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## Upper Harz Water Management System (Germany) No 623ter

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*Official name as proposed by the State Party:*

Upper Harz Water Management System

*Location:*

State of Lower Saxony,  
Districts of Goslar and Osterode am Harz  
Germany

*Brief description:*

The Upper Harz mining water management system, which lies south of the Rammelsberg mines and the town of Goslar, has been developed over a period of some 800 years to assist in the process of extracting ore for the production of non-ferrous metals. Its construction was first undertaken in the Middle Ages by Cistercian monks, and it was then developed on a vast scale from the end of the 16<sup>th</sup> century until the 19<sup>th</sup> century. It is made up of an extremely complex but perfectly coherent system of artificial ponds, small channels, tunnels, and underground drains. It enabled the development of water power for use in mining and metallurgical processes. It is a major site for mining innovation in the western world.

*Category of property:*

In terms of categories of cultural property set out in Article 1 of the 1972 World Heritage Convention, the proposed extension forms a *group of buildings*.

Furthermore, the property and its extension form a series of five main *groups of buildings* (Mines of Rammelsberg, Historic town of Goslar, Upper Harz Water Management System, Upper Harz mining remains, Walkenried Monastery).

### 1. BASIC DATA

*Included in the Tentative List:* 20 September 1999

*International Assistance from the World Heritage Fund for preparing the Nomination:* None

*Date received by the World Heritage Centre:* 22 January 2008

*Background:* This is an application for an extension of the Mines of Rammelsberg and Historic Town of Goslar site inscribed on the World Heritage List at the 16<sup>th</sup> session of the World Heritage Committee (Santa Fe,

1992) on the basis of criteria (i) and (iv).

*Consultations:* ICOMOS consulted TICCIH and several independent experts.

*Literature consulted (selection):*

Agricola, G., *De re metallica*, Basel, 1557.

Beddies, Th., *Becken und Geschütze: der Harz und sein nördliches Vorland als Metallgewerbelandschaft in Mittelalter und früherer Neuzeit* Frankfurt am Main, 1996.

Hughes, S., *The International Collieries Study, a Joint Publication of ICOMOS and TICCIH*, 2003.

*Technical Evaluation Mission:* 7-11 September 2009

*Additional information requested and received from the State Party:*

ICOMOS sent an initial letter to the State Party on 23 September 2009 concerning the following points:

- Justification for the serial approach of the proposed extension and with regard to the property already inscribed on the World Heritage List;
- Selection of the chosen sites;
- A declaration of Outstanding Universal Value for the whole property;
- A more thorough comparative analysis to justify the selection of the sites;
- A common management structure for the whole of the property.

The State Party replied on 19 November 2009.

ICOMOS sent a second letter to the State Party on 16 December 2009 concerning the following points:

- Making the comparative analysis more thorough;
- Changing the name of the property to "The historic mining system and its associated landscapes of Rammelsberg, the town of Goslar, and the Upper Harz";
- Giving details of the common management system for the whole property.

The State Party answered on 19 February 2010, sending a large amount of additional documentation. An analysis of this documentation is included in this evaluation.

*Date of ICOMOS approval of this report:* 17 March 2010

### 2. THE PROPERTY

#### *Description*

The property is a set of hydraulic and civil-engineering installations, some of which are underground. The hydraulic installations on the surface have given rise,

together with their natural environment, to the formation of a characteristic landscape. It also includes mining and architectural remains.

#### *The functions of the water management system*

This is a vast historic water-management system with many technical components. It is located in a highland area which is relatively complex in geographical and geological terms. It had two main purposes.

The first objective was to control and channel the water of the Upper Harz mountains in order to provide the power needed for mining. The system includes series of artificial ponds used as reservoirs. They are interconnected by a vast system of small channels, and include many hydraulic regulation devices. The hydraulic energy was initially intended to provide the power for vein ore mining and to drive the bellows of smelting works. The energy requirement increased sharply with the exploitation of ever deeper veins, and the need to install continuously operating drainage pumps. Some of the veins were mined at great depths, exceeding 800m at Grube Samson, which at the start of the 19<sup>th</sup> century was for a considerable time the deepest mine in the world. The energy was produced by the early use of large water-wheels, sometimes installed in underground chambers.

The second dimension of the hydraulic system is to form a set of underground drainage galleries to evacuate water from the mines by gravity flow to low points in the valleys. These galleries were particularly difficult to establish in the rock, especially in the 16<sup>th</sup> and 17<sup>th</sup> centuries when gunpowder was not yet used in mining. The galleries today form vast underground systems with many interconnections.

The surface system and the underground system form a series of subsystems which were directly and functionally linked over a long period to historic mine workings, with a dozen main shafts. The veins consist of a fairly wide variety of non-ferrous metal ores. They enabled the Upper Harz mining area to produce silver, copper, lead, and zinc from the Middle Ages until the 20<sup>th</sup> century. The oldest remains of the hydraulic system date from the 12<sup>th</sup> and 13<sup>th</sup> centuries. Initially created by Cistercian monks, the system was for the most part established between the 16<sup>th</sup> and the 19<sup>th</sup> centuries.

A large proportion of this complex system is still used for water management today, following the closure of the mines, to provide regional drinking water needs and to regulate water catchment.

#### *Geographical location*

The property is located in the western part of the State of Lower Saxony, in the heart of the highest region of the Harz mountains, the Upper Harz. This region consists of a complex set of hills, plateaux, and steep-sided valleys.

