasje%20HE%20Bre%c5%beice.pdf

Ploj, A. (2018): Brežice Hydroelectric Power Plant – promises and reality. A review of the implementation of the promised replacement habitats and mitigating measures

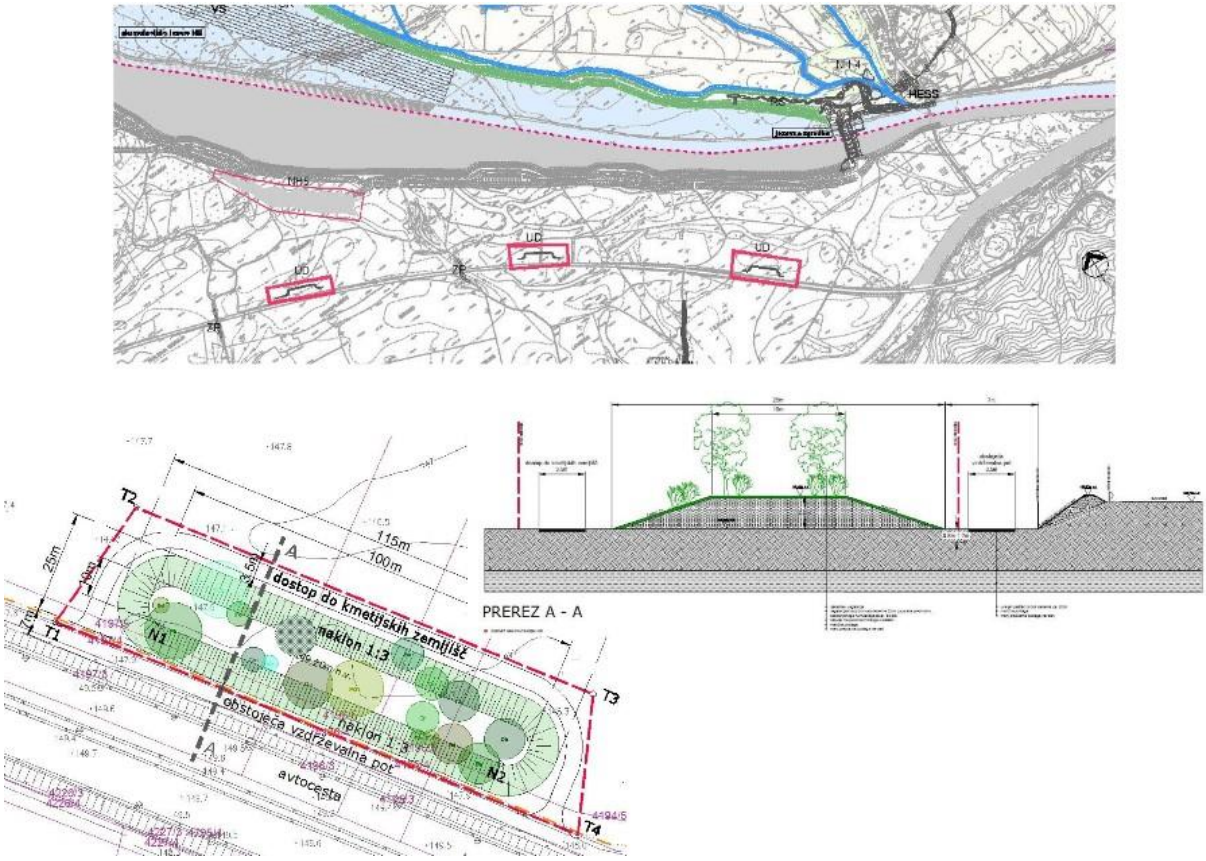

Figure 48: Plan for the construction of elevations for animals to retreat during floods[59]

Description of the implementation

It has been implemented, although not as written in the National Spatial Plan. For further functionality, repeated planting of shrubs and regular mowing is necessary.

Summary assessment of the suitability of the implementation

The measure has been partly implemented. Maintenance needs to be carried out.

3.18 Planting of autochthonous riparian trees and shrubs

Definition as per Decree

The measure is defined in Article 12(20, 21, 22)[60] of the Decree:

Article 12

[59] Vanič, N. (2016). Nature-conservancy measures within the framework of Brežice Hydroelectric Power Plant and their implementation. http://slocold.si/prezentacije/Z16_Pred_05_Vanic.pdf

[60] Title of the Articles: Replacement habitats, quiet areas and other habitats

(20) The widened banks of high water-energy embankments on the water-side are to be implemented on the left and right banks of the reservoir in order to provide for variedness similar to natural one, with different inclinations and continuous transitions into the overgrown terrain, and with installation of stones and rocks of various sizes. On the widened parts of the banks, autochthonous riparian trees and creepers are to be planted.

(21) In the implementation of the pool, the following is to be provided for:

- greening of the upper parts of the consolidated banks with autochthonous vegetation (on the water-side of the embankments: planting of shrubs and creepers in the place of stone coatings, sowing of grass and tree seeds, all this as initial measures that will enable further development of greening of the banks;

- sustainable eco-remediation measures that will include e.g. anti-erosion belt of reed beds, fascines and planting of riparian vegetation on less burdened places as far as erosion is concerned; lateral stone enforcements on the bank of the bed are to be implemented only where urgently needed;

- planting of trees on the banks and at the foot of the embankments along the pool on the air-side of the embankments, along the paths and drainage channels, reconstruction of the uneven stone coatings;

- construction of moorings for breeding rafts as replacement habitats;

- regular maintenance of the planted vegetation to prevent possible damages caused to the coatings.

