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**Autor:** Wey, Alain  
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## Lakes made by man

The number of artificial lakes in Switzerland created by the construction of dams has increased significantly since the end of the 19th century. Where are they? Why were they built? What purpose do they serve? A look at the proliferation of lakes made in Switzerland. By Alain Wey

"My goodness, so Sihlsee in Schwyz is an artificial lake", says the freshwater sailor. You'd be surprised at the number of constructions of this kind in our beautiful land. It all started with a few days beside an idyllic expanse of water. But wherever there is an artificial lake, there is a dam or a dike. It is goodbye to Jean-Jacques Rousseau's naive romantic vision. These dams were not built to enhance the beauty of the countryside or to attract tourists, but essentially to meet Switzerland's energy needs. Swiss engineers specialising in dam construction are able to provide their expertise worldwide because Switzerland was a pioneer in this field. Switzerland has a history steeped in lake construction.

Trailblazers, the Swiss? Lac de Pérolles in the south of Fribourg dates back to 1872, and its concrete gravity dam was the first to be built in Europe. There is Heidsee and Lake Davos in Grisons, Lac de la Gruyère and Montsalvens in Fribourg – in fact there are few cantons that do not have an expanse of artificial water called a lake. But as soon as you start looking at statistics in this field, you move into troubled waters owing to the fact that the definition of what constitutes a lake is ultimately subjective. Are basins used for the production of artificial snow (up to 50,000 m<sup>3</sup> of water) lakes? The engineer Georges Darbre,

head of the dams unit at the Federal Office of Energy, does not believe artificial lakes can exist without a dam or a dike because water levels are raised artificially. "In Switzerland, around 200 water-collection lakes are supervised by the Confederation."

The Federal Office for the Environment lists a hundred water-collection lakes with a surface area in excess of 0.1 km<sup>2</sup>. There are also compensation basins which aim to offset the negative effects of dams on aquatic wildlife. In addition, there are around a thousand smaller water-collection systems under the supervision of the cantons. "They are not necessarily full, but can be filled and may contain several thousand or tens of thousands of cubic metres of water. Those intended to protect against floods are dry for most of the year and full for a certain period." There are also constructions to protect against avalanches, such as those at dei Dragoni above Airolo in Ticino.

