Escuela Politécnica Superior de Linares

Grado en Civil Engineering

Universidad de Jaén
Escuela Politécnica Superior de Linares

Final Degree Project

'LOS LORES' MINE, LINARES

Student: **Selma Mujić**

Tutor: Prof. D. Carlos Enríquez Turiño and Prof. D. Antonio Garrido Almonacid
Depto.: Cartographic, Geodetic and Photogrammetry Engineering

Firmado digitalmente por GARRIDO ALMONACID ANTONIO - 24200049R
Fecha: 2024.07.02 19:15:46 +02'00'

june, 2024

CONCENT:

1. ABSTRACT

Built around mining complexes, mine chimneys are often forgotten monuments of industrial heritage that frequently testify to the rich history of mining in many regions around the world. This work explores the phenomenon of "Chimneys of Mines" in Linares, province of Jaén, which were once the focal point of lead production activities. I will provide a deeper insight into them, exploring the possibilities of modern technologies in documenting and preserving these architectural landmarks. I will conduct research starting from the geographical and historical context of the mining complexes in which these chimneys were built. The diversity of their locations and characteristics reflects various mining traditions and technologies used throughout history. Studying the geographical context provides insight into the natural resources that attracted this activity to a particular area, while analyzing history reveals the social, economic, and technological factors that shaped the development of the mining industry.

The main part of this work involves the application of modern technologies, particularly the use of drones for collecting data on mine chimneys. By utilizing high-quality cameras, drones enable precise capturing of objects and terrain with high resolution and detail. After gathering the photographic data, software such as Metashape will be used to process point clouds, allowing the creation of three-dimensional models containing accurate information about the chimneys and the surrounding environment. This outcome in the software will provide detailed 3D models that can be used for various purposes, such as analysis, visualization, or in my case, creating architectural drawings.

Once the data is processed, I can export it to BIM format, which is compatible with the tools I plan to use for creating architectural drawings. In the context of my research on "Chimneys of Mines," using the BIM format would allow me to possess precise information about dimensions, materials, and other characteristics, making it to draw architectural drawings correct. I will be drawing site plans and facades as architectural drawings.

2. INTRODUCTION

The topic dealt with in this paper is the group of mines 'Los Lores' Linares, which are one of the main attractions of the Linares city area. It is a group of 5 mines San Federico 1, San Federico 2, Axiliery, Santa Annie and La Victoria.

They were built during the mining boom in this area. The ore that exploded was lead. They are representatives of this area as well as the traditions and way of life that arose around these mines. Today they represent only reminders of past times and adorn the landscape with their chimneys.

My main task was to draw the architectural plans of each of these mines, that is, their 4 facades and a situational view. In that process, modern technologies such as a drone, described in point 4, were used, with which data was collected in the form of photos and GPS coordinates. The collected data is stored and processed in a program that regenerates a real 3D model using photos and coordinates. The program used is Metashape. Metashape allows us to export orthogonal photos in TIFF format in orthogonal projection. The next step is to import the TIFF format into the 2D program AutoCad, in which precise technical drawings were made, so that as a final product I received carefully drawn architectural drawings.

The work shows detailed steps that are explained and clarified in their entirety. The paper also contains a general analytical overview and research for understanding the given topic. The entire phenomenon of mining in this area, which manifested itself in the form of mines, was discussed.

The entire work tries to show the process of creating architectural designs from beginning to end, that is, from collection, processing, processing to the final drawing, and draws attention to the importance of architectural analyses, observations and proposals.

Keywords :

mines, heritage, drones, architecture drawings

2.1. INTRODUCCIÓN (TRADUCCIÓN ESPAÑOLA)

El tema tratado en este trabajo es el grupo de minas "Los Lores" de Linares, que constituyen uno de los principales atractivos de la zona de la ciudad de Linares. Se trata de un grupo de 5 minas San Federico 1, San Federico 2, Axiliery, Santa Annie y La Victoria.

Se construyeron durante el auge de la minería en esta zona. El mineral que explotaban era plomo. Son representativas de esta zona, así como de las tradiciones y el modo de vida que surgieron en torno a estas minas. Hoy sólo representan recuerdos de tiempos pasados y adornan el paisaje con sus chimeneas.

Mi principal tarea fue dibujar los planos arquitectónicos de cada una de estas minas, es decir, sus 4 fachadas y una vista de situación. En ese proceso se utilizaron tecnologías modernas como un dron, descrito en el punto 4, con el que se recogieron datos en forma de fotos y coordenadas GPS. Los datos recogidos se almacenan y procesan en un programa que regenera un modelo 3D real utilizando fotos y coordenadas. El programa utilizado es Metashape. Metashape nos permite exportar fotos ortogonales en formato TIFF en proyección ortogonal. El siguiente paso es importar el formato TIFF al programa 2D AutoCad, en el que se realizaron dibujos técnicos precisos, de modo que como producto final obtuve dibujos arquitectónicos cuidadosamente dibujados.

El trabajo muestra pasos detallados que se explican y aclaran en su totalidad. El trabajo también contiene una visión analítica general y una investigación para la comprensión del tema dado. Se analiza todo el fenómeno de la minería en esta zona, que se manifiesta en forma de minas.

Todo el trabajo trata de mostrar el proceso de creación de diseños arquitectónicos de principio a fin, es decir, desde la recopilación, el procesamiento y la elaboración hasta el dibujo final, y llama la atención sobre la importancia de los análisis, las observaciones y las propuestas arquitectónicas.

Palabras clave:

minas, patrimonio, drones, dibujos de arquitectura

3. OBJECTIVES

The main goals of this work is to show the architectural drawings of the current state of the mine, as well as the process of how it was created. From the site visit itself, data collection using modern technologies and data processing in graphic programs. The work should be used for the purpose of maintaining the monument to the mine and the mining of this area. Drawings as indicators of the current state with the principle that in the near future they can be used as a reference for future works of restoration and conservation of mines and the like.

We have four main goals:

1.Analyze general information of mines to better understand their role in industrial heritage.

2.Apply modern technologies, such as drones and software tools for data processing, to document and collect data for a three-dimensional model.

3. Detailed architectural analysis and explanation.

4.Create architectural drawings of chimneys with precise dimensions and details using data collected by drones and data processing software.

Through achieving these goals, this work aims to contribute to a better understanding, documentation, and preservation of the mines as significant parts of industrial heritage, providing a foundation for further research and activities in the field of cultural heritage preservation.

Image 1. – Santa Annie – view of east facade from Metashape, Linares, Spain
Source: Author's archive

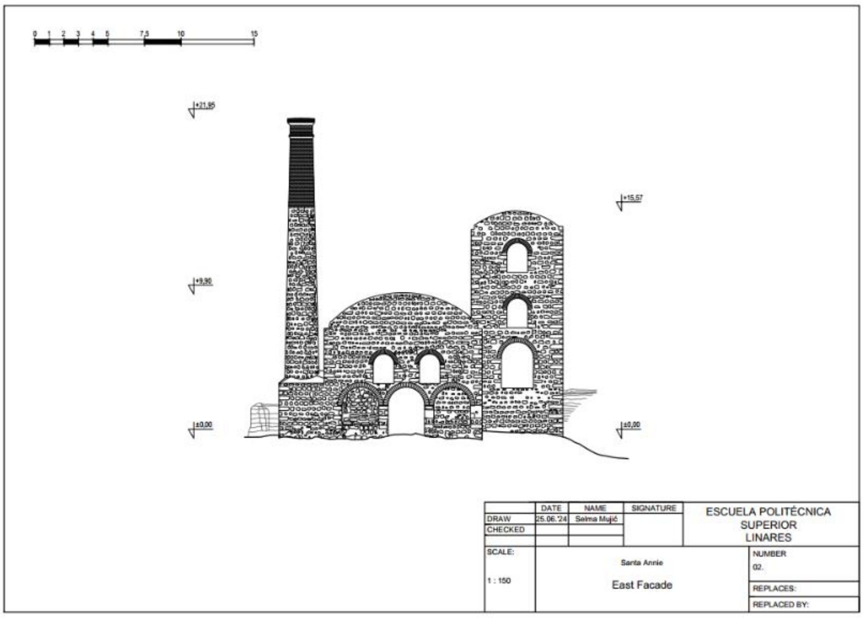


Image 2. – Drawings of Santa Annie east facade, Linares, Spain
Source: Author's archive

4. MATERIALS

4.1. Collecting general informations of mines

Mining is a fundamental industry that has played a vital role in the economic and technological development of human civilization. Since ancient times, humans have extracted natural resources from the Earth's crust to meet their various needs, ranging from the production of tools and construction materials to the extraction of precious metals and minerals. The history of mining is as old as human history itself, with early civilizations like the Egyptians, Romans, and Greeks developing mining techniques that laid the groundwork for modern practices. These early efforts were labor-intensive and often dangerous, but they were crucial in establishing the foundations of trade, industry, and culture.

Image 3. - La Tortilla Mine, Linares, Spain

Source: https://elpais.com/ccaa/2014/03/18/andalucia/1395152391_908988.html

At its core, mining involves the process of locating, extracting, and processing valuable geological resources, such as coal, ores, gemstones, and industrial minerals. These resources are essential for a wide range of industries, including manufacturing, energy production, infrastructure development, and the creation of consumer goods. For instance, the extraction of iron ore has enabled the production of steel, a critical material for construction and manufacturing. Similarly, coal mining has fueled energy production, powering industrial revolutions and modern economies. The diversity of materials obtained through mining highlights its indispensable role in societal progress and development.

4.1.1. 'Los Lores' Linares

Linares, a town just 30 km northeast of Jaén, has metal foundations. The origins of this can be traced back to prehistoric times, when humans discovered abundant metal ores such as silver, lead, copper and iron, all of which were used until the 20th century. The city was originally called Castulo. The mines in Castul were so rich that the Carthaginian general Hannibal married the Himilca princess of Castul to take control of the main mine. Mines were desired by many before, and the Tartessians, Greeks and Phoenicians all benefited from the copper, silver and lead found at Castulus. It was not final, because the Romans, Visigoths and Moors also fought for power. The British, Belgians, Germans and French also did the same.

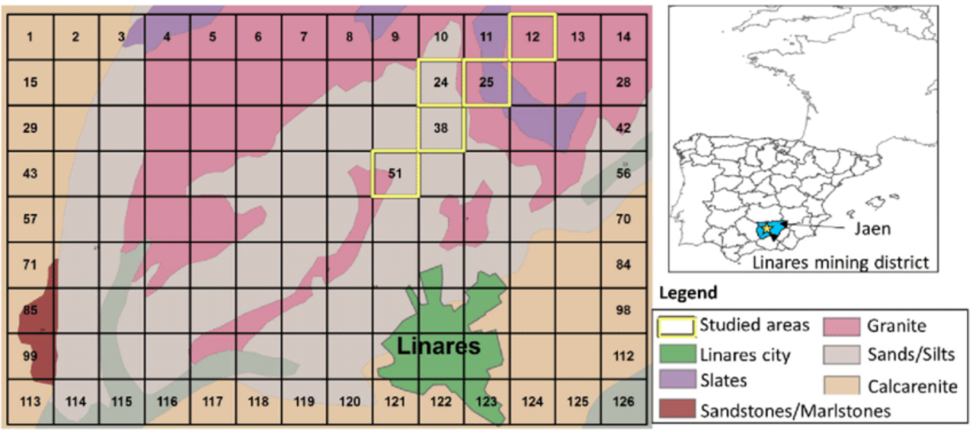


Image 4. - Situation map of the Linares mining district in the province of Jaen (Spain), with outcropping lithology and studied grid squares (1 km 2 each)
Source: Impact of Old Pb Mining and Metallurgical Production in Soils from the Linares Mining District (Spain) – research work

Linares was originally mentioned in 1155 after the conquest of Alfonso VII, where he presented it to Suero Diaz. Díaz lost control of the city when Fernando III accepted the surrender of Linares from Aben-Mahomed in 1227, the second historical mention of the city. Linares joined Baeza, another historically important city nearby, which is only 12 kilometers away. The inhabitants of Linares began their struggle for independence in the 14th century, but it was not until 1565 that King Felipe II finally granted the city independence.