(22) Along the motorway fencing, three ground elevations are to be implemented in about 100 m long and 10 m wide belts above the water surface with the return flood period of 100 years with a very gentle slope, which will enable agricultural use. On the upper part, trees and shrubs are to be planted in order to provide additional terrain for the retreat of animals during floods.

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Detailed description of the measure

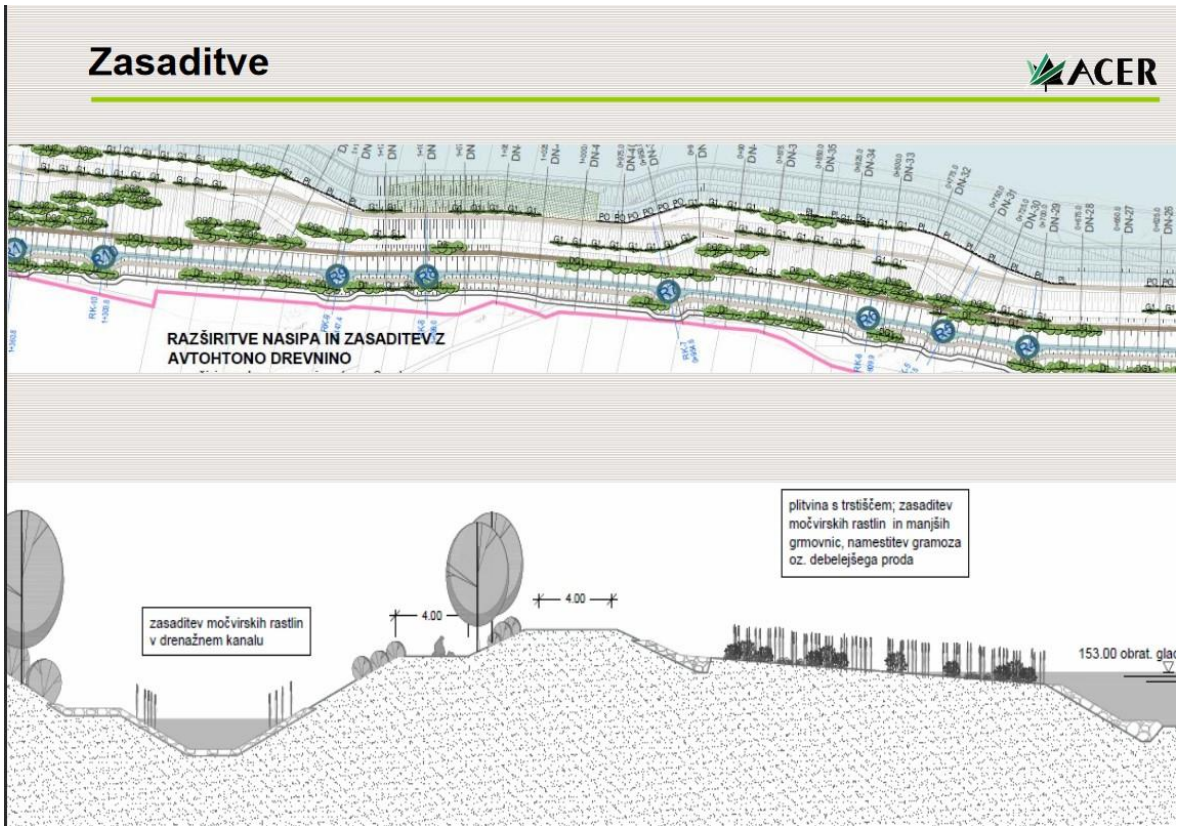

Figure 49: Planting plan[61]

The measure is described in the above Article.

Description of the implementation

The upper parts of the consolidated banks are bare, neither planted with vegetation nor greened with autochthonous plants. The great majority of the planting attempts went to ruin, the plants went dry and died. On the water-side of the flood defence embankment no shrubs and creepers have been planted, the embankments along the water have not been greened, and the entire shore was built from composed stones which, however, is not in accordance with the plan. Anti-erosion belt of reed beds and riparian plants are nowhere to be found. Plantings should implicitly be regularly maintained, considering that in certain places the invasive Goldenrod *(Solidago sp.)* can already be found. The plantations are momentarily non-functional and dead.

[61] Hudoklin, J., 2016. Landscape architectural reconstructions on the right bank of the pool of Brežice Hydroelectric Power plant. http://www.slocold.si/prezentacije/Z16_Pred_04_Hudoklin.pdf

Figure 50: Planting attempt proved to be a complete failure.

Figure 51: Attempt of tree planting at the widened part of the embankment

Figure 52: The majority of plants dried up and died.

Figure 53: The banks are fortified with composed stones and not planted with vegetation; in places, the invasive Goldenrod *(Solidago sp.)* can already be seen.

Figure 54: Greening of the upper parts of consolidated banks with autochthonous plants has not been carried out.

Ploj, A. (2018): Brežice Hydroelectric Power Plant – promises and reality. A review of the implementation of the promised replacement habitats and mitigating measures

Figure 55: The widened parts of the embankment have not been planted with shrubs and trees.

Summary assessment of the suitability of the implementation

Only partially implemented, several plantings are lacking, many plantings went to ruin. New plantings are to be implicitly established anew, also in those parts where nothing was planted at all: on the banks along the water, on the outer parts of the embankments, in reed belts and on ground elevations.