The property and its buffer zone extend over a central quadrangular area, the Clausthal plateau, which is approximately 8km by 8km. It forms a dense hydraulic network whose visible part is a tight-knit set of ponds and small connecting channels. The extent of the property is determined by the land occupied by the hydraulic parts, the dams, and the artificial dykes. This central part surrounds the town of Zellerfeld; however, Zellerfeld does not form part of the nominated extension. The Clausthal plateau is roughly 10km south-west of the historic town of Goslar and the Rammelsberg mines, the property already inscribed.

The property also includes several large hydraulic extensions:

- The first extends over roughly 12km to the east and south-east of the Clausthal plateau, and is also made up of networks of channels and ponds, but these are less tightly knit than in the central part.
- An isolated hydraulic extension to the south, more than 25km away, close to the town of Bad Lauterberg.
- A very early hydraulic system to the west of the plateau, known as the Valley of Pandelbach.

Finally, the property includes two sets of buildings: the metallurgical site of Grube Samson, some 20km south-east of Clausthal-Zellerfeld, and the group of monastic buildings of Walkenried some 30km south-east of Clausthal-Zellerfeld.

#### *The mining and metallurgical elements*

The property nominated for the extension includes remains which bear witness to historic mining and metallurgy in the Upper Harz.

In the southern and south-eastern parts of the Clausthal plateau they consist of:

- The Rosenhöfer site, which has the two most spectacular underground water-wheel chambers of the property, one of which is oval and 15m high, while the other is in a cylindrical shaft 24m deep; they are linked to a system of underground channels.
- The Knesebeck shaft consists of a main building, a pithead frame, two water-wheel chambers, and the associated mining drainage system.
- The Ottiliae shaft comprises a main building, an annex, a pithead frame, and an underground drainage system.
- The Kaiser Wilhelm II shaft has a main building, a large pithead frame and annexes, and an underground drain.

To the south-east, the property includes the remains of the mine and metallurgical site of Grube Samson, consisting of a huge building in three parts, functional annexes, and an artificial pond.

### *Basic elements of the water management system*

The property includes 719 basic hydraulic elements. They are grouped together on the basis of technical complementarity, depending on topographic and hydrological conditions, around the twelve historic mining sites of the Upper Harz.

According to the State Party, the component parts of the water-management system can be divided up as follows:

- The 63 historic artificial ponds included in the property are formed by a dam which is mostly of masonry. They are still in a functional condition. One of them dates back at least to the 8<sup>th</sup> century; nine are pre-1650; the great majority, however (41) were built between 1650 and 1700, and the others at later dates.
- The property also includes the remains of 44 ancient dams which are now abandoned.
- It has 39 main surface ditches in an operational condition, representing a length of around 70km; in some cases, they are edged with masonry walls.
- It has 513 remains of secondary ditches, with a length of some 240km;
- 34 mining tunnels in operational condition, with a length of just over 21km;
- 18 remains of disused tunnels, with a length of just over 9km;
- 2 mine drainage galleries in operational condition, with a length of 4.5km;
- 6 remains of drainage galleries, with a length of around 88km.

Depending on their location, topography, and mining conditions, the Upper Harz mining water-management subsystems exhibit significant technical differences, illustrating the variety of solutions and the innovations introduced at the various periods of operation. Innovative tests of hydraulic and mining machines, sometimes at very early dates, were carried out in the Upper Harz.

### *The Cistercian Monastery of Walkenried*

The property also includes the Cistercian Monastery of Walkenried, which dates from the 12<sup>th</sup> and 13<sup>th</sup> centuries. It is put forward as the place that gave rise to the mining works of the Upper Harz and its water-management system, and also as a centre for metallurgical innovation in Europe.

It has a set of buildings with a square plan, around a central Gothic cloister. Its layout and style are similar to the Order's first establishments in Burgundy, with short wings to the south and east, and it includes small built annexes, one of which is located on a separate plot of land, 200m to the north-west of the monastery. The abbey church, built between the 13<sup>th</sup> and 15<sup>th</sup> centuries and now in ruins, is located to the north of the cloister. It is the oldest Gothic church in central and northern Germany.

With a few exceptions, including the monasteries, the elements of the property are situated in hilly forested areas forming part of the Upper Harz Natural Park.

### *Rammelsberg Mines and Historic town of Goslar*

The metal ore mines of Rammelsberg were worked continuously in the Middle Ages and the modern period. The nearby historic town of Goslar played an important role in the Hanseatic League because of the wealth of the Rammelsberg ore deposits.

### **History and development**

The surface metal-bearing veins, both at Rammelsberg and in the Upper Harz, were known and worked during the Bronze Age. They were also known and again worked during the Early Middle Ages, generating the wealth of the princes who controlled them.

The metallurgical history of the Harz was reborn with the construction of Walkenried Monastery, undertaken in 1127 by Cistercian monks who came from France. The Cistercian Order was closely connected with mining and played an important role in the development of metallurgy in medieval Europe. The use of water-wheels to improve the output of ore-smelting furnaces seems to have been introduced in the early 13<sup>th</sup> century by monks in the Harz. Amongst the hydraulic remains from this period is the set of four small ponds in the Pandelbach Valley, to the west of the property. A medieval underground hydraulic installation is mentioned, the Aghetucht drain, which dates back to the 12<sup>th</sup> century. The Banedik pond in the Clausthal is also said to date from the 13<sup>th</sup> century. Draining by galleries and the use of water-wheels for removing water also seem to have been introduced by the monks at this period.

The apogee of the monastery came at the end of the 13<sup>th</sup> century. It was then inhabited by 80 monks and 180 lay brothers. They controlled and directed the mine workings of the region, up to the crisis in the medieval world in the mid-14<sup>th</sup> century. It caused a sudden and lasting disruption of mining activities in the Harz, resulting in an irreversible decline in the Cistercian presence.

