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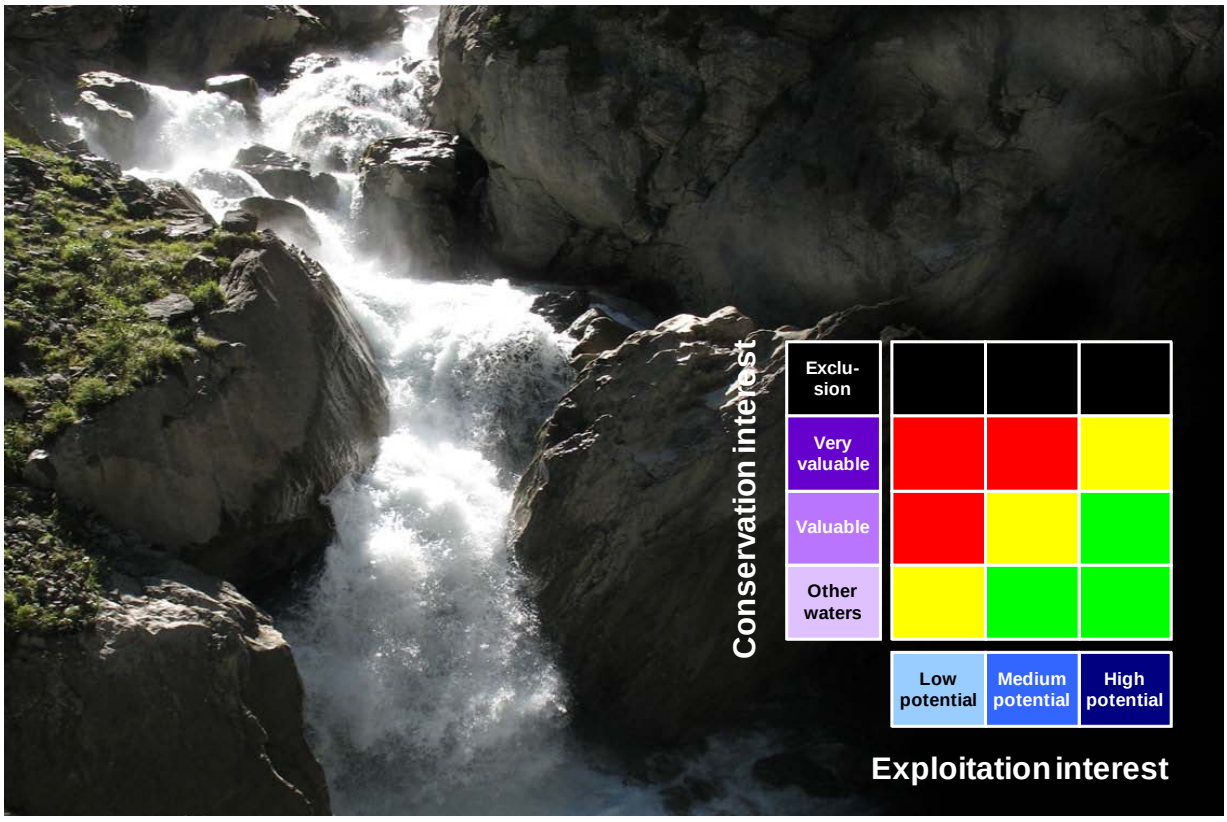
Recommendations for developing cantonal conservation and exploitation strategies for small hydropower plants



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This publication is an enforcement aid issued by the FOEN, SFOE and ARE in their capacity as supervisory authorities and is addressed primarily to the enforcement authorities. It seeks to clarify undefined legal concepts contained in the relevant Acts and Ordinances so as to facilitate consistent enforcement practices. Authorities who give due consideration to these aids can safely assume that Federal law is being correctly implemented. Alternative approaches are, however, permissible provided they comply with the legal requirements.

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Table of contents

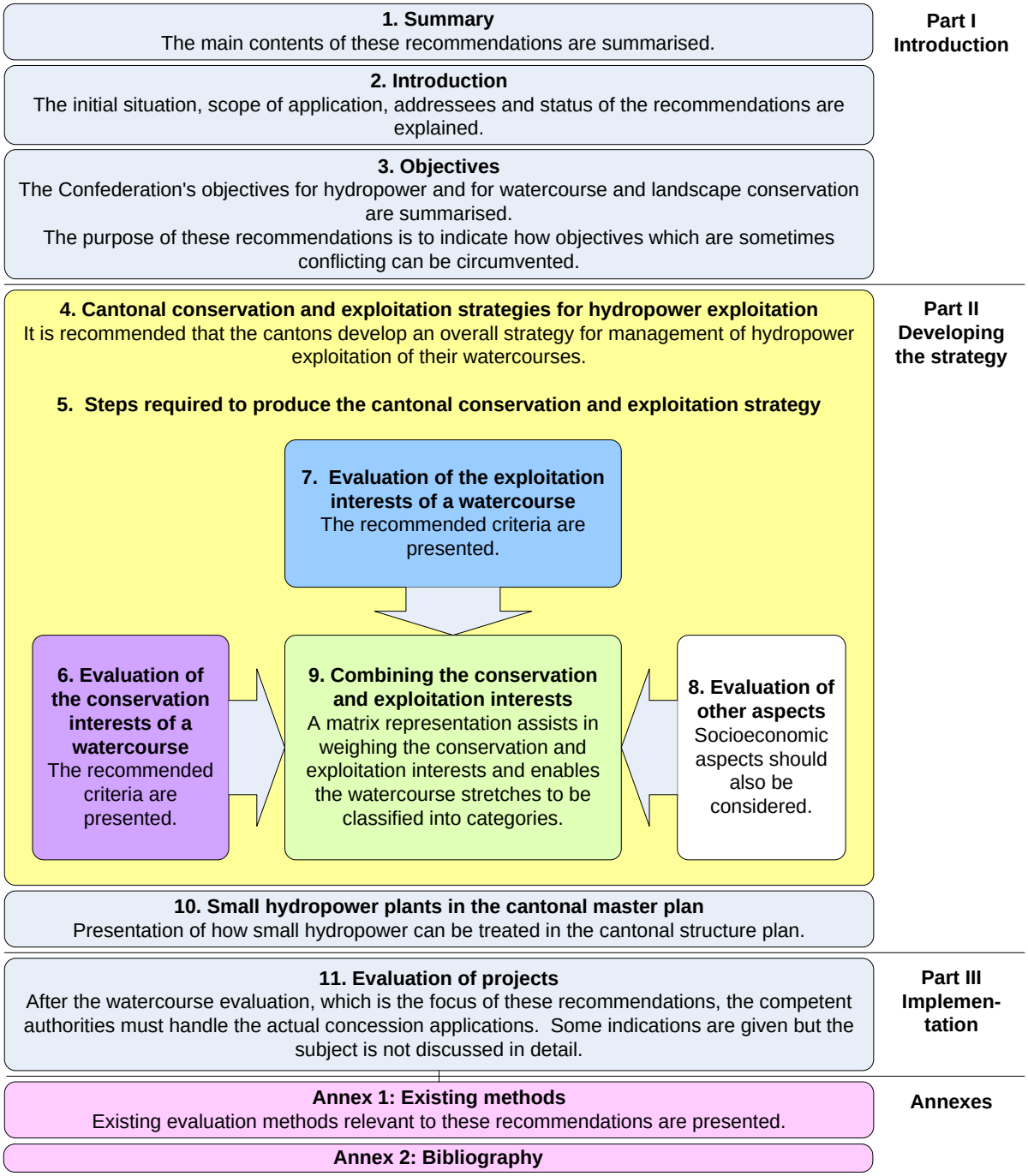
Part I: Introduction

1 Summary

1.1 Schematic overview

Figure 1 shows a schematic overview of the contents of these recommendations. The most important statements in the recommendations are summarised in Section 1.2.