3.19 Regular monitoring of species and habitat types in the area of replacement habitats

Definition as per Decree

The measure is defined in Article 12(24)[62] of the Decree:

Article 12

(24) In the area replacement habitat types, monitoring of the status of species and habitat types is to be regularly carried out.

[62] Title of the Article: Replacement habitats, quiet areas and other habitats

Ploj, A. (2018): Brežice Hydroelectric Power Plant – promises and reality. A review of the implementation of the promised replacement habitats and mitigating measures

Detailed description of the measure

No additional information.

Description of the implementation

It is not known whether annual monitoring is being implemented, however, no report or monitoring results have been received or published to date.

Summary assessment of the suitability of the implementation

It is not known whether the monitoring is carried out.

3.20 Regulation of the Močnik stream

Definition as per Decree

The measure is defined in Article 14(4)[63] of the Decree:

Article 14

(4) For the groundwater drainage purposes, the Močnik stream is also to be regulated. Upstream from the outflowing part, in the approx. 3.7 km long section, it is to be deepened to 1.0 m below the present bottom, i.e. with widening of the stream bed on one side, while one bank and part of the bottom is to be retained in the present state. In the area of the widening, the fifth bank is to be consolidated with composed stones. The new bank is to be covered by fertile soil, grassed over and planted with vegetation.

Detailed description of the measure

The measure is described in the above Articles.

Description of the implementation

The Močnik stream has been regulated, deepened and widened. The works have been implemented, but the area has not been planted with autochthonous vegetation.

Summary assessment of the suitability of the implementation

The Močnik stream has been regulated and completed only from the aspect of construction-economic works, while the environmentally friendly measures have not been implemented at all.

[63] Title of the Article: Necessary treatments for the regulation of groundwater depths and protection from its impacts

Ploj, A. (2018): Brežice Hydroelectric Power Plant – promises and reality. A review of the implementation of the promised replacement habitats and mitigating measures

3.21 Regulation of the outflowing parts of the Sava tributaries

Definition as per Decree

The measure is defined in the Article 15(1,2,4)[64] of the Decree:

Article 15

(1) At the outflowing parts of the Sava's tributaries Žlapovc, Potočnica, Leskovški potok and Močnik, minor works are to be carried out, such as local protection, regulation of the stream's bed and sanitation cutting. The Močnik stream's water is to be enriched through its connection with the drainage channel behind the high water-energy embankment along the pool on the left bank.

(2) In the areas of the Močnik and Struga at Vrbine near Brežice, the streams' beds are to be cleaned and regular maintenance works carried out.

(4) The outflowing parts are to be regulated in such a manner as to enable fish passing from the pool or the Sava to the tributaries, and vice versa. The riparian vegetation is to be preserved as much as possible, while the removed vegetation is to be replaced with autochthonous tree species, where seedlings as big as possible are to be used.

Detailed description of the measure

The measures are described in the above Articles.

Description of the implementation

No details are known as far as the Žlapovc and Potočnica are concerned, whereas the works at the Močnik and Struga streams are still being carried out and have not been completed as yet.

Summary assessment of the implementation

Implementation of the measure is in progress. As to date, planned safe passage for fish from the pool or the Sava to the tributaries is not available or functional.

3.22 Construction of the sandbank to be utilized by Sand Martins

Definition as per Decree

The measure is defined in Article 26(3)[65] of the Decree:

Article 26

(3) On the water surfaces north and east from Raceland, which were created with sanitary works after the completed gravel extraction, quiet recreation activities are to be allowed, such as: rowing,

[64] Title of the Article: Regulation of the outflowing parts of the Sava's tributaries
[65] Title of the Article: Reconstruction of the area of Raceland in the area of Stari Grad gravel pit

windsurfing, kiting, swimming and diving. These activities are permissible between 15 May and 15 October, with organized activities on the water (e.g. competitions and regattas) to be concluded by 18.00 hrs. In the area, no angling and fingerling stocking is allowed. In the area of the gravel pit, no activities that would have negative impacts on biodiversity (particularly in respect of birds) are to be carried out. Within the framework of the Environmental Protection Consent, the acceptability of ski lifts and water skiing surfaces with regard to nature conservation and presence of animal species, for which this activity would be disturbing, is to be determined. If established that that this is possible, suitable location is to be determined on the basis of these assessments. Access to water for boats and bathers is to be provided north of the envisaged tourist facility planned in the area outside the boundaries of the National Spatial Plan. Along the entire north bank of the gravel pit, a breeding wall for Sand Martins *(Riparia riparia)*, perhaps also for Bee-eaters *(Merops apiaster)* and Kingfishers *(Alcedo atthis)*, is to be constructed and annual monitoring of Sand Martins and other endangered bird species carried out. The wall is to be predominantly vertical and at least 2 metres high. If it is to be constructed at the site of the existing Sand Martin colony, the works should not be carried out between 20 April and 30 August. The wall is to be preserved without overgrowth and its annual maintenance to be provided for. If its inclination changes owing to the crumbling and falling sand, the original inclination is to be reinstated. Protective buoys are to be set 15 metres from Sand Martins' breeding wall, in order to provide for a safe distance of the navigating route from the banks.

