



O-920962


WATER POLLUTION ABATEMENT PROGRAMME  
**THE CZECH REPUBLIC**

PROJECT 3.2

Model Reclamation  
of a Stream in the  
Protected Area Poodri

Project Report for Phase I and  
Programme of Work for Phase II

# NIVA - REPORT

Norwegian Institute for Water Research  NIVA

Report No.:	Sub-No.:
O-920962	
Serial No.:	Limited distrib.:
2837	Open

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Report Title: Water pollution abatement programme. The Czech Republic.  Project 3.2. Model Reclamation of a Stream in the Protected Area Poodri	Date: January 1993 Printed: NIVA 1993
	Topic group: International activities
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	Pages: 12 Edition: 50

Contractor: The Norwegian Ministry of Environment	Contractors ref. (or NTNF-No.):
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## Abstract:

A model stream in the Poodri area was selected on the basis of information on Poodri and its tributaries, including NIVA excursions to the protected area accompanied by Czech researchers. A proposal was prepared for reclamation of the model stream Bilovka, and a physical/chemical and biological monitoring programme was planned for the reclamation period.


4 keywords, Norwegian

1. Restaurering
2. Vannforurensning
3. Overvåking
4. Poodri, Tsjekkia

4 keywords, English

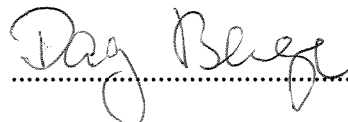
1. Reclamation
2. Water pollution
3. Monitoring
4. Poodri, Czech Republic

Project leader



.....Leif..Lien.....

For the Administration



.....Dag..Berge.....

ISBN-82-577-2234-0

***Preface***

*The Governments of Norway and Czech and Slovak Federal Republic have signed a bilateral environmental protection agreement. As part of this agreement several collaborative projects have been identified. The permanent Norwegian - Czechoslovak working group for the protection of the environment has discussed these projects and decided to contract Norwegian Institute for Water Research (NIVA) in co-operation with the Water Research Institute (WRI), Prague, Institute of Industrial Landscape Ecology (IILE), Ostrava, Mining University, Ostrava (MUO), and Povodi Odry (PO) to execute several projects under the programme area "Abatement strategies in the River Odra catchment".*

*One of the projects is "Model reclamation of a Stream in the Protected Area Poodri". The project proposal was developed jointly by NIVA, IILE, MUO, and PO together with Poodri Management. Under a mission to Ostrava region in October 1992, the project was discussed and NIVA should prepare the first draft of the joint report. The objective of this report is to describe the selection of a model stream, proposal for reclamation of the model stream, and prepare a monitoring programme for the reclamation period.*

*Oslo, January 1993*

*Leif Lien*

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## **Introduction**

Substantial parts of the streams and rivers in the intensively used landscape near Ostrava city are channelled. This is also, to some degree, the situation in the newly established protected landscape area "Poodri". This area can be looked upon as a model area for both theoretical and practical application of experiences with stream reclamation. The project is the first attempt of such activity in the Odra river catchment area. It is intended to reclaim only a smaller part of a stream as an example of how to improve the ecological situation in areas which are worth to protect. Reclamation of this stream in practice will be "the starting point" for a project of greater extent which will be situated into heavily affected streams in the Ostrava and Karviná districts where almost all streams are channelled.

## **The protected area Poodri**

The Poodri area is a flood plain including the main river Odra and a number of tributaries, all originally meandering. In addition, Poodri has meander lakes, fish farm ponds and old channels for inflow to ponds and mills. The protected area Poodri was established in order to protect its wetland ecosystems. The range, shape and nature of Poodri is dependent upon the water flow of the upper parts of River Odra, upstream Ostrava city. Poodri has an area of 81.5 km<sup>2</sup> and the elevation of the flood plain is between 214 and 282 m above sea level (see Fig 1).