Stemming originally for the need for silver coins, the renewal of mining in the Harz took place at the start of the 16<sup>th</sup> century. It led to the opening of new mines and the gradual introduction of water-management systems, as at Grube Samson from 1521, in the Clausthal in 1554, etc. Mining privileges were thus granted by the various sovereign princes of the region to miners living in the mountains (*Bergfreiheiten*). These were confirmed in the 17<sup>th</sup> century by their successors. Regional mining development then assumed very significant proportions. Water-management systems were systematically installed and deep shafts were sunk. For example, seventeen drainage galleries were constructed from 1524 to 1561.

The Harz became the major region in Europe for the exploitation of non-ferrous metals. It was one of the major centres for the development and control of the European copper market, particularly through the Fugger dynasty of merchants and financiers. It is mentioned in several examples given by Agricola, and was the inspiration for his *De re metallica*, the authoritative work on metallurgy and mining in the Renaissance (1556).

Many improvements were regularly made to the mining facilities and its hydraulic system. For example, from the 17<sup>th</sup> century the degree of expertise permitted the use of horses for the energy needs of the mine to be abandoned. Technical innovation made possible empirical improvements in metallurgical processes and the exploitation of new ores, contributing to the significant increase in production.

The social and administrative rules that were introduced, particularly by the princes of the von Braunschweig family, Herzog Julius and Herzog Heinrich, provided stability for the mining operators and facilitated the long-term investment necessary for the often very laborious construction of the mining and water-management system of the Upper Harz. For example, the main drain of the Clausthal plateau, in the 16<sup>th</sup> and 17<sup>th</sup> centuries, near the Innerste valley, needed 120 years of works. The investment involved financial shares (*Küxen*) of a very modern type, acquired by aristocrats, rich merchants, and towns (for example those of the Hanseatic League).

Regional mining reached its high point in the 17<sup>th</sup> and 18<sup>th</sup> centuries, as extension of the water-management system and deepening of the shafts were systematically continued. The main innovations were the water engine of G. Winterschmidt (c 1750) and the great Tiefer-Georg-Stollen underground drainage system. Constructed during the second half of the 18<sup>th</sup> century by the mining administrative coordination office (*Berghauptmann*), this system was at that time the most extensive in the world (18.5km).

In the 19<sup>th</sup> century the Upper Harz was still fully operating, and still one of the main sources of mining knowhow in Europe, at a time when the major technical innovations of the industrial revolution in Britain were beginning to appear. The excellence achieved in hydraulics and the specific character of the very deep veins in the Harz were such that it was not immediately necessary to adopt foreign techniques. The steam engine, for example, only had a role at a later stage, and remained of secondary importance for a long time, the hydraulic compressor being preferred.

Several important innovations took place during this period: a vertical lift driven by water power and capable of reaching depths of 500-700m (G.L.W. Dörell, 1833); the invention of wire cable (W.A.J. Albert, 1834); and an early version of the blasting cartridge (F. Schell, 1866).

A mighty underground drainage system, 400m below the Clausthal, was once again begun in the late 1840s as ore extraction went deeper. The Ernst-August-Stollen was completed in 1864 (32.7km).

New shafts came into operation in the mid-19<sup>th</sup> century, while others, such as the Kneesebeck, which was in use up to 1974, were modernized. The Otiliae and Kaiser Wilhelm II shafts were equipped with the first steel headframes to be built in Germany, in the 1880s. The first large German hydraulic compressors were developed in the Harz, in the 1900s.

However, from this period onwards, and as the demand for non-ferrous metals increased sharply on the markets, the ore mines of the Harz, already substantially exploited, faced competition from the emerging production of other continents. The great Grube Samson mine closed in 1910. Many of the Clausthal mines closed as a result of the economic crisis in the 1930s. Efforts were then made to convert the water-management system of the Upper Harz for the generation of electricity, and turbines were fitted in the Otiliae and Kaiser Wilhelm II shafts.

A major change in the water-management system and its objectives took place in the 1960s and 1970s when the last working mines were shut down (the last one, Hilfe Gottes, was closed down in 1992). The equipment of the shafts for electricity generation continued, particularly outside the historic mining zone, but the Upper Harz was perceived at that time above all as a major reserve of good-quality drinking water in the heart of Germany. Its landscapes, with artificial ponds and lakes, were recognized as having great value, and it became a popular tourist destination. The State of Lower Saxony gradually acquired ownership of the water-management system between 1972 and 1981, and a public ownership system was introduced. Protection against flooding is also a key objective of the present water-management system.

The additional documentation of 19 November 2009 focuses on the results of recent historical and archaeological research, which demonstrates the major role in mining played by the Cistercian order throughout the Harz region, and the pioneering nature of this role in Europe. The research also demonstrates links between the various mining sites of the Harz in their international influence in the modern and contemporary periods.

### **3. OUTSTANDING UNIVERSAL VALUE, INTEGRITY AND AUTHENTICITY**

#### ***Comparative analysis***

The nomination dossier for the Mines of Rammelsberg and Historic Town of Goslar justifies their inscription by referring to “*the best preserved and most extensive underground water power system in Germany.*”

The comparative analysis in the present extension application focuses on water-management sites with similar mining functions, the installation of which dates back to the pre-industrial period and to the first tests of water-powered machines. Only European states would seem to have attained a sufficient level of technical innovation to have comparable mining sites incorporating the use of water power. Interchanges between different European mining regions have been considerable over the course of history, particularly through the migration of skilled workers.