Detailed description of the measure

The plan proposes that at the upper part of the gravel pit, i.e. on the surface that already exists and is not subject to the replacement habitats within the scope of the National Spatial Plan for HPPP Brežice, a broader recreational use of water is to be allowed: rowing, surfing, water skiing, kiting and bathing (swimming). As in none of the stated recreations motor driven boats are to be allowed, they can be considered quiet recreational activities. For water skiing, electric lift will be used, which would be installed in the bank near the envisaged motel. Access to water for boats and bathers is foreseen north of the motel and Raceland. There will be no access to the banks outside this area. The Pagrat company will construct the wall for Sand Martins on the entire north bank of the gravel pit and take care of its annual maintenance (removal of overgrowth, rebuilding of the wall). Through its maintenance, creation of hiding and dwelling places for the species that could prey on Sand Martins (e.g. foxes, martens, birds of prey) will be prevented[66].

Regular annual maintenance of the wall is necessary, as it is to be retained without overgrowth. If its inclination changes owing to the crumbling and falling sand, the original inclination is to be reinstated[67].

Annual monitoring of Sand Martins and other endangered bird species in the area of Stari Grad is to be implemented by the firm Pagrat[68].

[66] See p. 409, National Spatial Plan for Brežice Hydroelectric Power Plant, Geateh d.o.o. Ljubljana, 2011

[67] See p 410, Environmental Report for the National Spatial Plan for the area of Brežice Hydroelectric Power Plant, Geateh d.o.o. Ljubljana, 2011

[68] See p. 411, National Spatial Plan for the area of Brežice Hydroelectric Power Plant, Geateh d.o.o. Ljubljana, 2011

Ploj, A. (2018): Brežice Hydroelectric Power Plant – promises and reality. A review of the implementation of the promised replacement habitats and mitigating measures

Description of the implementation

The breeding wall for Sand Martins *(Riparia riparia)* has not been completed and is not being maintained. No details as to its regular maintenance have been received and it is not known whether it is being implemented at all.

Summary assessment of the implementation

The measure has not been suitably implemented or is not being implemented at all.

3.23 Planting of the area's external boundaries with trees

Definition as per Decree

The measure is defined in the Article 26(5)[69] of the Decree:

Article 26

(5) The area's outer boundaries are to be planted with trees of locally characteristic species, such as Common Ash *(Fraxinus excelsior)*, Common Oak *(Quercus robur)*, Common Alder *(Alnus glutinosa)*, Viburnum *(Viburnum)*, Elderberry *(Sambucus nigra)*, Privet *(Ligustrum vulgare)*, Common Hawthorn *(Crataegus monogyna)* and Midland Hawthorn *(Crataegus laevigata)*). The species structure is to be adapted to the expected rise of the groundwater level. For the wider area of Raceland, landscape architectural plan is to be prepared, which is to embrace anti-noise green belt towards Spodnji Stari Grad.

Detailed description of the measure

The measure is described in the above Article.

Description of the implementation

Planting has been implemented only partially, but is already in need of restoration. In the state as they are now, the plantations are non-functional. The landscape architectural plan has been prepared.

Summary assessment of the suitability of the implementation

The measure has been implemented, but proper restoration is necessary.

[69] Title of the Article: Reconstruction of the area of Raceland in the area of Stari Grad gravel pit

Ploj, A. (2018): Brežice Hydroelectric Power Plant – promises and reality. A review of the implementation of the promised replacement habitats and mitigating measures

3.24 Planting of trees and shrubs on the banks of the Sava's tributaries

Definition as per Decree

The measure is defined in Article 39(2,3,6)[70] of the Decree:

Article 39

(2) The existing vegetation is to be preserved as much as possible in the area of the carried out works, particularly as far as autochthonous species and natural riparian plants are concerned. The same applies to the continuous riparian vegetation; where this is not possible, suitable autochthonous shrubs and trees are to be planted.

(3) Along the reservoir's banks as well as the Sava's tributaries, gravel banks, replacement habitats and other sections stipulated with the National Spatial Plan, trees and shrubs are to be planted, which should follow to the greatest extent possible the patterns and species structure of the existing riparian plants. Among others, the following are to be planted: Goat Willow *(Salix caprea),* Cornelian Cherry *(Cornus mas),* Dogwood *(Prunus avium),* Norway Maple *(Acer platanoides),* Lime *(Tilia angustifolia)*, Common Osier *(Salix)* and Weeping Willow *(Salix babylonica).* In these places, trees and shrubs are to be planted in clusters and in the shape of hedgerows by paying regard to landscape patterns. Planting is to be carried out immediately upon completed ground works as the first measure, by which further growth with natural succession will be provided for.

(6) At the sections where no works need to be carried out, the Sava's banks are to be retained in their present state, while at the sections where local protection and stone coatings are foreseen, they are to be treated sustainably, with predominantly vegetational protection. The banks of the Sava's tributaries are to be treated, except where classical treatment is necessary owing to the immediate proximity of buildings and village roads, sustainably, with planting of larger tree seedlings.

Detailed description of the measure

The measures are described in the above Articles.

Description of the implementation

The banks have nowhere been preserved in their existing state, no reinforcements have been carried out sustainably, and no banks have been treated with predominantly vegetational protection. Planting has not been implemented by considering landscape patterns.

Summary assessment of the suitability of the implementation

The measure was carried out only partially, but immediate restoration is necessary. Exiting situation does not serve the planned purpose for nature and landscape conservation.

[70] Title of the Articles: Landscape architectural reconstructions

Ploj, A. (2018): Brežice Hydroelectric Power Plant – promises and reality. A review of the implementation of the promised replacement habitats and mitigating measures

3.25 Passage for water dependent organisms on the left bank and planting of trees and shrubs

Definition as per Decree

The measure is defined in the Article 39(7,8)[71] of the Decree:

Article 39

(7) On the Sava's left bank, at the section from 500 m upstream from the dam of the Nuclear Power Plant to 380 m downstream from this dam and on the Sava's right bank at the section from 400 m upstream from the dam of the Nuclear Power Plant to 290 m downstream from this dam, no new trees are to be planted. However, regular maintenance of the existing vegetation is to be provided for.