4.1.1.1. The advent of Mining and Railway

Linares started to improve. In 1691, he founded a mint for the production of copper coins. He also expanded his business to the manufacture of gunpowder and ammunition. Casa de Munición was founded in 1756. The mining industry in the 19th century was supported by new laws that promoted investment. The era of prosperity has begun. In the late 1800s, foreign companies such as British, French, Belgian and German were involved in mining operations. They were served by the vice consulates in Linares. The train came in 1865, followed by the tram in 1904. Linares had a total of five railway stations, one of which was the impressive Estacion de Madrid, inaugurated in 1925.

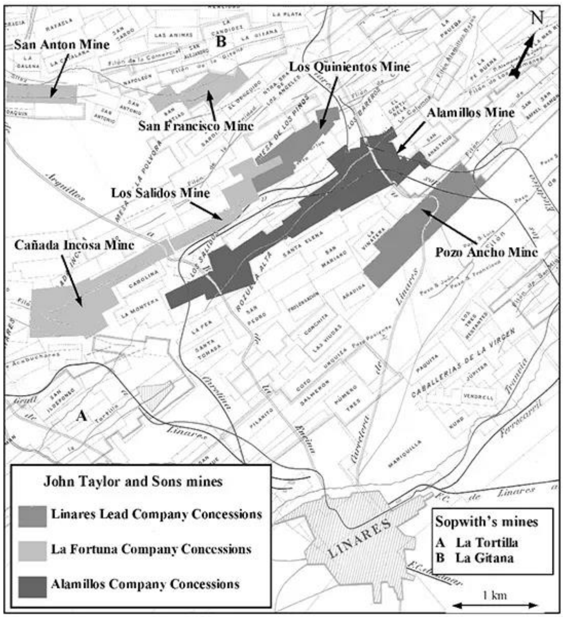


Image 5. - Shaft head gear Linares

Source: https://www.visit-andalucia.com/mining-in-jaen-province/

4.1.1.2. Mining in Linares

In the 19th century, the Linares lead mining region was among the top lead producers globally. Linares' success as a lead producer was partly thanks to the English lead mining companies that arrived from 1849, such as Linares Lead Mining, La Fortuna, and Alamillos, founded by John Taylor and Sons, a London-based mining consultancy firm, and the Spanish Lead Company, led by Thomas Sopwith Junior.

These companies introduced innovative technology, including steam engines designed by Cornish, to mining operations. The Spanish government later adopted this equipment at the Arrayanes mine. In the second half of the 19th century, the population of Linares expanded to accommodate the booming industry, and the British community was recognized through a British vice-consulate, one of the few established in the interior of Spain. Currently, this sector features a distinctive mining landscape, filled with engine houses, chimneys and other mining features, many of which were built by English corporations. A small English cemetery, well maintained, also houses the graves of those connected to mining and who occasionally lost their lives in mining accidents.

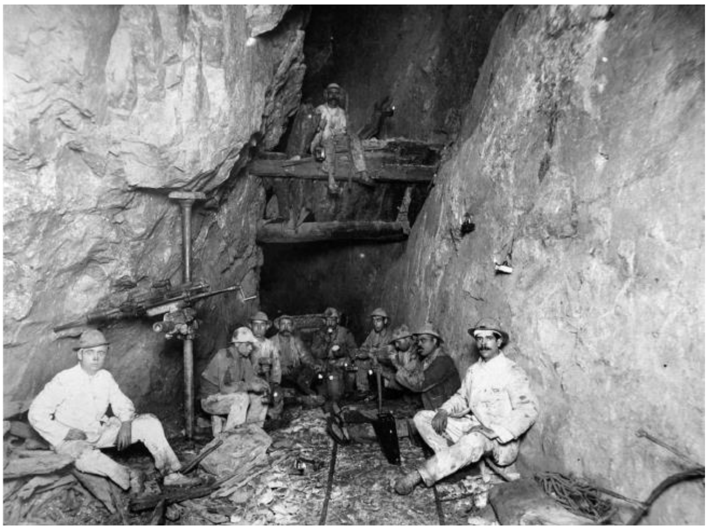


Image 6. - Linares’ lead miners during a break (1914)
Source: Linares mining park – research work

4.1.1.3. **The Railway in Linares**

In the late 1800s, three railway companies ran broad gauge lines in Linares: Madrid, Zaragoza and Alicante, Andalusian and Southern Spain. A fourth railroad, less wide than usual, extended to La Carolina. MZA built Linarejos station, also called Madrid train station. It was built in the Neo-Mudejar style to imitate an upside-down wagon. The horizontal two-tone brick structure has four circular formations at each corner symbolizing wheels. The loading shed next to it is now the Mining Interpretation Center, while a smaller building that used to be a toilet now serves as the Ayuntamiento Consumer Office.

4.1.1.4. La Tortilla Mine

The visible remains of La Tortilla mine stretch for a little over 3 km, ranging from the Victoria shaft in the south to two tall chimneys in the north. Once a mine road, now split by a main highway, linked all the shafts to the ore-dressing facility. At the Victoria shaft, there is a small engine house and chimney that date back to the early 20th century. To the north are the two pumping engine houses and chimneys of Santa Annie and San Federico shafts, built in the 1880s, along with a small winding engine house that was used for both shafts. Next to the recently constructed highway, there is the Worthington shaft which includes a boiler house and chimney (1897) used to provide steam for operating underground pumping engines. Recently, a survey and excavation were conducted in this entire area, and restoration efforts have been initiated. Furthermore, a visitor center is currently being built just south of the Santa Annie shaft, and will eventually be designed to blend in with the natural surroundings through landscaping.

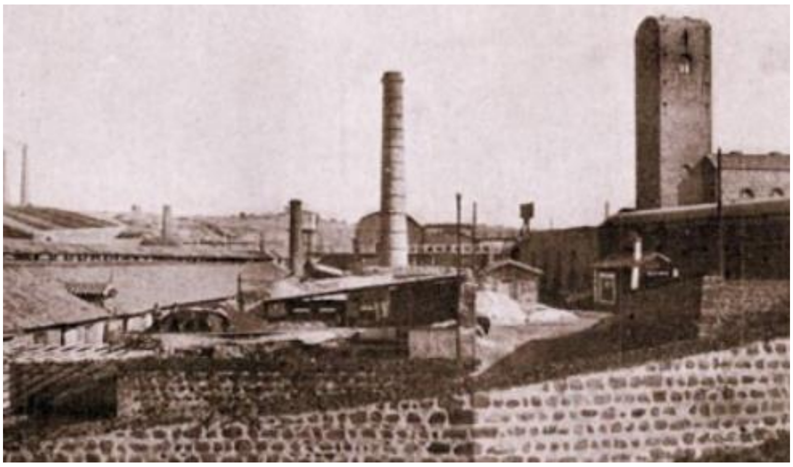


Image 7. - FoundryLa Tortilla Linares

Source: Linares mining park – research work

4.1.1.5. Lord Derby – Los Lores mining

Los Lores mining concession, which used to be a part of the La Tortilla foundry, consisted of three wells: San Federico, Santa Annie, and Victoria. The three wells are named San Federico (238 m), Santa Annie (320 m) and Victoria (320 m). They stopped doing what they were doing in the 1940s.

Lead production in the Linares – La Carolina mining district exceeded England's by 1896, with more than 10,000 employed by the late 19th century, thanks to substantial foreign investment.

Remnants of industrial archaeology are scattered throughout the mining region, including buildings, railway stations, engine houses, chimneys, derricks, and roads. These remains play a crucial role in the cultural and historical legacy of the Jaén region, extending through eight municipalities: Linares, La Carolina, Bailén, Baños de la Encina, Vilches, Guarromán, Santa Elena, and Carboneros.

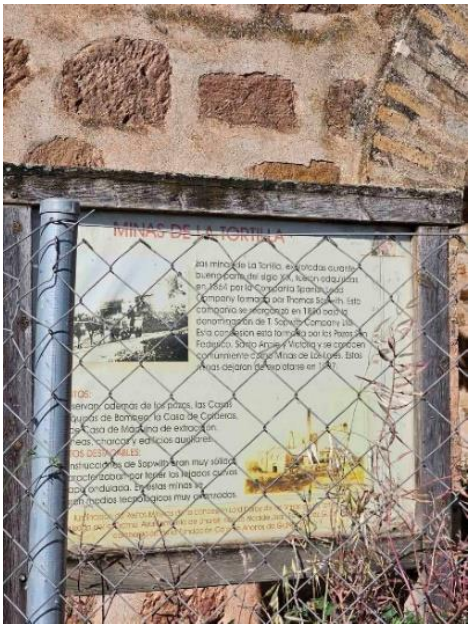


Image 8. - Information board at the location

Source: Author's archive

4.1.2. Geographical aspect

The Los Lores complex, located in the province of Jaén, represents the dynamic interaction between nature and industrial development.The mining complex is located in an area known for its varied geographical features, including rough terrain, lush vegetation, and a Mediterranean climate that has had a significant impact on human settlement and activity in the region.

Jaén province is famous for its plentiful mineral deposits, especially lead, which has traditionally lured mining activities and boosted the region's economic growth. The landscape, consisting of a combination of hills, ravines, and waterways, presented obstacles and advantages for mining projects. The availability of mineral resources in the region, along with its strategic location in the Andalusian mining belt, led to the expansion of the mining industry and solidified the area as a key hub for mineral extraction and processing.

Image 9. - Appearance of the environment

Source: https://i.pinimg.com/originals/0b/36/c1/0b36c148a1c29ae5180f4f6eb2b75fd0.jpg

4.1.3. Historical aspect

Complex Los Lores, situated in Andalusia, Spain's Jaén province, has a significant historical importance linked to the area's mining legacy. The complex is named after Lord Derby, a major figure in the mining sector who played a crucial role in founding it. Originating in the 19th century, the complex developed during a time of high mining operations due to the finding of precious minerals in the area. It rapidly turned into a center of industrial activity, drawing in workers from different regions of Spain and other places.

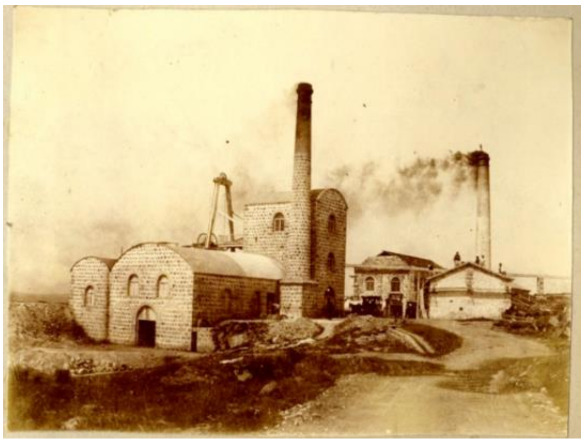


Image 10. - Engine and boiler houses in La Tortilla mines at the beginning of twentieth century

Source: Post-mining Remnants and Revitalization – research work

The history of Los Lores has seen periods of success and challenges, mirroring the ups and downs of the mining sector. At its height, the complex experienced remarkable growth and progress, making a significant impact on the economic success of the nearby region. Nevertheless, similar to numerous mining ventures, it encountered obstacles like labor conflicts, economic recessions, and environmental issues.

Even with the difficulties, the enduring legacy of Los Lores serves as a tribute to the determination and creativity of those who constructed and managed it. Today, the complex serves as a symbol of the area's industrial history and remains a focus of interest for historical preservation endeavors.