Poodri flood plain is situated in the centre of the "Moravian Gate", on the border between the Baltic and Black Sea watersheds. Thereby it is a particularly important biocorridor. Poodri is also situated in the contact zone between the Hercynian and Carpathian biogeographical sub-provinces. The influence of the Pannonians province also reaches this area.

The protected Poodri is surrounded by roads, railways, villages, industry areas and intensive farmland. Also within the protected area there are roads, railways, farms, fish farms and other human activity. The protection status of Poodri is a landscape protection, and the human activity is somewhat restricted. In the centre of the flood plain the human activity consist of fishery, agriculture and forestry. The other influences come from border areas of the protected area Poodri. Within Poodri there are several smaller areas with special protection (reserves) where human activities are considerably restricted.

## **Objectives of model reclamation studies in Poodri.**

The main objective is to obtain experience on how reclamation of streams and rivers can improve the ecological situation in areas which are worth being protected. In order to reach this goal the following sequence was proposed:

1. Inspection, estimation and evaluating data on the present status of the channelled streams and their surroundings.
2. Proposal for a specified stream part for model reclamation studies.
3. Specify required parameters and carry out monitoring of stream, stream banks and adjacent flood plain before, during and after reclamation for documentation of ecological changes.

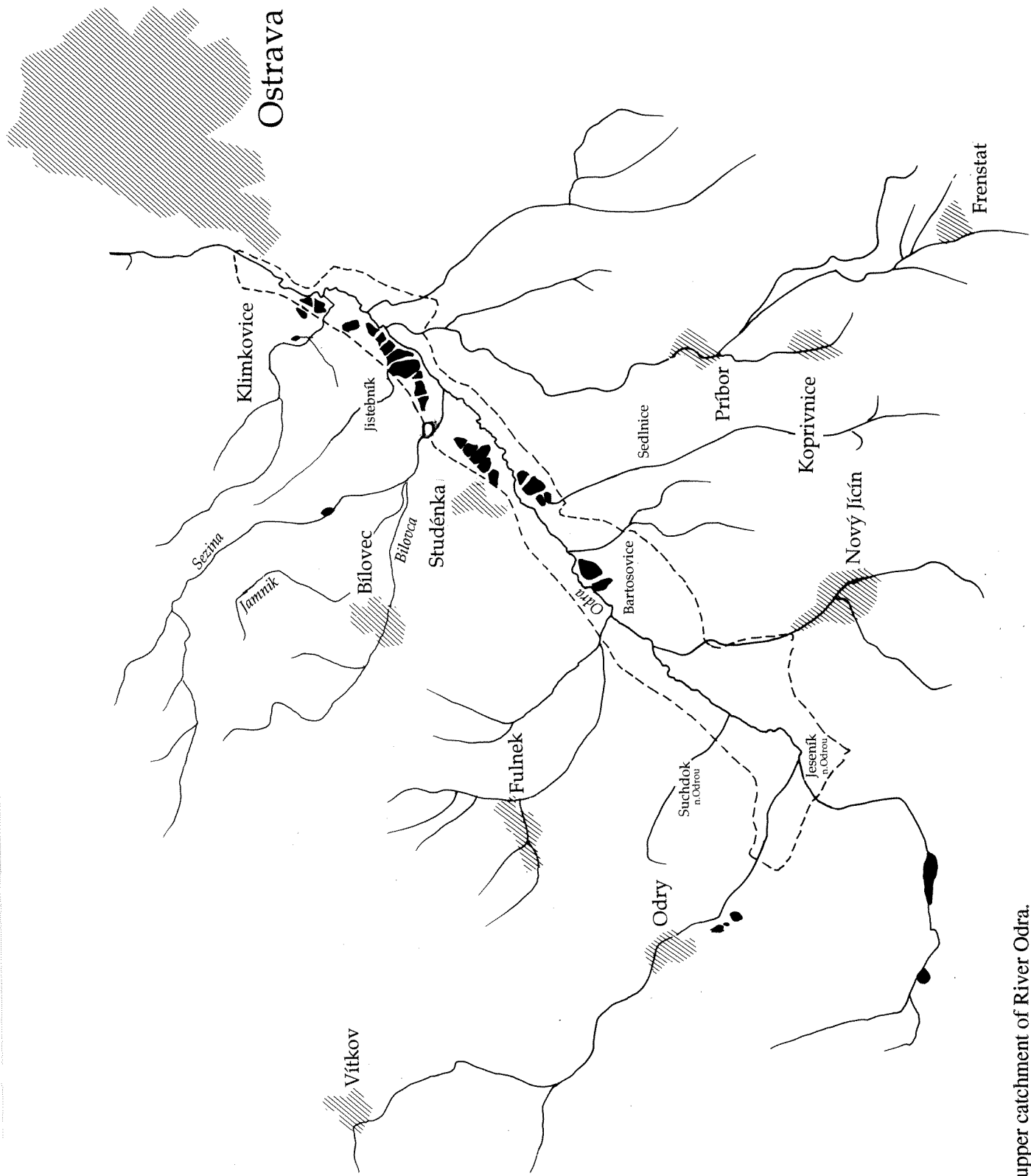


Fig. 1. The upper catchment of River Odra. The protected area Poodri are located within dotted line.

## **Selection of a model stream**

During the period 26. - 30. October 1992 a study team started working on the three items listed in the objectives. By excursion on ground and from air the Poodri area was surveyed and became acquainted to the team. Additional information from Czech researchers and available written data from Poodri gave a good background information of the present status of the protected area.