(8) On the right bank of the accumulation reservoir in the area approximately 700 m upstream from the barrier, the foot of the air-side of the banks of high water-energy embankments is to be planted with quick growing tall trees, while the bank itself is to be planted with low vegetation. On the left bank, towards Brežice Castle, a more gently rising bank is to be constructed, in which a passage for water dependent organisms is to be also built, along which trees are to be planted to make the planned works in the area of influence of Brežice Castle disturbing as little as possible.

Detailed description of the measure

The measure is described in the above Articles.

Description of the implementation

No additional information.

Summary assessment of the suitability of the implementation

The measure has been implemented, but immediate restoration is necessary.

3.26 Physical relocation of dead trees and animal species

Definition as per Decree

The measure is defined in Article 52(2)[72] of the Decree:

Article 52

(2) In the treatment of gravel pits' habitats, the following requirements are to be taken into account:

[71] Title of the Articles: Landscape architectural reconstructions
[72] Title of the article: Nature conservation measures

- Prior to the flooding of gravel pits, physical relocation of dead and felled old trees is to be provided in accordance with the provisions of this Decree and of some less mobile animal species, e.g. European Pond Terrapin *(Emys orbicularis)*, to replacement biotopes or temporarily to other biotopes, from which they are to be relocated back to them after their final reconstruction.

- Prior to the flooding of Vrbina gravel pit, dragonfly larvae and European Pond Terrapin individuals are to be moved to SH1 and SH2.

- Half of all planned replacement habitats are to be reconstructed prior to the filling of the reservoir, while other works shall start to be implemented after the first filling and then gradually in the ensuing years, subject to the dynamics of gravel extraction from gravel pits.

- At the beginning of physical interventions into the area of Vrbina gravel pit, 50% of water habitats must be functional. The area of Vrbina gravel pit encloses the water surface and a belt of 40 m wide land along the gravel pit.

- In the area of replacement habitats, the following is to be constructed in agreement with the service authorized for nature conservation: access paths and educational trails, bird watching platforms and information boards, as well as all other facilities associated with maintenance and promotion of habitats.

- In the areas of replacement habitats, no sports and angling activities are admissible, except for the part of SH1, where rowing (boating) is permitted. Timetable and types of activities in these areas as well as presentations are to be adapted to the ecological demands of the species living there and other characteristics of every individual replacement habitat.

Detailed description of the measure

Prior to the flooding of Vrbina gravel pit, dragonfly larvae and European Pond Terrapin individuals are to be moved to SH1 and SH2[73].

The measures are described in the above Article.

Description of the implementation

In May 2016, 12 European Pond Terrapins *(Emys orbicularis)* were relocated. Then dragonfly larvae were relocated as well as dead old trees under expert control.

Summary assessment of the suitability of the implementation

The measure has been implemented. For its results, monitoring should be carried out.

[73] See p. 412, Environmental Report for the National Spatial Plan for the area of Brežice Hydroelectric Power Plan, Geateh d.o.o. Ljubljana, 2011

Ploj, A. (2018): Brežice Hydroelectric Power Plant – promises and reality. A review of the implementation of the promised replacement habitats and mitigating measures

3.27 Construction of embankments for the passage of amphibians

Definition as per Decree

The measure is defined in Article 52(8)[74] of the Decree:

Article 52

(52) Anti-flood embankments are to be constructed in such a manner as to enable amphibians an undisturbed passage to their breeding sites.

Detailed description of the measure

No additional information.

Description of the implementation

No additional information.

Summary assessment of the suitability of the implementation

It is not known whether the measure has been implemented or not.

3.28 Regulation of the Sava's tributaries, enabling uninterrupted passage for water dependent organisms

Definition as per Decree

The measure is defined in Article 52(12)[75] of the Decree:

Article 52

(12) **.** In the setting up of the reservoir's banks and of the Sava's tributaries, the following requirements are to be taken into consideration:

- The Sava's tributaries are to be regulated only to the necessary extent, i.e. with sustainable measures and use of natural materials.

- The riparian vegetation along the Močnik stream can be removed only in most urgent cases and on one bank only. During the possible relocation of its bed, it is to be replanted anew. The works should be carried out as quickly as possible in order to limit any disturbances to the shortest time possible.

- In the areas where riparian vegetation or hedgerows are to be removed, a suitable replacement with planting of autochthonous tree species is to be provided for.

[74] Title of the Article: Nature conservation measures
[75] Title of the Article: Nature conservation measures

Ploj, A. (2018): Brežice Hydroelectric Power Plant – promises and reality. A review of the implementation of the promised replacement habitats and mitigating measures

- Where encroachments upon the banks cannot be avoided, natural materials are to be used for the strengthening purposes and banks with varied inclinations constructed.

- In the tributaries that hold important fish species from the nature conservation and aquaculture point of view, their outflows into the reservoir or into the Sava are to be regulated in such a way as to enable passage of fish from the hydro plant's accumulation to the tributaries, and vice versa, to enable undisturbed transit ability of the European Otter's *(Lutra lutra)* water corridors.

- The envisaged retainers of floating material on the Sava's tributaries should in no way prevent upstream and downstream transition of water dependent organisms.

