FIThydro

# Description of a Test Case:

# River Günz

## Germany

The Test Case Günz includes 5 HPPs with fish ladders:
Deisenhausen, Höselhurst, Wattenweiler, Ellzee and Waldstetten

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**Figure 1: Fish counting station at the bypass-channel Deißenhausen**

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# 1. Description of the Test-Case

## 1.1. Description of the water bodies related to the hydropower plan

The 5 hydropower plants (HPPs) of the river Günz are within the water body 1_F041 between the water bodies 1_F030 (downstream) and upstream water bodies östliche (“eastern”) Günz 1_F044 and westliche (“western”) Günz 1_F038. All water bodies have a moderate ecological potential.

**Ecological status**

| | |
|---|---|
| Eastern Günz: | moderate |
| Western Günz: | moderate |
| Günz: | moderate |
| Danube: | good |

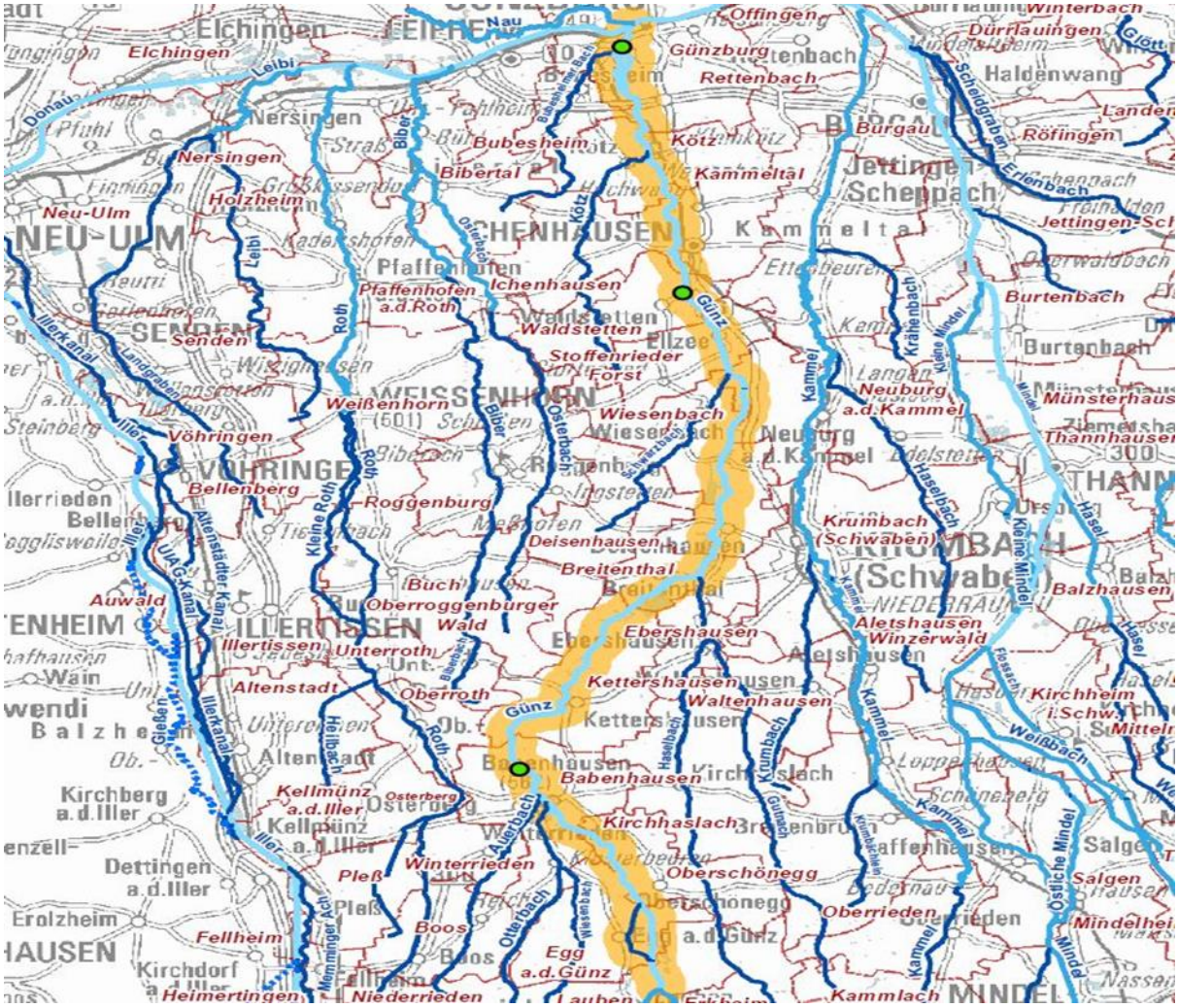


**Figure 2: Water body 1_F041 Günz**

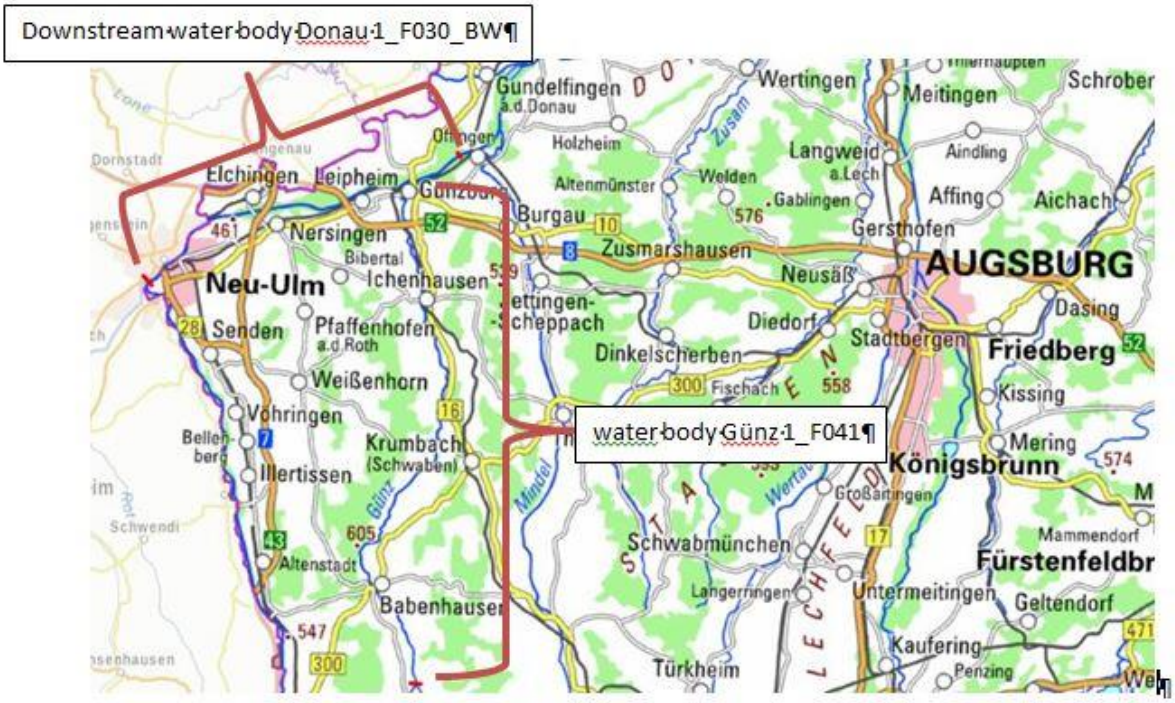


**Figure 3: Water body Günz and downstream water body Donau**

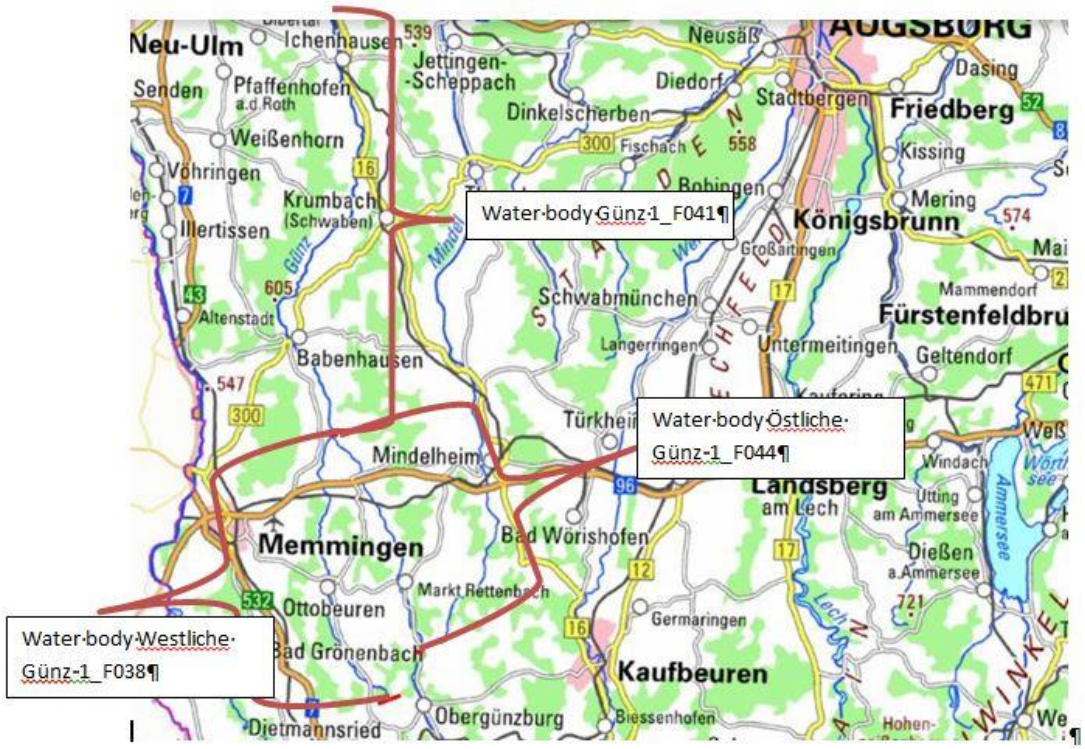


**Figure 4: Water body of eastern and western Günz**

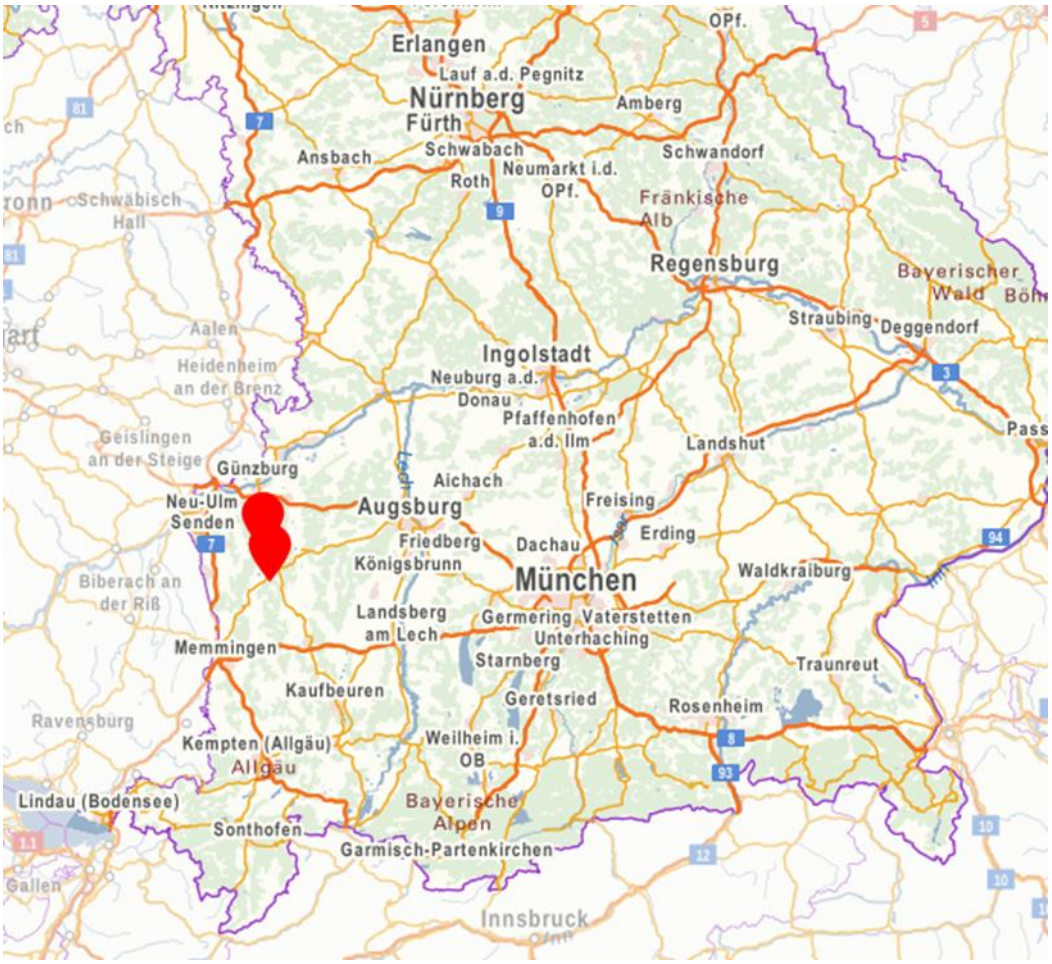


**Figure 5: Water bodies related to the HPPs of the river Günz**

### 1.1.1. Hydrology of the Günz

The hydrology is characterized by peak flows in winter due to snow melting and some peak flows in the summer after heavy rain events.

The mean interannual discharge of the river Günz is estimated at 7,8 $m^3/s$.

### 1.1.2. Main pressures

Several pressures are listed for the Günz:

**Table 1: Main pressures on the Günz**

| | |
|---|---|
| **Water treatment plant effluents** | medium |
| **Spillover of Stormwater overflows** | minimal |
| **Nitrogen derived from agriculture** | not significant |
| **Pesticides** | significant |
| **Water supply** | not significant |
| **Continuity** | Former times high, since 2014 the continuity is built through fish bypass channels |
| **Hydrology** | high |
| **Morphology** | moderate |

**Table 2: Measures to be implemented at the river basin scale of the Günz**

| | |
|---|---|
| **Flow change** | No hydro-peaking for many years, homogenous water flow |
| **Fish migration measures** | Nature like fish ladder (fish bypass channel) combined with sections of technical ones at every BEW power plant of the river Günz |
| **Pollution control** | no |

