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Environmental changes and the first Olympic Winter Games. Infrastructure projects for 'Chamonix 1924'

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ABSTRACT

This paper investigates the infrastructure projects undertaken for the event initially known as the *Semaine des sports d'hiver*, which took place in Chamonix, France, from 25 January to 4 February 1924 and was later recognized as the first Winter Olympics. Although the already famous resort town was able to use its existing hotels to accommodate visitors and athletes, it also made a considerable investment in the construction of new sports infrastructure. Following an agreement signed just 9 months before the Games, these facilities included a large ice rink, a bobsleigh run and a ski jump. The project was entrusted to the Ponts et Chaussées engineers, who encouraged local firms to help with the construction. Archival analysis will be used to examine the relationship between the project and the changing environment. Our aim is to show how the work in Chamonix modified the environment by exploiting certain natural elements (e.g. water, soil and forests) and, conversely, how the natural (in particular, the geological and climatic) and historical (notably land ownership) components of the environment affected the execution of these works.

KEYWORDS

Environmental history; Olympic Winter Games; architectural design; construction management; sport facilities; Chamonix

Introduction

This paper presents an alternative historical perspective of the first Olympic Winter Games, which took place in Chamonix, from 25 January to 4 February 1924. The so-called Winter Sports Week (*Semaine des sports d'hiver*) was supervised by the French Olympic Committee, which also organized the Paris Games later the same year. Some 250 athletes from 16 nations took part in six specialities: bobsleigh, skating, ski jumping, curling, hockey and cross-country skiing. Although the International Olympic Committee could not officially include the Games in the 8th Olympiad due to tensions with the federations of the Nordic countries, which were already organizing an international winter sports competition under the name of the Nordic Games, the event would be recognized as the first Olympic Winter Games the following year.[1]

The allocation of the Winter Olympics to Chamonix was the result of dynamics crossing national, international and local levels. Some authors have pointed out that the choice of the destination was more the result of the will of the City of Paris than that of the Olympic Committee.[2]

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[1]Pallière, "Les premiers Jeux d'hiver de 1924 : la grande bataille de Chamonix".

[2]Arnaud, "Olympisme et sports d'hiver : Les retombées des Jeux Olympiques d'hiver de Chamonix 1924".

Others have noted the importance of Jean Lavaivre, former director of the Hotel des Alpes and the first mayor of Chamonix with a background in the tourism industry, in obtaining the Games. Besides some privileged relations between local authorities and central government politicians, Chamonix could also boast genuine infrastructure advantages. The already renowned destination for alpinism and *villégiature* (summer tourism) had introduced a tourism tax in 1918 in line with a French law on so-called *stations touristiques*[3] and could provide accommodation in numerous hotels, as well as a well-developed rail connection with Paris, Lyon and Geneva. Moreover, Chamonix had started the process of transforming the town from a summer-tourism destination to a winter sports resort, hosting the first ski competitions in 1906 and launching some ambitious infrastructure projects, such as the Mont Blanc tramway, the Aiguille du Midi funicular, the Brévent cable car and the construction of a large outdoor *patinoire* (ice rink). Finally, the valley's orographic layout, offering close proximity between the hotels located in the town centre and the competition venues on the slopes, was an additional advantage.

However, Chamonix's readiness to host a major sports event did not negate a series of challenges, making the preparations for the Olympic Games seem like a 'battle'.[4] The first of these was the limited time available to build the infrastructure, since the official agreement was signed only 9 months before the opening of the event, in a geographical and climatic context that imposed some limitations on the construction sites.

The existing literature on Chamonix 1924 mainly consists of research into the history of sports, with some contributions dealing with the disciplines and competitions held in Chamonix or the stakeholders and the transnational network that made the event possible.[5] In addition, the premises of territorial marketing accompanying the preparation and characterizing the heritage of the Games have been analysed,[6] along with the importance of the 1924 event in the advent of skiing as a tourism practice.[7] A monograph was recently published to celebrate the centenary of the First Olympic Games, with contributions from both academic and local historians. Among other themes, the financial aspects of the Games,[8] the engagement of local inhabitants in their preparation and the backgrounds of some of the athletes[9] have been uncovered.

In general, considering the state of the art, little attention has been devoted to the spatial transformations carried out for the first Winter Games. This paucity is probably due to a commonly accepted vision of the Games in Chamonix as belonging to a first generation of 'minimal infrastructure investments'.[10] However, while it is true that the number of participants was trivial compared with more recent editions (and also lower than expected), constructing the infrastructure has been recognized as a real 'challenge'.[11] On this point, while the town could rely on existing hotels to accommodate visitors, athletes and journalists (according to archive material, around 950 tourist beds were reserved in 29 structures of different categories[12]), major work was required to build

[3]Law of 24 September 1919 creating hydromineral, climatic and tourist resorts (*stations hydrominérales, climatiques et de tourisme*), introducing special taxes and regulating the National Tourist Office.
[4]Pallière, "Les premiers Jeux d'hiver de 1924 : la grande bataille de Chamonix".
[5]Pérez-Aragón et Viuda-Serrano, "The Icy Road towards the First Olympic Winter Games in Chamonix 1924".
[6]Durand, "Les JO d'hiver de Chamonix en 1924: L'émergence d'un 'marketing' des territoires et la mise en place de mécanismes toujours présents".
[7]Arnaud, "Olympisme et sports d'hiver : Les retombées des Jeux Olympiques d'hiver de Chamonix 1924".
[8]Tissot, "Désastre financier ou triomphe économique?".
[9]See the contributions of Joelle Dartrigue-Paccalet in Sorez, *Chamonix 1924. Les Premiers Jeux Olympiques d'hiver*.
[10]J. Essex and de Groot, "The Winter Olympics: Driving Urban Change, 1924–2022," 65.
[11]Pérez-Aragón and Viuda-Serrano, "The Icy Road towards the First Olympic Winter Games in Chamonix 1924"; Pallière, "Les premiers Jeux d'hiver de 1924 : la grande bataille de Chamonix".
[12]See an undated document of the dossier *3R4 organisation logement,* Archives of the Municipality of Chamonix (AMC).

the sports infrastructure from scratch. As defined in an agreement signed by Count Clary, president of the French Olympic Committee, and mayor Jean Lavaivre on 20 February 1923,[13] a bobsleigh track, a skeleton track and sled run (later abandoned), a ski jump and a massive outdoor ice rink with sport fields attached to it were to be built. A *pavillon des sports* located along the south side of the ice rink was also designed by architect Rouet. Its spaces could accommodate celebrations and staff accommodation, while the roof terrace could be used as a grandstand during competitions. On a larger scale, the railway connections between Chamonix, Paris, Lyon and Geneva were to be improved, and the Chamonix – Aiguille de Midi cable car project was to be resumed.

According to the resolution of the municipal council (*délibérations du conseil municipal*), in order to finance the work, the municipality committed itself to a loan of 800,000 francs,[14] including a 30-year loan of 500,000 francs with Crédit Foncier (guaranteed by the proceeds of the tourist tax) and 300,000 from private investors following an appeal for public subscriptions.[15] The French Olympic Committee (COF) had initially pledged a subsidy of 500,000 francs to fund the preparation of the Games, but we did not find any evidence of such a payment in subsequent documentation. Documents simply indicate that a sum of 50,000 francs due to be paid by the COF to the municipality in 1926 was later reduced to 25,000 francs.[16] Moreover, according to the agreement of 20 February 1923, the income from ticket sales accrued to the COF, which returned 40% of this revenue to the municipality. We can argue that, similar to later editions of the Games, Chamonix assumed the financial risk, which also had implications for the development of construction works, as we will discuss below.