Based on these information a specified stream part was selected for the model reclamation study. Five streams were initially proposed by different authorities:

1. Bilovka
2. Sedlnice
3. Bartosovicky p.
4. Suchdolsky p.
5. Krivy p.

Bilovka was chosen for the reclamation study:

Bilovka stream is channelled within the Poodri area (see Fig 1 and 2). Outside Poodri, Bilovka is partly channelled as well. Three tributaries form the stream Bilovka. Bilovka is polluted from different sources: Metallurgic industry, human sewage, pig farms, poultry, cattle farms and non-point discharge from agriculture. Downstream the town of Bilovec the fish fauna is extinct.

The main reasons for selecting Bilovka for the model study were:

1. Channelled stream located inside Poodri.
2. Practical possibilities for restoring parts of the old meanders.
3. Most types of pollutions affecting the whole region were present.
4. The only locality proposed by both federal and local authorities.
5. Well suited for practical studies.
6. Appropriate size of the stream - fairly large, with conditions applicable to the River Odra as well as other streams in the area.

(Sedlnice was not located within the Poodri area and the proposed stream part was at present, although channelled, in not too heavily polluted conditions. Bartosovicky p. was located partly inside and partly outside the Poodri area, but closely surrounded by houses and roads and preparing a meandering of the stream would be very complicated. Suchdolsky stream is located inside Poodri but longer parts of the stream was led into an underground pipeline in an agricultural area. Krivy p. is located outside Poodri and it was not permanent water flow in the stream).

## **Reclamation of the model stream Bilovka**

The reclamation of a stream was identified to be a complex matter. Five main sections were identified for reclamation:

- 1) Return the stream to its former river bed.
- 2) Reduce or stop the pollution to the stream.
- 3) Revegetation and restocking of fauna in the streams and stream banks.
- 4) Monitoring of flooding and hydrological changes.
- 5) Monitoring of the water quality and re-establishment of the biota.