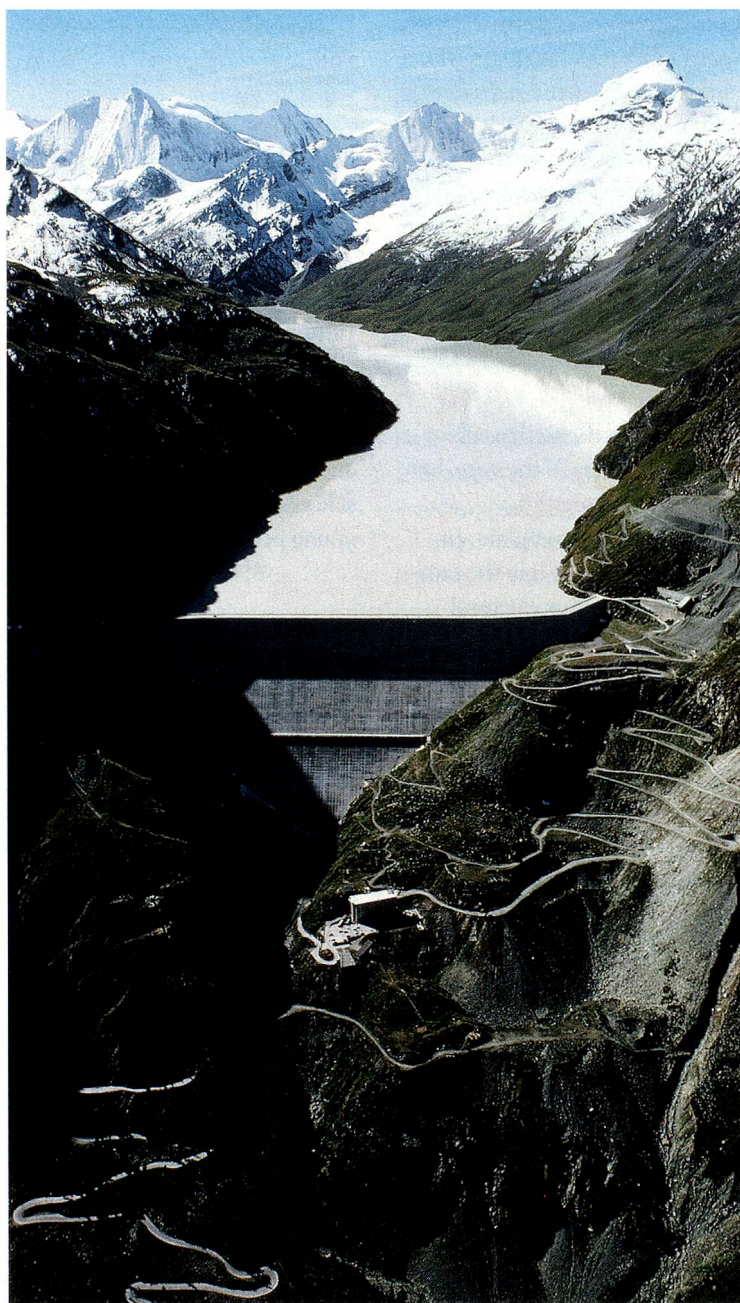
### Around 200 water-collection lakes

The economic boom that Switzerland experienced after the war required the development of hydraulic energy: between 1950 and 1970, almost 80 dams above 15 metres in height were built. The "Grande Dixence" constructed between 1950 and 1961 is still the highest gravity dam in the world, standing at 285 metres. Of the 200 water-collection lakes under the management of federal government, very few do not contain water on a permanent basis. There are, of course, significant fluctuations determined by hydroelectricity management.

"The vast majority of artificial alpine lakes are empty during the winter. The Grande Dixence, for example, provides reserves which are managed so that the lakes are full at the end of the rainy season, which is the beginning of winter. All the potential energy and water collected in the lake is used during the winter and the lake is empty by the beginning of spring."

### Energy from hydropower

Hydroelectric energy accounts for around 60% of



The Grande Dixence, Switzerland's largest dam, holds back the Lac des Dix lake in Valais



## SWISS ENGINEERING

Switzerland has a very high density of dams per km<sup>2</sup>. "Our dams are very high, mainly made of concrete and built for relatively small volumes of water", says George Darbre. "Swiss engineering companies specialising in this field have an excellent global reputation and work all over the world. They provide their expertise in Iran, Turkey, Italy, Asia and Central and South America. They work all over the place."

total Swiss power production. "Around half of this 60% comes from systems installed along watercourses, like the reservoirs on the Rhine and the Aar", says Georges Darbre. "The other half comes from reservoir systems such as those on Lac des Dix, which provides 20% of the power production from water-collection lakes." The artificial lakes therefore provide 30% of total Swiss energy production. Mr Darbre also explains that the reservoir systems benefit society when severe storms or heavy floods hit, as was the case in 2005. "In Mattmark, the Canton of Valais acquired a section of the lake so that water is retained in the lake rather than running into the valley in the event of heavy rainfall."

### Lac de la Gruyère

Whenever an artificial lake is built, nature finds a new ecological balance. There are, of course, two sides to the coin. Rivers which previously had abundant supplies of water become tributaries for the lake's hydroelectric production system. Fish often pay a heavy price as they are deprived of their freedom to migrate. This is the unavoidable result of sustainable development. However, the electricity production, irrigation, water supply and protection against natural catastrophes represent vital progress. The hard line adopted by critics is mitigated by factors that are often overlooked. For example, Lac de la Gruyère provides hydroelectric power and attracts tourists to the region. Built between 1946 and 1948, Rossens' barrage and the water-collection lake (Switzerland's third-largest) on the Sarine changed the appearance of southern Fribourg. A mountain region was transformed into a lakeside paradise. "There would not be as many tourists without the lake", says Alexandre Gal, an engineer with the Fribourg Groupe E. Various archaeo-

## SOME OF OUR ARTIFICIAL LAKES

Name of lake	Volume of lake in million m <sup>3</sup> of water	Dam	Year of construction	Height of dam	Length of dam
Lac des Dix (VS)	401	Grande Dixence	1950-1961	285 m	695 m
Lac d'Emosson (VS)	227	Emosson	1974	180 m	555 m
Lac de la Gruyère (FR)	220	Rossens	1947	83 m	20 m
Lac de Mauvoisin (VS)	211.5	Mauvoisin	1951-1957	250 m	520 m
Lago di Luzzone (TI)	108	Luzzone	1960-1963	225 m	510 m
Mattmarksee (VS)	101	Mattmark	1967	120 m	780 m
Sihlsee (SZ)	96.5	Hühnermatt	1937	17 m	191 m
Schiffenensee (FR)	65	Schiffenen	1963	47 m	417 m
Lac de Montsalvens (FR)	12.6	Montsalvens	1920	55 m	115 m
Lac de Pérolles (FR)	0.4	Maigrange	1872	24 m	195 m

## ALL THE ARTIFICIAL LAKES IN SWITZERLAND



logical remains are revealed when the level of the lake falls by ten to fifteen metres at the end of April. These include the ruins of the Roman bridge of Avry-devant-Pont and the walls of an old farm at the port of Bry. The small island of Ogoz with its thirteenth century medieval towers and chapel attracts romantics and those fascinated by Atlantis. Flora and fauna have also developed in harmony. At the southern point of the lake, one of Switzerland's largest willow plantations is found in Broc in the mouths of the Jogne and Sarine. In conditions that are favourable to its growth, the white willow has been planted in a forest which some people say is enchanted. With a silver-green hue, it has provided a habitat favourable to a host of insects that many species of bird are fond of.

The journey of the freshwater sailor has come to an end. He will not forget his trip to Fribourg or the mystical form of the artificial lake in Schiffenen. A topographical marvel, viewed on a map or from the sky, it looks like a dragon spread across the ground.

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