



TENTATIVE LIST SUBMISSION FORMAT



STATE PARTY: *Deutschland/Germany*
DATE OF SUBMISSION:

Submission prepared by:

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NAME OF PROPERTY: *Hydraulic Engineering and Hydropower, Drinking Water and Decorative Fountains in Augsburg*

State, Province or Region: *Germany, Bavaria*

Latitude and Longitude, or UTM coordinates: *48°22'12" N, 10°54'0" E*

Description:

Hydraulic Engineering and Hydropower, Drinking Water and Decorative Fountains in Augsburg combine to make up a complex system of water management that features significant technical and architectural monuments and noteworthy industrial archaeology objects in the time from the 15th to the early 20th century. These elements provide a complete account over this period of the succession of and connections between technological developments. The significance of water has been held in high regard for centuries and this is expressed through exquisitely decorated fountains.

The Romans established Augsburg at the confluence of the Lech and Wertach rivers and from this time the city was being supplied with process water from the Singold across the Lechfeld plain via open water channels. Augsburg has been using the water power from the Lech canals from at least the Middle Ages.

The Hochablass, which first appeared in public records in 1346, is the weir in the south east of Augsburg and guides water from the Lech into the broad network of canals which were also fed by additional diversion channels of the Lech, spring-fed brooks, the Singold river and since the late 16th century, is also supplied by the Wertach river. In 1552 and 1911/12 the Hochablass was relocated and underwent massive structural changes.

Canals for generating power were probably being dug as early as from the 8th century onwards. The town charter of 1276 contains the first mention of four canals fed by the Lech. In 1462 a charter granted to Augsburg by Kaiser Friedrich III gave the city the right to divert as much water as it wished from the Lech into the canals. These canals provided process as well as drinking water, served as transport routes for building materials and firewood, powered grain mills and hammer mills, delivered raw materials to craftsmen and were used for waste removal.

The construction of the first water tower, which was still made from wood, commenced in 1412 and municipal provision of running water began. Since Augsburg's upper town is located on a high plateau, waterworks pumped drinking water to the water towers, generally piston pumps driven by waterwheels. Until 1737/38 the Untere Brunnenturm (Lower Water Works) was an exception to this rule where seven Archimedes' screws in the "Machina Augustana" lifted water. From the high basins in the water towers the drinking water flowed out to public wells in a continuous through-flow system via wooden pipes. Springs nearby the well towers provided drinking water. In addition to the waterworks built from ca. 1414 at the Rotes Tor (Red Gate) the water from the Brunnenbach supplied by clean springs lead through the wet moat using an aqueduct carefully separated from process water. Before 1843 there were a total of seven water works with nine water towers in operation.

In place of the medieval water basins/second generation gothic well systems Hubert Gerhard and Adriaen de Vries created three Mannerist-style monumental fountains between 1588 and 1600 which served as the showpieces for the city's drinking water supply system.

In 1879 the towerless waterworks at Hochablass, a globally renowned technical innovation, replaced the drinking water system of the then seven water towers. The water power provided by the canals supported the early industrialization of Augsburg, a city far from any coal deposits, and encouraged important textile, machine and paper factories to settle. From 1840 the changes made to water power by water wheels and turbines enabled the city's early transformation into an industrial metropolis. Since 1902 hydroelectric power stations supplied the large factories with power.

Justification for outstanding universal value:

The uniqueness and the outstanding universal value of Augsburg's water management system and the city's waterworks is based, predominantly on:

1. the continuity and universal understanding of the meaning, management and use of water from Roman times until the early 20th century – particularly in the time from 1400 to 1923.
2. the architectural and technical monuments of water management, which to this day illustrate the technological development stages and the presence of a "water-knowledge cluster" (Karl Ganser, 2012) between the Late Middle Ages and the Industrial Age. Where buildings and technical installations have not survived, the technical expertise is documented in the Augsburg archives, libraries and collections in the form of sketches, manuscripts, printed works, instruction paintings and hydro-technology models from the 17th, 18th and 19th century from the world's only model display hall at the Maximilian Museum in Augsburg.
3. the city's unique threeness of the monumental fountains in Maximilianstraße (Augustus, Mercury and Hercules fountains), which were designed by Hubert Gerhard and Adriaen de Vries, two of Europe's most celebrated sculptors. The fountains are "Creations of the highest artistic perfection" (Rolf Kießling, 1989). This succession of three cast bronze fountains in a public area is the only such example worldwide.
4. the understanding of and focus on water that has not only been expressed through protective measures since the Early Modern Age and through the documentation about hydraulic engineering and waterworks published in Augsburg, but also through the celebration of water in architecture and the visual arts.
5. the network of canals in Augsburg, which still exists today and which benefits from the unique topographical position of Augsburg between the Lech, the Wertach and the Lechfeld plain where water is abundant.

The protection of water as a valuable resource, an economically sound and sparing approach to it and the high value placed on water, which is articulated in the architecture, art and publicity means Augsburg is looked to as a global example. The hydro-technology models of the model display hall at the Maximilian Museum, the only one of its kind worldwide, and the wealth of material at the Augsburg city archives, the Augsburg State and city libraries and the art collections document the significance of water management. Today, the waterworks at Rotes Tor and the waterworks at the Hochablass, the Augsburg State Museum of Textile and Industry and the Lechmuseum Bayern north of Augsburg all provide information on water management.

Criteria met [see Paragraph 77 of the Operational Guidelines]:

(Please tick the box corresponding to the proposed criteria and justify the use of each below)

(i) (ii) (iii) (iv) (v) (vi) (vii) (viii) (ix) (x)

The Augsburg water management system is an outstanding result of human creativity over the course of many generations and stages of technological development. The ensemble of significant architectural and technical monuments and the canal network provide a means for understanding Augsburg's development in terms of water technology, from the economically prosperous Late Middle Ages to its early development into an industrial metropolis; at every step this development has been supported by the water management system.

Regarding point (ii): The historical Augsburg water management system reflects the period between the time when self-governed German Free Cities increased their power and the industrial age. All the architectural and technical monuments on the canal network provide solid proof of the development of water usage and water technology between the early 15th and early 20th century. Canals and spring-fed brooks, the Lech weir at the Hochablass, the waterworks at Rotes Tor, three more waterworks/towers and three monumental fountains document the Free City's water provision structures.

Hydro-technology models in the unique model display hall at the Maximilian Museum in Augsburg, original surviving instruction paintings in the waterworks at Rotes Tor and sketches, engravings, manuscripts and printed material in Augsburg's archives, libraries and art collections document the elements of water technologies from the past half millennium which have not survived. In this way, it can be seen that from around 1412 the Free City used classical engineering knowledge to pump water and was considered a technological revolution for the cities north of the Alps. Augsburg's fountain masters perfected this technique of using a piston pump driven by a waterwheel, which is why their skills were in high demand in the 16th and 17th centuries in many places across central Europe. In the 18th century the "Augsburg Team of Masters brought about [...] leading pre-scientific mechanical engineering products, as shown in the public records" (Wilhelm Ruckdeschel, 1989).

The creation of Augsburg's monumental fountains by two leading Dutch sculptors of the Late Renaissance period – Hubert Gerhard and Adriaen de Vries – show the strong cultural influence of Italy on the artistic city; Augsburg was one of the first German cities to adopt the ideas and ideals of the Renaissance. The Augustus fountain, the Mercury fountain and the Hercules fountains are a late reference to the fruitful relationship between Augsburg and Italy and also represent the high point in Augsburg's casting art. At the same time they demonstrate how art constitutes an "irreplaceable factor in a city's politics" (Bruno Bushart, 1998) across the centuries: besides answering the functional needs of the Free City's infrastructure, the monumental fountains also fulfilled the requirement of political representation. This can be interpreted as a sign of the high value placed on the supply of drinking water. The figures at the base of the Augustus fountain personify the four main waterways in Augsburg: the Lech, Wertach, Singold and Brunnenbach with each figure displaying attributes that symbolize the various uses in terms of water management. Members of the Fugger and Welser families were significantly involved in implementing the fountains and their artistic program.