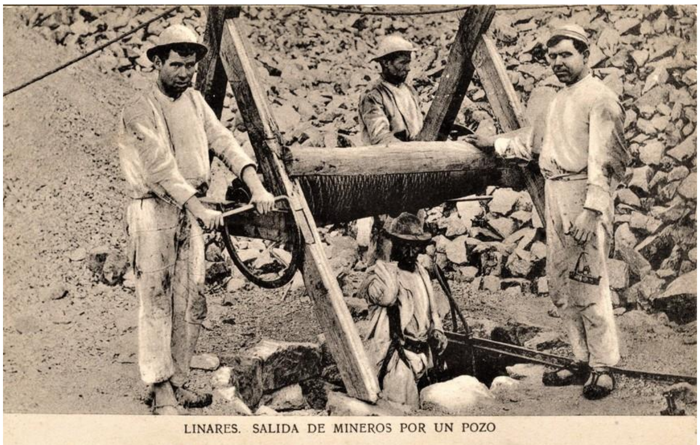


Image 11. - The descent of miners into a shaft, Linares, ca. 1908.
Source: https://www.mindat.org/loc-211342.html

Image 12. – San Federico, La Tortilla 1897.
Source: Las Minas de Linares – apuntes historicos, Francisco G. G.

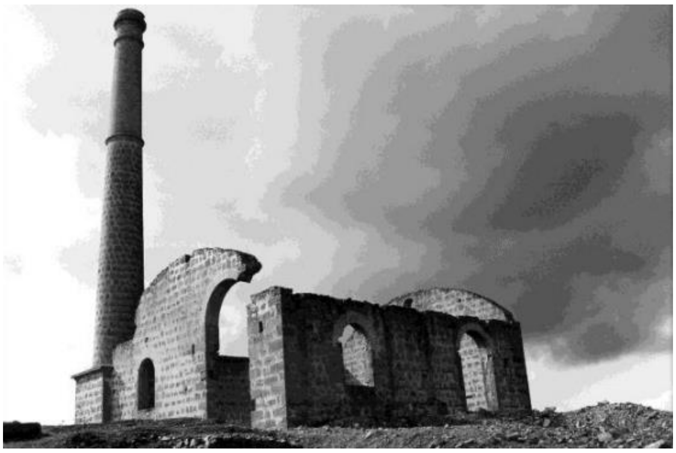


Image 13. – Pozo Victoria, La Tortilla 1996.
Source: Las Minas de Linares – apuntes historicos, Francisco G. G.

4.2. Collectiong data

4.2.1. Visit location

As a student, I conducted a field survey of the Los Lores mining complex. Upon arriving at the site, I was met with the impressive sight of the complex, whose characteristic chimneys rise above the surrounding landscape. There are a total of five: Pozo La Victoria, Santa Annie, Auxiliary, Pozo San Federico 1, and Pozo San Federico 2.

A special emphasis was placed on the field research methodology, including data collection, photography recording, observations, and environmental analysis. I gathered information about the structure of the complex and the current state of the infrastructure. The field survey of the complex provided me with valuable insights into the practical aspects of the study.

Image 14. - Field work
Source: Author's archive

This mining complex bears witness to past times of intense industrial activity and human intervention in nature. All the mines are almost in the same condition, but they still stand as silent witnesses of past mining activities. Although the mines are located next to the main road, it is surrounded by beautiful nature and olive groves. The atmosphere at the location was quiet and you could feel the spirit of the past. Although the mines are abandoned and in poor condition, their significance should not be overlooked.

Although I was limited and could not get close to every mine, I was able to see quite a lot and take photographs that later helped me in my further work.

Image 15. – Mines today

Source: Author's archive

4.2.2. UAS/Drone

UAS, also known as Unmanned Aerial System, is a combination of a UAV (Unmanned Aerial Vehicle), a ground-based controller, and a communication link, used for remote or autonomous flight activities. I employed a drone as a standalone aircraft in my research to take high-quality aerial images of the Los Lores mining area. The ability to reach distant locations enabled me to take in-depth aerial pictures of the land, giving important visual information for recording and upcoming projects that are inaccessible from the ground. We closely monitored the weather and adjusted the flight plan when necessary.

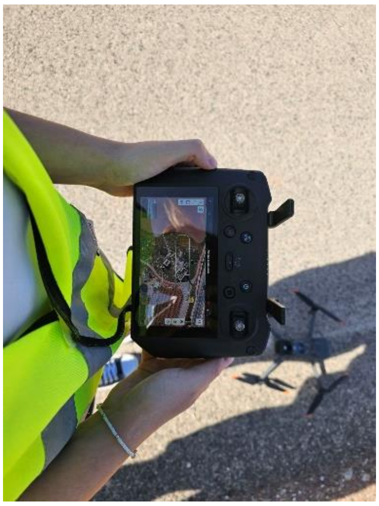


Image 16. – The drone controller

Source: Author's archive

4.2.2.1. Equipment preparation

Once we have become acquainted with the area and items, we transition to filming with a drone. Initially, we must conduct an inspection of the drone, batteries, remote control, and camera. We begin by configuring the GPS at the chosen location. The drone will capture identical coordinates. We must use our smartphone and GPS to modify the coordinates on the controller. I checked this again to confirm.

Afterwards, we will continue with calibrating the camera and adjusting the required settings for top-notch filming. This includes making changes to the camera on the drone to guarantee clear, sharp, and accurate footage. In the settings menu, we input essential data like setting the altitude at 60 meters and selecting 4 points for image capture.

Image 17. – GPS coordinate

Source: Author's archive

4.2.2.2. Flight

After finishing all necessary preparations, the drone can be launched. The drone will capture photos on its own for approximately 2-3 minutes before coming back to the initial launch spot. Afterwards, we worked with the professor to conduct a second drone flight, adjusting the GPS settings and doubling the speed. The coordinates are always consistent.

Finally, we captured footage of the outside using a drone positioned 30 meters high, as well as establishing more flight paths parallel to the building. In this case, the camera was tilted at a -45 degree angle. The drone flew the designated path twice, going in different directions each time.

Image 18. – The drone flying
Source: Author's archive

The drone is equipped with an automatic return-to-home feature for situations such as signal loss or low battery.

After we have completed taking high-resolution photos of every chimney from different perspectives and elevations, highlighting specific elements and characteristics, we meticulously pack away all of our gear and depart from the location.

Image 19. – Pozo San Federico 01 i 02

Source: Author's archive

4.2.3. Metashape

The next step is to use the data collected on-site using the drone, namely the photographs, in the Metashape software. With these photographs, we will create a three-dimensional model with precise points and dimensions. We will then use this model to export it into the desired format needed for creating architectural drawings.

Metashape is sophisticated software created by Agisoft for processing digital images using photogrammetry techniques. It enables the generation of detailed 3D models from 2D images with high resolution and accuracy. The software makes use of point cloud processing technology to rebuild intricate structures and terrains.

Metashape

Image 20. – Logo of Metashape

Source: https://www.pugetsystems.com/labs/articles/metashape-benchmark-1457/

Metashape was the most important program for the drawings I did. I used this software because of its ability to make very accurate 3D models using photos. It is crucial for the documentation and further analysis of the mine. This software is efficient and automatically recognizes common points between photos and thus makes clouds and 3D models. For my work, it was important to export the desired results to tif. format supported by the program.

4.2.3.1. Extracting cloud points

1. Upload photos to the program
- First we need to start the Metashape program.
- Then we will open a new project.
- The next step is to import the photos we took on location with the drone. We click on Workflow - Add Photos and then select the desired photos.

2. Alignment of images
- A mandatory step is to align the photos because this way we can create the initial cloud of points. Click on Workflow - Align Photos.
- We need to set Precision - Higt or Highest.
- The program will then analyze the photos to find common points and create the initial part of the point cloud.

3. Building a dense cloud of points
- After aligning the graphs, click on Workflow - Build Dense Cloud.
- In the Build Dense Cloud dialog, I selected Quality as High.
- This step took a little longer.

4. Building a 3D model
- Then I made a 3D model. I clicked Workflow-Build Mesh.
- Then in Build Mesh I set the Source Data to Dense Cloud and selected the appropriate settings.

5. Building Texture
- The next step was to add texture to the 3D model. I clicked on Workflow - Build Texture and selected the desired data.
- Metashape generated the texture using the imported images.

6. Generation of orthomosaics
- The next step is to click on Workflow - Build Orthomosaic.
- In Build Orthomosaic, I set Surface to Mesh.

7. Export of orthomosaics
- When the orthomosaic is generated, I exported the desired tiff. format. Click on File - Export - Export Orthomosaic.

- I chose typhus. format and set the necessary options.
- The last step is to save the file on the computer.

4.2.4. AutoCad

AutoCAD is a CAD software program created by Autodesk for designing on computers. It is used for creating precise 2D and 3D drawings and models. AutoCAD is widely utilized in various fields such as architecture and engineering in my case. The software provides tools for drafting, annotating, and editing geometrical shapes and objects, allowing users to produce detailed and accurate technical drawings and plans. This is a versatile tool for professionals involved in design and drafting.

Images 21. – AutoCad logo

Source: https://es.m.wikipedia.org/wiki/Archivo:AutoCad_new_logo.svg

In AutoCad I have scaled the photo 1:1 using the selected reference. Then the final and main part of my project begins. I continue to draw line by line, stone by stone, in the exact shapes and dimensions as they are in reality. I worked in layers where I could adjust the color, line weight, line type and transparency. After completing the lengthy drawing process, I placed the drawing on A3 paper in the selected scale and filled in the information in the header.

4.2.4.1. Exporting tif. format from Metashape

-Open your project in Metashape.

-Go to File -> Export -> Export Orthomosaic (or another appropriate format).

-Choose the option to export in TIF format and save the file to your desired location.

Images 22. - Orthographic view of the situation

Source: Author's archive

Images 23. - Facade

Source: Author's archive

4.2.4.2. Importing tif. format into AutoCad

-Open AutoCAD.

-Go to Insert -> Raster Image Reference.

-Find and select the TIF file that you exported from Metashape.

-Click Open to import the file.

In the image insertion window, adjust the insertion point, scale, and rotation as needed, or simply click OK to insert the image with default settings.

4.2.4.3. Scaling image in AutoCad

-Click on the inserted TIF image to select it.

-Type SCALE in the command line and press Enter.

-Select the reference point (typically one of the corners of the image).

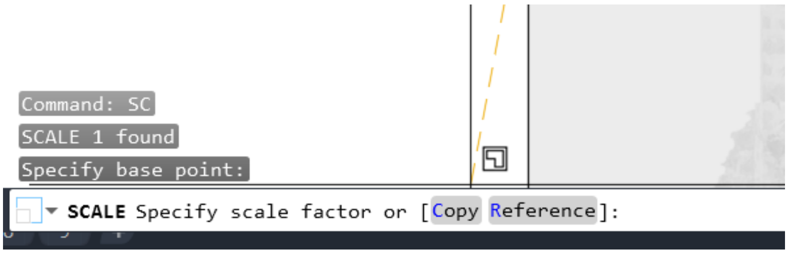


Image 24. – How to scale

Source: Author's archive

Enter the scaling factor or click on the screen to visually scale the image. I know the exact length and dimension from Metashape, and I can use the Reference option to input the actual length.

4.2.4.4. Drawing in AutoCad

-Use drawing tools such as LINE, POLYLINE, TRIM, EXTEND, etc. to draw over the inserted TIF image.

-Set layers, colors, and line types as needed for better organization and clarity of the drawing.

-I use tools such as MOVE, ROTATE, etc. to precisely align your drawings with the inserted image.