Figure 1: Schematic overview of the chapters and annexes of these recommendations



1.2 Main statements and contents of the recommendations

1.2.1 Conflicting claims

The partially conflicting claims to watercourses as an energy source, habitat and landscape element represent a challenge. When evaluating small hydropower plants, all the relevant interests must be considered and weighed against each other. A three-stage procedure is proposed for this:

— Development of a strategy: designate watercourses in which rational and reasonable hydropower exploitation is possible in principle and those where conservation has priority.

— In the project planning for hydropower plants (preferably as early as the feasibility study stage), the watercourse evaluation undertaken in the strategy should also be considered.

— When considering the concession applications, the watercourse evaluation should also be taken into account.

1.2.2 Cantonal strategies for prioritisation in respect of conservation and exploitation

In order to use hydropower in the best possible way whilst continuing to protect valuable watercourses, it is recommended that each canton formulate a strategy for the management of hydropower exploitation. This should contain standardised procedures with defined criteria and evaluation classifications. This will ensure that (stretches of) natural watercourses with a high ecological and landscape value are protected. The assessment of the value of a watercourse must not be based merely on individual stretches but must cover the full water system catchment area.

Hydropower exploitation is proposed mainly for sites where high exploitation potential exists and the ecological and landscape value is low. In principle, preference should be given to upgrading existing power plants (particularly large plants) or using existing infrastructure rather than building a new plant on an unexploited watercourse stretches. If a new plant is built, the potential available must be utilised as fully as possible.

1.2.3 Conservation and exploitation criteria for the classification of watercourses into categories

The FOEN, SFOE and ARE have compiled lists of conservation and exploitation criteria to be considered in the watercourse evaluation, as it should be carried out on a standardised national Swiss basis as far as possible. The cantons can add to these lists as required.

The FOEN, SFOE and ARE propose a procedure for weighing the respective interests of conservation and exploitation. For this purpose watercourses are classified into four categories:

— Exclusion: the watercourses must be protected under legislation and no projects are possible.

— Conservation: the ecological and/or landscape interests of watercourses in this class generally outweigh the hydropower exploitation interests. As a rule no projects are possible.

— Restriction with special requirements: projects must meet higher specifications, the legal discretion is interpreted in favour of conservation and exploitation must represent only minimal intervention.

— Interest: the legal discretion is interpreted more in favour of hydropower exploitation due to the lower impact. As a rule projects are possible.

1.2.4 Existing methods

These recommendations do not contain any fixed methods. They describe the procedure recommended by the FOEN, SFOE and ARE for developing conservation and exploitation strategies. To assist the cantons, there are references to existing methods already formulated.

2 Introduction

2.1 Initial situation

With the introduction of the cost-covering feed-in tariffs for electricity from renewable sources (CFT) in the legal framework of the revision of the Energy Act of 26 June 1998 (EnG, SR 730.0[1]), the economic conditions for new or significantly renovated and extended small hydropower plants have improved. Many new projects, or projects previously not pursued for economic reasons, are now likely to be more cost-effective. Within a short period a large number of projects have been initiated and registered for CFT with swissgrid, the national grid company. Although the chances of these projects being realised are variable, the cantonal and municipal services will be faced with a large number of them in the coming years. From the perspective of the authorisation authorities (cantons, communes), there is a need for standardised evaluation criteria for projects involving watercourses in particular.

2.2 Scope of application

These recommendations apply to small hydropower projects with an average gross mechanical output[2] of up to 10 megawatts on watercourses, namely for storage and run-of-river plants with or without water abstraction. The recommendations mainly cover evaluation of watercourses in terms of the interest in their conservation or exploitation.

The cantonal authorities define how they evaluate the individual projects and actual concession applications on the basis of the watercourse evaluation.

With their focus on the weighing of interests between claims to exploitation and conservation of the watercourses, these recommendations can also be applied to larger hydropower projects.

2.3 Addressees

The recommendations are addressed to the enforcement authorities, namely the cantonal and communal services that handle small hydropower projects. As, in most cases, the service involved is cantonal. the term “cantons” has been used in the rest of this document for convenience.

The recommendations are also intended to inform investors, planners and other interested groups of the possible cantonal strategies and the criteria to be applied.

2.4 Significance of the recommendations

This publication is an enforcement aid issued by the FOEN, SFOE and ARE in their capacity as supervisory authorities and is addressed primarily to the enforcement authorities. It seeks to clarify undefined legal concepts contained in the relevant Acts and ordinances so as to facilitate consistent enforcement practices. Authorities who give due consideration to these aids can safely assume that Federal law is being correctly implemented. Alternative approaches are, however, permissible provided they comply with the legal requirements.

[1] Not all Swiss legal texts have been translated into English. Those available can be consulted here: http://www.admin.ch/ch/e/rs/rs.html

[2] Definition under Art. 51 of the Federal Act of 22 December 1916 on the Use of Hydraulic Power (Water Rights Act, WRG, SR 721.80)

3 Objectives

3.1 Objectives for hydropower under the Energy Act

The Confederation wishes to promote the use of hydropower more actively in the future using a variety of measures. New plants are to be built and existing plants refurbished and extended with ecological requirements being factored in, so as to exploit the available potential. Instruments for this are the cost-covering feed-in tariffs (CFT) for hydropower plants up to an average gross mechanical output of 10 megawatts and the measures to promote hydropower laid down in the “Renewable Energies” action plan. The quantitative target under Art. 1 para. 4 EnG is to increase the average annual electricity generation from hydropower plants from its level in the year 2000 by at least 2000 gigawatt hours by 2030.

3.2 Objectives for watercourse conservation

According to Annex 1 of the Waters Protection Ordinance of 28 October 1998 (GschV, SR 814.201) the hydrodynamics (unit bed load discharge and water level and flow regime) and the morphology should correspond to the natural conditions. Other objectives are defined for the biocoenoses of the flora and fauna of surface waters, the environment under their influence and the space requirement of the watercourses.

These objectives are widened to include landscape aspects in various instruments such as the Swiss Landscape Concept (SLC), which is compulsory for the authorities, the Landscape 2020 Guiding Principles and the Guiding Principles for Swiss Watercourses issued by the FOEN. Some of the objectives are to upgrade the status of water in the landscape, to create space for natural dynamics and to concentrate infrastructure in developed areas and build it without significant impact on biotopes and landscapes needing conservation.

3.3 Objectives of these recommendations

Some of the objectives for hydropower under the Energy Act are inconsistent with those for the conservation of watercourses, species, habitat and landscape. In particular, hydropower plants often affect the natural water dynamics required in the Waters Protection Ordinance and generally have a negative impact on the habitats of flora and fauna and on the landscape.