Research questions and methodology

An approach via environmental history

The article seeks to uncover an as yet little-explored part of history by examining the spatial, landscape and environmental transformations that accompanied the preparation of the first Winter Olympics in Chamonix. Our goal is to widen the perspective that often characterizes analyses of the spatial changes prompted by the Olympics or similar large-scale events. Instead of solely assessing the environmental impact of infrastructure development, we will delve into the nuanced interplay between the infrastructure and the environment.[17] Literature on the Winter Olympics has often addressed this issue by investigating both the exploitation of natural resources during the Games (e.g. the use of water to produce artificial snow) and the built heritage (including various abandoned infrastructures), whose footprint is often more visible than what is perceived in the urban context.[18] Indeed, an approach using the lens of environmental history will make it possible to shift from the impact analysis towards the study of the interactions between anthropic and non-

[13]Fund 2 O 2181, Archives de la Préfecture concernant l'administration communale, Archives départementales de la Haute-Savoie, Annecy. Later abbreviated to 2 O 2181, AD 74.
[14]*Déliberations du Conseil Municipal*, 06/02/1923, later confirmed in 06/01/1924, 1D 32 1923-24, AMC.
[15]*Déliberations du Conseil Municipal*, 06/02/1923, 1D 32 1923-24, AMC.
[16]Those data, which are based on personal archival surveys are not aligned with information collected by other historians. For a better understanding of the financial aspect of the event, which has partially been neglected in this contribution, see, among others: Pallière, "Les premiers Jeux d'hiver de 1924 : la grande bataille de Chamonix," 47–50; Tissot, "Désastre Financier Ou Triomphe Économique?".
[17]Chappelet, "The Legacy of the Olympic Winter Games: An Overview"; J. Essex et Chalkley, "Olympic Games: catalyst of urban change"; Konstantaki, "Environmental Sustainability of Olympic Games: A Narrative Review of Events, Initiatives, Impact and Hidden Aspects"; Müller et al., "An evaluation of the sustainability of the Olympic Games".
[18]Dansero and Mela, "Bringing the Mountains into the City: Legacy of the Winter Olympics, Turin 2006"; J. Essex, and de Groot, "The Winter Olympics: Driving Urban Change, 1924–2022"; Kietlinski, "'A Strong, Sustainable Legacy:' The Environment and Japan's Winter Olympics"; Konstantaki, "Environmental Sustainability of Olympic Games: A Narrative Review of Events, Initiatives, Impact and Hidden Aspects".

anthropic components of the environment. This idea has been promoted by historian William Cronon, who states that 'in studying environmental change, it is best to assume that most human activities have environmental consequences, and that change in natural systems (whether induced by humans or by itself) almost inevitably affects humans'.[19] The mutual relationship between society and (the rest of) nature requires a recognition of the environment as an actor[20] in the flow of historical events. Therefore, our objective is to show, on the one hand, how the works undertaken in Chamonix for the first Winter Olympics modified the environment through the exploitation of natural elements such as water, soil and forests and, on the other hand, how natural (in particular, the geological and climatic) and historical (notably land ownership) components of the environment impacted the execution of the construction works. Preservation of the environment was not as much of a social and political issue in the early twentieth century as it is today. Therefore, focusing on environmental change offers historians a perspective to uncover new aspects from sedimented narratives, rather than serving as a criterion for evaluating the design processes that took place to prepare for this event.

The research question and the set of references that contributed to framing it need to be clarified through two premises in order to outline both the methodological and theoretical boundaries of our argument.

First, in 1993, William Cronon described the work of environmental historians as an attempt to 'pull nature into the stream of human history',[21] while McNeill defines environmental history as 'the history of the relationship between human societies and the rest of nature on which they depended'.[22] This perspective (without underestimating the diversity among environmental historians), which emerged in the United States in the 1970s, has fascinated historians, transcended borders and led to the creation of a recognizable field of study worldwide in the 1990s. However, some aspects of this approach, aligned with the global environmental emergency, are not completely new, especially when viewed against older European traditions in history and geography (such as the Annales School historians, historical geography, landscape history and rural history). For instance, these traditions already embraced the idea of land as being co-constructed by both anthropic and non-anthropic agents or adopted the *longue durée* as a temporal framework.[23] Moreover, environmental historians are not alone in challenging the separation between culture and nature. This ongoing debate engages anthropologists, philosophers[24] and, recently, theorists of the Anthropocene, a paradigm that calls for a re-evaluation of humanity's position within the realm of living beings and their role on the planet.[25]

Secondly, the term 'environment' has different meanings depending on language and discipline, as well as geographical and historical context.[26] For this reason, the term requires explanation.[27] Its definition varies between two extremes: on the one hand, an operational definition derived from biology, in which the environment is limited to those elements that contribute to explaining a phenomenon; on the other hand, an all-encompassing albeit often uncritical idea that 'the

[19]Cronon, "The Uses of Environmental History," 13.
[20]Latour, "Agency at the Time of the Anthropocene".
[21]Cronon, "The Uses of Environmental History," 11.
[22]McNeill, "The Nature of Environmental History," 347.
[23]Fressoz et al., *Introduction à l'histoire Environnementale*; Chakrabarty, *The Climate of History in a Planetary Age*.
[24]Descola, "Par-delà la nature et la culture"; Ingold, *The Appropriation of Nature: Essays on Human Ecology and Social Relations*.
[25]Bonneuil and Fressoz, *L'événement Anthropocène. La Terre, l'Histoire et nous.*
[26]Pelletier, "Environnement".
[27]Young, "Environment: term and concept in the social sciences," 113.

environment is everything'.[28] When the environment is intended as a comprehensive entity, the researcher is confronted with the impossibility of offering holistic knowledge on it. In this case, the study of the relationship between infrastructure and environment considered in both its natural and cultural components would require (at least) profound interdisciplinary research, as well as more time and means for collecting data. Instead, we limit ourselves to considering those elements constituting the environment of the sites that were affected by the construction of sports facilities and, more than others, have played a role in the development of the design and construction process.

An investigation of the design and construction process

From a methodological point of view, it seemed fruitful to analyse the history of the design and construction of the sports infrastructure required to host the Games. Although adopting the temporal framework of the design process means abandoning the long-term outlook that is central to environmental studies, doing so offers an interesting angle from which to observe the multifaceted relationship between anthropic actions and the site. And indeed, the examination of the sports infrastructure projects as a process revealed a series of frictions, misalignments, renunciations and desynchronisations ('*frictions, désajustements, renoncements, désynchronisations*'[29]) characterizing the journey from conception to construction. These challenges, as will be shown below, sometimes stemmed from the project's connection to a specific geographical site.

The results are based on archival research conducted at various repositories: the Archives of the Municipality of Chamonix (AMC), the archives of the association Les amis du vieux Chamonix (AVC), the Archives of the International Olympic Committee (ACOI) in Lausanne and the Departmental Archives of Haute-Savoie (AD 74). Documents about the design and construction processes (e.g. drawings, urban or regional plans and administrative acts or meeting minutes related to the creation of sports and transport infrastructure) have been prioritized.

The analysis of the interrelations between the sports infrastructure (the ice rink, the ski jump, the bobsleigh track) and the environment is structured around three main components of the chosen sites that were transformed by the project and influenced the design and construction process by either facilitating or complicating it. These were: 1) the land, in terms of ownership and use; 2) the soil, considered in its geological and material component; and 3) the water, in the form of resource exploited and in the form of atmospheric precipitation.

The object of study

The agreement of 20 February 1923 designated responsibility for the design and construction of the sport facilities to a division of Ponts et Chaussée engineers, specifically the Bonneville district of the Haute-Savoie department, under the supervision of Engineer Baticle. The built heritage of those works has now almost completely disappeared (i.e. the ice rink and the bobsleigh track) or been repeatedly modified (i.e. the ski jump). However, a description of what happened is facilitated by the Official Report of the 8th Olympiad, published after the Summer and Winter Olympics in France in 1924. We can also rely on photos of the event, some of which are kept by the AMC

[28]Ibid., 91.
[29]Devisme and Matthey, "Projets en échec : déroutes et déréalisations," 1.

(fonds Auguste Cottet) and the AVC, while others were displayed in Turin at the National Museum of the Mountain in 2013 and 2014.[30]

- The ice rink (*patinoire*)

Driven by a desire to equip itself to host winter tourism and compete with other international winter sports hubs, the Chamonix municipal council had first expressed an interest in constructing an ice rink in 1919.[31] For this reason, elected representatives of the municipality travelled across the border to Davos and Villars-sur-Ollon to draw inspiration from the structures built in these Swiss towns. (Figure 1) The initiative gained official recognition as a public interest project in 1922 by presidential decree[32] and was set to be located in a marshy area known as Bouchet, adjacent to the left bank of the Arve. The project was ambitious, with an area of approximately 36,000 square metres and a diameter of some 500 metres, comprising a large ice surface (90 × 227 metres) with rounded ends, surrounded by sports fields including a track for skijouring, races and a curling rink (60 × 34 metres). Grandstands were also planned on the north side (four grandstands for a total of 2,000 standing) and on the south side (a grandstand for 1,000 seated and standing spectators, as well as a grandstand of honour for around 500 people). A *pavillon des sports* was also to be built on the south side, with accommodation for staff and space for ceremonies.[33]

- The ski jump (*tremplin de saut à ski*)

To ensure a successful Winter Games, it was essential to provide the athletes with a launch ramp that could accommodate jumps of at least 60 metres – the prevailing record at the time. To this end, there had to be an inclined surface of sufficient length to give the jumper the speed needed to achieve the desired trajectory, as well as a landing area with a decreasing slope where this speed could be absorbed; between these two tracks, the ground had to be laid out in such a way as to have a profile that approximated the trajectory followed by the jumper.[34]

According to the project, the ramp would be around 79 metres long, with a slope ranging from 30° to 5°, and would have three starting points. The runway was to have a total length of 178 metres.[35] The project was on the south-facing slope in the area known as 'du Mont'.