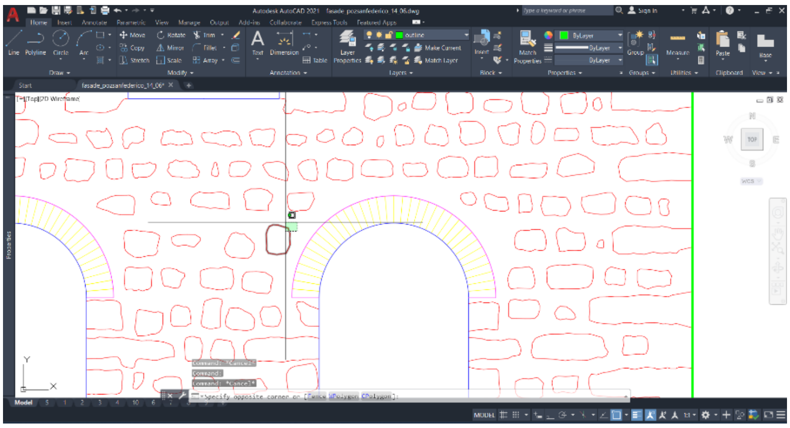


Image 25. – Drawing details

Source: Author's archive

4.2.4.5. Exporting the drawings

-Once you have finished drawing, you can export your drawing to the desired format.

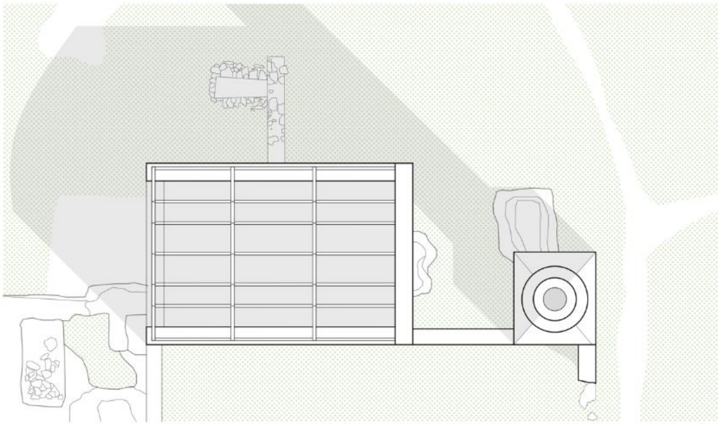
-Go to File -> Export -> Export to PDF (or another format like DWG, DXF).

-Choose the range of the drawing you want to export and adjust other options as needed.

-Click Save to save the file.

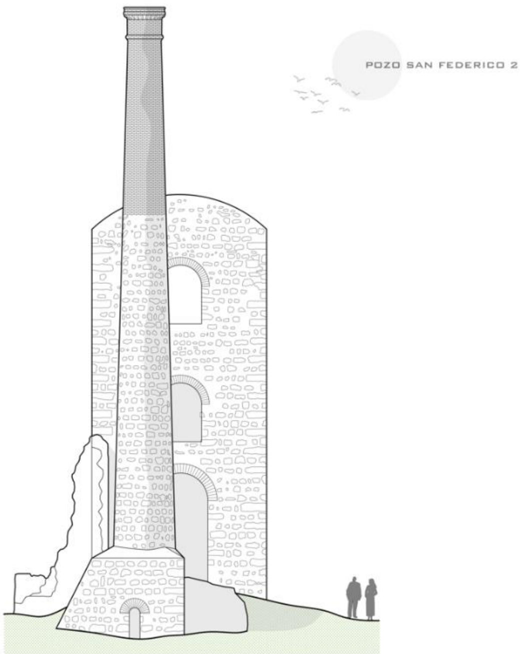
-Saving Your Work:

-Don't forget to save your work in DWG format by going to File -> Save As and selecting DWG format.



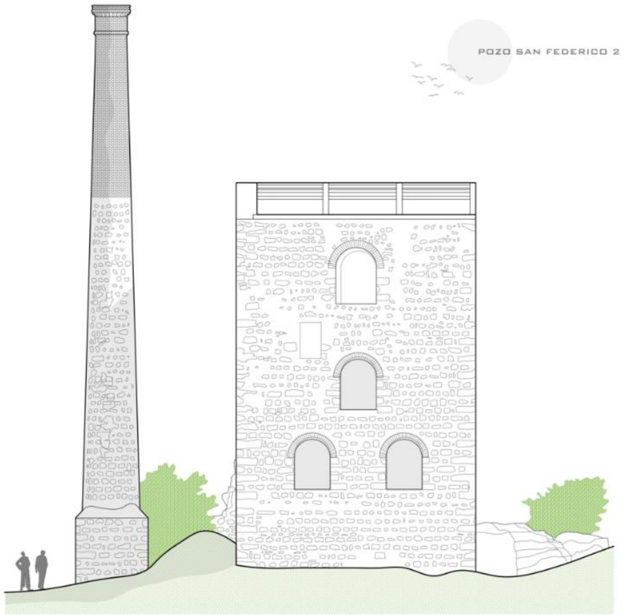
Images 26. - Example 01 of architectural drawings

Source: Author's archive



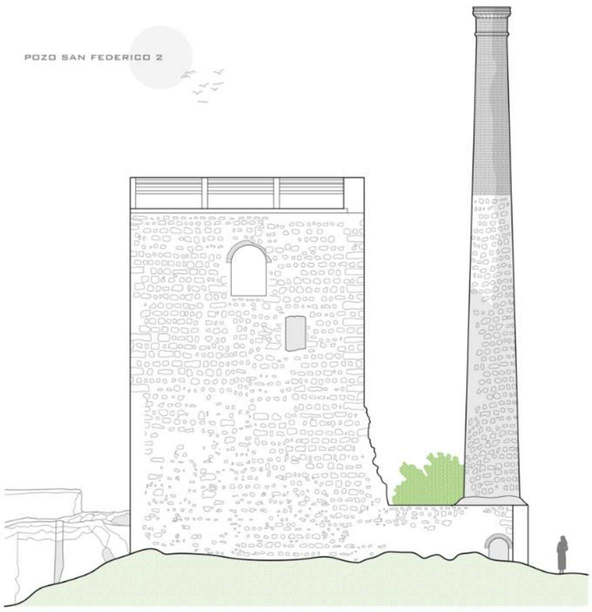
Images 27. - Example 02 of architectural drawings

Source: Author's archive



Images 28. - Example 03 of architectural drawings

Source: Author's archive



Images 29. - Example 04 of architectural drawings

Source: Author's archive

5. METHODS

The goals that were set at the beginning were achieved by complying with all the technological steps that followed the data collection in the field and the field visit. The drone flew over the intended terrain with the drone in pre-programmed and calibrated routes. Respecting all the regulations that need to be followed due to technical reasons that are explained in the paper. Going out into the field helped when looking at the whole situation and the state in which the mines are located.

Using the two software on the computer, which are described in point 4., show us the versatility of today's inventions and how we can use it for useful purposes in our profession. Proper use of their tools can bring us results like these architectural drawings.

The work is based on the clarification of the entire process of processing and data collection, as well as the method of using the collected data. Modern technologies and their work process itself make work easier. All this has the purpose of documenting the condition of the mine in the field, which is not in the best condition. The general analytical aspect deepens the knowledge of the given topic and additionally emphasizes the essentiality of the work and the importance of having proper documentation of this type of objects that represent cultural heritage. It is also crucial for further monitoring of the development and life of the buildings, all for the purpose of their protection, which reflects the importance of this work.

6. RESULTS AND DISCUSSION

6.1. Location

The Los Lores mining complex is located in the center of the Linares area, within the province of Jaén, in the southern region of Andalusia, Spain. The mine is located about 300 kilometers south of Madrid, within the Sierra Morena mountain range.

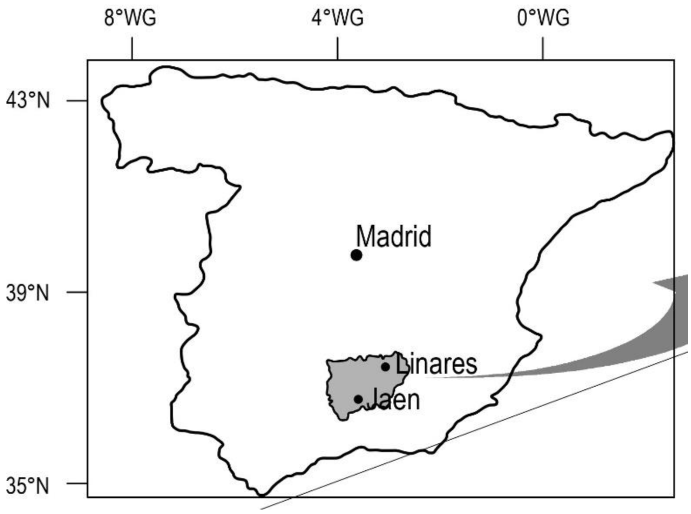


Image 30. – Makro location

Source: Author's archive

The mines of the Los Lores complex are in a key position, with convenient connections to important transport routes such as major highways, railways and close to the Guadalquivir River. This favorable location was key to the growth of the mining complex and its connection to the local and national economy.

The rugged terrain of this area is defined by rolling hills, deep valleys and Mediterranean weather. The mines were helped and hindered by the natural environment, which led to the development of creative engineering solutions and adaptations to the specific conditions of the area.

The precise location of the Los Lores complex in Linares is at 38°05'N, 3°38'W. This location has played a key role in the history, growth and overall importance of the Spanish mining sector.

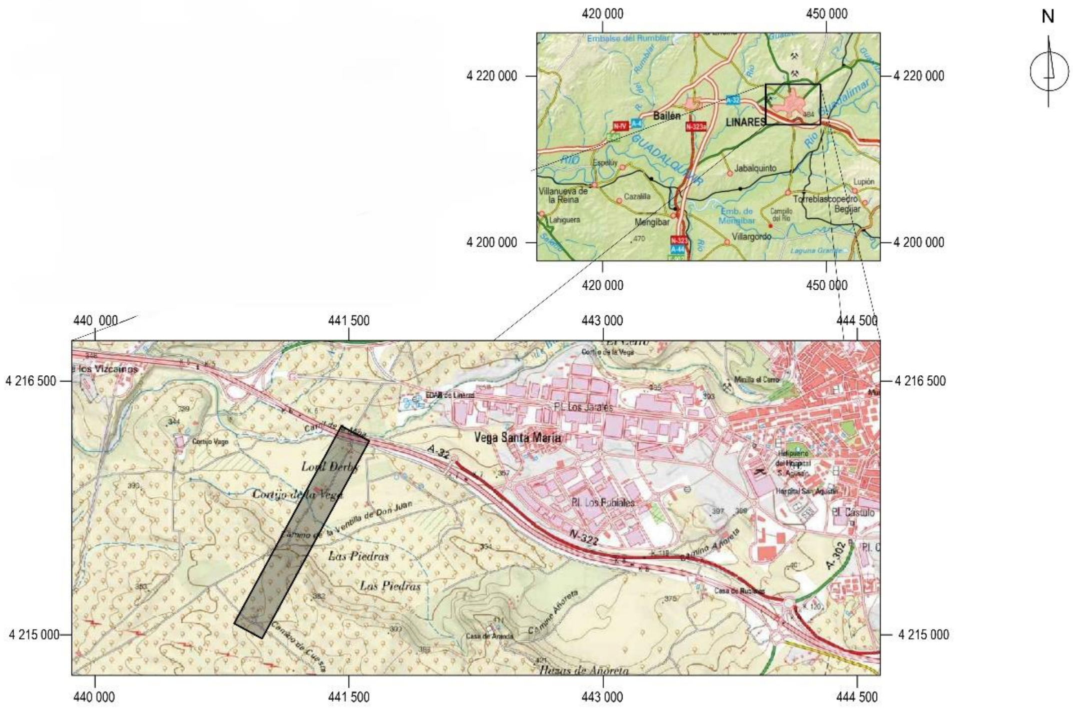


Image 31. – Location with coordinates

Source: Author's archive

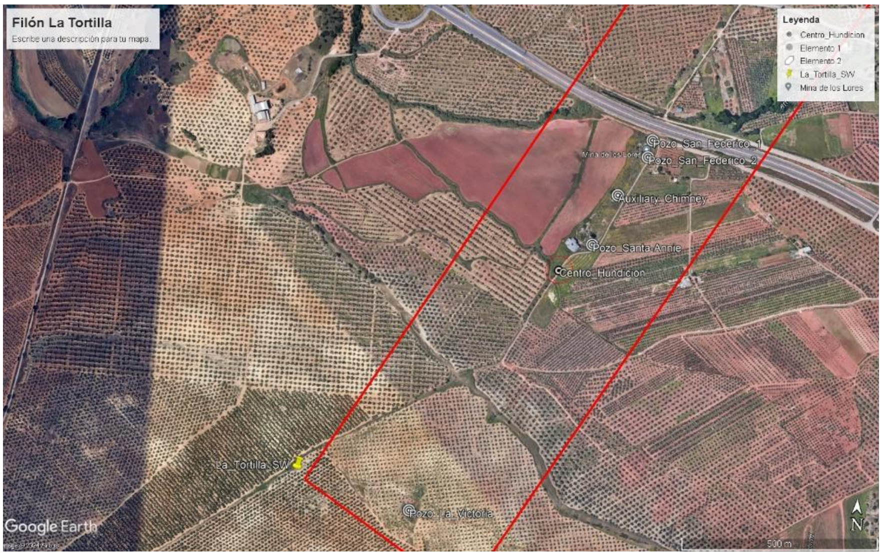


Image 32. – Google earth view

Source: Author's archive

6.2. Architectural analysis

An important part of this work is the architectural analysis, which I performed thanks to all the collected data. I gave my comment on certain parts from a structural and aesthetic point of view. It is important to understand the elements once found 'in situ'. Below is a description of the most important points.