These recommendations offer the cantons a guide as to how to handle these sometimes conflicting legal objectives. They offer the stakeholders a guide to decision making with the aim of balancing the different claims to the watercourses against each other. They indicate where rational and reasonable exploitation is possible and where conservation has priority.

A list of the main criteria is proposed and can be extended by the cantons as necessary. A list of this type is used to evaluate and objectively assess the different conservation and exploitation interests and weigh them against each other transparently if conflicts arise. This means that projects are evaluated nationally under comparable criteria. The planning security for applicants is also increased.

Coordinated over large areas, the recommendations can also be used by the cantons to designate the locations suitable for hydropower exploitation and include them as mandatory in their spatial planning instruments.

Part II: Developing the strategy

4 Cantonal conservation and exploitation strategies for hydropower utilisation

4.1 The most important recommendation: developing cantonal conservation and exploitation strategies

The FOEN, SFOE and ARE recommend that the cantons develop an overall **conservation and exploitation strategy** for management of hydropower exploitation in their watercourses.

The objective of the conservation and exploitation strategy is the appropriate **division of the watercourses** into those where rational and reasonable hydropower exploitation is possible in principle and those where conservation has priority. Conservation and exploitation should be promoted equally by limiting conflicts as far as possible at the planning stage. This should be achieved using a standard procedure and with defined criteria and evaluation categories. The following aids are suggested to the cantons for this:

Lists of the main **conservation criteria** which must be followed under Federal law for the evaluation of the ecological and landscape value of watercourses (= conservation interests → chapter 6) and **exploitation criteria** for evaluation of the potential for exploitation (= exploitation interests → Chapter 7)

A **method for combining** the conservation and exploitation interests (→ chapter 9)

In view of the large number of new small hydropower projects, it is important to formulate and implement the conservation and exploitation strategy as quickly as possible. If individual projects have to be evaluated before the strategy is completed, the cantons should apply these recommendations with their minimum criteria and assess the watercourses in question with their hydrological catchment areas.

4.2 Watercourse suitability map

It is recommended that the cantons produce a map of their watercourses based on their conservation and exploitation strategy. The map shall show the suitability of the watercourses for exploitation. It shall therefore indicate where conservation has priority and where rational and reasonable exploitation is possible.

If production of a map is not possible, due for example to lack of comprehensive basic data, the cantons can focus on the watercourses and their hydrological catchment area which are covered by feasibility studies and concession applications actually in progress.

4.3 Quantitative targets for hydropower growth

It is recommended that quantitative targets for the growth of hydropower are also defined in the cantonal strategies. The achievability of the target should be verified by appraisal of the usable watercourse stretches. This should include the reduced production due to compliance with the residual flow regulations and the anticipated consequences of climate change.

4.4 Possibility of compensation payments

At Federal level there is no current basis for compensation payments between an exploited watercourse and one to be protected. However, approaches with a similar objective do exist (reallocation of use), such as compensation payments under the Ordinance of 25 October 1995 on Compensation for Losses due to the Use of Hydraulic Power (VAEW, SR 721.821) and the compensation for lower residual flow volumes as part of the conservation and exploitation planning under Art. 32, let. c of the

Federal Act of 24 January 1991 on the Protection of Waters (Waters Protection Act, GSchG, SR 814.20). Cantonal solutions should be sought if necessary.

4.5 Transparency and participation

In order to be successfully implemented, the conservation and exploitation strategy must be accepted by as many of the stakeholders as possible. These include:

— the various cantonal offices and services,

— nature conservation organisations,

— the power plant operators,

— representatives of the regions, tourism, recreation

— the communes or other stakeholders (depending on the context).

A transparent procedure for developing the strategy that includes all the parties involved is essential for its success.

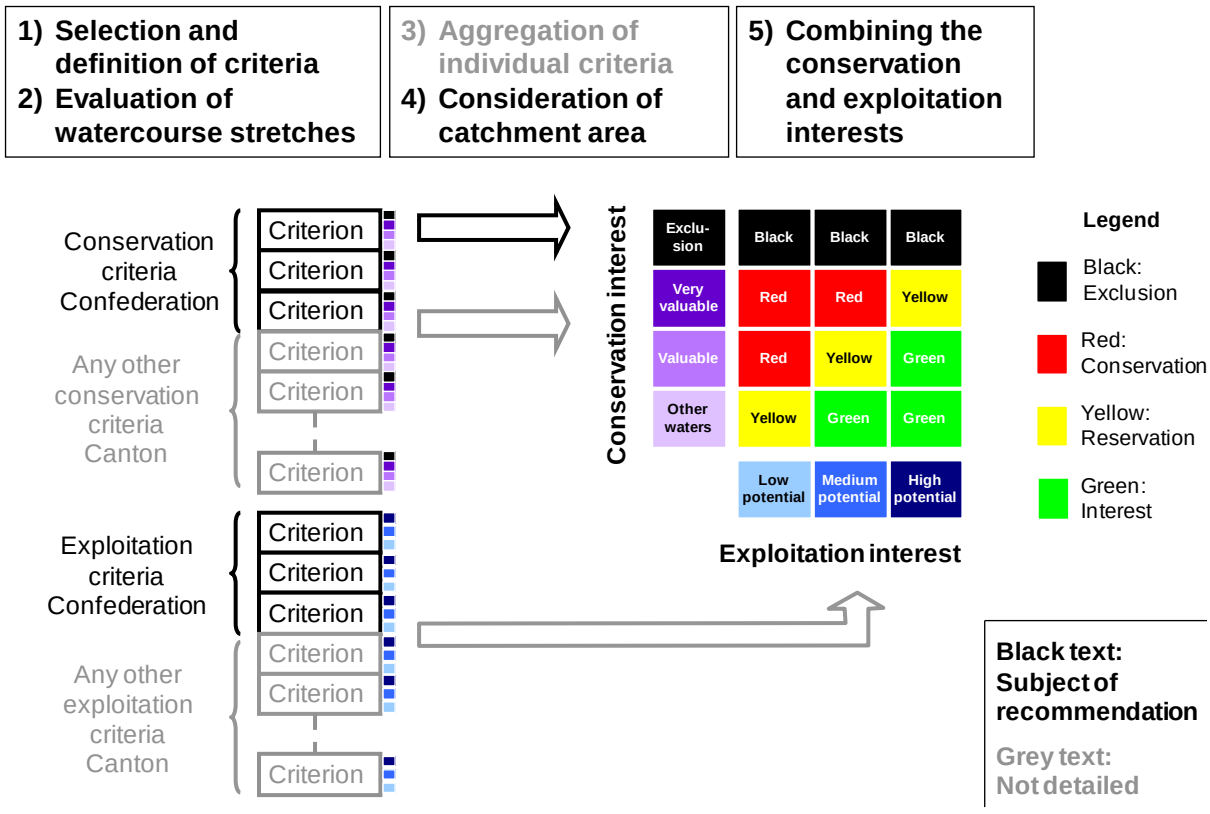
5 Steps required to produce the conservation and exploitation strategy

Table 1 summarises the suggested steps to produce a conservation and exploitation strategy. Figure 2 gives a schematic view of the steps which can also be used for an individual evaluation:

Table 1: Steps taken to produce a cantonal conservation and exploitation strategy