Three sites were finally judged to be the most comparable to the Upper Harz water management system:

- The industrial gold and silver mines of Banská Štiavnica, Slovakia (1993, criteria (iv), (v)), were first developed in the 13<sup>th</sup> and 14<sup>th</sup> centuries; some of the mines are deep and there is a water-power system that is very similar to that of the Upper Harz, but less extensive. One of the specific features of this system is the high dams built in the 18<sup>th</sup> century.
- The mining district of Freiberg (Germany, Tentative List) has a mining water-management system similar to that of the Upper Harz, built between the 16<sup>th</sup> and 19<sup>th</sup> centuries.
- The silver mines of Kongsberg (Norway) were first developed by mining engineers who came from the Upper Harz at the end of the 18<sup>th</sup> century, and the principles of their water-management system are similar.

Other sites are only briefly examined, as their characteristics are considered to be too different from those of the Upper Harz: Eastern Harz, which is located close to the Upper Harz, the Mining Area of the Great Copper Mountain in Falun, Sweden (2001, criteria (ii), (iii), (v)), and the Příbram mines in the Czech Republic.

Following the request made by ICOMOS on 16 December 2009, the State Party has provided a thorough additional analysis, comparing the property nominated for the extension with:

- Properties already inscribed on the World Heritage List, including major water-management systems such as, in Europe, the Pont du Gard (France, 1985), Segovia (Spain, 1985), Las Médulas (Spain, 1997), Kinderdijk-Elshout (Netherlands, 1997), Mérida (Spain, 1993), Banská Štiavnica (Slovakia, 1993), and on other continents, Machu Picchu (Peru, 1983), Potosí (Bolivia, 1987), Rice Terraces of the Cordilleras (Philippines, 1995), Lijiang (China, 1997), Xidi and Hongcun (China, 2000), Dujiangyan Irrigation System (China, 2000), Xochicalco (Mexico, 1999), the *afñaj* (Oman, 2006), Kuk (Papua New Guinea, 2008), and Shushtar (Iran, 2009);
- Other properties with major water-management

systems, particularly in Europe;

- Non-ferrous mining sites already inscribed on the World Heritage List such as, in Europe, Røros (Norway, 1980), Falun (Sweden, 2001), Cornwall and West Devon (United Kingdom, 2006), Banská Štiavnica (Slovakia, 1993), Kutná Hora (Czech Republic, 1995), Las Médulas (Spain, 1997), and on other continents Potosí (Bolivia, 1987), Guanajuato (Mexico, 1988), Zacatecas (Mexico, 1993), and Iwami Ginzan (Japan, 2007);
- Cistercian monasteries already inscribed on the World Heritage List: Fontenay (France, 1981), Studley Royal (United Kingdom, 1986), Alcobaça (Portugal, 1989), Poblet (Spain, 1991), Maulbronn (Germany, 1993), and Kutná Hora (Czech Republic, 1995).

This comparative analysis shows the large number of properties already inscribed for these various attributes on the World Heritage List. However, the Upper Harz water-management system emerges firstly as a highly original and pioneering ensemble, and secondly by virtue of its exceptional scale and complexity. Cistercian monasteries are also well represented on the World Heritage List, and with integrity and architectural and structural richness that are far superior; however, Walkenried appears to be one of the very first to have been built to the same model as Fontenay and, above all, its pioneering role in metallurgy for more than three centuries is remarkable and on a very large scale, and it is intimately linked with the other elements on which the value of the property nominated for the extension is based.

ICOMOS considers that the comparative analysis, including the additional study of February 2010, adequately justifies all the elements of the series, particularly in terms of their overall hydraulic significance, for the mining values of the property, and for the value of the Cistercian monastery.

ICOMOS considers that the State Party has provided sufficient information in its additional documentation of 19 November 2009 to express the link between the proposed extension and the property of the Mines of Rammelsberg and Historic Town of Goslar, which has already been inscribed on the List. These are facets of the same set of mining installations, based on a social and technical system that is specific to the region, from the Middle Ages to the modern and contemporary period.

ICOMOS considers that the comparative analysis justifies consideration of the approval of the proposed extension.

#### ***Justification of Outstanding Universal Value***

The property proposed for the extension is considered by the State Party to be of Outstanding Universal Value

as a cultural property for the following reasons:

- The Upper Harz Water Management System is the largest of its type in the world. The perfected system of artificial storage of water made it possible to use water for mining purposes, to provide both power and underground drainage.
- The mining industry of the Upper Harz has played a pioneering role in the development of technical innovations for the extraction of metal ores at great depths, and particularly in the management of water and its use for power. Over a long period it was a fertile source of inspiration in Europe.
- The installations bear testimony to the development of water management in the mining industry, from the Middle Ages to the present day. In fully operational conditions, they demonstrate the coordination of an exceptionally large number of complementary hydraulic elements.

*Outstanding Universal Value of property already inscribed:*

The Goslar-Rammelsberg ensemble is one of the oldest mining and metallurgical complexes in the world, and unquestionably the one whose industrial activities continued over the longest period of time without interruption. The Rammelsberg complex is remarkable for the wealth of its industrial remains from all periods.

Goslar has retained practically intact its original layout and structures. Located close to the Rammelsberg mines, the town of Goslar played an important part in the Hanseatic League because of the richness of the Rammelsberg metal-ore veins. From the 10<sup>th</sup> to the 12<sup>th</sup> century it became one of the seats of the Holy Roman Empire. Its historic centre, which dates back to the Middle Ages, is perfectly preserved, and includes some 1,500 timber-framed houses dating from the 15<sup>th</sup>-19<sup>th</sup> centuries.