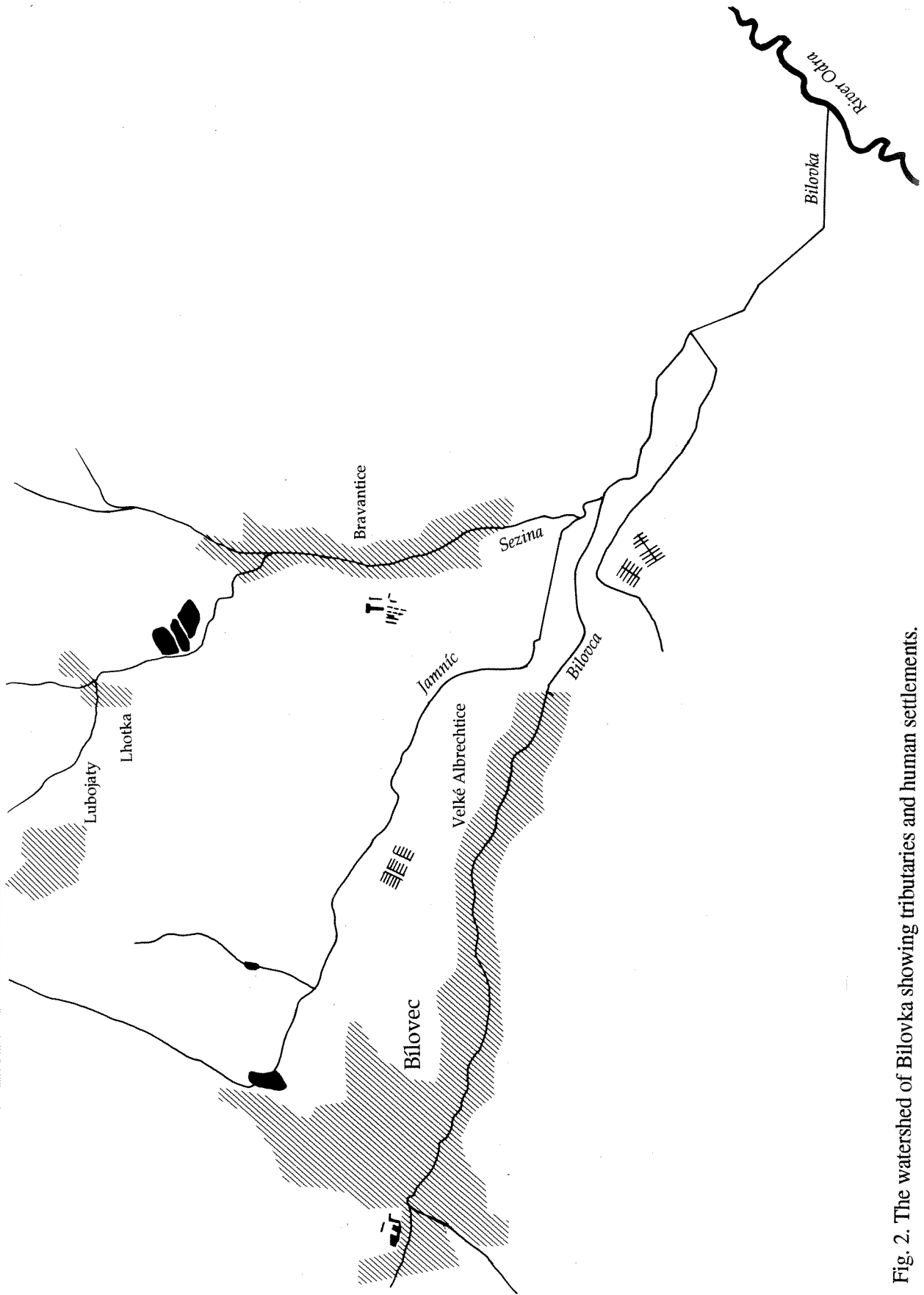


Fig. 2. The watershed of Bilovka showing tributaries and human settlements.



1) Return the stream to its former river bed.

Inside the Poodri area Bilovka is now completely channelled. According to air photos and old maps it is possible to locate parts of the old meandering stream Bilovka. It is also practically possible to dig up the old meandering river bed and lead the stream on to that. For study purposes it is convenient to maintain the upper part of the channelled Bilovka within Poodri as reference.

The idea of returning the channelled stream into a meandering one is of course to restore the more natural river bed, its vegetation and fauna, and the surrounding landscape elements, but also a substantial self-purifying capacity are expected. This will be one of the main scope to document in this study.