No.	Description	Chapter/Section
0	**Project definition:** define objectives, sequence, evaluation area, subject, forms of participation etc. to develop the strategy.	4
1	**Selection and definition of evaluation criteria:** if necessary, add other criteria to the conservation and exploitation criteria selection described in these recommendations and define rating scales.	6 7 8
2	**Evaluation of watercourse stretches:** evaluate the watercourses in the area using the criteria.	
3	**Aggregation:** aggregate the various conservation and exploitation criteria to establish conservation and exploitation interests for each watercourse stretch.	6.3 7.3
4	**Consideration of the watercourse system in the catchment area:** review and if necessary adapt the conservation and exploitation interests for each stretch in the light of the whole catchment area.	6.4 7.4
5	**Combining the conservation and exploitation interests:** divide the watercourse stretches into categories according to their potential for exploitation.	9
6	**Evaluation of projects:** evaluate the current feasibility studies and concession applications on the basis of the strategy developed, taking account of other criteria.	11

Figure 2: Steps taken to produce a cantonal conservation and exploitation strategy



6 Evaluation of the conservation interests of a watercourse

6.1 Overview

Section 6.2 lists the criteria for evaluation of the conservation interests of the watercourse stretches based on federal law. It represents a **minimum list** of criteria which must always be considered. According to need and the regional context, cantons may add other criteria to this list for their own requirements. Examples of other studies are listed in Annex 1.

Section 6.3 describes how to aggregate the individual criteria to generate an overall evaluation of the conservation interest of each watercourse stretch. Under the regulations the cantons can decide how they want to do this. To assist them, existing methods are listed in Annex 1.

Section 6.4 indicates that the conservation interests of a stretch must always be evaluated in the light of the whole hydrological catchment area of the watercourse system.

6.2 Criteria for evaluating the conservation interests of a watercourse stretch

6.2.1 Rating scales

For reasons of space, only the highest conservation category is shown in table 5, not the full rating scales. The examples in table 2 and table 4 show three full rating scales.

Two-class rating scales

Many of the conservation criteria either apply or do not apply to a watercourse stretch ("Yes-No criteria"). The appropriate conservation category for these is given in table 5. Two examples are shown in table 2 and table 3.

Table 2: Example of rating scales for so-called "Yes-No criteria" (Exclusion)

No. and name: S1: Federal Inventories of Fens, Raised Bogs and Transition Bogs

Conservation category: Exclusion

Rating scale:

Watercourse characteristics	Conservation category
Watercourses in inventoried fens, raised bogs and transition bogs (Federal inventories)	**Exclusion**
Watercourses not located in inventoried land.	**Other watercourses**

Table 3: Example of rating scales for so-called "Yes-No criteria" (Very valuable)

No. and name: S13: Natural or near natural watercourses under ecomorphology level F

Conservation category: Very valuable

Rating scale:

Watercourse characteristics	Conservation category
Natural or near-natural watercourses under ecomorphology classification F of the modular concept or existing potential for such watercourses	**Very valuable**
Slightly modified, heavily modified, artificial, non-natural or culverted watercourses under ecomorphology level F of the modular concept	**Other watercourses**

Multi-class rating scales

The four-class rating scale according to table 4 is used for the other conservation criteria. The boundaries between the classifications on the scale are defined by the cantons. Examples of how this can be done are documented in Annex 1.

Table 4: Example of a rating scale if grading is necessary.

No. and name: S5: Federal Inventory of Landscapes and Natural Monuments of National Importance (BLN), if the conservation objective would be impaired by exploitation.

Conservation category: Exclusion / Very valuable

Rating scale:

Watercourse characteristics	Conservation category
Serious impact on the conservation objective	**Exclusion**
No or only minor impact	**Very valuable**
(Not applicable to this criterion)	**Valuable**
The watercourse is not located in a BLN area.	**Other watercourses**

6.2.2 List of conservation criteria

The FOEN, SFOE and ARE recommend evaluating the need for conservation of watercourses using the following criteria and conservation categories. The list contains the minimum conservation criteria required. The cantons are free to add further criteria as necessary.

Table 5: Minimum selection of criteria for evaluation of the conservation interest

Conservation category	Criteria	Remarks
a) Federal inventories		
Exclusion	S1: Federal Inventories of Fens, Raised Bogs and Transition Bogs	Under Art. 78 para. 5 of the Federal Constitution of the Swiss Confederation (SR 101), facilities cannot be built in mire biotopes. Therefore hydropower exploitation is excluded.
Exclusion	S2: Federal Inventory of Mire Landscapes	Under Art. 23d of the Federal Act of 1 July 1966 on the Protection of Nature and Cultural Heritage (NHG, SR 451), hydropower exploitation is excluded.
Exclusion	S3: Federal Inventory of Alluvial Zones and new projects (candidates)[3]	There is a conservation interest of national importance. For both these criteria, intervention would always result in serious damage, so that a project should be ruled out irrespective of the importance of the intervention interest (Art. 4 para. 2 of the Ordinance of 28 October 1992 on the Protection of Floodplains of National Importance (Floodplains Ordinance, SR 451.31), Art. 7 of the Ordinance of 15 June 2001 on the Protection of Amphibian Spawning Sites of National Importance (AlgV, SR 451.34) and Art. 29 para. 1 let. a of the Ordinance of 16 January 1991 on Nature and Cultural Heritage Protection (NHV, SR 451.1) (planning protection for uncleared and new projects).
Exclusion	S4: Federal inventory of amphibian spawning sites and projects not finally cleared	

[3] Projects not yet cleared in supplements 1 and 2 of the Floodplain Inventory (see dossier for 1998 and 2001 hearings)

Conservation category	Criteria	Remarks
Exclusion / Very valuable	S5: Federal Inventory of Landscapes and Natural Monuments (ILNM), if the conservation objective would be impaired by exploitation.	— Serious impact4: "Exclusion". Even if the overall exploitation interest in generating electricity using small power plants is of national importance, the individual exploitation interest cannot generally outweigh the conservation interest. The result is exclusion (Art. 6 NHG). — Minor impact or none: "Very valuable". Although there is a conservation interest of national importance, if the impact is only slight or minor, a small power plant is possible as a result of weighing the interests (Art. 6 NHG).
Exclusion	S6: Federal Inventory of Reserves for Waterbirds and Migratory Birds	Hydropower exploitation conflicts with the conservation objectives. Art. 6 of the Ordinance of 21 January 1991 on Reserves for Waterbirds and Migratory Birds of International and National Importance (WZVV, SR 922.32) requires an assessment of interests. As with S5 (BLN), Art. 6 NHG applies if there is a serious impact. In these cases the protection imperative equates to exclusion (cf. Ruling of the Swiss Federal Supreme Court 134 II 97 E.3.5.2 p.105).
Exclusion	S7: Fish Spawning Sites and Crayfish Sites of National Importance	There are surveys of nationally important areas for grayling, nase fish and crayfish. A permit is always required for intervention in fisheries under Art. 8 and 9 of the Federal Act of 21 June 1991 on Fish and Fisheries (BGF, SR 923.0). The relevant areas can be found in the following FOEN enforcement guidelines: — Grayling Populations of National Importance, Fishery Notices No. 70 — Monitoring of nase fish in Switzerland, Fishery Notices No. 82 — National Action Plan on Crayfish, January 2006
b) Other protected areas		
Exclusion	S8: Areas protected under the Ordinance on Compensation for Losses due to the Use of Hydraulic Power (VAEW)	Hydropower exploitation is ruled out by law.
1)	S9: Legally binding protection and utilisation plan (SNP) under Art. 32, let. c GSchG	The conservation category depends on the regulations in the relevant SNP.
Exclusion	S10: Core zone of national park, nature discovery park, existing national park	According to Art. 17, para. 1, let. d of the Ordinance of 7 November 2007 on Parks of National Importance (ParkV, SR 451.36) and Art. 23 para. 1, let. c ParkV, hydropower exploitation is ruled out.