The water management structures of the Early Modern Age triggered the early industrialization of the city. Nowhere else in Europe can the stages of industrialization be understood so clearly as in Augsburg (Karl Ganser, 2010). An example of the factories that were built from 1836 on the industrial canals is the Augsburg Kammgarn Spinning Works (AKS) at Schäfflerbach, which was founded in 1837. Since 2010 the Augsburg State Museum of Textile and Industry has been using a part of the AKS to demonstrate the importance of Augsburg as a location for industry.

With operations starting in 1879, the waterworks at the Hochablass perfectly combined the technical standards of the day with innovative developments: by using four ten-meter-high air-pressure chambers it became possible to establish an innovative system for supplying drinking water that did not rely on water towers. This technique served as a model for the rest of the world for decades. Moreover, this architectural and technical monument combines functionality with the highest esthetic requirements, which can be seen from both the architecture and the oriental-style ornamental decoration of the interior.

Augsburg's factories used the prolific water power of the canals from 1840 with turbines which drove the machines using transmission. Shortly after 1990 hydroelectric power stations supplied Augsburg's factories with power. Many existing turbine houses were converted for this. In 1902 the palatial hydroelectric power station was constructed on the Wolfzahnau. Back then river power stations had not yet been technically perfected, hence a new large canal was dug in 1901 running parallel to the river in which the water of all the Lech canals was combined for this power station to conclude the Lech-side canal system. In 1921 a second large canal parallel to the Wertach was constructed in order to power the hydroelectric power station that went into operating in 1922 on the Wertach canal. Both large canals and the hydroelectric power stations are monuments to industrial archaeology.

Regarding point (v): The development of Augsburg since the late Middle Ages in terms of city planning, economics and culture has been strongly influenced by the interplay between the city's population and water. Augsburg has benefited from the unique topographical location formed by the Lech and the Wertach for its diverse water management system. Besides generating hydropower (for grain mills, hammer mills, water wheels, turbines and hydroelectric power stations) and providing drinking water the canals have also been used for timber rafting, log driving, waste removal, providing basic feedstock (for paper makers, dyers and tanners, among others) and as a cooling system for the free imperial city's Stadtmetzg (meatworks) built by Elias Holl in 1609.

Water management continues to dominate the city's look today: south of the city by the Hochablass, the two diversion channels of the Lech, spring-fed brooks and channels that were once separated into drinking water and industrial water as well as in today's nature reserve and protected drinking water area "Stadtwald Augsburg" (City Forest). The eastern part of the old town is completely structured around the canals, the position of the city ditches and the waterworks located on them. From 1836 onwards partially until 1921 collections of factories were built along the canals in the industrial region to the east and north of the city walls according to typical town-planning concepts (palatial factory buildings, grand houses for factory managers and workers' villages). Internationally successful companies are located here today; their predecessors chose to base themselves in Augsburg because of the water power. 35 small hydroelectric power stations on the Lech canals act as a reminder of Augsburg's industrial past. The triad of monumental fountains dominates Maximilianstraße, a prominent line of sight through the city center.

Statements of authenticity and/or integrity:

The monuments to Hydraulic Engineering and Water Power, Drinking Water and Decorative Fountains in Augsburg each have a high degree of authenticity and integrity. The monuments have been preserved in their original form as far as possible. Thanks to their extraordinary well-preserved condition, they provide a unique opportunity to understand the technical structures of the historic water management system today.

The canal landscape along the Lech, the Wertach and on the Lechfeld plain probably developed from around 764 to 1921. 29 canals (total length 78 km) were diverted from the Lech and four canals (12 km) from the Wertach. 19 streams (46 km) in the Stadtwald Augsburg are fed by a diversion channel of the Lech and from sources in the Lechfeld plain to the south of Augsburg. The preserved canals and streams are monuments to industrial archaeology and are still used today for electricity generation. At the powder mill sluice on the Kaufbach, the historic hoisting gear for the sluice gate with its gear transmission and drive shaft has been preserved as a technical monument.