ICOMOS considers that the State Party, in its additional document of 19 November 2009, has satisfactorily analysed the overall coherence and value of the property already inscribed on the World Heritage List (Mines of Rammelsberg and Historic Town of Goslar) in historical, technological, and heritage terms. For more than a thousand years, Rammelsberg and the Upper Harz formed a coherent mining region in which the same protagonists were involved, both in running the mining operations and in pursuing economic interests, with a socio-technical system to which the property already inscribed and the proposed extension belong.

ICOMOS considers that the justification is satisfactory as regards both the property covered by the extension and the new ensemble thereby formed.

ICOMOS suggested in its letter of 16 December 2009 that a new name should be considered for the new

ensemble, expressing its various constituent parts. In its reply of 19 February 2010, the State Party accepted this suggestion, and proposed the following name: "The historic mining network of the Rammelsberg mine, the historic town of Goslar, and the Upper Harz water-management system".

#### *Integrity and authenticity*

##### *Integrity*

*The functional integrity* of the water-management system is fully maintained for a very significant proportion of hydraulic elements, as regards both the number and the geographical distribution inside the property nominated for the extension. All types of functional elements are represented. The other elements, which are archaeological monuments, are sufficiently visible in the landscapes to give an accurate idea of the maximum extent attained by the system.

The mining installations are no longer in operation, and they constitute remains that testify to a past technical function that is visible (see Conservation).

*The integrity of the historic testimony* provided by the nominated hydraulic installations over a period of 800 years is, however, rather weak. In fact, the heritage of the hydraulic system, which in fact goes back to the medieval monastic period, is extremely scanty: it consists only of the four small ponds of the Pandelbach Valley, to the west of the property, 40km from the monastery as the crow flies, and one pond in the Clausthal. One medieval underground hydraulic installation is mentioned in the dossier (the Aghetucht drain, 12<sup>th</sup> century), but it does not seem to be included in the archaeological inventory. The water-management system included in the extension proposal bears witness essentially to the development of such mining water systems from the 16<sup>th</sup> to the 19<sup>th</sup> century. The technical values attributed to the medieval period are more of a general documentary nature, particularly with regard to the Cistercian monks, rather than of a heritage-related nature.

*The visual and landscape integrity* of the property proposed for the extension is of good quality, both as regards the water-system landscapes and mining and industrial remains, and also the Walkenried monastery.

The choice of the constituent parts of the property proposed for the extension is extremely comprehensive. It draws appropriate distinctions between elements that are still operational and the others. The ensemble thus formed is coherent and is capable of adequately expressing and significantly strengthening the functional, historic, and landscape value of the property proposed for the extension. The understanding of the socio-technical system of the Upper Harz emerges as a coherent and complete whole, which provides a good explanation of how it came to be one of the major sources of inspiration for mining techniques in Europe,

from the Middle Ages to the 19<sup>th</sup> century.

#### Authenticity

The development of the *water-management system* has followed extensions of the needs of the mining system in its different component parts, and it has always been operational and under control. Each of the technical elements - dykes, ditches, dams, etc. - has required maintenance and repairs, and sometimes rebuilding, over the years, but within a context of great morphological and functional continuity. This was dictated by topographical and hydrogeological factors, and by the continuity of technical practices. However, in order to make better management possible, some hydraulic subsystems were restructured, and dams were equipped with special features in order to cope with rises in water level. Traditional materials were reused up to the 20<sup>th</sup> century. The decline of mining in the 1930s restricted the visible use of new materials such as concrete and steel. The main change was the fitting of hydroelectric turbines in two of the shafts. This was, however, an adaptation that remained fully consistent with the earlier functions of providing power. These are, moreover, essentially underground items of equipment whose visual impact is limited. Furthermore, the traditional management of the ponds was carried out using a specific *Teich-Striegel* system, only two examples of which are apparently extant today, the others having been destroyed and then replaced by contemporary systems by the company responsible for management in the second half of the 20<sup>th</sup> century.

The authenticity of the *mining elements* and the industrial elements is unquestionable. However, these are quite often recent elements, i.e. the remains of mining operations from the end of the 19<sup>th</sup> century and the 20<sup>th</sup> century. The water-wheel chambers have been carefully restored and satisfactorily meet the required conditions of authenticity.

The situation of *Walkenried Monastery* has changed over time. Initially located in the countryside, it is today at the centre of a village. The cloister has been restored, and is now reused as a museum and cultural centre.

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ICOMOS considers that, despite occasional shortcomings, the conditions of integrity and authenticity have been met.

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#### *Criteria under which inscription is proposed*

The property is nominated on the basis of cultural criteria (i), (ii), (iii), and (iv).

The Mines of Rammelsberg and Historic Town of Goslar are inscribed on the World Heritage List on the basis of criteria (i) and (iv).

*Criterion (i): represent a masterpiece of human creative genius;*

This criterion is justified by the State Party on the grounds that the Upper Harz Water Management System represents a unique masterpiece of human creative genius which documents the utilization of natural water resources for mining over more than 800 years. In particular it bears witness to power and shaft drainage solutions which were regularly adapted to the needs of mining.

These characteristics reinforce the unique and outstanding technical and urban values already recognized over the long history of European mining history for the property already inscribed.

ICOMOS considers that the Upper Harz Water Management System significantly reinforces the dimension of representing a masterpiece of human creative genius which has already been recognized for the Mines of Rammelsberg and Historic Town of Goslar.

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ICOMOS considers that this criterion has been justified.

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*Criterion (ii): exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design;*

This criterion is justified by the State Party on the grounds that the pre-industrial energy supply system of the Upper Harz set an example for the highest technological state of the art in European mining areas over many centuries. It is a tangible example of constant technical innovation to foster lasting economic and industrial development.

Recent historical and archaeological research shows the major role played by the Cistercian order throughout the Harz region and its pioneering dimension in Europe. It also shows the links between the various mining sites of the Harz in their international influence in the modern and contemporary periods.