[4] If it is difficult to distinguish between serious, minor and no impact at the strategy stage, this must be performed in the project evaluation.

Conservation category		Criteria	Remarks
Very valuable	Valuable	S11: Regional nature park	Impact on the conservation value defined under the relevant Parks Charter (Art. 26 ParkV) in relation to habitat types, landscape and sites of local character under Art. 20 ParkV. — Serious impact: "Very valuable" — Slight impact: "Valuable" Spatial planning safeguards under Art. 27 ParkV by the canton; intervention is possible on the basis of appropriate weighing of interests under Art. 3 of the Spatial Planning Ordinance of 28 June 2000 (RPV, SR 700.1).
Exclusion	Very valuable	S12: UNESCO World Heritage Sites	— With watercourse conservation objective: "Exclusion" — Without watercourse conservation objective: "Very valuable". Basis: Art. 5 of the Convention for the Conservation of the World Cultural and Natural Heritage of 23 November 1972 (World Heritage Convention, SR 0.451.41).
c) Morphology and landscape			
Very valuable		S13: Natural or near-natural watercourses under ecomorphology classification F of the modular concept or existing potential for such watercourses	The very short stretches in the ecomorphological surveys should be summarised in an overall evaluation. Note: In the Swiss Plateau, natural or near-natural watercourses are ecologically very valuable. In mountain regions, however, many watercourses are natural without being ecologically very valuable. The mountain cantons may adapt the conservation category and rating scale to their conditions.
Very valuable		S14: Revitalisation planned or completed	As with criterion S13, revitalised watercourse stretches are considered very valuable. In addition, investments made or planned by public authorities should in general not be affected. The framework is given by the cantonal revitalisation plans developed under the revised Waters Protection Act.
Very valuable		S15: Rare types of watercourse	There are special types of watercourse which are not inventoried or protected but which require conservation. It is suggested that the cantons produce a list of those to be protected.
Very valuable		S16: Landscape value	It is suggested that the cantons produce a list of special features that should be conserved such as waterfalls, gorges etc. They can also include cantonal nature reserves and other unexploited and almost undeveloped landscapes of high value featuring watercourses. If this is not done, this criterion must be considered in the specific project evaluation of interests.

Conservation category	Criteria	Remarks
d) Other habitats needing conservation		
1)	S17: Emerald Network sites	These are habitats in need of conservation under Art. 18 para. 1bis NCHA for which an evaluation of interests must be carried out under Art. 18 para. 1ter NHG. The need for conservation of these sites is mainly determined by the target species and habitats in the Emerald Network that are affected by the project.
1)	S18: Habitats and endangered species needing conservation under Art. 18 para. 1bis NHG, particularly springs and other bank vegetation.	These are habitats in need of conservation under Art. 18 para. 1bis NHG and Art. 14 para. 3 NHV for which an evaluation of interests must be carried out under Art. 18 para. 1ter NHG. If the area is under cantonal or municipal protection, the protection status is defined in the relevant decree. If data on the need for conservation is not initially available, it must be obtained to assess the specific project interests. The species are weighted according to the classifications in the Red Lists, the lists of priority species and if these lists are not complete, on the basis of an expert assessment.
1)	S19: Mires, alluvial zones and amphibian spawning sites of regional importance which are included in a cantonal inventory.	
Very valuable	S20: Special fish habitats: a. Spawning sites for lake trout, goby, brook lamprey, bitterling and grayling b. Lake trout migration corridors c. Watercourses for salmon reestablishment programmes	a. Red List species with “seriously endangered” status. The situation of these fish species prevents additional impact, as this would also counteract the ongoing conservation effort. b. Lake trout are reliant on navigable rivers for ascent and descent.
Exclusion	S21: Watercourses with populations of the threatened fish species rock pickerel, sofie, savetta, marble trout and nase	Red List species with “threatened with extinction” status. The situation of these species of fish prevents additional impact.

1) The conservation category cannot be specified in advance; it depends on the constraints or existing conservation regulations.

6.3 Aggregation of conservation criteria

The watercourse stretches are evaluated using the selected conservation criteria. Depending on the type of criterion, the data already available and the size of the area evaluated, this is achieved by evaluation and analysis of reports and maps, mathematically, by analysis in a Geographical Information System (GIS), by expert opinion, by field inspections etc. It is recommended that the results of the assessments be recorded in the GIS and displayed on standardised maps.

The individual criteria are then aggregated to assess the conservation interest of the watercourse stretches.

This aggregation can be carried out by weighting and summation. As there is no generally applicable weighting for the individual criteria, the weighting is pragmatic: it takes place based on expert opinion, preferably involving the representatives of the various stakeholders. However, aggregation shall not take place if the watercourse is the subject of an exclusion criterion, since exploitation is always ruled out.

These recommendations do not stipulate any weightings, aggregation methods etc., but refer to existing documents and previous work. See Annex 1.

6.4 Consideration of the watercourse system in its catchment area

The conservation criteria listed in Section 6.2 and the aggregation described in Section 6.3 mainly cover individual watercourse stretches. For example, a stretch is or is not located in a conservation area. This evaluation is relatively simple, but only generates a reliable evaluation of the conservation interest to a limited degree. The conservation interest expresses the ecological and landscape value of a watercourse stretch, which is very strongly influenced by the characteristics of the adjacent stretches. Examples of this are endangered species habitats (conservation criterion S18 in table 5) and fish spawning sites (conservation criterion S7), the value of which depend on the watercourse continuum.

The ecological functions of a watercourse can only be fully understood by looking at its full catchment area. In the light of this, the evaluation of the individual stretches should be followed by an overall conservation interest evaluation looking at the full catchment area. This can change the evaluation of the conservation requirement for an individual stretch.

The evaluation of the suitability of watercourses for hydropower exploitation should consider the catchment area involved in its entirety. All the relevant interests should be fully integrated if possible.

It is easier to evaluate the individual stretches than the full catchment area. If good databases are available, the individual evaluation can be largely automated in a Geographical Information System (GIS), but this is impractical for an entire catchment area. An expert assessment is needed.

7 Evaluation of the exploitation interests of a watercourse

7.1 Different interests in relation to hydropower exploitation

In order to develop a balanced conservation and exploitation strategy, the relevant cantons must assess the benefits of exploiting the relevant watercourse stretches in addition to their conservation interests as described in chapter 6.

Two basic approaches are available for exploitation interests.

- Economic approach: the exploitation of a watercourse stretch is of interest if a power plant can be constructed with initial costs lower than the potential financial reward.
- Optimum utilisation: the exploitation of a watercourse stretch is of interest if the limited hydraulic resources are used as rationally, efficiently and effectively as possible.