- On the water-side of the accumulation's banks, 2 to 10 m large bays with different water depths (dunes, pools) are to be set up in places where hydraulically possible.

Detailed description of the measure

The measures are described in the above Articles.

Description of the implementation

Small bays with different depths were constructed, as well as the passage for fish. Both measures have been implemented only partially, as no planting has been carried out or their restoration is necessary. In order to check the remaining items of this Article, expert supervision and monitoring should be introduced, which would show whether the measures have been implemented and whether they function as they should.

Information on the implementation is insufficient.

Summary assessment of the suitability of the implementation

Only partially carried out, more information would be obtained with a thorough expert supervision and monitoring.

3.29 Monitoring

Definition as per Decree

The measure is defined in Article 67 (1,2)[76] of the Decree:

Article 67

(1) The investors are to provide for comprehensive monitoring plans prior and during construction and during the operation for the works planned with the National Spatial Plan, as regulated in the Environmental Report, and will be stipulated in the report on the on the environmental impacts and in the environmental monitoring report.

[76] Title of the Article: Monitoring

(2) In the detailed monitoring stipulation, the already carried out measurements of the null state should be considered. In parts where possible, monitoring is to be adapted and adjusted with other existing national and local monitoring schemes of the environmental quality status. During physical measurements of the status of the environmental components (soil, surface waters, quantity and quality of groundwater, air, noise, animals and plants), at least such a number of points of supervision are to be provided that a substantiated information on the status of individual environmental component can be obtained. The points of monitoring should enable a continued data acquisition. The monitoring is to be carried out in accordance with the regulations that cover the sphere of first measurements and operational monitoring of noise and conditions for their implementation, and in concordance with the guidelines from the environmental impacts report. The results of the monitoring are public. The investors are liable to take care of the accessibility of the data, particularly as far as the Institute for the Protection of Cultural heritage of Slovenia is concerned (owing to the possible rise of groundwater level, which could affect the unexcavated archaeological remains in the ground).

Detailed description of the measure

The measure id described in the above Articles.

Description of the implementation

There is no methodology, the monitoring is not being carried out, and nothing has been reported so far.

Summary assessment of the suitability of the implementation

It is not known whether it is being implemented or not.

3.30 Maintenance

Definition as per Decree

The measure is defined in Article 68 (1,4,8)[77] of the Decree:

Article 68

(1) Within the framework of management, the investors of the planned works are to provide for their maintenance in compliance with the maintenance requirements in such a manner that the functionality of the carried out works is preserved.

(4) On the banks of the accumulation reservoir, the Sava's tributaries and drainage channels, the riparian vegetation is to be regularly maintained. On the banks above the upper operational water surface (or medium high water), supple shrubs and trees are to be preserved.

(8) Replacement habitats, rafts and other facilities for the breeding of birds, as well as shoals in the pool are to be regularly maintained in order to retain a favourable conservation status of species. Any

[77] Title of the Articles: Maintenance

changes in terms of maintenance of these constructions are admissible only on the basis of monitoring results, with preliminary compliance with the authorized nature conservation service.

Detailed description of the measure

The measures are described in the above Articles.

Description of the implementation

Maintenance of the planned constructions is implicit for their functionality. Field inspection has shown that the carried out constructions are not maintained or sanitized. If the islands and rafts are not maintained, they will become non-functional in the very ensuing breeding season. Sand Martins *(Ripaira ripaira)* and Kingfishers *(Alcedo atthis)*, too, are losing the precious nest sites, as the sand walls are not being renewed; they are crumbling and becoming overgrown with herbage. Maintenance in the area of replacement habitats and mitigating measures is practically non-existent, or is carried out with minimum input.

Summary assessment of the suitability of the implementation

The measure is not being implemented.

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4. Habitat loss calculation

4.1 Method

On the basis of the chart of replacement habitats, prepared by ZRSVN (Institute of the Republic of Slovenia for Nature Conservation) – Lower Sava River in 2008[78], a habitat loss calculation has been made with the aid of the ArcGis (© ESRI) programme. For the calculation, the area shown below has been used. Habitat types were merged in logical groups, the contents of which are described further in the text.