- The bobsleigh track (*piste de bobsleigh*)

Constructing the 1,370-metre bobsleigh track with 19 curves, a minimum radius of 11 metres and a maximum of 150, as well as 22 different gradients, was a complex task. The design of the profiles and tracks was dictated by mathematical laws in order to prevent the bobsleighs from tipping over during the race, where teams could reach 115 km/h:[36] 'Alignments and circles of curves are connected in plan by the "lemniscate of Bernoulli", whose gradual curvature, from the point

[30]Arvin-Bérod, *Chamonix 1924. L'inverno Diventa Olimpico*.
[31]*Extrait du registre des délibérations de la Chambre de l'Industrie*, 22/02/1919, 2 O 2181, AD 74.
[32]Decree of 12/01/1922, 2 O 2181, AD 74.
[33]The ice rink project is described in the *Cahier des charges* drawn up by engineers of the Ponts et Chaussées (Subdivisionnaire M. Bondet, Ing en chef M. Baticle, Arrondissement de Bonneville), 7/4/1923, 2 O 2181, AD 74.
[34]*VIIIme Olympiade. Rapport Officiel du Comité Olympique Français*, 650.
[35]Project for the construction of a ski jump at Le Mont, drawn up by Engineer Subdivisionnaire Rondet, 20/07/1923, 2 O 2181, AD 74.
[36]*VIIIme Olympiade. Rapport Officiel …* , 652.

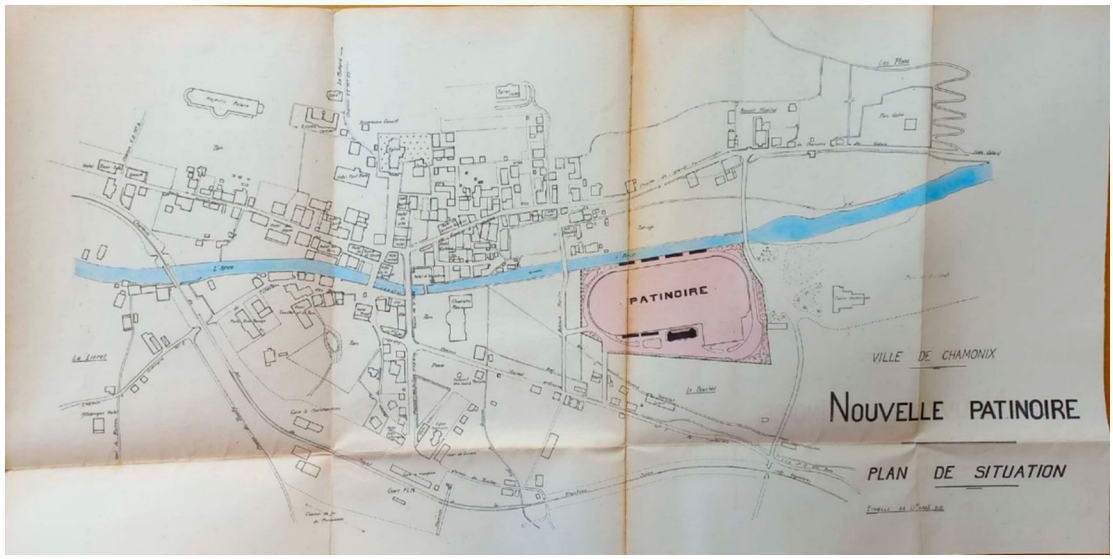

Figure 1. The new ice rink. General Plan 7/04/1923, 2 O 2181 Arch. dép. Haute-Savoie.

where it leaves the alignment to the point where it enters the circle, avoids the sudden onset of centrifugal force.'[37] The profiles followed the shape of a cubic parabola with a maximum height of 4 metres.

The track was located on a slope with a difference in altitude of about 150 metres, on land belonging to the municipal forest of Pèlerins, on the southern side of the valley, near the first section of the 'aerial funicular' leading to the Aiguille du Midi. The presence of this cableway, which was still under construction at the time, is probably the main reason for the location of the run, which could then be used for bobsleighing.[38]

Analysis and results: Interrelations between the project and the environment

Land

The procedures that were put in place for the design and construction process also reveal some elements that allow a discussion on the relationship between the project and the physical and historical environment. Although the sources we have consulted do not allow us to establish whether there was any opposition from the local population or private owners, we can – at least – see how the central administration, involved in the authorization process, welcomed and facilitated the promoters' request.

Despite the scale of the operation, the acquisition of the 21 plots of land belonging to 17 private owners for the construction of the new ice rink (Figure 2) seemingly took place without opposition, apart from some hesitation resulting from the absence of architectural drawings at the time. All lots were sold at 8 francs per square metre.[39] The unconditional support of the Prefect and the commission in charge of the study undoubtedly facilitated the process. Similarly, the local authority had no

[37]Ibid. Translated by the author.
[38]*Délibérations du Conseil Municipal*, 10/09/1922, 1D 32 1922, AMC.
[39]*Extrait du registre des délibérations du Conseil Municipal*, 23/04/1922, 2 O 2181, AD 74.

difficulty in obtaining the land from which to take the fill material to level out the runway. The site, identified inside an area next to the Lac du Bouchet, was a garden adjoining the Hotel du Casino, a former spa. Mr Giacomini, concessionaire of the Hotel du Casino, authorized the removal of some

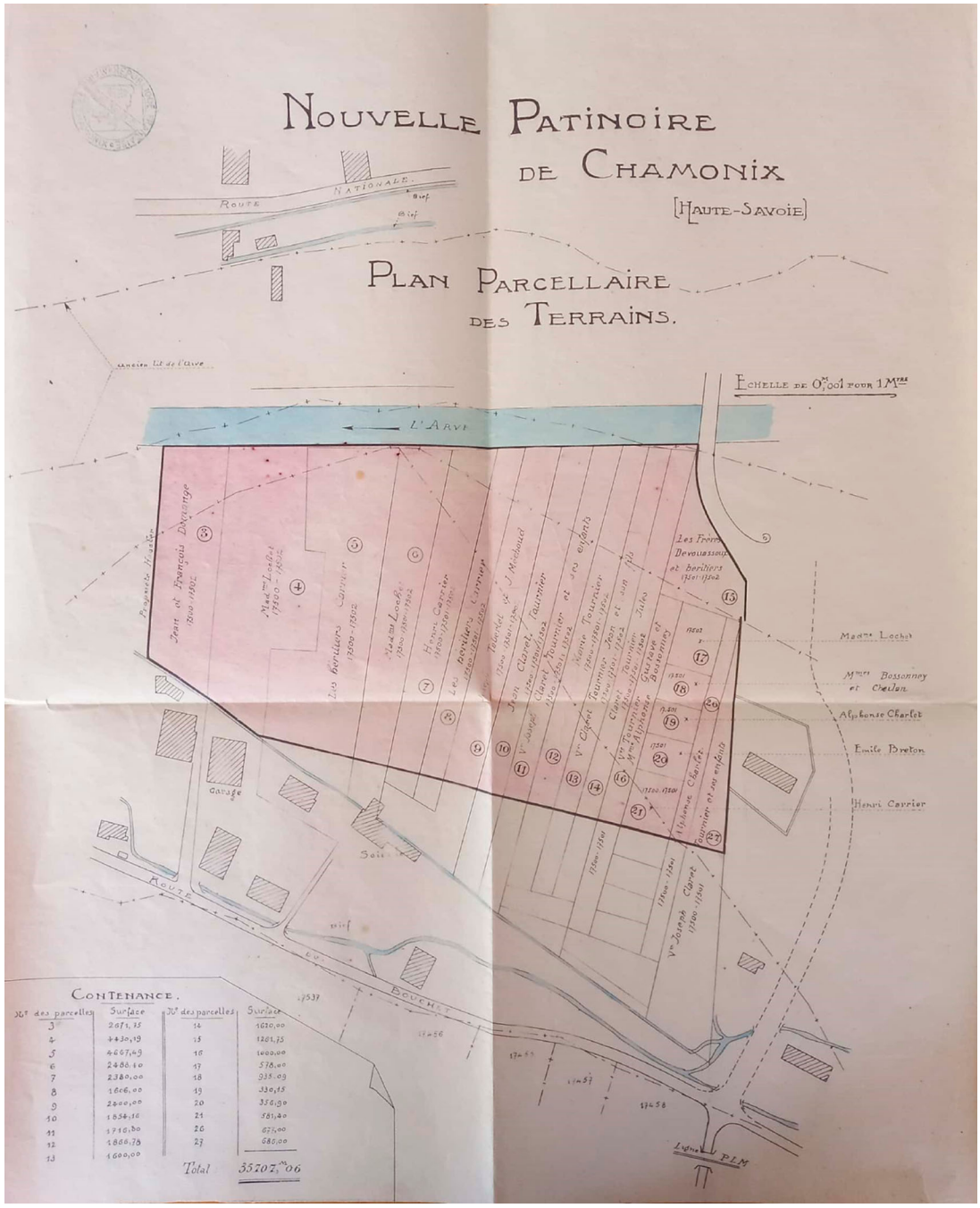

Figure 2. Plan of the land affected by the ice rink project, 12/02/1922, 2 O 2181, Arch. dép. Haute-Savoie.