The first approach represents the economic viewpoint of the power plant operator. The regulatory authorities (canton or communes) also share it, e.g. due to hydroelectric fees, power generation, promotion of economic growth etc. However, the authorities are also interested in the second approach, namely sustainable use of resources. Therefore the FOEN, SFOE and ARE recommend:

Ensuring that if a new plant is built, the watercourse is used as **effectively** as possible.

- The energy and ecology potential of each power plant location should be exploited to the maximum.
- The new plant must not prevent implementation of another power plant project with a better environmental cost-benefit ratio[5].
- Micro hydropower plants must be very well justified in the authorisation procedure. In particular, it is important to have a good ratio between additional energy production and ecological and landscape intervention. Special attention should be paid to safety factors (e.g. flood protection).
- The overall efficiency of small and especially micro hydropower plants is generally a good indicator of the quality and economics of the project. For this reason, and to achieve a high energy yield, priority should be given to high efficiency projects. Projects with poor efficiency are not worth supporting.

[5] Examine for example,
- whether a small power plant or a small power plant cascade is worse for the environment and electricity generation than a larger plant with a longer bypass stretch.
- whether more efficient hydropower utilisation is possible by transfer to an existing power plant. Transfer should particularly be given preference if it provides summer storage for the hydropower.

7.2 Criteria for evaluating the exploitation interests of a watercourse stretch

The following criteria are recommended for evaluating the exploitation interests of watercourse stretches.

Table 6: Proposed criteria for evaluating the benefits of exploitation of a watercourse stretch

Criteria	Remarks
"Economic approach"	
N1: Gradient of watercourse	The exploitation interests increase with the gradient.
N2: Flow	The greater the flow, the greater the theoretical potential. However, only certain ranges are of interest for exploitation.
N3: Gradient/flow ratio	Exploitation is only of interest if this ratio is within a specific range[6]. The longitudinal potential calculated by multiplying flow by height difference is only suitable for characterising the exploitation interest in some cases.
N4: Access	The easier the access for construction sites and power lines, the lower the initial costs.
N5: Flow consistency	Temporary watercourses which go dry for long periods are of less interest for exploitation (e.g. mountain streams at very high elevations).
N6: Existing dams or stepped falls	If a dam already exists (e.g. for historical reasons), exploitation of an otherwise uninteresting watercourse can be of interest[7].
"Optimum utilisation"	
N7: Efficient utilisation of watercourse	The hydropower potential available should be used very effectively. With a view to future developments, the maximum expansion should always be achieved. This means that a small power plant project should be evaluated negatively if it would impede or prevent viable larger construction with a better environmental benefit-cost ratio. This is in accordance with Art. 5 Waters protection Act. See also the remarks in section 7.4 on consideration of the catchment area. A possible indicator is the ratio between the potential of a watercourse utilised to the total potential available.

It is recommended that the cantons work with hydropower specialists to evaluate the exploitation interest.

7.3 Aggregation of exploitation criteria

Like the conservation criteria (cf. section 6.3), the watercourse stretches are evaluated using the selected exploitation criteria. Here again, recording of the evaluation results in a GIS is recommended in order to display them on standardised maps.

The individual criteria are then aggregated to assess the exploitation interests of the watercourse stretches.

This aggregation can be carried out by weighting and summation. As there is no generally applicable weighting for the individual criteria, the weighting is pragmatic: it takes place based on expert opinion, preferably involving the representatives of the various stakeholders.

[6] Example: a) Large river (Q = 100 m3/s) with low fall head (1 m), b) Small mountain stream (Q = 1 m3/s) with large fall head (100 m). Both watercourses have the same potential mathematically. Whereas the large river (a) is not of great interest for power generation, a small, steep mountain stream (b) with the same potential can be of great interest.

[7] Example: The potential of a watercourse is assessed as low on the basis of criteria N1 to N5, mainly because the gradient is slight. However if a weir already exists, the necessary investment costs are reduced, exploitation becomes interesting and the potential must be evaluated as medium or high.

These recommendations do not stipulate any weightings or aggregation methods.

7.4 Consideration of the watercourse system in its catchment area

It is recommended that the cantons take an overall view of each catchment area in order to evaluate, on the basis of criterion N7, “efficient utilisation of the watercourse”, where exploitation makes sense and where it does not. This is difficult to automate, it needs an expert assessment.

If the area evaluated is relatively small and clearly structured, this can be achieved during the full evaluation phase of the watercourse stretch. It may be more appropriate to defer the evaluation of large areas until concrete projects come forward.

8 Other aspects relevant to conservation and exploitation of a watercourse

Our watercourses and their riparian zones fulfil a variety of functions. The claims to the watercourses and their shaping are equally variable. Conflicting objectives are often unavoidable. Alongside the conservation of watercourses and hydropower exploitation factors discussed in the previous chapters, other aspects must also be considered, for example (non-exhaustive list):

— social functions of the watercourse (e.g. tourism, recreation etc.)
— safety (flood protection)
— Socioeconomic aspects (e.g. jobs, support for peripheral regions etc.)
— existing uses in the watercourse area (agriculture, trade and industry, residents, groundwater etc.)
— climate-neutral electricity production (CO2 substitution)
— …

It is recommended that the cantons include these aspects in their strategies. Annex 1 lists some existing or ongoing plans which have already tackled this subject.

Many conflicts can only be assessed in the actual project evaluation rather than at the strategy and regional prioritisation stage. The existing spatial planning and building permit procedures are applied to deal with these conflicts.

9 Combining the conservation and exploitation interests

9.1 Matrix representation

The conservation and exploitation interests should be combined using figure 3. The meaning of the colours in the matrix for watercourse exploitation is explained in table 7.

Figure 3: Matrix for assessing the conservation and exploitation interests of watercourses

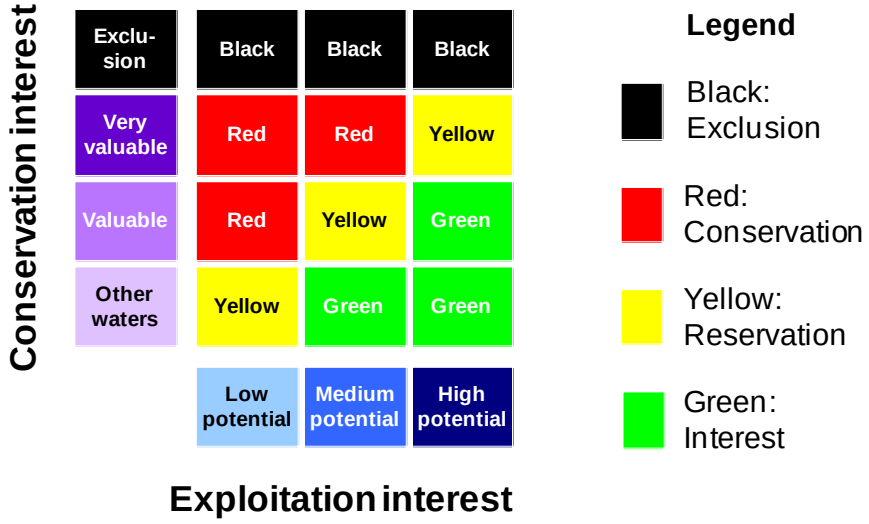


Table 7: Recommended requirements for hydropower exploitation and meaning of colours