ICOMOS considers that the information provided by the nomination dossier and by the additional document of 18 November 2009 is relevant. The documents set out new historical knowledge. The property already inscribed and the proposed extension together bear testimony to an important interchange of human values in the field of mining and hydraulic techniques, from the Middle Ages to the modern and contemporary periods in the European sphere.

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ICOMOS considers that this criterion has been justified for the whole property. It is added to the criteria previously recognized for the Mines of Rammelsberg and Historic Town of Goslar.

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*Criterion (iii): bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared;*

This criterion is justified by the State Party on the grounds that the Upper Harz Water Management System represents an exceptional testimony to a tradition of water utilization as a primary energy source in mining which has all but died out. This regional tradition aimed at achieving continuous adaptation to an environment that was unfavourable for transport, by the creative use of local materials.

ICOMOS considers that the traditional use of regional materials and adaptation are factors common to all mining sites. Furthermore, the other aspects referred to for this criterion are already recognized, particularly under criteria (i) and (iv).

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ICOMOS considers that this criterion has not been justified.

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*Criterion (iv): be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history;*

This criterion is justified by the State Party on the grounds that the Upper Harz Water Management System is the largest and most important mining water-management system in the world. It is outstanding testimony to the development of hydraulic power generation as a reaction to rising demand for energy for mining, from the medieval period until the industrial period. Its technical and architectural characteristics have been well preserved. Today it constitutes a set of installations that is both comprehensible and operational.

ICOMOS considers that the proposed extension significantly reinforces the attributes of Outstanding Universal Value already recognized for this criterion for the Mines of Rammelsberg and Historic Town of Goslar.

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ICOMOS considers that this criterion has been justified.

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ICOMOS considers that the proposed extension and the property already inscribed form a series which has been justified by the State Party.

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ICOMOS considers that the property proposed for the extension of the property already inscribed meets the conditions of integrity and authenticity, that it reinforces the criteria (i) and (iv), which have already been recognized, and that the new criterion (ii) has been justified for the property with the extension through the contribution of new historic and archaeological research.

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#### **4. FACTORS AFFECTING THE PROPERTY**

##### *Development pressures*

Urbanization, agriculture, and industry now have only a minor role in this region. The only important issue is that

of forestry in the Upper Harz, as the machines used in this activity could damage the archaeological remains. These factors are dealt with by the heritage management organization.

ICOMOS considers there is no significant development pressure.

##### *Tourism pressures*

The property proposed for extension is located within the Upper Harz Park area. This is a tourist destination frequented by visitors in large numbers (14.6 million a year) but scattered over a large geographical area. Visitors are informed and guided by the Harz Tourism Association. To date there has been no perceptible impact on the conservation of the property. Regional tourism capacities are not saturated, and they can deal with an increase in the number of visitors, particularly with regard to the property proposed for the extension.

ICOMOS considers, however, that a long-term vision is necessary in view of the expansion of tourism.

##### *Environmental pressures*

The State Party does not indicate that there is any environmental pressure on the property proposed for the extension.

ICOMOS considers that there is no environmental pressure.

##### *Natural disasters*

Water engineering structures are sensitive to high rises in water level. The dams are normally equipped with weirs to deal with such events. The banks of ditches and channels may occasionally suffer damage. The management system requires constant surveillance, and repairs are carried out immediately in the event of accidental damage, so as to prevent any domino effects.

ICOMOS considers that the State Party is in control of natural disaster risks.

##### *Impact of climate change*

The State Party does not indicate that there is any visible effect from climate change on the property proposed for the extension.

ICOMOS considers that at present there is no pressure from climate change.

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ICOMOS considers that there is no notable threat to the property in the short to medium term. A long-term vision of tourism expansion would however be necessary.

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## 5. PROTECTION, CONSERVATION AND MANAGEMENT

### **Boundaries of the nominated property and buffer zone**

The property proposed for the extension has a total surface area of 1,009.9ha. There are no inhabitants.

ICOMOS notes that the underground elements of the property mentioned in the nomination dossier for the extension inventory are included in their own right as elements of the property proposed for extension.

The buffer zone area is 5,654.7ha. The standard buffer zone is a strip 65m wide measured from the water limit. This corresponds to the hydraulic and environmental protection conditions currently in place. At certain points the buffer zone is widened to allow for a specific heritage feature - a mine shaft, a water-wheel chamber, or a mining or monastery building. It then follows the land register plot boundaries.

There are 460 inhabitants in the buffer zone.

The zone outside the buffer zone that protects the hydraulic elements of the property proposed for the extension is controlled by the regulations of the Upper Harz Natural Park.

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ICOMOS considers that the boundaries of the property proposed for the extension are satisfactory, and that the proposed buffer zone ensures adequate technical protection of the property.

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### **Ownership**

The Upper Harz Water Management System is the property of the State of Lower Saxony (*Land Niedersachsen*). The acquisitions from the former mining companies were completed in 1981. The property is currently owned by the following public bodies: the waterworks company (*Harzwasserwerke GmbH*) and the Lower Saxony State Forestry Service (*Niedersächsische Landesforsten*).

The Grube Samson mine is the property of the town administration (*Bergstadt St. Andreasberg*).

The Kaiser-Wilhelm II shaft is the property of the waterworks company (*Harzwasserwerke*).

The Ottiliae-Schacht shaft is the property of the town administration (*Bergstadt Clausthal-Zellerfeld*), which has entrusted its management to the Upper Harz History and Museum Association.

The Knesebeck shaft is the property of the town administration (*Bergstadt Bad Grund*).

The Rosenhöfer Radstuben mining site is the property of the Upper Harz History and Museum Association.