30,000 cubic metres of fill material from the Casino lake.[40] The Commission des Eaux et Forêts granted permission, underlining the low value it assigned to a natural site and justifying the municipality's choice in economic terms resulting from the proximity of the land to the project site:

> The site earmarked for the proposed extraction is a marshy area in which there is only bushy vegetation here and there, which is suffering, has no future and is of little value; a single small grove of spruce […] appears to have a future; it is indicated on the attached sketch and it has been agreed that it will be preserved. […] The planned extraction is expected to benefit the adjacent parts of the forest and have a positive impact on the surrounding stands. The excavation resulting from this extraction will naturally form a small lake, whose waters will merge with those of the existing lake. The municipality's primary concern is that the area occupied by this small lake should remain, as it is at present, subject to forestry regulations.[41]

For the construction of the ski jump, it was necessary to obtain 14 plots belonging to 11 owners (Figure 3) and covering a total of about 8,300 square metres, of which about 1,600 were 'forest' and the rest 'meadow'.[42] What today appears as a site surrounded by forest was then most probably an agricultural area, as suggested by the name, *Granges neuves* (new barns). An analysis of the municipal resolutions shows that all the owners of these plots of land agreed with the acquisition,[43] although they asked to retain the right to harvest (*droit de récolte*).[44] Thanks to the support of the Prefecture and the Commission des Eaux et Forêts, the municipality was able to take control of land used for forestry or agriculture without strong opposition from the inhabitants.

Again, both the state and the local administration considered the land in question to be of little environmental value:

> The trees to be cut down along the track are stunted spruces, and the stand in this part of the local forest has few prospects, as the ground is largely composed of erratic granite blocks from nearby glaciers and torrents.[45]

Thus, the Administration des Eaux et Forêts approved the removal of the trees. It also authorized using the wood for certain construction projects, such as a shelter for the bobsleigh run and lamp posts for the districts.

The procedure for acquiring the land on which the ice rink, the bobsleigh track and ski jump would be constructed illustrates certain aspects of the history of Chamonix during the interwar period. It was a period of transition towards a tourist economy, symbolized by the election in 1919 of a mayor from a family of hoteliers, Jean Lavaivre. Referring to the period stretching from 1918 to 1937, Bernard Debarbieux points out that agriculture had become a minority sector, rarely the focus of municipal attention. Similarly, the forest was also subject to the ambitions of tourist development.[46] From being a necessary resource for the subsistence of the community, its value was relegated to protecting dwellings from avalanches and landslides or to having an aesthetic purpose.

Soil

The scope statement (*cahiers des charges*) drafted by the Ponts et Chaussées engineers for the construction of the ice rink and its accompanying dam, as well as the ski jump, asked for the use of

[40]Undated declaration, 2O 2181, AD 74.
[41]Report of Mr Perrud, *Garde Général des Eaux et Forêts* in Bonneville, 24/03/1923, 2 O 2181, AD 74. Translated by the author.
[42]*État parcellaire des terrains à acquérir.* Dossier : Construction d'un tremplin de ski 'au Mont', TRA 6, JEU 1, AVC.
[43]*Délibérations du Conseil Municipal*, 10/06/1923, 1D 32 1923-24, AMC.
[44]*Délibérations du Conseil Municipal*, 26/07/1923, 1D 32 1923-24, AMC.
[45]Ibid. Translated by the author.
[46]Debarbieux, *Chamonix-Mont Blanc : 1860–2000. Les Coulisses de l'aménagement*, 97–131.

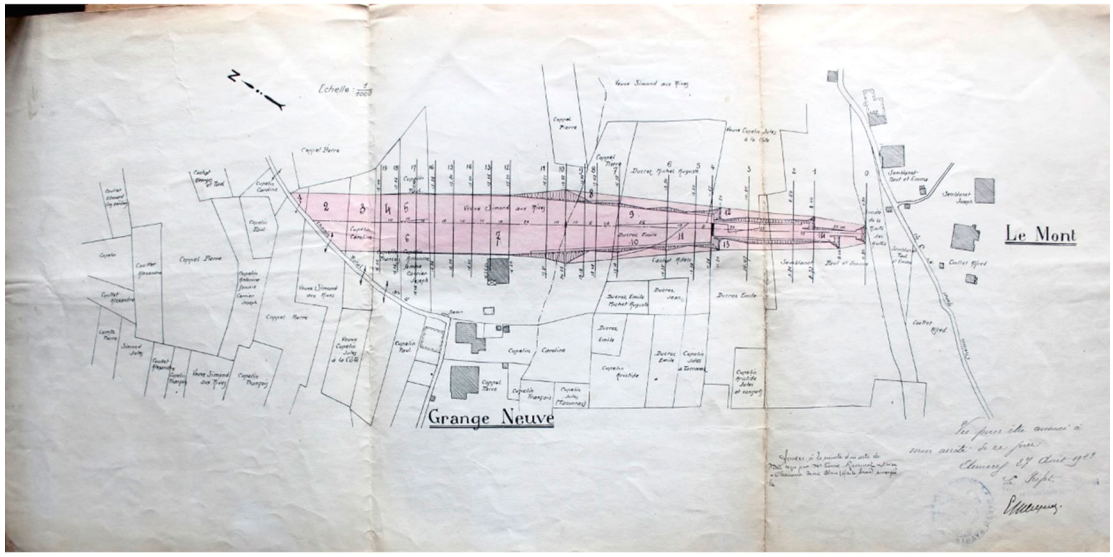

Figure 3. Plot of land to be acquired. Construction of a ski jump 'au Mont', TRA 6, JEU 1, Arch. Amis du Vieux Chamonix.

local raw materials wherever possible. It specified the origin and the place of extraction and delivery.

For the construction of the new dam needed to protect the ice rink and entrusted to the Chamonix-based company Paul Dussus, there was a plan for a concrete wall to be covered with pebbles from the Arve River.[47] The concrete and mortar would be made from sand and aggregates taken from the riverbed as well. Larger stones could be sourced from the Tisseurs block or the Mer de Glace moraine. This approach, as already mentioned, was also applied to the levelling of the ice rink floor, which required an influx of 30,000 cubic metres of gravel that had to come from the region.[48] (Figures 4 and 5) In this regard, the official account of the 8th Olympiad recounts some challenges during the construction process:

> The entrepreneur deployed an excavator that, according to the builder, was expected to produce 750 cubic metres per day. But the ground was not as anticipated. Instead of typical alluvial deposits, the site was littered with enormous stumps and large pebbles, over which the excavator buckets merely slid without making a dent. Starting in July, night work had to be organised, and by September, a special manual earth-moving operation with its own means of transport was set up. Numerous equipment breakdowns occurred, resulting in an average daily excavation volume of barely 140–150 cubic metres.[49]

Unforeseen events caused considerable delays, despite round-the-clock work (*travail continu*). After a formal notice (*mise en démeure*) by the Ponts et Chaussées, followed by a *mise en régie* (consisting of performing the work using the contractor's equipment and personnel, at the contractor's expense and risk),[50] the municipality tried to catch up by participating directly in the work.[51] To

[47] *Patinoire. Reconstruction de la digue en bordure de l'Arve. Devis et Cahier des charges*, 04/03/1923, 2 O 2182, AD 74.
[48] *Cahier des charges* for the construction of the ice rink, sections 15 to 20, signed by Subdivisionnaire M. Bondet, Ingénieur en chef M. Baticle, Arrondissement de Bonneville, 07/04/1923, 2 O 2181, AD 74.
[49] *VIIIme Olympiade. Rapport Officiel* … , 650. Translated by the author.
[50] *Délibérations du Conseil Municipal*, 01/09/1923, 1D 32 1923-24, AMC.
[51] *Délibérations du Conseil Municipal*, 22/01/1924, 1D 32 1923-24, AMC.