## 1.2. Presentation of the HPP's

### 1.2.1. Location of the HPP's

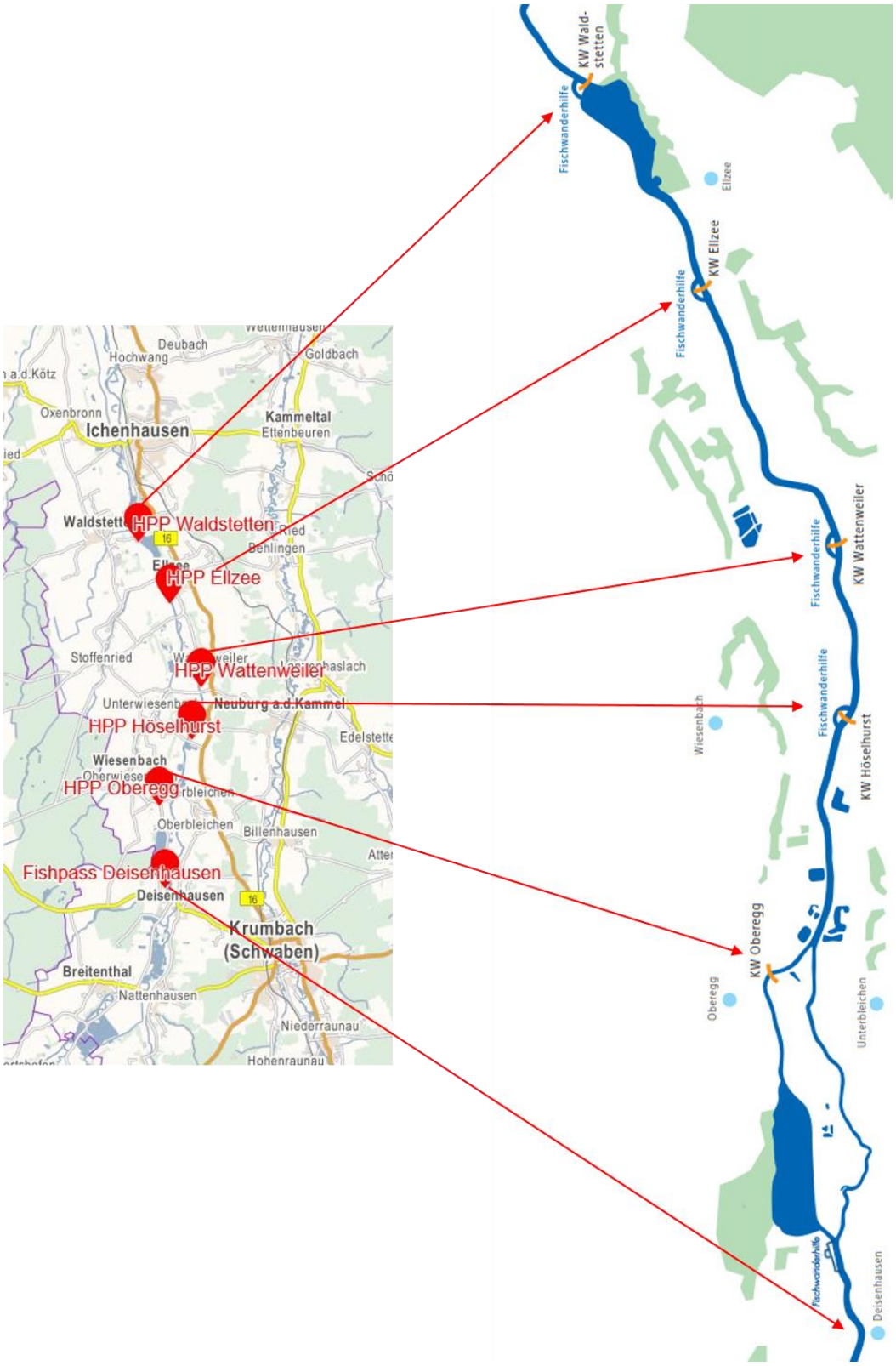


**Figure 6: Location of the HPPs and respective fish passes at the river Günz**

**Table 3: Main characteristics of the HPPs**

| | |
|---|---|
| Watercourse | Günz |
| Situation : | Run-of-river hydropower plants |
| Inter-annual discharge | 8,2 m³/s |
| Low-water flow : | 3,5 m³/s |
| Function of the dam : | Hydropower Plant |
| Maximum turbine discharge: | 17 m³/s |
| Species concerned : | reophilic fish population |

**Equipment and Technical Data:**

Flow through the turbines: 16,3 m³/s

1 Kaplan-turbine for each HPP, 150 – 250 rotations per minute

Drop height: 3,9 - 8,30 m

Mid Flow over the year: 8,0 m³/s

1,8 – 3,7 million kWh annual production for each HPP

### 1.2.2. E-flow

There are 5 HPP's. 4 of them are run-off-river. 1 the HPP Oberegg is a HPP with a diverted reach. The mean flow runs over the basin Oberegg, there is no hydropeaking. The old river called "Alte Günz" is used as a flood channel. The e-flow is 500 l/s at all time, which is the natural minimum water flow. This is the e-flow the authorities specified.

### 1.2.3. Downstream migration devices

There is no special downstream migration device, but downstream migration is possible during weir overflow.

### 1.2.4. Upstream migration devices

There is a fish bypass channel for upstream migration at every HPP (see pictures7 to 10 ):
Fish bypass channel at Deisenhausen (Source: BEW)

- Flow in the fishpass Deisenhausen: 500 l/s
- The others: about 300 l/s
- Length of the fish pass Deisenhausen 500 m.
- The others: 130 -180 m
- Fish bypass channel should also fulfil a compensation habitat function. Therefore, juvenile and spawning habitats have been built in the fish-bypass channel.

The bypass channel at HPP Deisenhausen has a flow of 500 l/s and is 500 m long. All other fish bypass channels have a flow of 300 l/s and a length of 130 – 180 m. All fish bypass channels are built as a nature like pond system. The first 10 m of every fish bypass channel is built as a technical vertical slot pass to ensure a more or less consistent water flow. In every fish bypass channel there is furthermore

a fish counting pool to register all (upward) migrating fish. This research study is done by Thomas Lechner (IBF Umwelt).

©BEW

**Figure 7: Teilungswehr Günz Channel and Old Günz HPP Oberegg**

©BEW

**Figure 8: Fish pass Deisenhausen**

**Figure 9: Fish ladder Ellzee**

**Figure 10: Fish ladder Höselhurst**

### 1.2.5. Sediment Management

There is no sediment management done at the river Günz. Fine sediments can be transported through the HPP.

## 2. Objectives of this Test Case

*What we are planning?*

Improvement of the compensation habitat function, specifically as spawning habitat and habitat for reophilie fish species. Comparison with comparable small side waters like *Schwarzenbach* in view of the present fish fauna.

*Why are we planning this on this Test Case?*

This section of the Günz is strongly morphologic downgraded and channelized. The morphologic improvement of the Günz itself is difficult because of the closeness to the settlements and no available areas. The improvement of habitat functions within the fish ladders itself is considered to have a good cost-benefit effect and could be a model for other existing and planned fish ladders.

*What are we expecting?*

The fish ladders will be even more attractive as habitat for the reophile fish population

*Relevance in FIThydro?*

We hope to find ways to build compensation habitat structures in fish-bypass channels. These structures can play a big role in upgrading the ecology of a strongly channelized river. If the plan to build compensation habitats like spawning and juvenile habitats in bypass-channels is successful, these methods could be applied in other rivers. The results could thus be introduced as successful compensation measures in the Decision Support Tool.

# 3. Presentation and results of activities in FIThydro

## 3.1. Improvement of spawning habitats within the fish bypass

In accordance with the Test Case objectives, the BEW placed gravel into 3 of 5 fish ladders to improve their function as spawning habitat for the reophile target fish-species such as nase and barbel. To monitor the success of the measures the pools with fresh gravel as well as the pools with the existing substrate were sighted daily from the day of gravel placement until about the end of Mai. This period was chosen to cover the spawning time of nase and barbel.

### 3.1.1. Data

*Placing gravel into the fishways by BEW*

On 9.4.2018 and 10.4.2018 the BEW placed all in all about 42 tons of washed gravel with a grain size of 16/32 mm into the fishways Wattenweiler, Ellzee und Waldstetten. In each case the gravel was placed in three pools of the fishways. The amount of gravel per pool varied between 2 – 6 tons.

**Figure 11: placing gravel into fish ladder Wattenweiler**

The following aerial photos show the spots where the gravel has been placed.