2) Reduce or stop the pollution to the stream.

A metallurgic factory in Bilovec is building a treatment plant for metallic wastes. That hopefully will remove most of the toxic discharge into Bilovka and some of the indicator organisms might return, e.g. fish. This is crucial for the reclamation study. Also the effluents from the pig farms are expected to have great influence on the stream. Reductions of this run-off will have positive influence on the stream. Some sewage treatment plants are also planned and will further improve the water quality of Bilovka. However, plenty of pollution will still be entering the stream e.g. for studies of self-purification capacity of the meandering stream.

3) Revegetation and restocking of fauna in the streams and stream banks.

By written descriptions and nearby reference localities the "original" vegetation and fauna should be quite well known. In the "new" meandering part of Bilovka we suggest for the study purpose to replant and restock the lower half of the new meandering stream and leave the upper half for "natural" colonisation. This upper part will also provide information of various stages in a "natural" succession, leading to a final climax community.

A plan for regeneration and revitalisation of landscape and natural vegetation for this lower part will be produced. This will include re-introduction of forest patches and optimal land-use for natural meadow vegetation and development of species diversity.

4) Registration of flooding and hydrological changes.

The channelling of streams has been built for centuries in the Czech Republic for prevention of flooding. Particularly on the flood plain Poodri flooding was an annual event, and it was a natural part of the ecosystem. In order to reclaim the Poodri, a moderate annual flood is desirable. Further upstream and outside Poodri, no flood is wanted on farmland and villages.

During the last 30-40 years an agricultural change has taken place from small private farms to bigger co-operatives. The dividing lines between the small private farms and also between the various fields within the small farms used to be hedges of shrubs and trees. These hedges were expected to prevent flooding from higher areas of the catchments where most farmlands are located. During the co-operative process most of the hedges were cut down to make bigger field units, and thus the expected flood preventions were removed. There has also been a change in land use from meadows to more intensively used croplands. Increasing flooding during the last years has been observed but it remains to be documented, e.g. correlated to precipitation and other climatic factors.

If increased flooding is documented, smaller agricultural areas in the upper parts of the Bilovka catchments should be restored with "original" vegetation hedges. By non-planted reference localities in similar areas, hydrological regimes and soil erosions could easily be monitored.

5) Monitoring are described in detail below.

### **Monitoring of the reclamation stream Bilovka.**

#### **Sampling stations**

A total of 15 monitoring stations (9 permanent and 6 possible temporary) are suggested for the reclamation study (see Fig 3).

Stations 1 and 2 illustrate small upstream farmland catchments for flooding and soil erosion studies. One area for replanting the vegetation hedges and one for references.

Stations 3, 4 and 5 are reference stations for water quality before the streams enter areas with high inflow of pollution. Station 6 is located closely downstream to the metallurgic factory in Bilovec.

Stations 7 and 8 will describe the water quality of the streams Jemec and Sezina and stations 9 and 10 will show the water quality of the main tributaries downstream the area of high pollution. Stations 11 and 12 will illustrate the change of water quality before and after passing a big pig farm. Station 12 will also state the water quality before entering the channelled reference part of Bilovka.

Station 13 together with station 12 will show the self-purification capacity of the channelled stream and station 13 will also be a reference station for the new meandering part of Bilovka. Stations 14 and 15 will illustrate the self-purification capacity of the new meandering Bilovka stream.

Some stations, marked with open circles, might be expected to be operating only in the first period of the study. Stations 1 and 2 will be operating if flooding is documented during the last decades.

#### **Parameters and sampling frequency.**

An extensive list of parameters are suggested in the starting up period. The list includes both physical/chemical and biological parameters. Biological parameters cover botany, zoology and bacteria. Stream sediments will also be examined for metals.

The sampling frequency will generally be every month (12 times a year), but varying considerably with the different parameters.