The former buildings at the Hochablass, first mentioned in 1346 were destroyed by floods and fire. After the record floods of 1910 the current Lech weir was built in 1911/12 with armored concrete and it remains intact and in operation today.

Unique to Central European architecture, the waterworks at the Rotes Tor with three water towers, two fountain masters' houses and an aqueduct have all been completely preserved. The Große Wasserturm (Large Water Tower) and the Kleine Wasserturm (Small Water Tower) at the Rotes Tor (Red Gate) as well as the Untere Brunnenturm (Lower Waterworks) are in essence the oldest existing water towers in Germany and probably also in Central Europe. As a reminder of Augsburg's outstanding fountain master, Caspar Walter, there are six oblong instruction pictures on wooden panels in the Kleine Wasserturm (1753) created from his sketches. In 1742 Walter built a beautiful double-flight spiral staircase for the Kastenturm (Granary Tower) which is preserved today. The figure of a Triton serving as drain cock (the so-called "Fountain Lad") created by Adriaen de Vries (around 1600) is now displayed in the Maximilian Museum in Augsburg. The lower parts of the water towers still show the Gothic-style elements from the previous constructions. The Große Wasserturm (brick-built from 1463 onwards), the Kleine Wasserturm (from 1470 onwards) and the Kastenturm (from 1599 onwards) were built on the foundations of medieval defense towers that fortified the city. Renovation works uncovered exceptionally well-preserved red chalk inscriptions and the remains of wall paintings.

The Lower Waterworks, probably active from 1450, raised in 1538, today essentially shows the condition of the buildings in 1684. A pump house built over a city stream has been preserved. Near this pump house a cast-iron canal bridge, built by Georg von Reichenbach in 1848 – today a technical monument – crosses the city stream. Until 1897 water for the pump station flowed across this bridge.

Elias Holl built the Untere St.-Jakobs-Wasserturm (Lower St Jacob Water Tower) in 1609. This Renaissance structure has been renovated and is preserved in very good condition.

In place of the three then out-of-commission small water towers at the Vogeltor (Bird Gate) a medieval defense tower was converted to a water tower for a new, better performing waterworks probably before 1779.

The Augustus Fountain dates from 1594 and was designed by Hubert Gerhard; the Mercury and Hercules fountains date from 1599 and 1600 and were made by Adriaen de Vries. They are among the most splendid bronze monuments of the Renaissance to be found north of the Alps. After the restoration of the original bronze the figures on the fountains were replaced and currently are replaced with replicas, while the well-preserved originals are kept at the Maximilian Museum in Augsburg. This museum also houses the so-called "Augsburger Wappner" (Augsburg Knight In Armour), a fountain figure made in around 1516 by Sebastian Loscher from red marble, and the original Neptune's fountain figure made in 1536/37 by an unknown Augsburg master. The Neptune is the only preserved cast bronze fountain figure from the time before Giambologna and was also the oldest preserved monument of a nude in a public space in Germany.

Over 60 hydro-technology models constructed between the 17th and the 19th centuries remain intact today and are on display in the model display hall at the Maximilian Museum in Augsburg or are in storage.

The palatial, neo-Renaissance-style waterworks at the Hochablass, built in 1878/79, have been renovated and are now a well-preserved architectural and technical monument and a unique monument to industrial heritage. The forged air-pressure chambers are also preserved, as are the original machine workings of the piston pumps. The decorative paintings in the interior were uncovered in 1991 and restored in 1993. They are an important treasure of 19th century industrial architecture.

In 1902 the hydroelectric power station on the Wolfzahnau was the first of Augsburg's hydroelectric power stations. The exposed brickwork construction which was built over the end of the canal system and restored in the 1970s to its original condition contains the flywheel generator, standing at more than five meters high and still in operation, and its turbine from 1913, as well as a functioning twin Francis turbine from 1910. The hydroelectric power station continues to generate electricity today.

In 1921 the last large industrial canal to be dug was the Wertach canal, on which the Wertach power station was constructed and remains to this day. The machine workings from 1921 have been retained in their original condition, with the exception of one turbine.