**Figure 12: Location of gravel input fishway Wattenweiler**

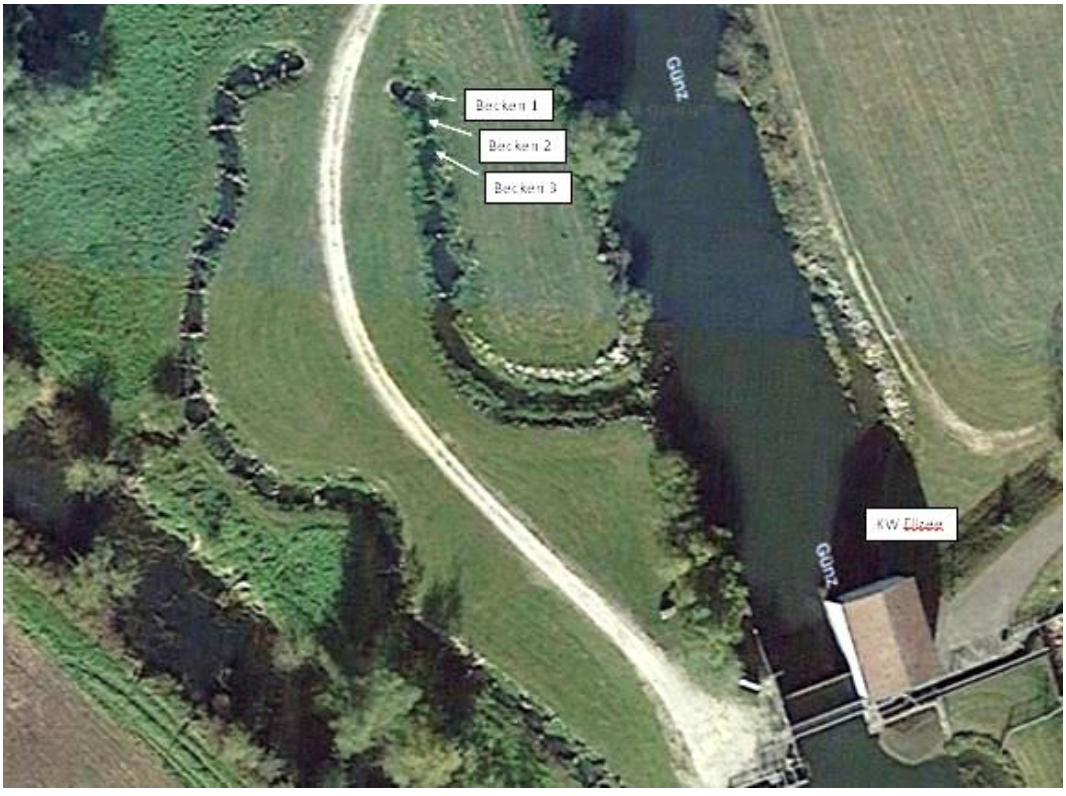


**Figure 13 Location of gravel input fishway Ellzee**


**Figure 14 Location of gravel input fishway Waldstetten**

### 3.1.2. Methodology

*Immediate success control*

As the spawning period of the species nase was expected to run within the time when gravel was placed in the fishways, they were sighted daily in order to record any spawning. For this, samples of substrate from the ground of the pools with fresh gravel and also from a comparable number of pools without fresh gravel were extracted. These samples of substrate were sighted for fresh spawn.

### 3.1.3. Results

On 13.4.2018 - only 4 days after adding the gravel- successful spawning of nases at the fishway Wattenweiler could be documented. On 50% of the stones in all 3 pools with fresh gravel at least one or several glued on nase-eggs could be found.

**Figure 15 spawn of nase on fresh gravel**

On 13.4.2018 spawning activities of nase could also be documented on the existing coarse substrate at the fishladder Ellzee. On some of the chunks of the old substrate glued on eggs of nase were detected. However, these could only be found within a shadowed area of the short technical part of the fishway under the bridge right below the upstream exit.

**Figure 16 Spawn of nase at fishway Ellzee**

## 3.2. Population analysis

As a success control of the planned and already realised measures, inventories of the fish stock present in the fishway were made.

### 3.2.1. Data

The present fish fauna was recorded in all 5 fishways by electric-fishing.

### 3.2.2. Methodology

The inventory of the fish-stock was done by electric fishing. For this, a battery fed backpack electric-fishing device was used.

Data of the electric-fishing device:

- Type: Efgi 650
- Manufacturer : Bretschneider Spezialelektronik, Chemnitz
- Power: 650 W DC Power and 1300 W Pulse current

**Figure 17 Electric fishing at fish ladder Höselhurst**

In order to catch the fish gently, only DC – power was used. Before fishing, the flow of each fish ladder was throttled to about 50 % to increase the catch-effectivity. At the point of throttling the flow, the underwater entrance was closed with a net so that no fish could escape into the river. The fishing was done upstream pool after pool with a personnel strength of 3. All caught fish were kept within a basin and after measurement and documentation released back into the fish ladder.

### 3.2.3. Results

The following data provide an overview of the results that were documented.