6.2.1. Structural analysis

The mines of the mining complex have different geometric characteristics that reflect the technical requirements and architectural styles of the time when they were built. Accurate measurement of the height, diameter and thickness of chimney walls is essential for understanding their construction. It is possible to notice that all mines belong to the same style and method of construction as well as the very use of materials and their intended use. I noticed some differences depending on their location, terrain, needs and size of ore deposits.

Size: Mines differ in size and capacity as well as in terms of volume, all depending on the capacity of the plant that needed to be supplied. Precise height measurements obtained from the 3D model help identify the different types of mines within the complex.

Image 33.- View of one mine

Source: Author's archive

Diameter and thickness: Masonry structures of the basic volume of the mine, which does not include chimneys, are dependent and proportional in relation to its spatial dimensions as well as to the needs it had to supply. The size and height of the chimney depends on the location of the mine, its surrounding environment, the capacity of the mine and the thickness and construction method of the chimney structure. So it is noticeable in these mines different ways of decorating the end of the chimney as aesthetic elements. The chimney structure represents a vertical element, so it is necessary to ensure their concentrated mass on one smaller surface properly, so that on each of the chimneys we can notice a square base built of larger and more massive hewn stones. While the middle parts of the chimney are made of smaller stones that are concentrically arranged in circles to form the very structure and appearance of the chimney. The final part is made of bricks that are stacked in a circle, respecting the rules of masonry. Decorative chimney finishes vary. Using a 3D model, it is possible to precisely determine these dimensions and analyze their influence on the stability of the structure.

The analysis of the materials used gives insight into the construction technique and the availability of resources at the time of the construction of the mine. Material identification is key to understanding the longevity and resilience of these structures.

Brick: Most of the mines were built of brick, which was the main building material due to its resistance to high temperatures and availability. Brick as a building material is represented mostly in the construction of the highest parts of the chimney due to its ease of use and installation at height. It is noticeable that a unified dimension of bricks was used in all mines. Due to the height of the chimney, we could not determine exactly whether it was classic bricks or radial bricks. But that doesn't even matter, because they are built in such a way that in the final product they form concentric circles to form a chimney. We can emphasize the narrowing of the dimensions towards the top of the chimney, which was achieved by the very method of masonry and the use of bricks.

Image 34. – Bricks details
Source: Author's archive

Stone and mortar: The use of hewn stone is represented in the construction of the main volumes of the mine. In such a way, given that a stereotom type of construction was used, the corners of the volume were reinforced in such a way that they used larger stones that overlapped in half of their length and so alternately until the desired height of the volume of the mine was reached. The surface of the infill walls between the corners was made of smaller stones that were bound with mortar and thus formed the entire volume. During the construction, openings were left that have arched ends that were made using precisely hewn stones to ensure the stability and static safety of the mine. It is noticeable that from within such a masonry construction, she paid attention to the correct stacking and overlapping of the rows of masonry stones. The current situation on the ground gives only room for speculating on how to cover the mine itself, which leads us to the question of why the front narrow walls of the main volume of the mine are shaped in a semicircular shape. Analysis of the type of mortar used to bind bricks or stones can reveal information about construction techniques and local materials, we concluded.

Image 35. - The difference in stone

Source: Author's archive

The stability of the mine structure is essential for their preservation and safety. By using 3D models and analysis, it is possible to identify potential constructive weaknesses and damages.

Image 36. - Upgraded structure

Source: Author's archive

Cracks and deformations: Analysis of the 3D model enables the identification of cracks and deformations that may indicate structural problems. Detailed examinations of these damages help in planning remedial works. It is also possible to monitor the position of the chimney, which in one of the mines has a noticeable deviation from the vertical position. It is necessary to regularly monitor damaged parts and cracks that become fatal over time due to atmospheric influences to which they are exposed. This may call into question the very stability of the structure. The first two mines, Pozo San Federico 1 and 2, are notable for certain types of rehabilitation that were carried out with the aim of preserving and preventing the creation of new cracks. From an architectural point of view, it was a debatable move, because it required the engagement of expert teams from different scientific disciplines who had to determine the correct measures and intensities of protection. Many factors influence proper protection, and this is a debatable topic. Individual procedures and interventions are undesirable, as I wrote about later.

Influence of weather conditions: Chimeneys are exposed to weather influences such as rain, wind and temperature changes, which can lead to material damage. Analysis of the impact of these factors helps to understand the long-term condition of the mine. Given that the climate of Spain is not known for low temperatures, snow and frost, which are fatal for such structures, we can say that here the greatest damage is caused by very warm temperatures during the year and occasional winds that appear in the area. The greatest damage to any object is caused by its non-use and carelessness. Such is the case with these mines that have stopped their production. Their use has ceased and they are volume-shaped structures left at the mercy of time and atmospheric influences, which can be seen in their current state.

6.2.2. Aesthetic analysis

The main point of the aesthetic analysis of the Lord Derby-Los Lores mining complex is to examine its architectural features and stylistic traits. This assessment demonstrates that the formation of these industrial buildings was not only shaped by functionality, but also by aesthetic principles, reflecting the cultural and historical significance of their era of development.

Ornaments and decorative elements: on the mines provide insight into the aesthetic preferences and technical skills of the builders. These elements often also serve practical purposes, such as additional strengthening of the structure. Such as the details of the end edges on the chimneys, as well as some brick rings that were added to the chimneys, which is noticeable in their spatial design. The entire volumes of the mine are clean and clear in their form, and as an additional dimension they are added by the chimneys, which represent the dominant verticals in relation to the rest of the proportion of the volume of the mine. Mine chimneys represent vertical benchmarks that emphasize and characterize the entire landscape of this area.

Image 37. - Details around the window

Source: Author's archive

Edge Decorations and Reliefs: Many mines have decorations on the edges, such as decorative bricks or stone cornices, which add visual interest and emphasize the verticality of the structure. Aesthetically, the corners of the main volumes of the mine, which were created by overlapping finely carved stones of larger dimensions, also stand out. In some of the mines, there are small rosettes on the high points of the frontal facades. Some chimneys are decorated with reliefs or engravings that may contain symbolic or decorative motifs, such as geometric patterns, floral motifs or the initials of the mine owner.

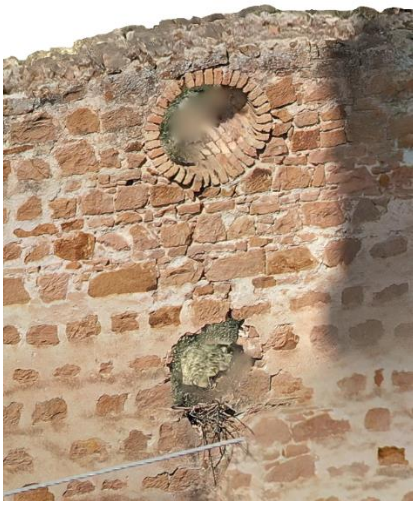


Image 38. - Similarity of the rosette on the facade

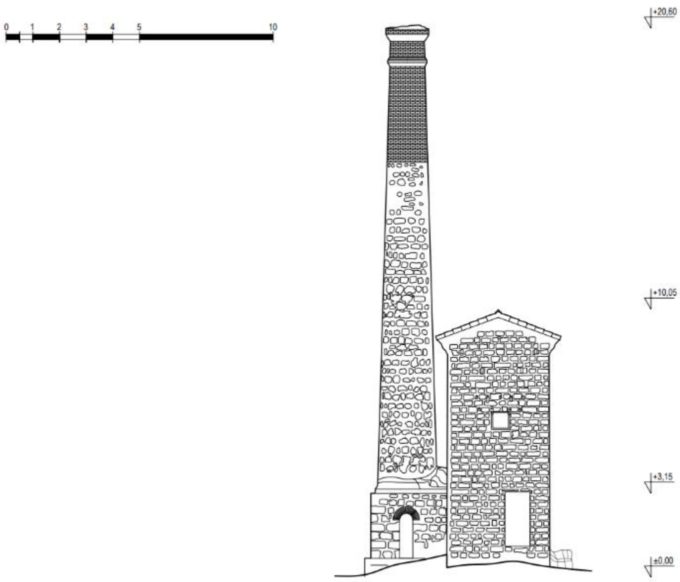
Source: Author's archive

Materials and Textures: A combination of different materials and surface textures, such as smooth and rough surfaces, adds visual layering and highlights different parts of the mine. As well as the different use of the size of individual building materials. In this context, it is necessary to note the design of the arches above the window openings, which are arched. They serve both aesthetic and structural purposes.

6.3. Architectural drawings

As one of the most significant and well-preserved mining complexes in Spain, the Los Lores complex in Linares has enormous historical, cultural and architectural value. The architectural drawings I made are significant for several reasons. I hope it will be used for many purposes as well as future research, improvement and promotion in the architectural and industrial sectors.

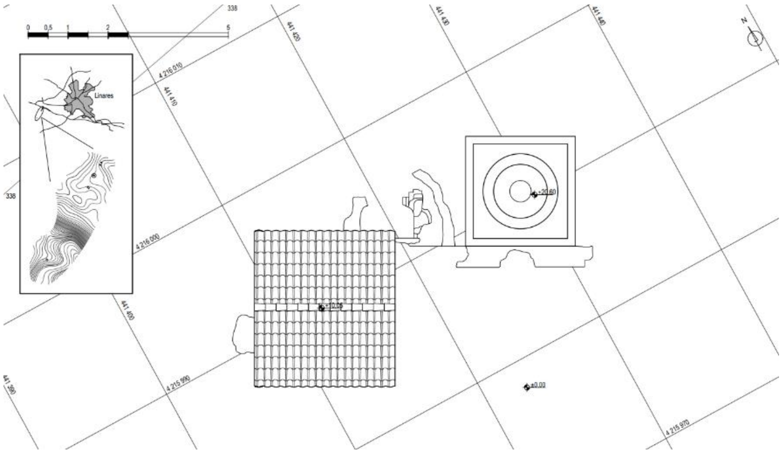
Viewed as new documentation, these architectural blueprints can serve as an accurate record. In the drawings, in addition to the main volume, every detail of the mines and chimneys is drawn in detail. We read the dimensions on elevations or a graphic scale.