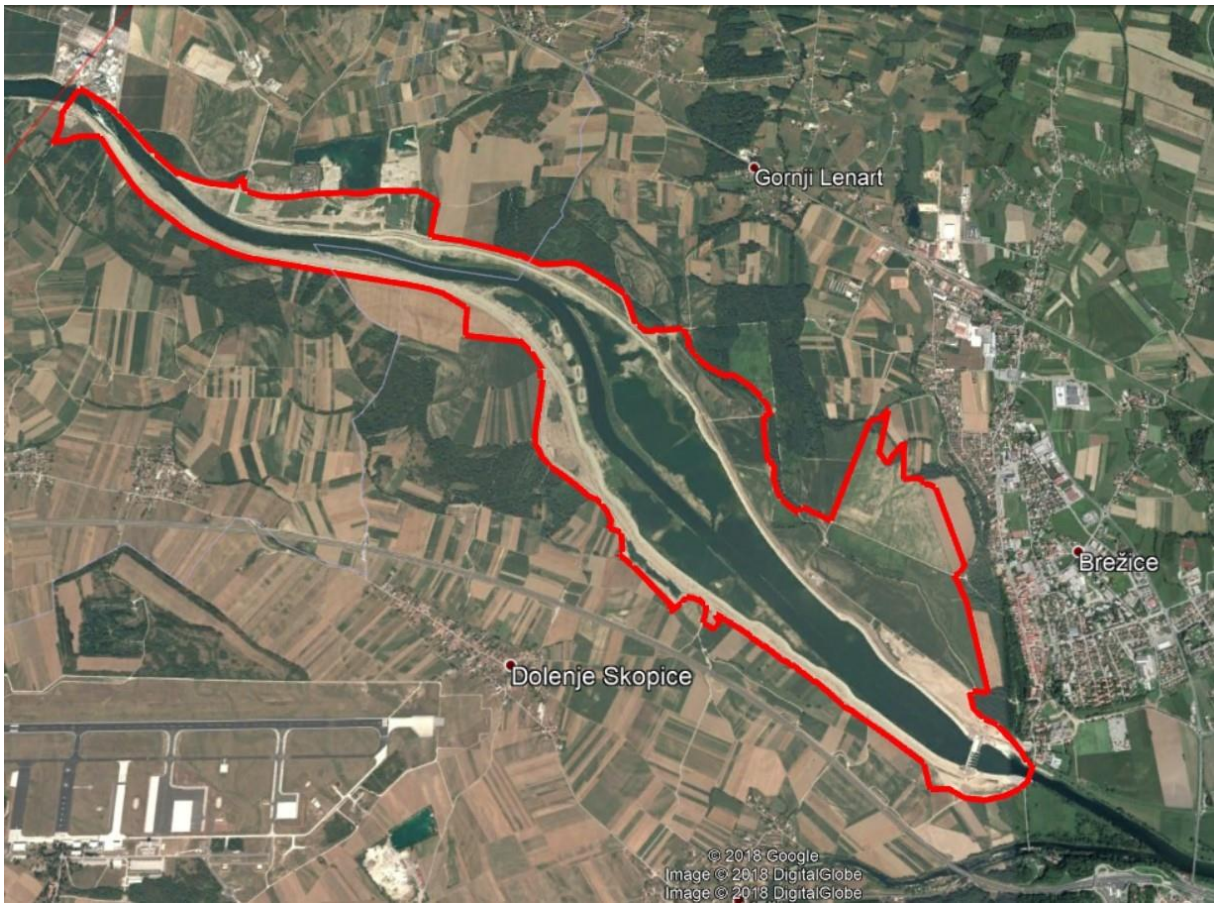

Figure 56: Area of the habitat loss calculation

List of habitat types presented in the area with appertaining sub-groups:

1. Asphalt roads
2. Cart tracks and dirt roads
3. Various landfills
4. Fields
5. Untilled fields and other tracts of land tilled until now

[78] ZRSVN, Habitat types, 19 December 2018. http://www.zrsvn.si/sl/informacija.asp?id_meta_type=62&id_informacija=705

6. Abandoned gravel pits/Vegetation of standing fresh waters
7. Streams with predominantly natural banks
8. Overgrown river banks with fine sand alluvial deposits
9. Sparsely overgrown river banks and gravel bars
   - Sparsely overgrown river banks and gravel bars
   - Sparsely overgrown river banks and gravel bars x Rocks and stone blocks in the river bed
10. Intermittent rivers, streams and torrents
11. Barbel zone
    - Barbel zone
    - Barbel zone / Vegetation of eutrophic running waters
12. Common Reedbeds
13. Ruderal communities
14. Moderately dry grasslands
    - Central European moderately dry grasslands with predominating Erect Brome
    - Central European moderately dry grasslands with predominating Erect Brome x Ruderal communities
    - Central European moderately dry grasslands with predominating Erect Brome x Central European xero-mesophilic lowland grasslands on relatively dry ground and inclined position with predominating Tall Oat-grass
    - Central European moderately dry grasslands with False Brome x Shrubby deciduous forests and tracts of land overgrown with deciduous tree species
    - Central European moderately dry grasslands with False Brome x Ruderal communities
    - European xero-mesophilic lowland grasslands on relatively dry ground and inclined position with predominating Tall Oat-grass x Moderately dry and intensely farmed grasslands
    - Central European moderately dry grasslands with False Brome x Shrubby deciduous forests and tracts of land overgrown with deciduous tree species
    - Central European mesotrophic to eutrophic lowland grasslands
    - Central European xero-mesophilic lowland grasslands on relatively dry ground and inclined positions with predominant Tall Oat-grass x Ruderal associations
15. Moderately dry intensively farmed grasslands
    - Moderately dry intensively farmed grasslands
    - Intensively farmed and additionally sown or fully sown grasslands
16. Wet intensively farmed grasslands
17. Ruderal abandoned grasslands
18. Hedgerows
    - Hedgerows and small groups of trees and shrubs
    - Hedgerows and small groups of trees and shrubs / Plantations and forest stands of Robinia
    - Hedgerows and small groups of trees and shrubs x Nitrophilous forest edges and wet riparian high-stemmed plants
19. Scrublands
    - Central European and sub-Mediterranean deciduous scrublands on rich soil
    - Central European thermophilous scrublands with Privet and Blackthorn x nitrophilous forest edges and wet riparian high-stemmed plants
    - Central European and sub-Mediterranean deciduous scrublands on rich soil x Plantations and forest stands of Robinia
    - Central European thermophilous scrublands with
    - Central European thermophilous basiphilous scrublands with Privet and Blackthorn x Central European moderately dry grasslands with False Brome
    - Central European thermophilous basiphilous scrublands