### 3.2.3.1. Fish-bypass Waldstetten

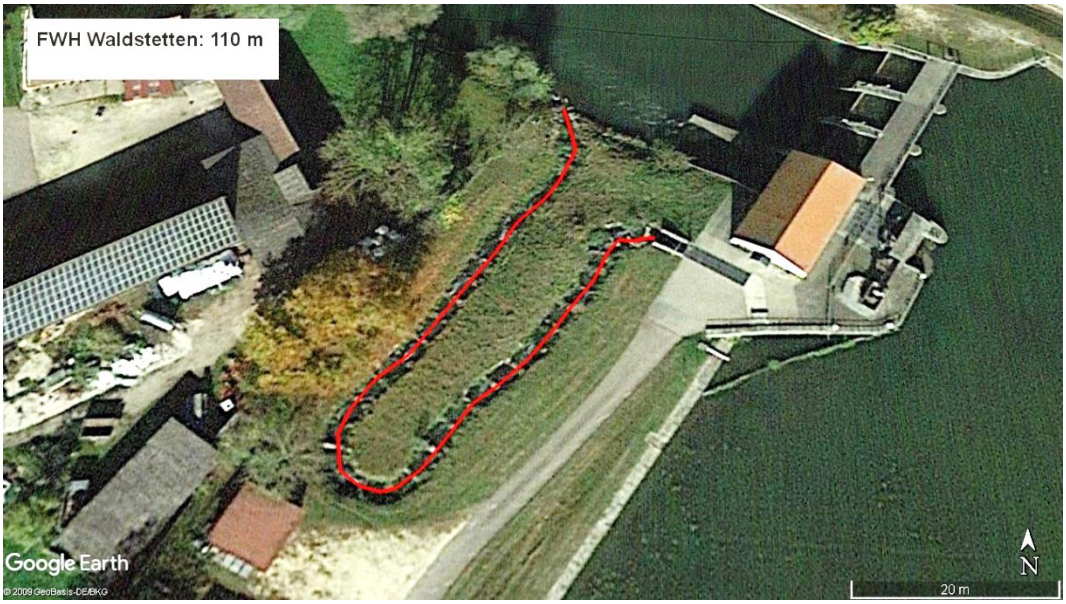


**Figure 18 Aerial photo fish ladder Walddstetten**

| Fishstock inventory: Fishladder Waldstetten 21.08.2018 | | | |
|---|---|---|---|
| Species | | Number | [%] |
| Eel | *Anguilla anguilla* | 19 | 5,9 |
| Chub | *Leuciscus cephalus* | 44 | 13,8 |
| Barbel | *Barbus barbus* | 69 | 21,6 |
| Perch | *Perca fluviatilis* | 1 | 0,3 |
| Prussian carp | *Carassius gibelio* | 1 | 0,3 |
| Gudgeon | *Gobio gobio* | 3 | 0,9 |
| Bleak | *Alburnus alburnus* | 110 | 34,4 |
| Nase | *Chondrostoma nasus* | 14 | 4,4 |
| Spirlin | *Alburnoides bipunctatus* | 59 | 18,4 |
| | | **320** | 100,0 |

**Table 4 Fish stock inventory: Fish ladder Waldstetten 17.08.2018**

### 3.2.3.2. Fish-bypass Ellzee

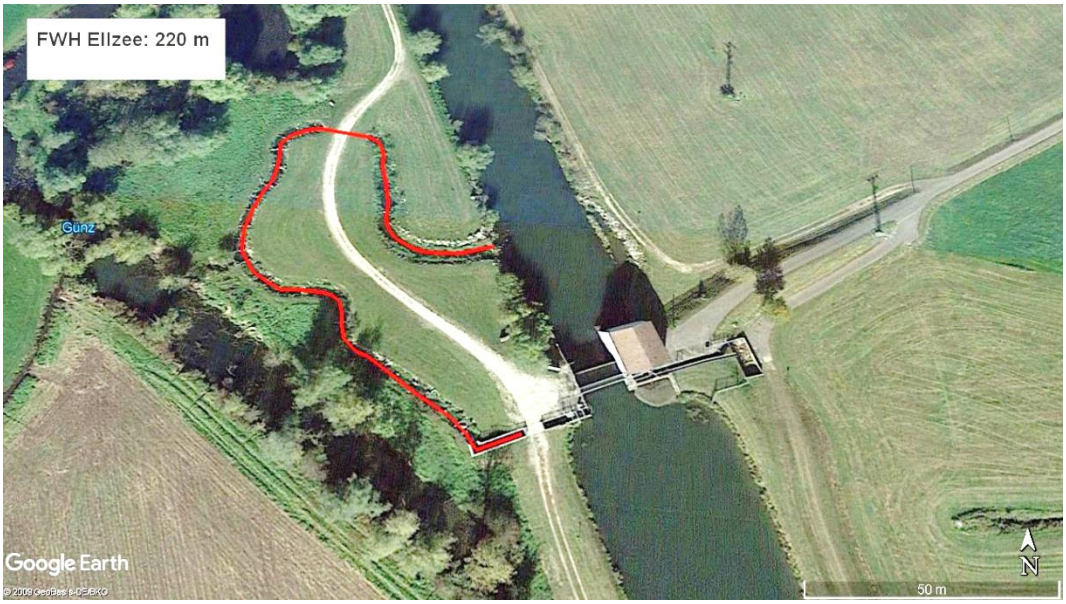


**Figure 19 Aerial photo fish ladder Ellzee**

| Fishstock inventory: Fishladder Ellzee 17.08.2018 | | | |
|---|---|---|---|
| Species | | Number | [%] |
| Eel | *Anguilla anguilla* | 12 | 2,0 |
| Chub | *Leuciscus cephalus* | 84 | 14,0 |
| Brown trout | *Salmo trutta* | 11 | 1,8 |
| Barbel | *Barbus barbus* | 26 | 4,3 |
| Perch | *Perca fluviatilis* | 2 | 0,3 |
| Prussian carp | *Carassius gibelio* | 1 | 0,2 |
| Silver bream | *Abramis bjoerkna* | 45 | 7,5 |
| Dace | *Leuciscus leuciscus* | 1 | 0,2 |
| Bleak | *Alburnus alburnus* | 75 | 12,5 |
| Nase | *Chondrostoma nasus* | 117 | 19,5 |
| Rainbow trout | *Oncorhynchus mykiss* | 1 | 0,2 |
| Roach | *Rutilus rutilus* | 179 | 29,9 |
| Tench | *Tinca tinca* | 1 | 0,2 |
| Spirlin | *Alburnoides bipunctatus* | 44 | 7,3 |
| | | **599** | 100,0 |