There is no intention to use the extensive parameter list on all sampling stations. The physical/chemical parameters are grouped in categories A to F. Group A is general parameters and should be sampled at all stations. Group B illustrates organic matters and should also be sampled at all stations in the starting period but might be reduced later on. The main ions (C) could be sampled at all stations but only twice a year. The nutrients (D) are probably important parameters in this study and should at least for a period be sampled 12 times a year at all stations. Heavy metals (E) are mainly known from the Bilovec factory and should be analysed every period on stations 3, 6, 9, 11, 12, 13, 14 and 15. Other metals (F) might also occur and should be analysed at the same stations a few times. If some of these metals are found in harmful concentration, they should be placed in parameter group E. It should also be analysed for all metals (E and F) a few times on all the other stations.

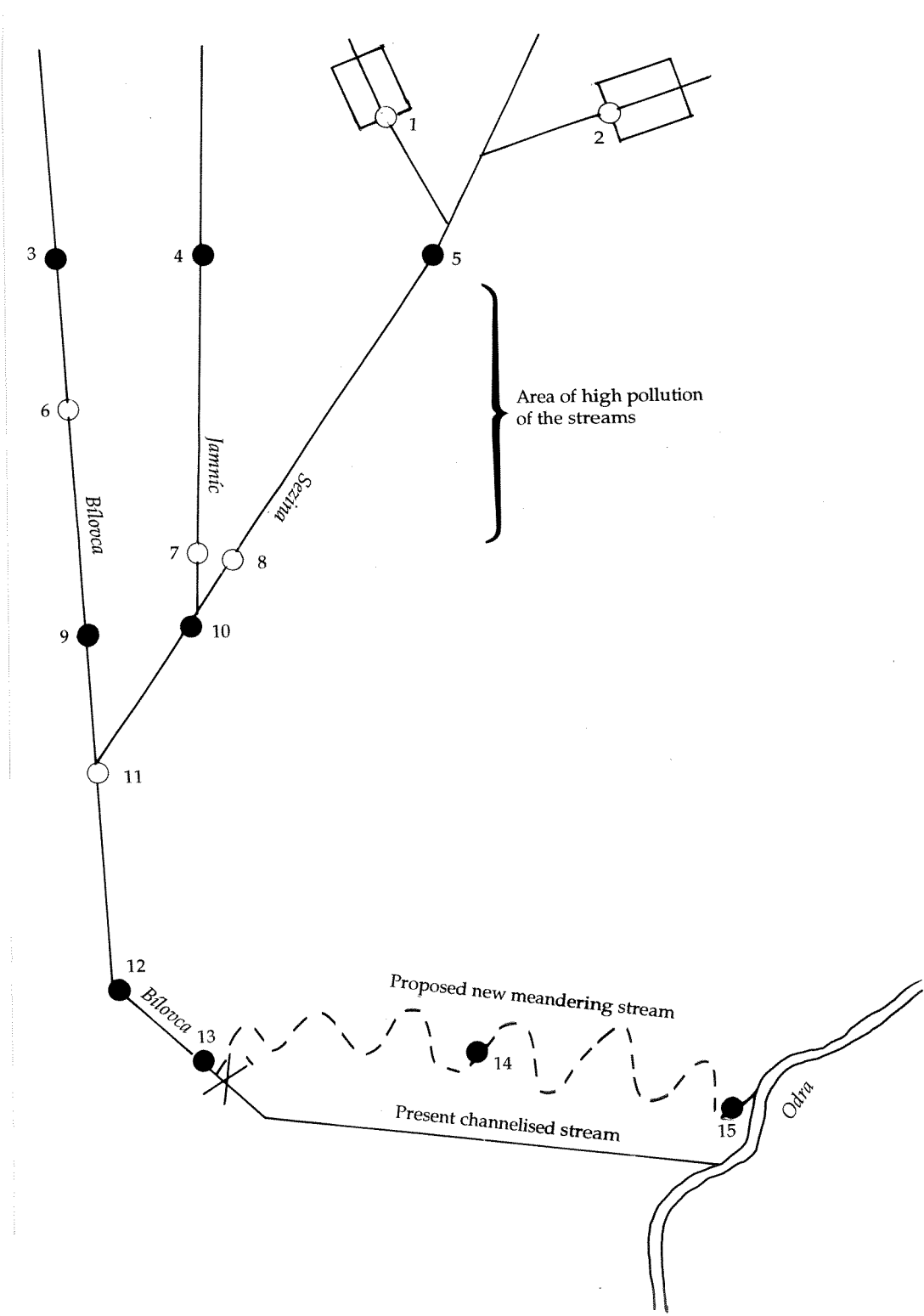


Fig.3. Schematic outline of the Bilovka watershed.

List of parameters:

Physical/chemical		Biological
pH		
Conductivity		Botany
Turbidity	A	Mosses
Alkalinity 4.5		Vegetation of stream bank and adjacent flood plain
Acidity 8.3		
BOD	B	Zoology
COD		Zoobenthos (+ <i>Astacus</i> )
		Fish
Ca		
Mg		
Na	C	Bacteria
K		<i>E.coli</i> (43°C)
Cl		
SO <sub>4</sub>		
Tot-N		
NO <sub>3</sub>		
NH <sub>4</sub>	D	
Tot-P		
PO <sub>4</sub>		
Cu	E	
Cd		
Hg, Fe, Zn, Mn	F	
Cr, Ni, Pb		

Biological parameters are included for many reasons. Mosses (*Fontinalis*) are suitable indicator species for heavy metal contaminations. Mosses will therefore be transferred from other streams to Bilovka, both upstream and downstream the metallurgic factory in Bilovec for continuous registration of heavy metal contaminations. Monitoring of filamentous algae should also be included.

The development of bank vegetation and adjacent meadow vegetation along the new meandering part of Bilovka will be studied. This project part includes the following steps:

1. Vegetation maps for the whole catchment. (Will be carried out as part of the Ecological stability program for the whole Poodri area.)
2. "Before-after" characterisation of indicator elements (plant species and certain vegetation units), including:
  - A geobotanical study of bank vegetation and the affected meadows, with special emphasis on the threatened and vulnerable species.
  - A succession study of the riparian vegetation from "year 0".
  - A characterisation of neighbouring forests (reference sites).

Zoobenthos will be sampled twice a year at all stations. *Astacus fluviatilis* will, if available, be used as indicator organism. Fish species will also be used as indicator organisms by electrofishing the sampling stations twice a year. Bacteria (*E. coli* 43 °C) will be analysed every month at all stations for indicating fresh sewage and manure.

### **Project organisation and reporting**

The purification of the stream and digging of the new meandering stream will be done by Czech investments. The main sampling and analysis of most parameters will also be done in the Czech Republic. However, in the initial period some sampling (fish, zoobenthos) will be a joint work (NIVA-Czech Republic), and for a period also the analysis of some heavy metals will be done at NIVA. During the whole study period most of the physical/chemical parameters should once a year be sampled for inter calibration with NIVA.

Annual progress reports will be performed with both Czech and NIVA participation. After three years a final report will be prepared also as a joint work.

### **Staffing**

The study team will consist of:

Mr. Tor Erik Brandrud, NIVA

Mr. Leif Lien, NIVA

Mr. Petre Brezina, PO

Ms. Sarka Neuschlova, Poodri Management

Mrs. Helena Raclavska, MUO

Mr. Konstantin Raclavsky, IILE

Mr. Alexander Skacel, IILE

Mr. Jan Stalmach, IILE

Ms. Barbara Stalmachova, IILE

The contact persons will be Leif Lien, NIVA and Alexander Skacel, IILE.

### **Time schedule**

Construction of the meandering part of Bilovka and the building of a treatment plant for the metallurgic discharge in Bilovec will hopefully take place in early 1993. Immediately after the construction of the new meander the described study should start. At least three years are expected before a "more stable" situation is expected after the constructions of the meander. A "steady state" situation might take decades.

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ISBN-82-577-2234-0