Figure 4. Document attached to the report of the Commissioner for Water and Forests, 04/02,1923, 2 O 2181, Arch. dép. Haute-Savoie.

complete the project, it was necessary to ensure the constant presence of a site manager[52] and to use exceptional means, such as a Decauville train, to speed up the transport of the stone blocks between the quarrying area and the construction site.[53]

[52]*Patinoire. Approbation bordereau de prix supplémentaire*. Signed by Ingénieur ordinaire and Ingénieur en chef M. Baticle, Arrondissement de Bonneville, 03/04/1924, 2 O 2182, AD74.
[53]Pallière, ed, "Les premiers Jeux d'hiver de 1924 : la grande bataille de Chamonix," 42.

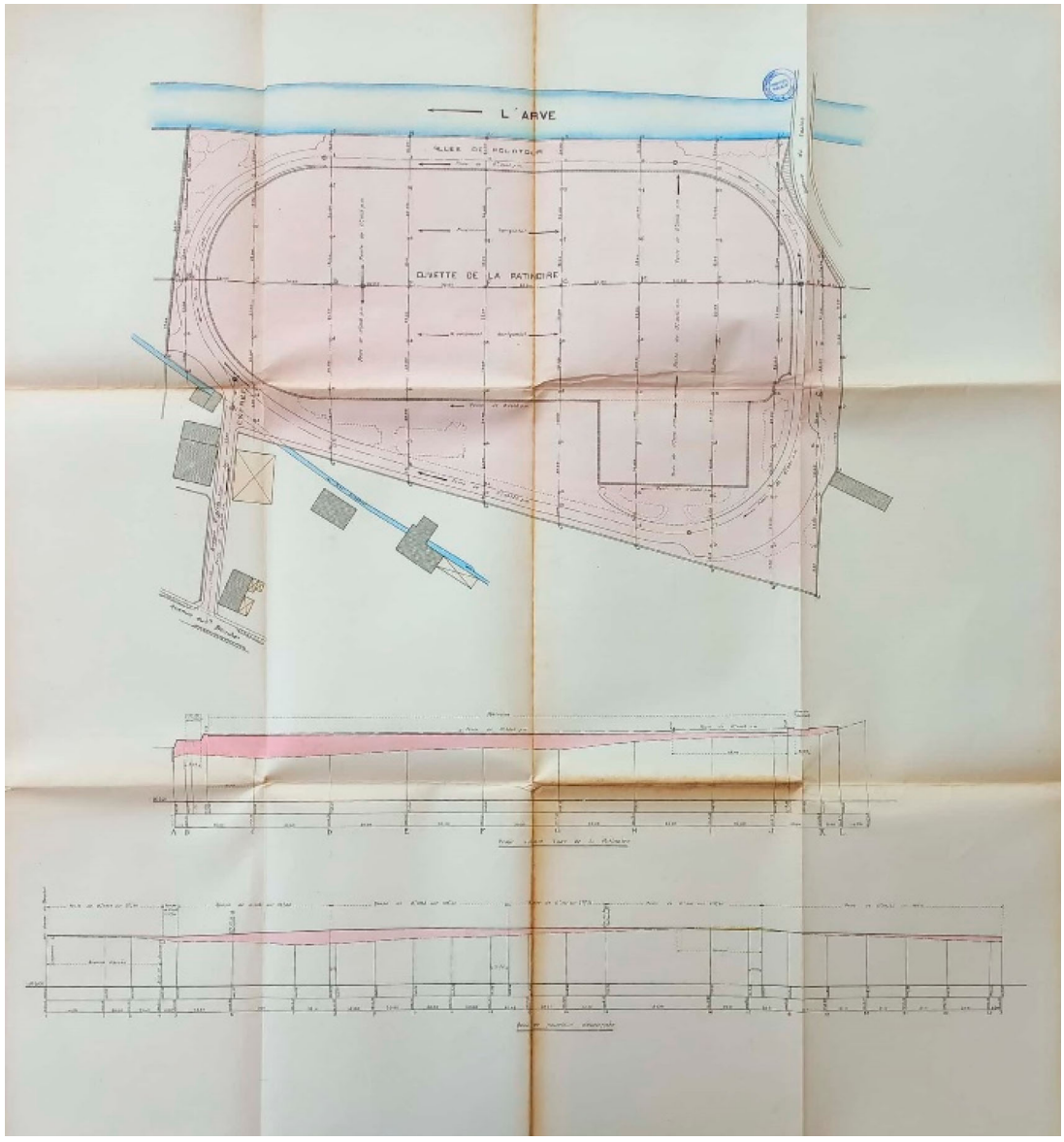

Figure 5. Project for the new ice rink. Levelling plan, 06/04/1923, 2 O 2181, Arch. dép. Haute-Savoie.

The nature of the terrain also made it necessary to reinforce the sewage pipes, and its difficult extraction led to the decision to build grandstands supported by a wooden framework rather than topsoil.[54]

The official report of the 8th Olympiad reveals that the construction of the ski jump itself was fraught with difficulties, partly due to the unknown nature of the ground. To shape the track as planned, an arch at a maximum depth of around 2 metres had to be excavated. The track had to

[54]*Patinoire. Approbation bordereau de prix supplémentaire.*

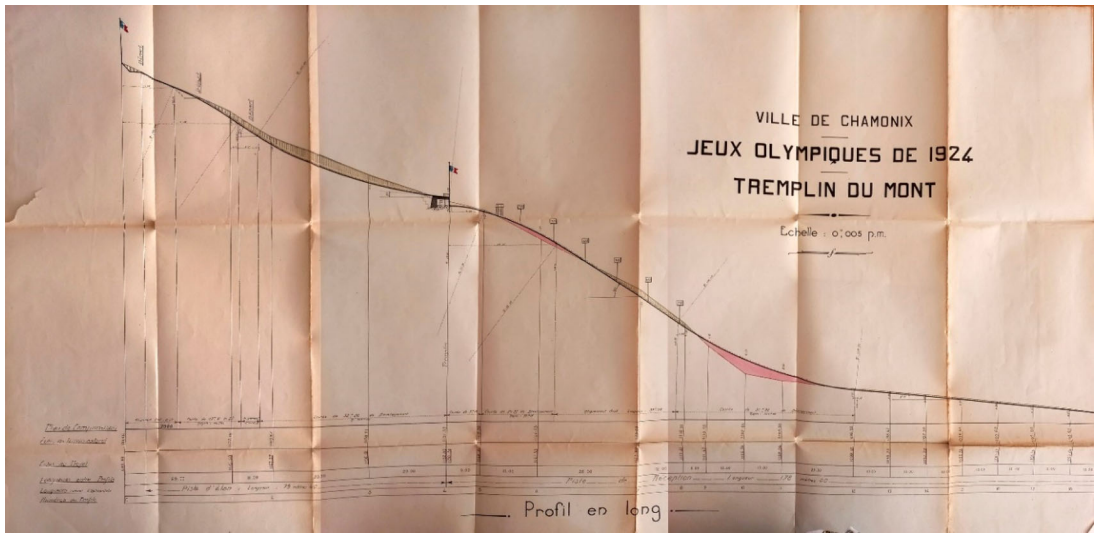

Figure 6. Project for the construction of a ski jump at Le Mont. Longitudinal profile 04/08/1923, 2 O 2182, Arch. dép. Haute-Savoie.

follow the shape of a convex parabola up to 60 metres, where the slope reached its maximum; from that point on, the profile became concave again (Figure 6). The specifications also required that the pebbles and gravel for the concrete and rubble be sourced from the bed of the Arve River or the Bossons Glacier moraine, and that the wood for the launch platform and steps be obtained from the forests in the region. During the excavation work, which was carried out by the local company Catella, it became clear that the volume of rock to be excavated was much greater than expected. In addition, the fill material intended for constructing the slope was found to be clayey and, therefore, unsuitable for the purpose. As a result, material had to be taken from another site, further delaying the project.

One of the most tangible effects of these unforeseen circumstances related to the geological component of the terrain is the increase in construction costs. Reports after completion of the ice rink inform us of the additional costs incurred for the creation of the ice rink, including 30,000 francs for night work and the hiring of a tractor.[55] The cost of the ski jump, initially estimated at around 60,000 francs, increased by 20,000 francs.[56] In this case, although the initial specifications called on the contractor to take responsibility for these unforeseen events, Catella asked for compensation of 15 francs per square metre of rock to be excavated, bringing the total to 4,500 francs, which was reduced to 3,000 francs following an agreement with the Ponts et Chaussées.