**Table 5 Fish stock inventory: Fish ladder Ellzee 17.08.2018**

### 3.2.3.3. Fish-bypass Wattenweiler

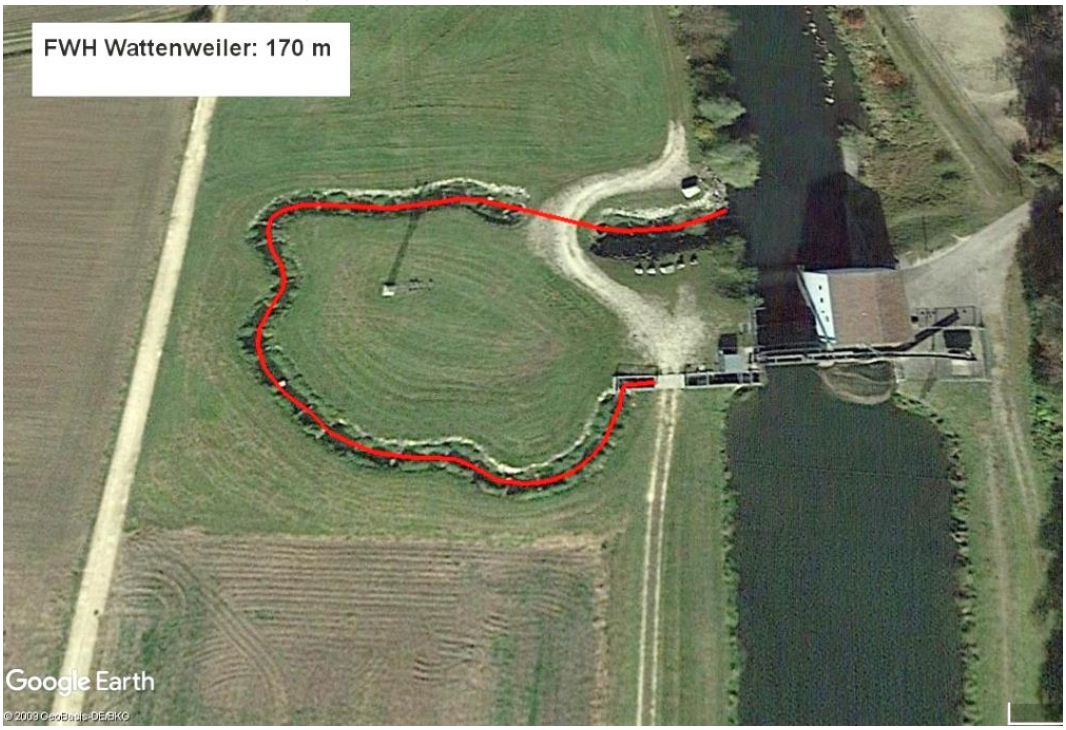


**Figure 20 Aerial photo fish ladder Wattenweiler**

| Fishstock inventory: Fishladder Wattenweiler 29.08.2018 | | | |
|---|---|---|---|
| Species | | Number | [%] |
| Eel | *Anguilla anguilla* | 7 | 1,4 |
| Chub | *Squalius cephalus* | 82 | 16,9 |
| Grayling | *Thymallus thymallus* | 1 | 0,2 |
| Brown trout | *Salmo trutta* | 16 | 3,3 |
| Barbel | *Barbus barbus* | 203 | 41,9 |
| Gudgeon | *Gobio gobio* | 2 | 0,4 |
| Dace | *Leuciscus leuciscus* | 5 | 1,0 |
| Nase | *Chondrostoma nasus* | 31 | 6,4 |
| Roach | *Rutilus rutilus* | 31 | 6,4 |
| Tench | *Tinca tinca* | 1 | 0,2 |
| Spirlin | *Alburnoides bipunctatus* | 105 | 21,7 |
| | | **484** | 100,0 |

**Table 6 Fish stock inventory: Fish ladder Wattenweiler 29.08.2018**

### 3.2.3.4. Fish-bypass Höselhurst

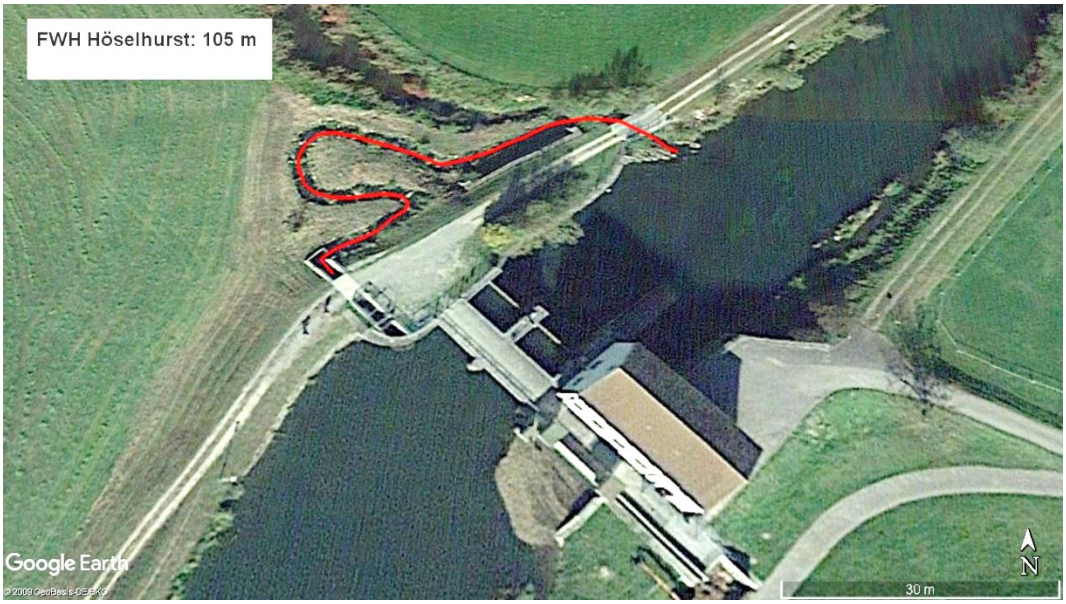


**Figure 21 Aerial photo fish ladder Höselhurst**

| Fishstock inventory: Fishladder Höselhurst 7.9.2018 | | | |
|---|---|---|---|
| Species | | Number | [%] |
| Eel | *Anguilla anguilla* | 4 | 1,1 |
| Chub | *Squalius cephalus* | 69 | 18,2 |
| Barbel | *Barbus barbus* | 154 | 40,6 |
| Perch | *Perca fluviatilis* | 1 | 0,3 |
| Gudgeon | *Gobio gobio* | 30 | 7,9 |
| Dace | *Leuciscus leuciscus* | 1 | 0,3 |
| Nase | *Chondrostoma nasus* | 13 | 3,4 |
| Roach | *Rutilus rutilus* | 1 | 0,3 |
| Spirlin | *Alburnoides bipunctatus* | 104 | 27,4 |
| Catfish | *Silurus glanis* | 2 | 0,5 |
| | | **379** | 100 |