The Walkenried monastery is the property of a foundation (*Stiftung Braunschweigischer Kulturbesitz*) acting on behalf of the district of Osterode am Harz.

### **Protection**

#### *Legal Protection*

In 1977 the Upper Harz Water Management System was classified as a *technical monument* by the State of Lower Saxony. This classification, introduced only shortly before this date, involved redefining its public functions and the current perimeter of its operational hydraulic installations that demonstrate continuity with earlier uses.

The Monument Protection Act (*Niedersächsischen Denkmalschutzgesetz*) of 1978 protects all the architectural elements and industrial structures of the property proposed for the extension.

The constitution of the State of Lower Saxony (1993) entrusts the administrations of the towns and districts with the protection of cultural properties.

The 1994 state development programme (*Landesraumordnungsprogramm*) regulates interventions on monuments and archaeological sites.

The property is covered by the 1998 Water Act of the State of Lower Saxony.

The property is covered by the development plans of the district of Osterode am Harz (1998) and of the district of Goslar (2006).

The environmental and landscape aspects are protected by the district Acts of 21 December 2000 (Osterode am Harz) and 7 May 2001 (Goslar).

The Upper Harz region was made a national park of the State of Lower Saxony in 2005.

#### *Traditional Protection*

The organization of the control of the water-management system since the Middle Ages, its progressive modernization, and the changes made in its technical functions (water supply, flood control, and hydroelectric power) may be considered to constitute a guarantee of traditional protection linked with the uses of the water.

#### *Effectiveness of protection measures*

The protective measures are adequate and are effectively applied.

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ICOMOS considers that the legal protection in place is adequate.

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### **Conservation**

#### *Inventories, recording, research*

The historic and mining documents are in the charge of various specialized departments of the regional authority, particularly public archives and libraries. The museums associated with the site also have significant documentary and iconographic material.

Various thorough inventories of the hydraulic elements were drawn up in the course of the management of the property, particularly in 1868 and 1989. In 2008 a new detailed survey was carried out, in conjunction with mapping.

A very substantial amount of documentation exists concerning the management and hydraulic maintenance of the property. These documents are managed by the waterworks company *Harzwasserwerke GmbH*.

A detailed inventory of the shafts and mining sites was carried out in 1983.

Inventories and architectural studies of Walkenried Monastery were carried out in 1922, in 1992, and in 2004-2005.

#### *Present state of conservation*

The present state of conservation of the property is generally good, from the hydraulic, mining, architectural, and landscape points of view. However, many ditches that have been abandoned in the contemporary management of the hydraulic system have been poorly maintained.

A large-scale and necessary intervention on the Walkenried Monastery in accordance with international conservation standards was scheduled in 2008-2009.

ICOMOS considers that a particular effort should be made to conserve the remains of the old method of operating the hydraulic system, particularly the abandoned ditches and the two surviving pond management systems (*Teich-Striegel*).

#### *Active conservation measures*

The maintenance and technical conservation of the water-management system are carried out on a regular basis by the management authority in charge of its operation (*Harzwasserwerke*).

#### *Maintenance*

The maintenance of the monastery buildings is carried out on a regular basis by the foundation (*Braunschweig*

*Stiftung*) which since 2006 has been in charge of this property and of the Cistercian museum.

A maintenance schedule is drawn up annually in the light of the findings during the property monitoring operations.

#### *Effectiveness of conservation measures*

The conservation measures in place are effective.

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ICOMOS considers that the conservation system for the property proposed for the extension is adequate.

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### **Management**

#### *Management structures and processes, including traditional management processes*

The management system for the hydraulic system was defined in its public form in 1977 (see Protection). It was revised in 1991 in conjunction with the drinking-water management agency (*Harzwasserwerken*). It is still operating on the same basis.

The Grube Samson mine, along with the various shafts and mining sites, are managed by the Upper Harz Museum Association, in conjunction with the town authorities concerned.

Walkenried Monastery and its museum are managed by the foundation which owns them (*Stiftung Braunschweigischer Kulturbesitz*).

The heritage and museum management structures are under the control of the Historic Monuments Office of the State of Lower Saxony and the Historic Monuments Protection Agency of the districts of Osterode am Harz and Goslar.

ICOMOS considers that an overarching management body for the serial property is essential, as called for in Paragraph 114 of the *Operational Guidelines for the Implementation of the World Heritage Convention*. This body must bring together all the partners engaged in the management of the extended property, include an overarching management authority, have significant human and material resources at its disposal, and be in charge of the coordinated application of a management plan for the new serial property. ICOMOS made a request to the State Party concerning this point in its letter dated 16 December 2009.

In its reply dated 19 February 2010, the State Party refers to an agreement in principle between the Ministry of Culture of Lower Saxony and the various administrative entities in charge of the property (town of Goslar, districts of Goslar and Osterode am Harz and the waterworks company *Harzwasserwerke*), for the establishment of a structure to coordinate the various parts of the property, including its proposed extension. Its purpose is to set up a joint working structure for the

coordination of management (entrances, communication, tourism, etc.) and the coordination of general policies. The State Party is proposing a provisional structure to begin this coordination task immediately, pending the institutionalization of the overarching authority. The task would be entrusted to the foundation *Stiftung Braunschweiger Kulturbesitz* (SBK), a major regional cultural partner and stakeholder, which is already in charge of Walkenried Monastery. The foundation has indicated its agreement in principle to playing this interim role and helping in the setting-up of the definitive authority. Two interim phases are proposed for this purpose. The State of Lower Saxony has moreover promised financial aid.