	Recommended requirements for hydropower exploitation / Meaning of colours
Black	**Exclusion → No exploitation** Exploitation of the watercourse is totally excluded and no weighing of interests is carried out. This classification should be used if: — full legal protection already exists, e.g. for mires and mire landscapes of great beauty and national importance, — conservation interests of national importance exist and intervention would cause a serious impact, — hydropower exploitation is always incompatible with the existing conservation objectives in the affected area.
Red	**Conservation → In general no exploitation is possible** The ecological and/or landscape interests associated with watercourses in this class are generally higher than the interest in exploitation of its hydropower. Therefore exploitation constitutes serious intervention and the watercourse is protected. Authorisation can only be obtained in exceptional cases, subject to very stringent conditions.
Yellow	**Reservation → Special conditions must be expected** On valuable watercourses with medium potential and very valuable watercourses with high potential, the ecological and/or landscape and hydropower exploitation interests are both high. The legal discretion granted for the authorisation is interpreted in favour of watercourse and/or landscape conservation and exploitation must represent only minor intervention. The applicant must expect the concession to be granted with special requirements and conditions, stringent if necessary, in favour of watercourse, nature and landscape conservation and must assume higher costs. Micro hydropower plants can generally be expected on other watercourses with low potential. The applicant does not have to expect the concession to be granted with more stringent requirements and conditions in favour of watercourse, nature and landscape conservation. However, because less funding is often available for the planning and operation of micro hydropower plants, safety (flood protection) and compliance with the legal watercourse and/or landscape protection regulations should be given special consideration.

	Recommended requirements for hydropower exploitation / Meaning of colours
Green	**Interest → Exploitation is generally possible** The ecological and landscape interests on watercourses in this class are usually lower than the hydropower exploitation interests. The legal discretion is interpreted in favour of hydropower exploitation due to the lower impact. The applicant can expect authorisation without more stringent conditions.

The matrix in figure 3 is a schematic representation for evaluation of watercourses. It does not replace the essential full assessment of the interests of individual projects (see chapter 11). The matrix indicates the extent of the scope of evaluation and that an assessment of interests will most probably not yield a different result. However, it does not anticipate the results of actual individual cases.

9.2 Prioritising

In addition to the watercourse categories defined in section 9.1 (colours), the weighting of the various conservation and exploitation criteria by the canton and the boundaries between the categories are also extremely important. The cantons have some discretion here and the recommendations do not replace their policy prioritisation between conservation and exploitation.

Classification of the watercourses is equivalent to spatial prioritisation for the construction of small hydropower plants.

The FOEN, SFOE and ARE also recommend the following principles:

To increase electricity generation from hydropower, the following have priority:

- Plants linked to existing infrastructure. These are generally unobjectionable from a water ecology point of view. They include drinking water, wastewater and residual flow hydropower plants, snow-making and irrigation facilities etc.
- Replacement, expansion and upgrading of existing power plants combined with remediation of the ecological and landscape impacts. These projects can represent an improvement to both power generation and conservation. These win-win situations should be the aim wherever possible.
- Recommissioning of disused power plants and the use of existing necessary thresholds combined with remediation of the ecological and landscape impacts, using the matrix as a guide[8] (see figure 3).
- Previously undeveloped sites should only be used as a last resort, using the matrix as a guide (see figure 3).

[8] If the site is located on a watercourse classified as “Red”, conservation has priority and renaturation is also to be examined.

10 Small hydropower plants in the cantonal structure plan

10.1 Treatment of small hydropower plants in the cantonal structure plan

The cantonal structure plans show how activities with a spatial impact can be coordinated in terms of the development aims and the chronology and resources that are planned for completion of the tasks (Art. 8 of the Federal Act on Spatial Planning, Spatial Planning Act, RPV, SR 700). Therefore the issue of hydropower is also covered in the cantonal structure plan if there is a high coordination requirement in relation to the exploitation of watercourses or if concrete projects with a significant spatial impact are already planned.

Small hydropower plants represent a sub-aspect of hydropower exploitation. A strategy for handling them must therefore be worked out from the objectives and a general hydropower exploitation strategy. This is normally embedded in the canton's objectives and strategies on energy, particularly renewables.

In the structure plan the canton should first define a strategy for hydropower exploitation which shows whether hydropower should be promoted and if so under what conditions. This strategy should then form the basis for handling small hydropower plants under Art. 6 RPV and the main results should be included in the cantonal structure plan.
Under Art. 6 para. 4 RPV, which requires the structure plans of neighbouring cantons to be taken into account, cooperation between the cantons and the regions must be guaranteed. Along with the interests of neighbouring cantons, national interests should also be taken into account (Art. 11 RPV).

Different levels of treatment of small hydropower plants in the structure plan

Depending on the importance given to small hydropower plants in a canton or region, appropriate levels are recommended for their treatment in the structure plan. Their importance is dependent on how the canton evaluates and weights the benefits of small hydropower plants and nature and landscape conservation against each other. A clear strategic position by the canton on renewable energies and power generation from small hydropower plants is therefore particularly important.

10.2 Possible structure plan content

10.2.1 Strategic objectives

The strategic content comprises concrete objectives, principles and priorities for the planning of small hydropower plants. They can include the following aspects:

— The role assigned to renewables and therefore to hydropower in the canton. Derived from this is the expression of the importance assigned to small hydropower plants in energy generation and information on any cantonal support policy, e.g. through fees for hydropower, optimised concession procedures, expansion and upgrading etc.

— The role of conservation interests in the canton (water ecology, nature and landscape) and other exploitation interests (drinking water, fisheries, tourism etc.) should be indicated.

— Principles for consideration of the spatial impact and potential conflicts, particularly with nature and landscape conservation and water ecology.

— Prioritising e.g. in terms of the different forms of energy, the sites etc. (c.f. also section 9.2)

10.2.2 Coordination of use of space interests

As also discussed in section 4.2, two basic procedures are possible to coordinate hydropower exploitation with the other claims to use of space:

— In their structure plans the cantons can designate areas which the evaluation of the watercourse stretches using the conservation and exploitation criteria indicates are unsuitable (exclusion zones), only very conditionally suitable (protected zones), conditionally suitable (reservation zones) or suitable (interest zones) for the operation of small hydropower plants (cf. table 7). It is possible to illustrate these zones in appropriate form using cartography, e.g. on a thematic map or the structure plan map.

— In the structure plan the cantons define conservation and exploitation criteria (c.f. sections 6.2 and 7.2) which must be followed so as to enable operation of small hydropower plants.

10.2.3 Requirements and assignments for further planning

The cantonal structure plan may set requirements for:

— How implementation of the cantonal strategy is to be addressed by the cantonal and municipal authorities. It details the responsibilities and the time frame for completion of tasks as necessary.

— What aspects regional structure plans or municipal exploitation plans have to undertake or tackle in greater depth.

Part III: Evaluating projects

11 Evaluating projects

Concrete projects and concession applications must still be evaluated on a case-by-case basis. As previously, many other criteria are applied, for example under environmental impact assessments. If watercourse criteria cannot be assessed in the evaluation of the watercourse stretches due to lack of data, this must be performed later in the project evaluation. The project evaluation incorporates the watercourse evaluation.