Several hydroelectric power stations with components of their historical equipment have been preserved, partially in what were converted early industrial turbine houses until 1923 as the last relics of large areas of factories on the Lech canals.

Comparison with other similar properties:

There are only three sites in the world on the UNESCO World Heritage List which are primarily based on the management of fresh water:

1. The Aflaj Irrigation Systems of Oman, a network of smaller and larger irrigation channels with a total length of more than one thousand kilometers which are still used today, on the list since 2006.
2. The Shushtar Hydraulic System in Iran, a system of bridges, dams and canals which were used for irrigation from the 3rd to 19th century, on the list since 2009.
3. The Upper Harz Water Management System, one of the largest pre-industrial systems for powering water wheels used in mining, as part of the Mines of Rammelsberg and Historic Town of Goslar World Heritage Site, on the list since 2010.

What distinguishes Augsburg from these three world heritage sites?

In contrast to the Aflaj in Oman, the hydraulic system of Shushtar and the Upper Harz water management system as well as other world heritage sites combined with water management systems, the monuments to "Hydraulic Engineering and Water Power, Drinking Water and Decorative Fountains in Augsburg" illustrate the complex development of very different technologies and uses, which has happened over more than half a millennium.

In and around Augsburg the technological very different facilities for hydraulic engineering, power generation and decorative fountains are in use today. This is true of the canal landscape, the Lech weir at the Hochablass, the monumental fountains and the early hydroelectric power stations, which still operate to some extent using the original machinery.

The esthetic and representative requirements of Augsburg were combined with the provision of drinking water. They encompassed decorative fountains that were highly regarded across Europe and buildings constructed for water management, whose role went far beyond functionality. Therefore, it is only in Augsburg that the practical purposes of the water management facilities were combined with such strong artistic ambitions that leading artists were commissioned to create the artworks. This demonstrates the high regard for water in Augsburg, which was expressed by means of these high-quality artworks that were combined with the technical installations for providing drinking water.

The city of Augsburg explains how water management systems benefited the skills of local tradespeople, for instance carpenters, goldsmiths, foundrymen and builders. The tasks of hydraulic engineering, utilizing hydro power and decorative fountains attracted prominent artists, engineers, authors, publishers, engineers and industrial pioneers.

In Augsburg the water management system was the trigger for the early industrialization of the city and led to the foundation of companies, some of which still exist and are now internationally active.

With other world heritage sites, applicants on the tentative list from other countries and monuments which are not on the world heritage list individual aspects of historic water management systems and decorative fountains play a role. A comparison with these sites describing chronological, typological and geo-cultural references was most recently carried out in 2013 as part of the Augsburg expression of interest in "Hydraulic Engineering and Hydroelectric Power, Drinking Water and Decorative Fountains in Augsburg. A Europe-wide comparison of the historical Augsburg Water Management System and its monuments" ["Wasserbau und Wasserkraft, Trinkwasser und Brunnenkunst in Augsburg. Die historische Augsburger Wasserwirtschaft und ihre Denkmäler im europaweiten Vergleich"] by Martin Kluger, 2013.

This comparative analysis showed that the historical Augsburg water management system is unique in the wide range of content. The unique selling points are the use and the extent of the networking of water management system technology, decorative fountains and the industrial culture witnessed by the monuments in a time period of 500 years, combined with hydro technical collections, documentation and publications.

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- The Tentative List submission format is available from the UNESCO World Heritage Centre and at the following Web address: <http://whc.unesco.org/en/tentativelists>
 - Further guidance on the preparation of Tentative Lists can be found in Paragraphs of the *Operational Guidelines*.
 - An example of a completed Tentative List submission format can be found at the following Web address: <http://whc.unesco.org/en/tentativelists>
 - All Tentative Lists submitted by States Parties are available at the following Web address: <http://whc.unesco.org/en/tentativelists>
 - The original signed version of the completed Tentative List submission format should be sent in English or French to: UNESCO World Heritage Centre, 7 place de Fontenoy, 75352 Paris 07 SP, France

States Parties are encouraged to also submit this information in electronic format (diskette or CD-Rom) or by e-mail to wh-tentativelists@unesco.org