39. – Drawing results of facade

Source: Author's archive

The drawings provide a new resource for preserving the historic integrity and authenticity of the site, enabling informed preservation efforts in the future. Also mine drawings can guide the adaptive reuse of sites, allowing for the sensitive transformation of the complex into cultural, educational or commercial spaces that respect its industrial heritage. In addition, they can be used to educate the public and future generations about the history, technology and engineering feats associated with the mining complex, and can also be used for tourism segments. Researchers and scholars can study the drawings to gain deeper insight into the site's construction, materials, and design as it evolves over time.



40. – Drawing results of situation

Source: Author's archive

6.4. Suggestions and project ideas

As a student of architecture, I would like to mention that it is very important how we as people relate to the object, in this case historically valuable mines. First and foremost, preserving the architectural integrity of the site should be a top priority. I must say that conservation is a very important segment for the mines in Linares. This includes cleaning, treating and protecting the original building materials to prevent further deterioration. I hope that the data I collected and the drawings I drew will be useful for further improvement and understanding.

Also, I would suggest some creative ideas so that this area where the mines are located could be repurposed and attract visitors in case one day the industry itself does not return to this area. I see a unique opportunity to transform this historic mining complex into a vibrant, multi-functional destination that celebrates its industrial heritage while adapting to modern needs.

One conceptual solution I would suggest is the adaptive reuse of the mine as a mixed-use cultural and educational center. It is possible to repurpose them to accommodate various complementary programs, such as:

-Industrial Heritage Museum: Dedicating special areas of the complex to museum exhibits depicting the history, technology and daily life of miners would provide visitors with an immersive, educational experience. Architectural drawings could be used for these purposes.

-Adaptive reuse of structures: Thoughtful conversion of some buildings and surface structures into cultural spaces, such as performance spaces, workshops and craft studios, would breathe new life into the complex while preserving its architectural integrity. Adaptive reuse could be guided by architectural documentation to ensure harmony between old and new functions.

-Education and research facilities: The integration of education and research facilities, such as a school of mining, a materials science laboratory or a center for industrial archaeology, would not only attract students and scientists, but also create sustainable activity and community engagement at the site.

-Outdoor recreation spaces: Careful inclusion of landscaped areas, walking trails and recreational facilities within the complex would encourage visitors to explore the site, experience its beauty and appreciate the interaction between the natural and built environment.

7. CONCLUSION

Through research and documentation of the Lord Derby mining complex, known as Los Lores, using modern technologies, I have achieved several significant goals. By employing drones equipped with high-quality cameras, I successfully captured and analyzed complex structures and the surrounding terrain with precision. These data were processed using Metashape software, enabling me to create detailed three-dimensional models of each mine, essential for further analysis and the creation of architectural drawings, which are the main focus of this work.

Site visits and field research allowed me to gather important firsthand data and experiences. The use of drones facilitated the capture of hard-to-reach areas, ensuring high accuracy and detail in the collected data.

This project has demonstrated how modern technologies can significantly contribute to documenting and preserving industrial heritage. The three-dimensional models and architectural drawings that I have created provide a foundation for further research, analysis, and scholarly work. My work not only contributes to the preservation of historical and cultural heritage but also offers valuable insights for future generations of researchers and experts in the fields of archaeology, architecture, history, and technology.

7.1. CONCLUSIÓN (TRADUCCIÓN ESPAÑOLA)

A través de la investigación y documentación del complejo minero Lord Derby, conocido como Los Lores, utilizando tecnologías modernas, he logrado varios objetivos significativos. Mediante la aplicación de drones equipados con cámaras de alta calidad, pude capturar y analizar con precisión las estructuras complejas y el terreno circundante. Estos datos fueron procesados usando el software Metashape, lo que me permitió crear modelos tridimensionales detallados de cada mina que son esenciales para un análisis posterior y la creación de dibujos arquitectónicos, que son en realidad la parte principal de este trabajo.

La visita al sitio y la investigación de campo me permitieron recopilar datos importantes y experiencias de primera mano. El uso de drones facilitó la captura de áreas de difícil acceso, asegurando una alta precisión y detalle en los datos recopilados.

Este proyecto ha demostrado cómo las tecnologías modernas pueden contribuir significativamente a la documentación y preservación del patrimonio industrial. Los modelos tridimensionales y los dibujos arquitectónicos que he realizado proporcionan una base para futuras investigaciones, análisis y trabajos científicos. Mi trabajo no solo contribuye a la preservación del patrimonio histórico y cultural, sino que también ofrece valiosos conocimientos para las futuras generaciones de investigadores y expertos en los campos de la arqueología, la arquitectura, la historia y la tecnología.

8. BIBLIOGRAPHICAL REFERENCES

1. The Linares lead mining district: the english connection Robert Vernon 2, Grange Field Road, Bredon, Tewkesbury GL20 7AZ, United Kingdom. Honorary Member, Colectivo Proyecto Arrayanes, Linares, Spain

2. "The Lord Derby-Los Lores Linares Mining Complex: Past, Present and Future" by José María Serrano Muñoz (2010).

3. "Mining in Linares: Historical Evolution and Future Perspectives" by José Ruiz Navarro (2005).

4. "The Mining Industry in Spain: A Historical Perspective" by José Luís Ruz Revenga (2018)

5. "The Role of Architectural Drawings in Industrial Heritage Conservation: Lessons from the El Complejo Minero Lord Derby-Los Lores Linares" by Juan Carlos Martínez Álvarez (2020)

6. Vernon R.W. 2013. Thomas Sopwith Jnr. La Tortilla and his other Mining Ventures at Linares, Spain. British Mining 95, Northern Mine Research Society, England

7. Anon. 1849. Linares Lead Mines. Mining Journal (London), p.284

8. Linares City Council. (2012). “Guide to Linares mining.”

9. Andalusian Institute of Historical Heritage. Ministry of Culture. (2017). “Mining Landscape of Cástulo-Linares”

10. Impact of Old Pb Mining and Metallurgical Production in Soils from the Linares Mining District (Spain) – research work

11. Linares mining park – research work

12. Post-mining Remnants and Revitalization – research work

13. Las Minas de Linares – apuntes historicos, Francisco G. G.

LINKS:

14. Mining Law https://www.boe.es/buscar/act.php?id=BOE-A1973-1018

15. The Geological Survey of Spain http://www.igme.es/

16. https://elpais.com/ccaa/2014/03/18/andalucia/1395152391_908988.html

17. https://www.visit-andalucia.com/mining-in-jaen-province/

18. https://www.mindat.org/loc-211342.html

19. https://www.pugetsystems.com/labs/articles/metashape-benchmark-1457/

20. https://i.pinimg.com/originals/0b/36/c1/0b36c148a1c29ae5180f4f6eb2b75fd0.jpg

21. https://oa.upm.es/69800/3/Parque_Minero_Linares_Spain.pdf

22.https://www.academia.edu/51801563/The_Linares_Lead_Mining_District_The_English_Connection

23. https://enveurope.springeropen.com/articles/10.1186/s12302-024-00895-9

24. https://medium.com/@Meschino/the-science-of-race-cultural-identity-nationalities-and-ethnicities-exploring-the-complexities-fd7546188d4e

25. https://elnuevoobservador.com/el-proyecto-de-mina-visitable-de-los-lores-comienza-a-ver-la-luz-al-final-del-tunel/

26. https://www.commercialarchitecturemagazine.com/the-history-of-industrial-architecture/

27. https://www.britannica.com/technology/history-of-technology/The-Industrial-Revolution-1750-1900

28.https://www.researchgate.net/publication/340750793_The_refurbishment_of_abandoned_industrial_areas_with_adaptive_re-use_strategies_analysis_of_decision_making_models_and_design_criteria