By contrast, the construction of the bobsleigh track, a technically complex job carried out by the Argentières-based Bignami-Gelatti company, did not seem to encounter any unforeseen problems: 'The work involved no difficulties other than those resulting from the execution of the bends, which required great precision.'[57] While we have not been able to consult the technical specifications in the relevant *cahier des charges*, the requirement about the use of local material was likely still in

[55] *Délibérations du Conseil Municipal*, 06/01/1924, 1D 32 1923-24, AMC.
[56] *Extrait du registre des délibérations du Conseil Municipal*, 02/03/1924, 2 O 2182, AD 74.
[57] *VIIIme Olympiade. Rapport Officiel* … Translated by the author. We were unable to find the specifications or detailed drawings of the bobsleigh track in the archives.

place, considering that the track was built in dry stone. However, the project's complexity and the municipality's need to complete the work in a short time frame meant that the contractor had to employ 90 workers on site at the same time, which also increased the cost.[58]

We can assume that the many difficulties encountered during the construction resulted from the lack of attention that the Ponts et Chaussées engineers paid to the physical conditions of the implantation sites, such as the topographical and geological components. An apparent lack of any geological or topographical survey in the archives could be due to the limited time and means of the archival research. However, it can at least be observed that the *cahier des charges*, which described the shape, dimensions and materials for the construction of the sports facilities in detail, did not mention any guideline imposed by the characteristics of the construction sites. Moreover, the conduct of surveys on the geological site was delegated to the construction companies together with the associated risk. In the case of the ski jump, for instance, a single price is applied for each excavation, loading, unloading and removal of material, regardless of the nature of the ground:

> By the mere fact of submitting his tender, the contractor will be deemed to have become aware before the awarding of the contract, either by the external appearance of the ground or by digging or soundings […] of the nature and any difficulties of the various parts of the work to be carried out.[59]

This could be one of the reasons why the call for tenders was limited to construction companies from the region, as required in the *cahier des charges* ('the number of foreign workers may not exceed 10%, unless authorised by the Prefect'[60]) and approved by the municipal council ('the execution of these works […] both for the ice rink and for the winter sports slopes and ski jump, may only be entrusted to a local contractor familiar with these works'[61]). The archives also contain several letters sent to the Prefect in May 1923 by contractors from outside the municipality whose bids were rejected, decrying an unfair procedure.[62]

However, an analysis of the three projects showed that the local origin of the construction companies was not sufficient to ensure the successful completion of the work.

Water and weather

The construction of winter sports infrastructure also included the setup of water supply and drainage systems essential for creating the ice surfaces. In the case of the ice rink, it was crucial to protect the levelled ground from the Arve embankment and to establish infrastructure for ice production and drainage, alongside a sewage system for the sports hall (Figures 7 and 8). Despite the Arve's proximity, the decision was made to use drinking water for rink irrigation by connecting to the city's existing network – the reason for this decision was likely the time constraint.[63] Pipes coming from the Route Nationale formed a ring around the ice rink, feeding seven sprinklers.[64] A single sewer network, with a total length of approximately 840 metres, was designed to collect the surface water from the ice rink, overflow from Lac Bouchet and wastewater from the *pavillon des*

[58] *Délibérations du Conseil Municipal*, 20/09/1923, 1D 32 1923-24, AMC.
[59] *Devis et cahier des charges* for the construction of the ski jump. Ingénieur subdivisionnaire Rondet, Ingénieur en chef Baticle, 6–7, 30/08/1923, 2 O 2182, AD 74. Translated by the author.
[60] *Cahier des charges* for the construction of the ice rink, 18. Translated by the author.
[61] *Délibérations du Conseil Municipal*, 04/02/1923, 1D 32 1923-24, AMC. Translated by the author.
[62] Among others: letter to the Prefect of Haute-Savoie from B. Achard, a contractor from Etrembières, 07/05/1923, 2 O 2181, AD 74.
[63] *Cahier des charges* for the construction of the ice rink, 20.
[64] *VIIIme Olympiade. Rapport Officiel* … 648.

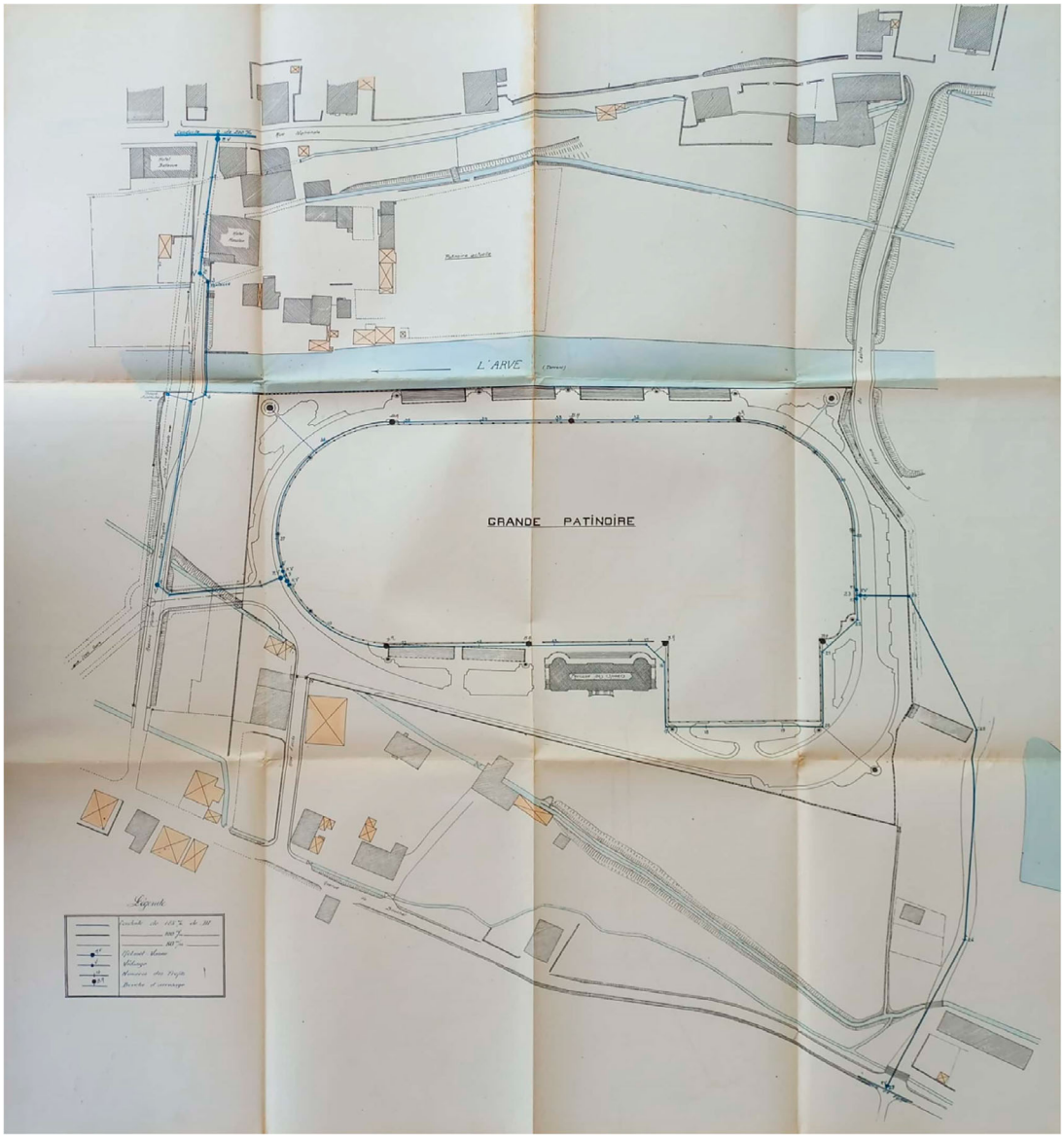

Figure 7. Ice rink. Drinking water distribution. General plan of the pipelines. 06/04/1923, 2O 2181, Arch. dép. Haute-Savoie.

sports.[65] In addition, a drainage system was planned for the groundwater passing under the ice rink, with pipes leading into this shared network.[66] For the bobsleigh track, a water pipeline was constructed to ensure the surface remained icy; the pipeline's diameter was modified during construction to also meet the water demands of the village of Les Pellerins, leading to the project's planned budget exceeding the original 104,000 francs by approximately 15,000.[67]

[65]*Cahier des charges* for the construction of the ice rink, 13.
[66]Ibid., 18.
[67]*Construction d'une piste de bobs aux Pellerins. Règlement des travaux*. Report of Subdivisionnaire Ingénieur Rondet, 25/02/1924, OJ 1924 W GENER, ACOI.