**Table 7 Fish stock inventory: Fish ladder Höselhurst 7.9.2018**

### *3.2.3.5. Fish-bypass Deisenhausen*

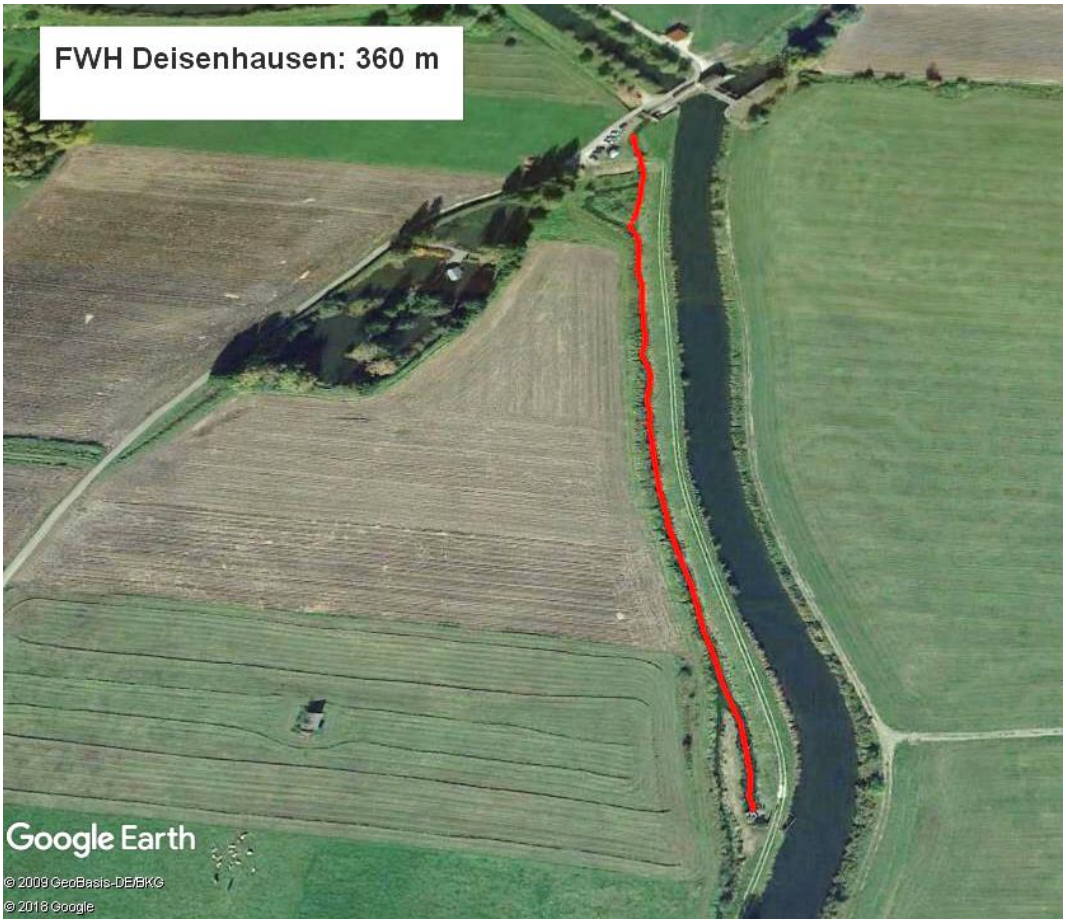


**Figure 22 Aerial photo fish ladder Deisenhausen**

| Fishstock inventory: Fishladder Deisenhausen 23.8.2018 | | | |
|---|---|---|---|
| Species | | Number | [%] |
| Eel | *Anguilla anguilla* | 11 | 0,8 |
| Chub | *Squalius cephalus* | 215 | 16,3 |
| Grayling | *Thymallus thymallus* | 2 | 0,2 |
| Brown trout | *Salmo trutta* | 1 | 0,1 |
| Barbel | *Barbus barbus* | 269 | 20,3 |
| Perch | *Perca fluviatilis* | 40 | 3,0 |
| Topmouth gudgeon | *Pseudorasbora parva* | 2 | 0,2 |
| Minnow | *Phoxinus phoxinus* | 48 | 3,6 |
| Prussian carp | *Carassius gibelio* | 2 | 0,2 |
| Gudgeon | *Gobio gobio* | 95 | 7,2 |
| Silver bream | *Abramis bjoerkna* | 2 | 0,2 |
| Dace | *Leuciscus leuciscus* | 70 | 5,3 |
| Pike | *Esox lucius* | 1 | 0,1 |
| Bullhead | *Cottus gobio* | 4 | 0,3 |
| Bleak | *Alburnus alburnus* | 67 | 5,1 |
| Nase | *Chondrostoma nasus* | 6 | 0,5 |
| Roach | *Rutilus rutilus* | 47 | 3,6 |
| Rudd | *Scardinius erythrophthalmus* | 1 | 0,1 |
| Tench | *Tinca tinca* | 7 | 0,5 |
| Stone loach | *Barbatula barbatula* | 217 | 16,4 |
| Spirlin | *Alburnoides bipunctatus* | 159 | 12,0 |
| Carp | *Cyprinus carpio* | 2 | 0,2 |
| Stickleback | *Gasterosteus aculeatus* | 55 | 4,2 |
| | | **1323** | 100,0 |

**Table 8 Fish stock inventory: Fish ladder Deisenhausen 23.8.2018**