ICOMOS is aware of the fact that it is difficult to create and approve a management authority in the space of a few weeks, and to coordinate the individual management systems that are in place and in operation. It considers that proposing a provisional overarching authority for the management of the whole of the property, extended to include the Upper Harz water-management system, is an initiative that is being taken too late to be effective. For the moment it is more a declaration of intent following the ICOMOS letter, than a viable project. No timetable has been established, no organization has been proposed for the long term, and no real guarantee of financing has been given.

*Policy framework: management plans and arrangements, including visitor management and presentation*

The property proposed for the extension is covered by a set of territorial management plans and measures that are the responsibility of the district and town authorities and of the National Park of the Upper Harz, by landscape conservation plans, and by the programmes of the various museums.

The water-system management plan, which is linked with the public service missions of the waterworks company (*Harzwasserwerke*), is an essential technical component of the management system.

The property management plan (Appendix C to the nomination dossier) covers the mining, technological, and architectural heritage of the property proposed for the extension. It sets out details of responsibilities, coordination, preventive initiatives to be scheduled, risk prevention, museum coordination initiatives, and the monitoring of the property.

Various measures have been taken to present the site to visitors, particularly by the network of four museums (the Clausthal-Zellerfeld mining museum, the Walkenried museum, the Grube Samson museum, and the Knesebeck shaft museum). The museums act as a decentralized interpretation unit, backed up by the presence of guides, a large number of visitor information initiatives, and signage. An individual electronic guide system is also in place.

ICOMOS considers that a permanent management system must be proposed for the whole property, including the extension. It must include a management plan for the whole extended property. Its management and coordination authority must be permanently defined as regards composition, structures, and missions; it must be provided with guaranteed human and financial resources.

*Risk preparedness*

The *Harzwasserwerke* is an organization whose staff are well prepared for the management of water-management system risks. It has various plans to be applied in the event of predictable high water-levels, and the human and technical resources required to deal with them.

*Involvement of the local communities*

The town authorities are closely involved in the management of the property and in the control of the management process. Local inhabitants in the region are actively involved in the museums association and in the reception of tourists.

*Resources, including staffing levels, expertise and training*

At the present time satisfactory financial resources are guaranteed for the various aspects of the property proposed for the extension: management, conservation and maintenance of the hydraulic installations, conservation of the mining elements and museums, and conservation of the monastery.

The State Office for Historic Monuments of Lower Saxony and the district authorities of Goslar and Osterode am Harz have sufficient scientific and technical staff at their disposal - conservation professionals, restorers, archaeologists, architects, and engineers of various kinds.

The *Harzwasserwerke* has at its disposal technical departments managed by specialized engineers, earth-moving and other equipment, and workshops for the hydraulic maintenance of the Upper Harz water-management system. Its staff are competent.

*Effectiveness of current management*

The management system of the property proposed for the extension is coherent, well coordinated, and effective. It is, however, necessary to extend it by means of an overarching structure covering the whole property, i.e. both the part that is already inscribed and the extension.

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ICOMOS considers that the management system for the property proposed as an extension is adequate. ICOMOS considers that it is essential to institute a common management and coordination authority with that of the Mines of Rammelsberg and Historic Town of Goslar.

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## 6. MONITORING

The State Office for Historic Monuments of Lower Saxony coordinates the monitoring of the property. For the last twenty years or so, all construction or reconstruction work has been carefully designed after discussions. Depending on the indicator concerned, the monitoring is carried out by the various partners involved in the management process: *Harzwasserwerke*, the district authorities of Goslar and Osterode am Harz, and the Upper Harz Museums Office.

The indicators are divided into four categories:

- The first is a check on the completeness of the property in all parts of the installations, which is carried out every five years.
- The second is monitoring of the state of preservation of the property with regard to its technical and architectural dimensions. The review is monthly in some cases. A maintenance plan is drawn up on the basis of these checks.
- The third concerns the state of preservation of the buffer zone, with monitoring carried out when necessary.
- The fourth is the monitoring of the number of visitors.

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ICOMOS considers that the monitoring of the property is satisfactory. However, it is necessary to establish regular intervals for the monitoring of the buffer zone, along with a standard methodology for this purpose.

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## 7. CONCLUSIONS

ICOMOS recognizes the possibility of significantly reinforcing the Outstanding Universal Value of the Mines of Rammelsberg and Historic Town of Goslar by the addition of the Upper Harz Water Management System, together with its own mining remains and the Cistercian monastery of Walkenried.

ICOMOS considers that the new property forms a series, and that this series is now completed.

### ***Recommendations with respect to inscription***

ICOMOS recommends that the extension of the Mines of Rammelsberg and Historic Town of Goslar to include the Upper Harz water management system, Germany, be ***referred back*** to the State Party to allow it to:

- Put in place a management system for the whole property, including its extension, and to group together and harmonize the management documents to form a management plan for the serial property.
- Institute a permanent overarching management and coordination authority in charge of the management plan, with guaranteed human and material resources, as called for in Paragraph 114 of the *Operational Guidelines for the Implementation of the World Heritage Convention*; this authority must include all the partners involved in the management of the property, must be officially approved, and must be put in place.

ICOMOS also recommends that the State Party give consideration to the following:

- Take care to conserve the remains of the old modes of hydraulic operation, particularly the abandoned ditches, and the two surviving pond management systems (Teich-Striegel);
- Develop a long-term plan for the expansion of tourism.
- Establish a regular time interval for the monitoring of the buffer zone and a standard methodology for such monitoring.



Map showing the boundaries of the nominated properties



Series of ponds (Hirschler Teich / Pfauen Teiche)



Hutthaler Widerwaage



Ernst-August-Stollen underground drainage gallery



Kaiser Wilhelm II shaft