20. Shrubby deciduous forests and tracts of land overgrown with deciduous tree species
    - Shrubby deciduous forests and tracts of land overgrown with deciduous tree species
    - Shrubby deciduous forests and tracts of land overgrown with deciduous tree species / Eastern European White Willow and Poplar stands
    - Shrubby deciduous forests and tracts of land overgrown with deciduous tree species x Nitrophilous forest edges and wet riparian high-stemmed plants
    - Shrubby deciduous forests and tracts of land overgrown with deciduous tree species / Plantations and forest stands of Robinia
21. Nitrophilous forest edges and wet riparian high-stemmed plants
    - Riparian high-stemmed plants
    - Nitrophilous forest edges and wet riparian high-stemmed plants
22. Eastern European White Willow and Poplar stands
    - Eastern European White Willow and Poplar stands
    - Eastern European White Willow and Poplar stands x Plantations and forest stands of Robinia
23. Illyrian floodplain Pedunculate Oak-Common Hornbeam stands
    - Illyrian floodplain Pedunculate Oak-Common Hornbeam stands
    - Illyrian floodplain Pedunculate Oak-Common Hornbeam stands x Plantations and forest stands of Robinia
    - Remnants of Central European Oak-Ash-Maple woodlands
    - Remnants of Central European Oak-Ash-Maple woodlands x Plantations and forest stands of Robinia
24. Poplar plantations
    - Poplar plantations
    - Poplar plantations x Nitrophilous forest edges and wet riparian high-stemmed plants
25. Plantations and forest stands of Robinia
26. Other plantations of deciduous trees
27. Plantations of autochthonous conifer trees
28. Forest glades with high-stemmed plants

4.2 Results

It was established that the construction of Brežice Hydroelectric Power Plant had a great negative impact on habitat types in the area. Five significant habitat types disappeared in full (100%): Abandoned gravel pits/Vegetation of standing fresh waters (17.44 ha), overgrown river banks with fine sand alluvial deposits (0.32 ha), sparsely overgrown river banks and gravel bars (4.39 ha), Common Reed beds (0.01 ha) and ruderal abandoned grasslands (0.70 ha). In 7 habitat types, at least 80% of the surface area disappeared: Barbel zone (99.83% - 60.18 ha), Ruderal communities (94.78% - 2.69 ha), wet intensively farmed grasslands (86.26% - 0.81 ha), hedgerows (91.59% - 0.56 ha), scrublands (88.14% - 30.72 ha), nitrophilous forest edges and wet riparian high-stemmed plants (83.02% - 7.71 ha) and East European White Willow and Poplar stands (82.68% - 26.68 ha).

Heavy losses were suffered also by other habitats, which present a significant and hardly replaceable habitat types. Hence, high shares of moderately dry grasslands were lost as well, the loss of which amounts to 17.89 ha (75.74%), and Illyrian floodplain Pedunculate Oak-Common Hornbeam stands, the destroyed share of which amounts to 15.05 ha (76.17%).

Habitat	Size in ha before	Loss in ha	Remainder in ha	Loss in %
Asphalt roads	0.1664	0.0014	0.165	0.84
Cart tracks	7.3155	5.0817	2.2338	69.47
Landfills	0.1013	0.1013	0	100
Fields	159.8169	99.1939	60.623	62.06
Untilled fields	1.6446	1.2665	0.3781	77
Abandoned gravel pits	**17.4404**	**17.4404**	**0**	**100**
Streams with natural banks	0.5489	0.0123	0.5366	2.24
Overgrown river banks	**0.3275**	**0.3275**	**0**	**100**
Sparsely overgrown river banks	**4.3955**	**4.3955**	**0**	**100**
Intermittent rivers, streams	0.6032	0.2181	0.3851	36.15
Barbel zone	60.2859	60.1838	0.1021	99.83
Common Reed beds	**0.0185**	**0.0185**	**0**	**100**
Ruderal communities	2.8442	2.6958	0.1484	94.78
Moderately dry grasslands	23.6245	17.8952	5.7293	75.74
Moderately dry int. grasslands	2.9547	2.2167	0.738	75.02
Wet int. farmed grasslands	0.9407	0.8115	0.1292	86.26
Ruderal abandoned grasslands	**0.7089**	**0.7089**	**0**	**100**
Hedges	0.615	0.5633	0.0517	91.59
Shrublands	34.8565	30.723	4.1335	88.14
Shrubby forests	3.8446	2.8338	1.0108	73.7
Nitrophilous forest edges	9.2916	7.7143	1.5773	83.02
East. Eu. White Willow stands	32.2783	26.6891	5.5892	82.68
Illyr. floodplain Pedunculate Oak-Common Hornbeam stands	19.7687	15.0589	4.7098	76.17
Poplar stands	134.5956	62.5566	72.039	46.48
Robinia plantations	0.4916	0.157	0.3346	31.94
Other deciduous tree plantations	1.3066	0	1.3066	0
Plantations of autocht. conifers	0.6196	0.3712	0.2484	59.9
Forest glades	0.4684	0.2609	0.2075	55.7
Total	521.87	359.49	162.38	

Table 4: Survey of habitat type loss in the area of Brežice Hydroelectric Power Plant

Bold red – habitats, the surface area of which was reduced by 100%*

Ordinary red – habitats, the surface area of which was reduced by at least 50%*

Ordinary orange – habitats, the surface area of which was reduced by 25% to 50%*

* Only natural habitats were taken into consideration

Ploj, A. (2018): Brežice Hydroelectric Power Plant – promises and reality. A review of the implementation of the promised replacement habitats and mitigating measures

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This study was prepared as part of the “Save the Blue Hearth of Europe” campaign.

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This study was prepared for:

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Supported by