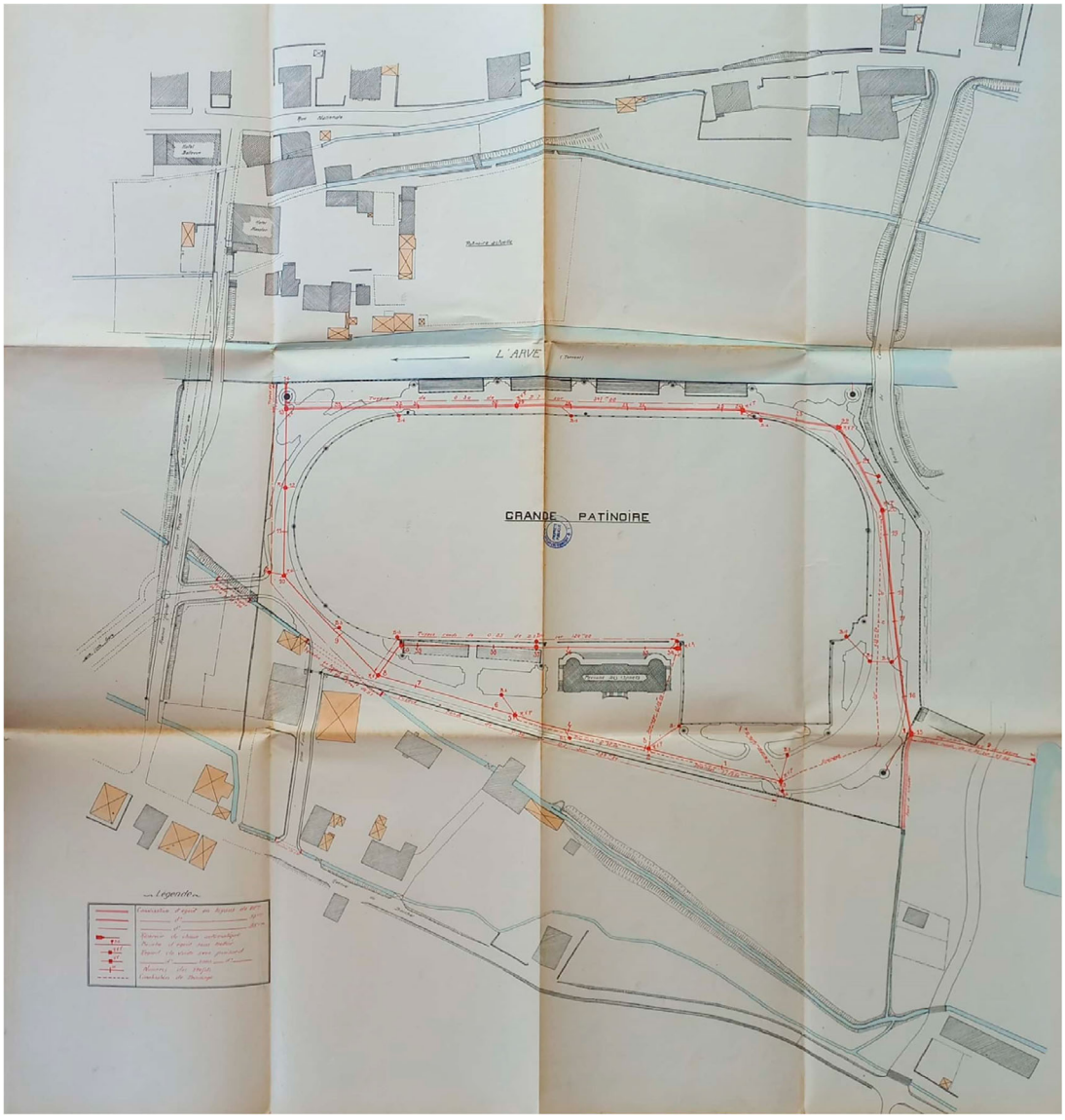

Figure 8. Ice rink. Sewers and drainage. General plan of sewers. 06/04/1923, 2O 2181, Arch. dép. Haute-Savoie.

Even though indoor ice rinks with air-conditioned environments already existed at the time,[68] the technological systems put in place in Chamonix for the creation of ice surfaces, in the case of the ice rink and bobsleigh, were totally dependent on atmospheric temperature. In fact, the very success of the Games was repeatedly threatened by extraordinary weather events shortly before the start of competition, as Roger Frison-Roche, secretary of the Winter Sports Committee, explains:

> I remember […] that astonishing morning when we put on our skis, we had to make tracks! […] In Chamonix, there was consternation! True, the weather had improved, but the snow was complicating everything. Staff were recruited from all over. Soon, 600 workers were working day and night with

[68]Arnaud, "Olympisme et sports d'hiver : Les retombées des Jeux Olympiques d'hiver de Chamonix 1924," 24.

> shovels to clear the snow down to the ice surface. The snow was carted away by hand sleds. It had compacted and was becoming more and more resistant […] We worked like this throughout the festive season and then for the first three weeks of January! The stadium and ice rink would be ready eight days before the opening of the Games. But alas, our joy was premature. As often happens after a long spell of good weather, the skies turned stormy, and then came the thaw. […] To make matters worse, it rained cats and dogs! […] As for the ice rink, transformed into a lake […] it was a pitiful sight. All night, we watched the barometer and thermometer, looking for the slightest sign that would signal the end of the thaw […]. There was no way we could rebuild the huge ice rink in one day![69]

Weather conditions also played a role in the construction of the infrastructure: For instance, the municipality repeatedly asked the Prefect to simplify the procedures[70] in order to start the construction in time for the 'good season'. For instance, work on the ice rink could only be carried out between March and April, when the Arve River was at its natural low water level. The short delays also prevented any changes to the course of the river.[71] Once again, the impact of weather conditions on the work was reflected in the financial budget. For example, to avoid frost, cement was used instead of lime in the construction of the concrete cubes supporting the fencing of the ice rink, as well as the walls supporting the grandstands.[72] Finally, the accounts from 1924 also include the cost of snow removal, which amounted to 30,000 francs out of a total of 300,000.[73]

Discussion and conclusion

Research on history of infrastructure in architecture and urban studies has recently highlighted the potential of going beyond the formal and spatial aspects. New approaches consider the design and construction process in its diachronic dimension and as driven by a network of actors.[74]

Here, the analysis of the creation of the three main sports venues built for the 1924 Olympic Winter Games yields insights into the complex and often controversial relationship between human infrastructure and the environment (encompassing natural, cultural and social aspects). Land, soil, water and weather were among the environmental elements that played a role in this process, either by being transformed by it or by influencing it.

In an article dealing with the 'architectural site', Augustin Berque identifies four major categories to describe how humans interpret the earth: resources, constraints, risks and amenities ('*ressources, contraintes, risques, agréments*').[75] Here, the land is the principal resource, whose control and ownership were apparently easily secured by the local authorities to build the infrastructure. At the same time, the physical components of land (here, 'the soil') turned out to be a source of both risk and constraint: risk, for the main contractor that engaged without having precise knowledge of the geological components and faced complications emerging from difficult excavations or unsuitable materials, and constraint for both the company and local authorities, which struggled to complete the work on time before the start of the Games. The climate (in this case, the weather) appears to be both a precondition for the winter sports event to take place and, for this reason, a recognizable source of *agrément* (amenity) for the athletes and visitors. By the same token, it is also

[69]Pallière, ed., "*Les premiers Jeux d'hiver de 1924: la grande bataille de Chamonix*" 10–11. Translated by the author.
[70]Letter from the mayor of Chamonix to the prefect of Haute-Savoie, requesting that the ski jump construction project be awarded through a restricted tender (*adjudication restreinte*) process, 06/08/1923, 2 O 2182, AD 74.
[71]*Patinoire. Reconstruction de la digue en bordure de l'Arve. Devis et Cahier des charges*.
[72]*Patinoire. Approbation bordereau de prix supplémentaire*.
[73]*Délibérations du Conseil Municipal*, 06/01/1924, 1D 32 1923-24, AMC.
[74]Heathcott, *The Routledge Handbook of Infrastructure Design. Global Perspectives from Architectural History*.
[75]Berque, "Οἶκος, terre et ¥€$: le site architectural comme ressource. Humans, Earth and Interpretation: Architectural site as resource," 3.

a source of constraint as, for example, the climatic conditions also restricted the construction phase. Water is a resource because it guarantees the habitability and sanitation of venues. When turned into ice, due to climate conditions, it is a source of *agrément*. Nevertheless, weather and water precipitations are also a source of risk, as shown here by the heavy snowfall that was followed by rain and warm temperatures, which threatened the possibility of using the ice surfaces and, thus, taking part in the event.