The evaluation includes all the project components, for example access and adjacent infrastructure such as approach roads or power lines.

A building permit procedure generally takes place alongside the concession procedure. Both are carried out under the relevant cantonal laws.

These recommendations do not discuss concrete projects in detail but a few indications are given below.

There are also exclusion criteria at project evaluation level, such as:

— protected waters zones S1, S2

— dry meadows and grassland of national importance

— …

These criteria are site-specific and often very small-scale. Since an exclusion can often be circumvented by modifying the project, these criteria have not been recommended for the watercourse stretch evaluation.

Many other criteria must be considered in the evaluation. They include the following inventories:

— UNESCO World Heritage Sites in Switzerland

— Inventory of Swiss Heritage Sites (ISOS)

— Inventory of Historical Traffic Routes in Switzerland (IVS)

— Swiss Inventory of Cultural Property of National Importance (KGS Inventory), 2009 edition

Examples of best practice projects for use as guidance for the project evaluation can be found in the 2010 Alpine Convention Guidelines.

Annexes

1. Summary of existing conservation and exploitation strategies and methods
2. Bibliography

Annex 1: Summary of existing conservation and exploitation strategies and methods

Some projects, strategies and methods which can be used for implementation of these recommendations are listed below.

Methodik zur Bewertung und Klassierung der Nutzungseignung von Fliessgewässerstrecken (Methodology for analysis and classification of the suitability for exploitation of watercourse stretches), Water Agenda 21 (WA-21), October 2009:
www.wa21.ch/index.php?section=media9&path=%2Fmedia%2Farchive9%2FD_Wasserkraftnutzung%2FRegionale%20Strategien%2FProjekt%20Klassifizierung%20Fliessgewaesserstrecken%2F (in German)

The WA-21 methodology developed and tested enables conservation and exploitation interests to be quantified using evaluation criteria. A comparison of conservation and exploitation interests is followed by classification of the watercourse stretches into categories. Requirements of varying strictness are laid down category by category for water projects or exploitation is completely ruled out. The results and experience from this study are incorporated into these recommendations.

Wassernutzungsstrategie des Kantons Bern (Canton of Bern water use strategy):

www.bve.be.ch/bve/de/index/direktion/ueber-die-direktion/dossiers/wasserstrategie.html (in German or French)

The canton of Bern's method was developed jointly with that of WA-21. They have many common features. Bern bases the evaluation of its watercourses on the hydropower potential and the conservation claims from the standpoint of both fisheries and water ecology. By combining the actual records for these three bases, the watercourses can be classified into categories. On this basis, a complete cantonal water use map with the watercourses categories has been produced. An instrument for the sustainability evaluation has also been developed for the comprehensive assessment of new projects and concession applications.

Beurteilung und Bewirtschaftung der Wasserkraft im Kanton Freiburg, Synthesebericht für das Mitwirkungsverfahren vom Februar 2010 (Evaluation and management of hydropower in the canton of Fribourg, summary report for the participation procedure of February 2010):

http://admin.fr.ch/shared/data/pdf/cha/potentiel_hydraulique_fd.pdf (in German or French)

The watercourses are evaluated by criteria enshrined in the structure plan. Small hydropower plant exploitation is classified into three categories, "suitable", "conditionally suitable" and "unsuitable", by comparing conservation and exploitation interests. A map of the whole canton is not produced. The individual watercourse stretches are evaluated when a concession application is made.

Erhebung des Kleinwasserkraftpotentials der Schweiz (Survey of the small hydropower potential of Switzerland), Netzwerk Wasser im Berggebiet (NWB), in preparation:

http://www.netzwerkwasser.ch/aktivitaeten/projekte/aktuelle-projekte/wasserkraftpotential/ (in German)

The purpose of this project is to develop a basis for decision-making which can be used to identify suitable sites for new small hydropower plants in Switzerland. All the relevant influencing factors such as technical, socioeconomic and ecological aspects should be considered.

Wasserkraft in Tirol (Hydropower in Tyrol), draft, December 2009:

www.tirol.gv.at/fileadmin/www.tirol.gv.at/presse/downloads/Entwurf_Kriterienkatalog.pdf (in German)

An extensive list of criteria is presented for evaluation of hydropower projects. The various criteria are described in detail.

Common guidelines for the use of small hydropower in the Alpine region, Alpine Convention - Platform water management in the Alps, publication scheduled for spring 2011:

As in these recommendations, a matrix is used for comparison of conservation and exploitation interests. Best practice examples are listed (including some from Switzerland).

Annex 2: Bibliography

Alpine Convention, Platform Water Management in the Alps, 2011: Common guidelines for the use of small hydropower in the alpine region

Canton of Bern Office of Water and Waste Management, 2010: Wassernutzungsstrategie 2010

Canton of Bern Office for Environmental Coordination and Energy, 2010: Beurteilung von Projekten für Kleinwasserkraftwerke (< 10 MW) aus Sicht der nachhaltigen Entwicklung. Instrument zur Nachhaltigkeitsbeurteilung auf der Stufe Vorprojekt

Bolliger, Roman; Zysset, Andreas; Winiker, Michèle, 2009: Schutz- und Nutzungsplanung nach Gewässerschutzgesetz. Erfahrungen, Beurteilungskriterien und Erfolgsfaktoren. Umwelt-Wissen No. 0931. Federal Office for the Environment, Bern. 74 pages

Ernst Basler + Partner AG 2005: Ausnahmen von den Mindestrestwassermengen im Rahmen einer Schutz- und Nutzungsplanung (Art. 32 Bst. c GSchG). SAEFL (contractor)

Federspiel et al., 2009: Wasserkraft in Tirol

Michor, Klaus, 2006: Checkliste für Wasserkraftwerke bis 15 MW Engpassleistung aus naturschutzfachlicher Sicht

NOK & Environmental Associations, 2009: Ökofilter für die Wasserkraft. Ein Methoden-Handbuch zur ökologischen Beurteilung von möglichen Standorten für zukünftige Wasserkraftanlagen

Office of the State Government of Styria, Austria, 2008: Kriterienkatalog zur Ausweisung naturschutzfachlich hochwertiger Fliessgewässer (-abschnitte) in der Steiermark

SFOE, FOEN, ARE 2010: Empfehlung zur Planung von Windenergieanlagen. Die Anwendung von Raumplanungsinstrumenten und Kriterien zur Standortwahl

SFOE, FOEN, Water Agenda 21 Hydropower Dialogue Working Group; Wehse, Heiko; BG Ingenieure und Berater, 2009: Methodik zur Bewertung und Klassierung der Nutzungseignung von Fliessgewässerstrecken

Water Agenda 21 2010: Regionale Strategien für die Wasserkraftnutzung und den Schutz der Gewässer. Standpunkt der Arbeitsgruppe Dialog Wasserkraft

Zeh Weissmann, Heiko; Könitzer, Christoph; Bertiller, Anita, 2009: Strukturen der Fliessgewässer in der Schweiz. Zustand von Sohle, Ufer und Umland (Ökomorphologie); Ergebnisse der ökomorphologischen Kartierung. Stand April 2009. Umwelt-Wissen No. 0926., Federal Office for the Environment, Bern. 100 p.