If these categories offer an insightful description of the relationship between anthropic action and the earth, the possible limitation of such a paradigm in describing environmental change lies in the point of view, which is still trained on the human perspective. Indeed, in the social sciences, the main issue in defining the environment often involves determining humanity's place within it, debating whether humans are considered part of the environment or external to it.[76] Our starting point considered the concept of the environment close to that of the *milieu*, as adopted by French geographers following Vidal de la Blache, while referring to the mutual relationships between the observed living being and the broader reality.[77] However, our analysis is still influenced by the disciplinary focus of history and architecture as social sciences: in the end, the relationship is never a perfectly biunivocal interaction. According to this perspective, the elements (i.e. land, soil, water, weather) do not exist independently but are only recognized through humans' interpretation in their act of inhabiting the planet.[78]

Nevertheless, this perspective allows us to examine the history of Chamonix 1924 alongside more recent editions of the Winter Olympics. Today, as was the case a century ago, these events are characterized by a dual relationship with the environment. On the one hand, the Olympic Winter Games (among other major events) consume natural resources, including land and, in recent years, water to guarantee the production of artificial snow; on the other hand, despite technological advances that make it possible to recreate artificial climatic conditions for winter sports, dependence on climatic conditions persists. This dependence still manifests itself in the increasing economic and environmental costs of such enterprises, as well as growing social opposition to these events.

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[76]Young, "Environment: term and concept in the social sciences," 86–90.
[77]Vidal de la Blache, "Les groupements et les milieux," 347; Pelletier, "Environnement," 359.
[78]Berque, "Οἶκος, terre et ¥€$: le site architectural comme ressource. Humans, Earth and Interpretation: Architectural site as resource".

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Bibliography

Arnaud, Pierre. "Olympisme et Sports d'hiver : Les Retombées Des Jeux Olympiques d'hiver de Chamonix 1924." *Revue de Géographie Alpine* 79, no. 3 (1991): 15–36. https://doi.org/10.3406/rga.1991.3610.

Arvin-Bérod, Alain, ed. *Chamonix 1924. L'inverno Diventa Olimpico*. Torino: Museo Nazionale della Montagna, 2014.

Berque, Augustin. "Οἶκος, Terre et ¥€$: Le Site Architectural Comme Ressource. Humans, Earth and Interpretation: Architectural Site as Resource." *Les Cahiers de La Recherche Architecturale Urbaine et Paysagère* 11 (2021). https://doi.org/10.4000/craup.6763.

Bonneuil, Christophe, and Jean-Baptiste Fressoz. *L'événement Anthropocène. La Terre, l'Histoire et Nous*. Paris: Seuil, 2013.

Chakrabarty, Dipesh. *The Climate of History in a Planetary Age*. Chicago: University of Chicago Press, 2021.

Chappelet, Jean-Loup. "The Legacy of the Olympic Winter Games : An Overview." In *The Legacy of the Olympic Games : 1984–2000 : International Symposium, Lausanne, 14th, 15th and 16th November 2002*, edited by Miquel Moragas, 54–66. Lausanne: International Olympic Committee, 2003.

Cronon, William. "The Uses of Environmental History." *Environmental History Review* 17, no. 3 (1993): 1–22.

Dansero, Egidio, and Alfredo Mela. "Bringing the Mountains into the City: Legacy of the Winter Olympics, Turin 2006." In *The Palgrave Handbook of Olympic Studies*, edited by H. J. Lenskyj, and S. Wagg. London: Palgrave Macmillan, 2012. https://doi.org/10.1057/9780230367463_12.

Debarbieux, Bernard. *Chamonix-Mont Blanc : 1860–2000. Les Coulisses de l'aménagement*. Servoz: Edimontagne, 2001.

Descola, Philippe. "Par-Delà La Nature et La Culture." *Le Débat* 2, no. 114 (2001): 86–101.

Devisme, Laurent, and Laurent Matthey. "Projets En Échec : Déroutes et Déréalisations." *Les Cahiers de La Recherche Architecturale Urbaine et Paysagère*, December 2021, [En ligne]. https://doi.org/10.4000/craup.8258.

Durand, Christophe. "Les JO d'hiver de Chamonix En 1924: L'émergence d'un "Marketing" Des Territoires et La Mise En Place de Mécanismes Toujours Présents." In *Les Jeux Olympiques de 1924 à 2024 : Impacts, Retombées Économiques et Héritage*, edited by Pierre Chaix, 25–45. Paris: L'Harmattan, 2018.

Franco, Caterina. "La Création de Nouveaux Équipements Sportifs : Une Épreuve Environnementale." In *Chamonix 1924: Les Premiers Jeux Olympiques d'hiver*, edited by Julien Sorez, 97–106. Grenoble: Glénat, 2023.

Fressoz, Jean-Baptiste, Frédéric Graber, Fabien Locher, and Grégory Quenet. *Introduction à l'histoire Environnementale*. Paris: La Découverte, 2014.

Heathcott, Joseph, ed. *The Routledge Handbook of Infrastructure Design. Global Perspectives from Architectural History*. New York: Routledge, 2022.

Ingold, Tim. *The Appropriation of Nature: Essays on Human Ecology and Social Relations*. Iowa City: Univ. of Iowa Press, 1987.

J. Essex, Stephen, and Brian Chalkley. "Olympic Games: Catalyst of Urban Change." *Leisure Studies* (2010): 187–206. https://doi.org/10.1080/026143698375123.

J. Essex, Stephen, and Jiska de Groot. "The Winter Olympics: Driving Urban Change, 1924–2022." In *Olympic Cities. City Agendas, Planning, and the World's Games, 1896–2020*, edited by John R. Gold, and Margaret M. Gold, 3rd ed., 64–89. London: Routledge, 2017.

Kietlinski, Robin. "'A Strong, Sustainable Legacy:' The Environment and Japan's Winter Olympics." *The International Journal of the History of Sport* 38, no. 13–14 (2021): 1476–93. https://doi.org/10.1080/09523367.2021.1958784.

Konstantaki, Maria. "Environmental Sustainability of Olympic Games: A Narrative Review of Events, Initiatives, Impact and Hidden Aspects." *Journal On Tourism & Sustainability* 1, no. 2 (2018): 48–66.

Latour, Bruno. "Agency at the Time of the Anthropocene." *New Literary History* 45, no. 1 (2014): [Online] 1–18. https://doi.org/10.1353/nlh.2014.0003.

May, Vincent. "Environmental Implications of the 1992 Winter Olympic Games." *Tourism Management* 16, no. 4 (1995): 269–75. https://doi.org/10.1016/0261-5177(95)00016-H.

McNeill, J. R. "The Nature of Environmental History." *History and Theory* 42 (2003): 5–43.

Müller, Martin, Sven Daniel Wolfe, Christopher Gaffney, David Gogishvili, Miriam Hug, and Annick Leick. "An Evaluation of the Sustainability of the Olympic Games." *Nature Sustainability*, no. 4 (2021): 340–48. https://doi.org/10.1038/s41893-021-00696-5.

Pallière, Johannès, ed. "Les Premiers Jeux d'hiver de 1924 : La Grande Bataille de Chamonix." *L'histoire En Savoie. Chambéry : Société Savoisienne d'histoire et d'archéologie*, 26, no 103 (1991): 79–80.

Pelletier, Philippe. "Environnement." In *Dictionnaire Critique de l'anthropocène*, edited by Groupe Cynorhodon, 358–61. Paris: CNRS éditions, 2020.

Pérez-Aragón, Pedro, and Alejandro Viuda-Serrano. "The Icy Road towards the First Olympic Winter Games in Chamonix 1924." *The International Journal of the History of Sport* 38, no. 13–14 (2021. https://doi.org/10.1080/09523367.2021.2009460.

Popelářová, S., and M. Janiga. "Winter Olympic Games as Environmental Problem." *Oecologia Montana* 17, no. 1–2 (2008): 34–40.

Sorez, Julien, ed. *Chamonix 1924. Les Premiers Jeux Olympiques d'hiver*. Grenoble: Glénat, 2023.

Tissot, Laurent. "Désastre Financier Ou Triomphe Économique?" In *Chamonix 1924. Les Premiers Jeux Olympiques d'hiver*, edited by Julien Sorez, 111–22. Grenoble: Glénat, 2023.

VIII Olympiade. Rapport Officiel. Comité Olympique Français, 1924. https://library.olympics.com/Default/doc/SYRACUSE/32625/les-jeux-de-la-viiie-olympiade-paris-1924-rapport-officiel-comite-olympique-francais?_lg=en-GB.

Vidal de la Blache, Paul. "Les groupements et les milieux." In *Principes de géographie humaine : Publiés d'après les manuscrits de l'auteur par Emmanuel de Martonne* [Online]. Lyon: ENS Éditions, 2015. https://doi.org/10.4000/books.enseditions.328.

Young, Gerald L. "Environment: Term and Concept in the Social Sciences." *Social Science Information* 25, no. 1 (1986): 83–124.