9. PLANS

9.1. Location maps

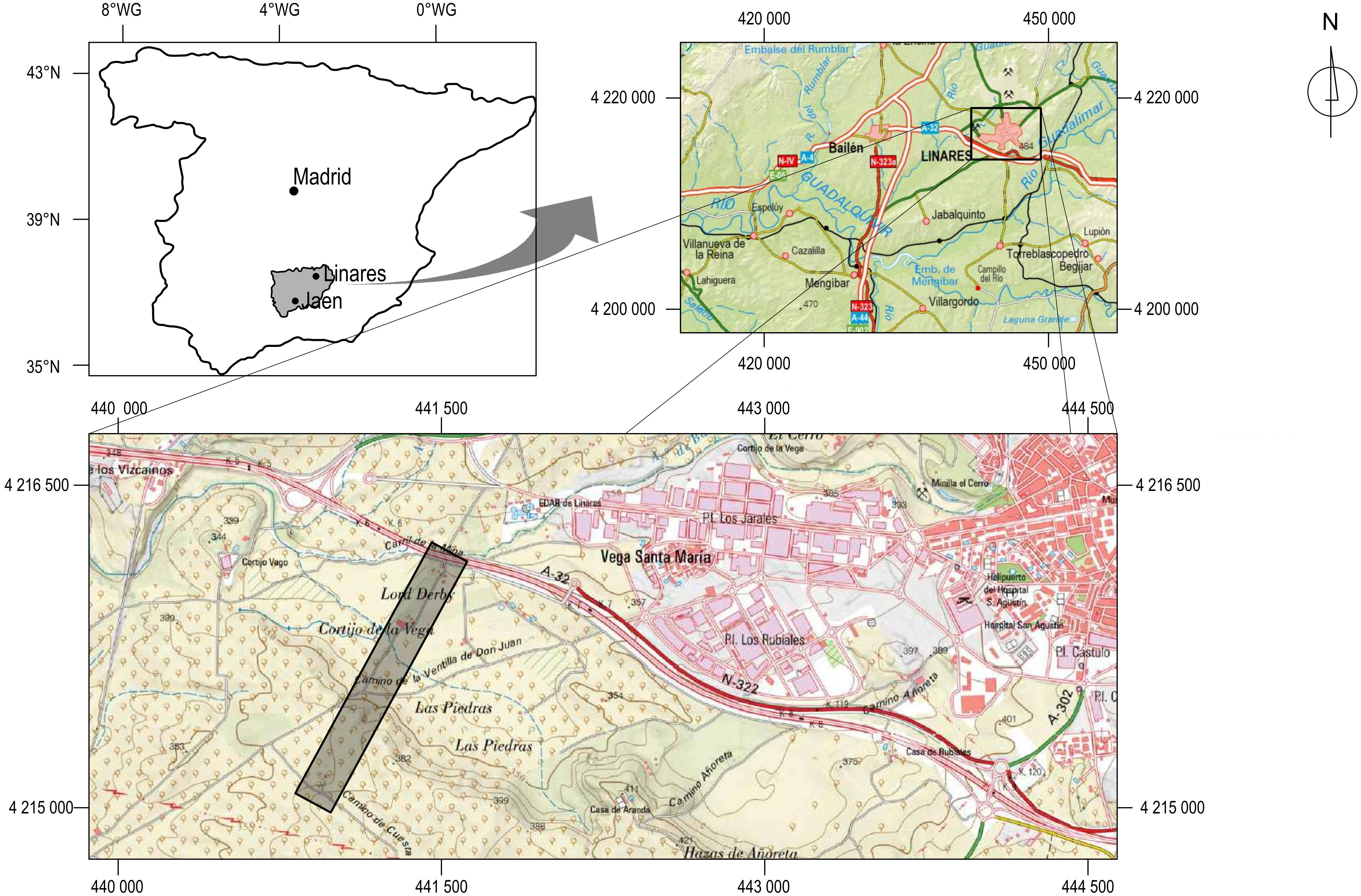
9.2. Pozo San Federico 1

9.3. Pozo San Federico 2

9.4. Auxiliary Chimney

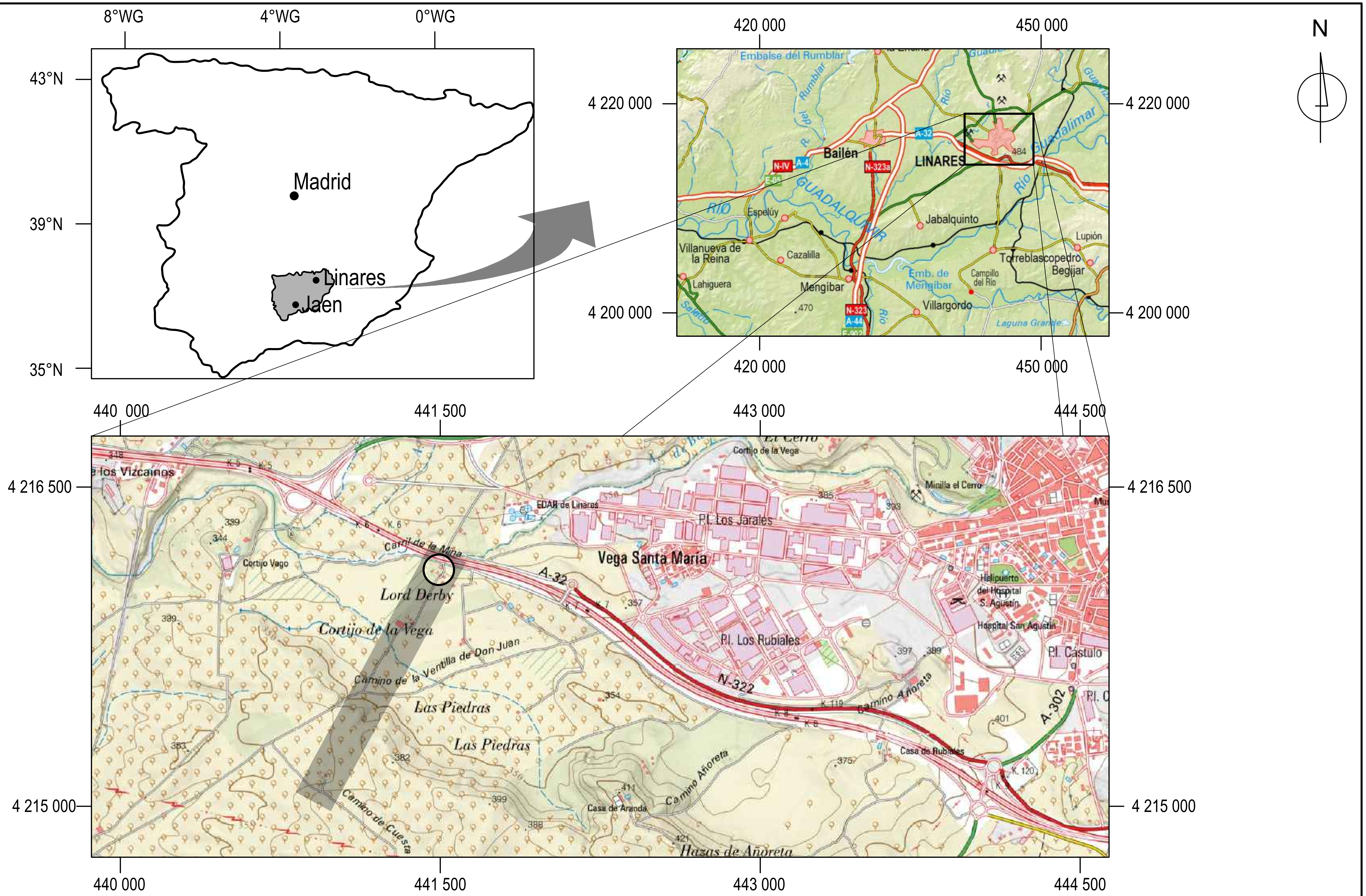
9.5. Pozo Santa-Annie

9.6. Pozo La Victoria



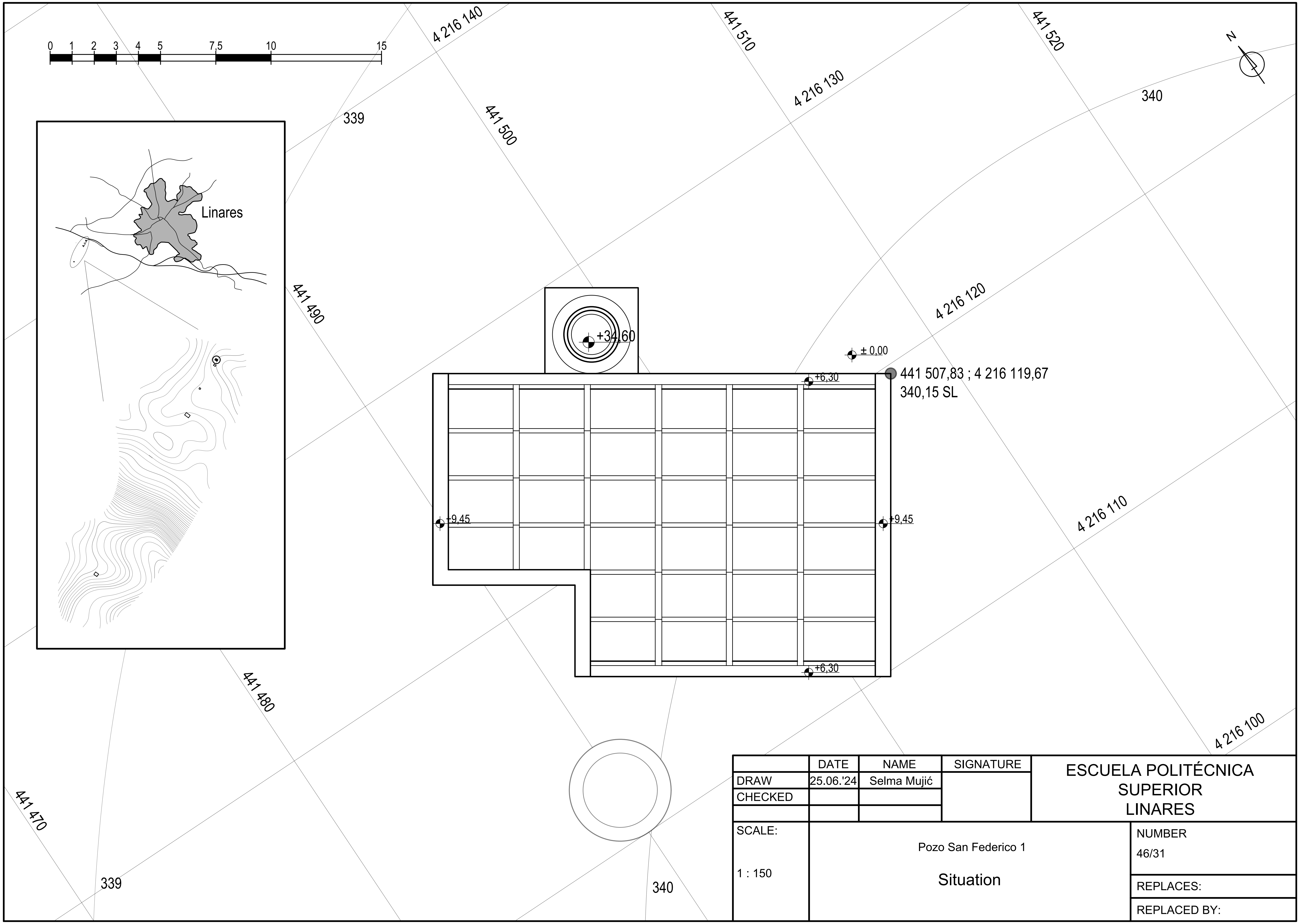
	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				

SCALE:	Map situation	NUMBER 44/31
		REPLACES:
		REPLACED BY:



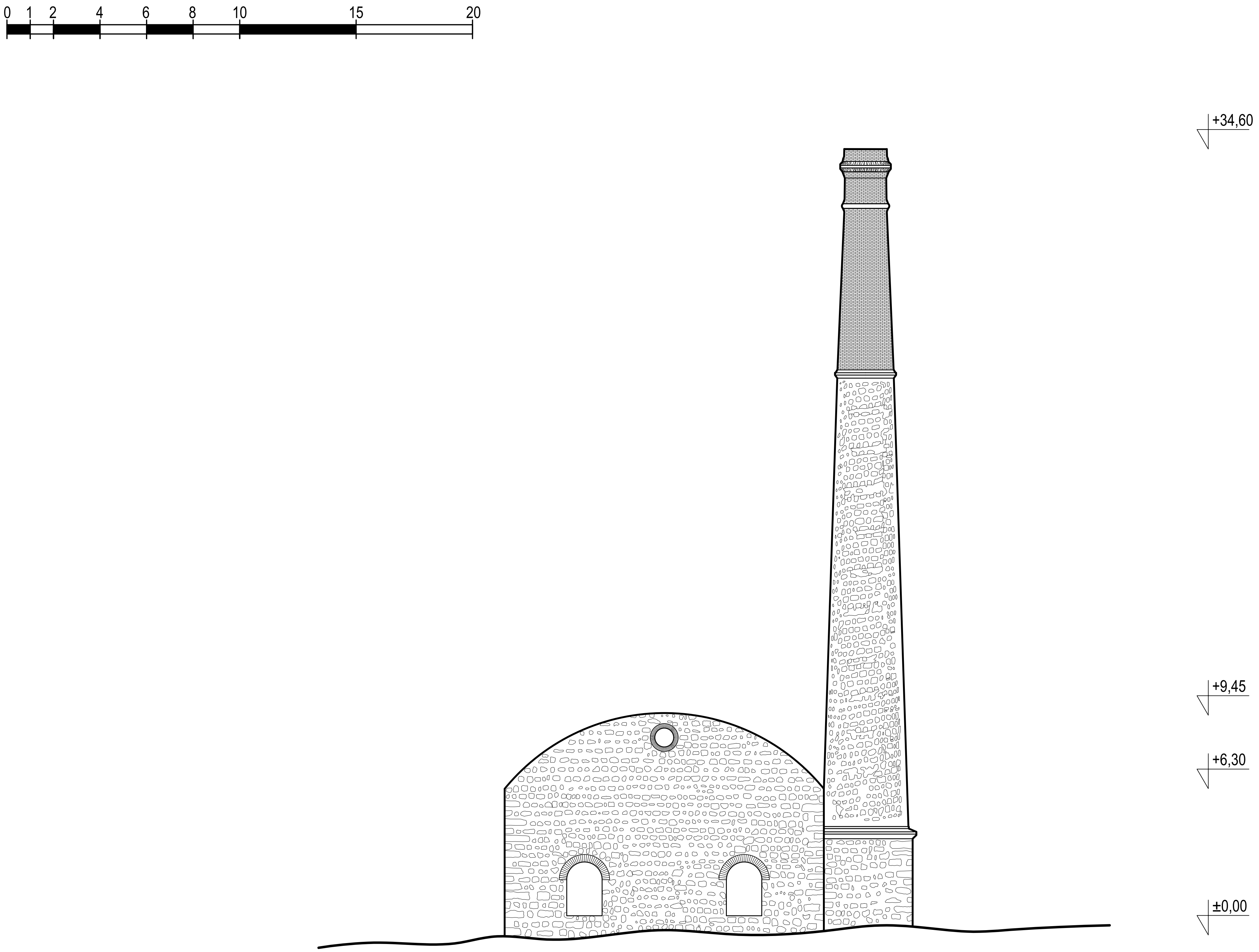
	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				

SCALE:	Pozo San Federico 1 Map situation	NUMBER 45/31
		REPLACES:
		REPLACED BY:



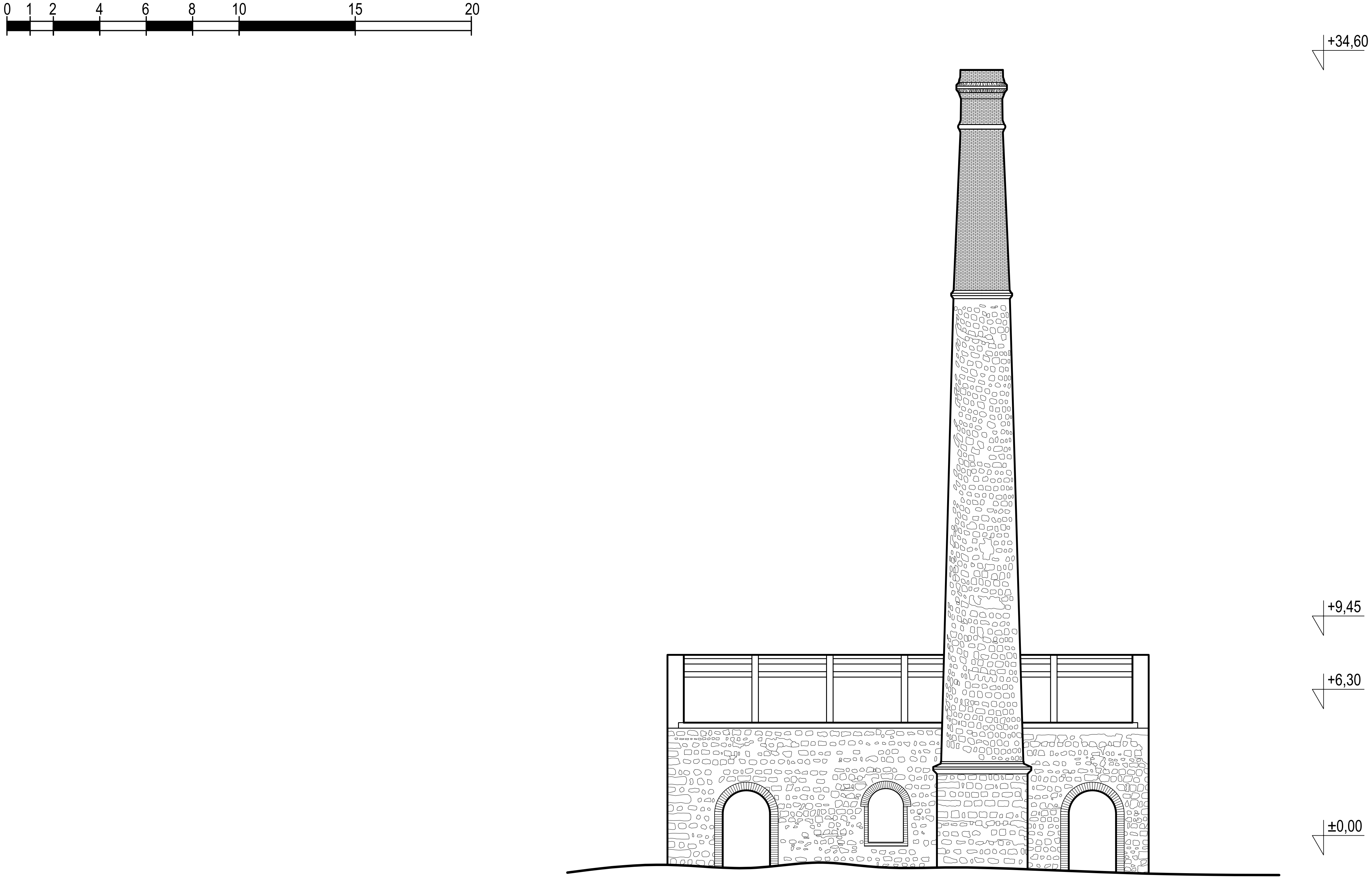
	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				

SCALE: 1 : 150	Pozo San Federico 1 Situation	NUMBER 46/31
		REPLACES:
		REPLACED BY:



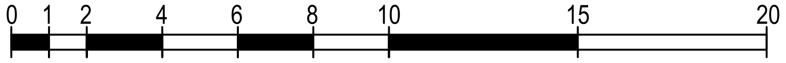
	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				

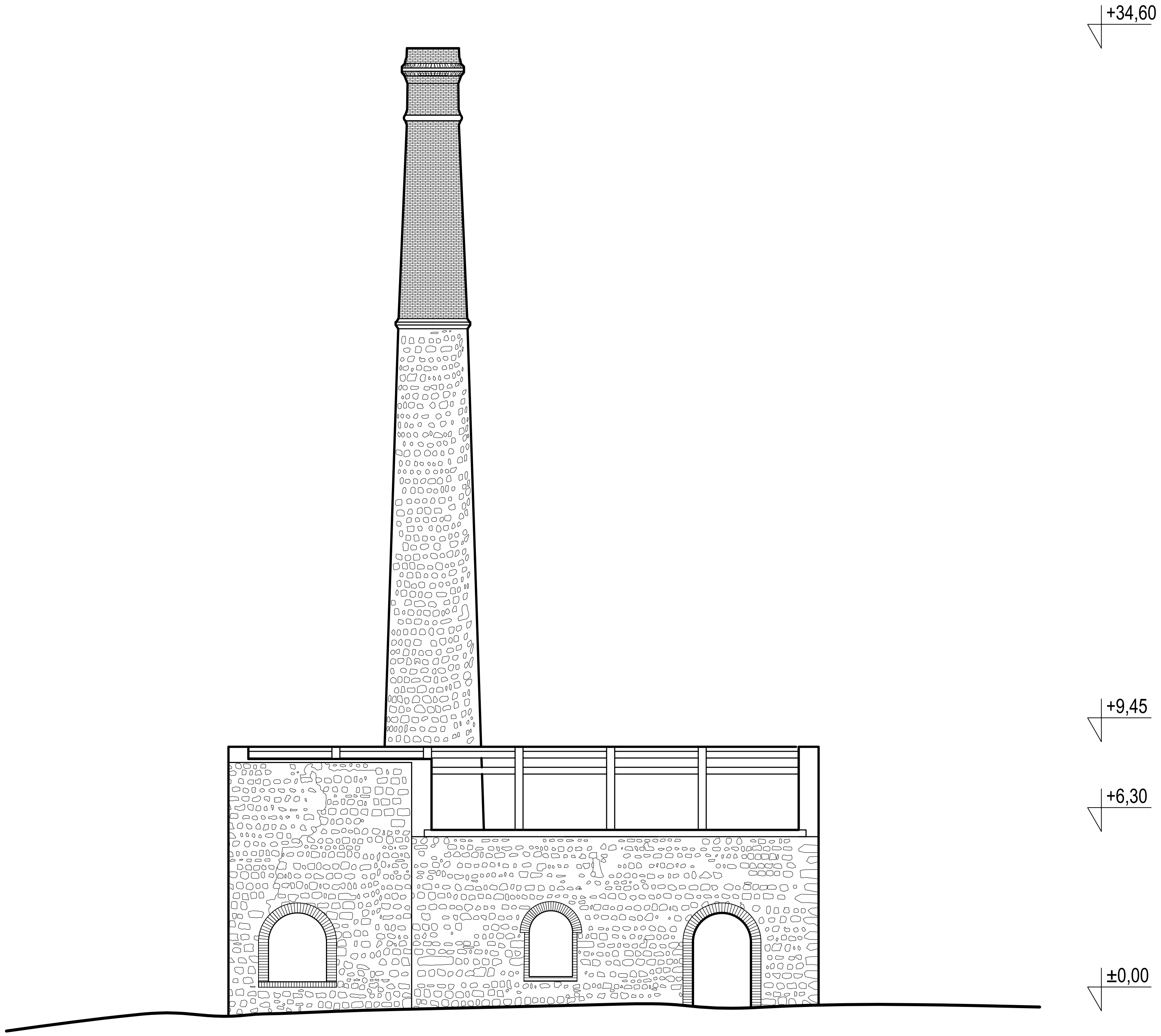
SCALE: 1 : 200	Pozo San Federico 1 East facade	NUMBER 47/31
		REPLACES:
		REPLACED BY:



	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				

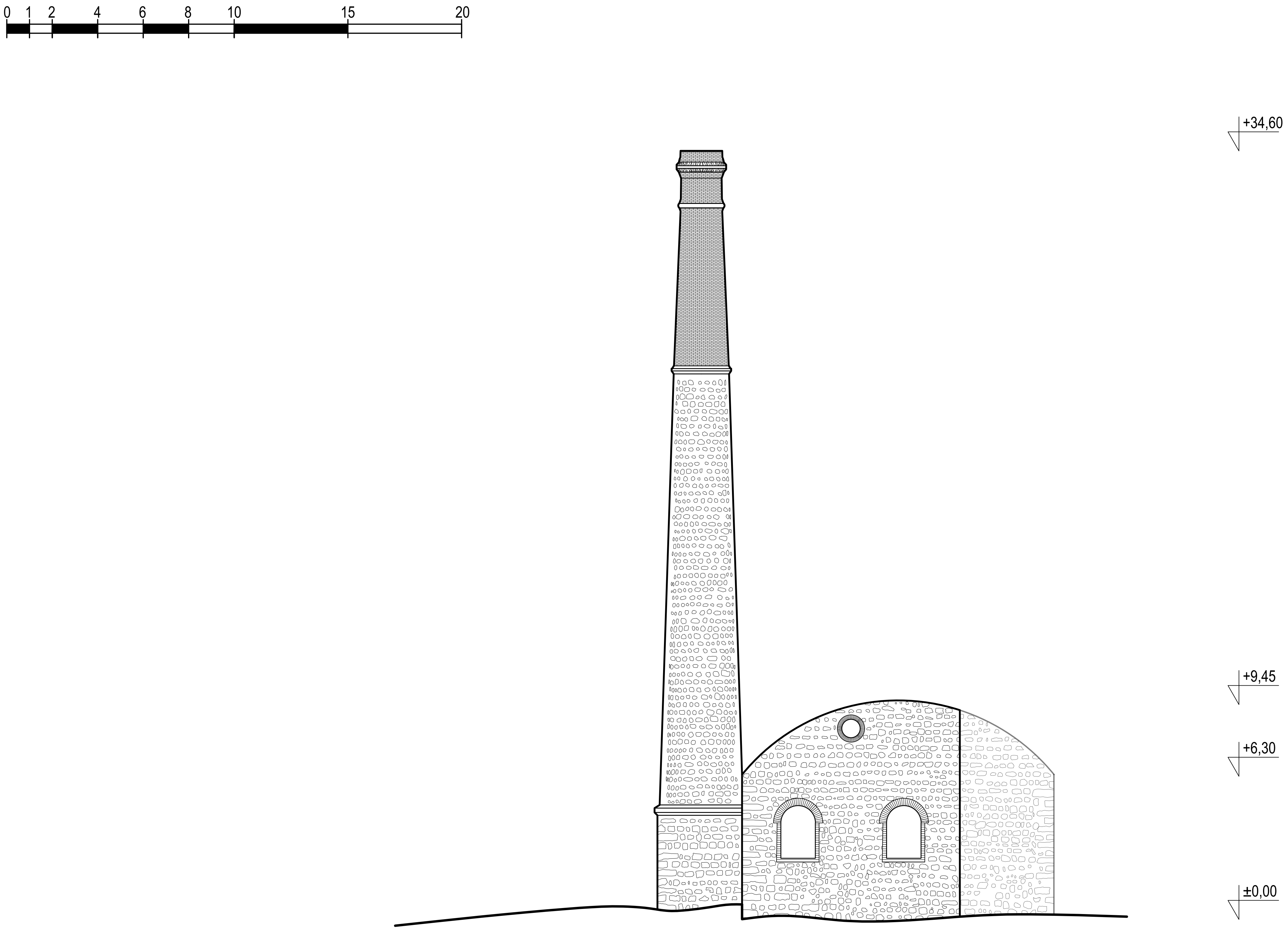
SCALE: 1 : 200	Pozo San Federico 1 North facade	NUMBER 48/31
		REPLACES:
		REPLACED BY:



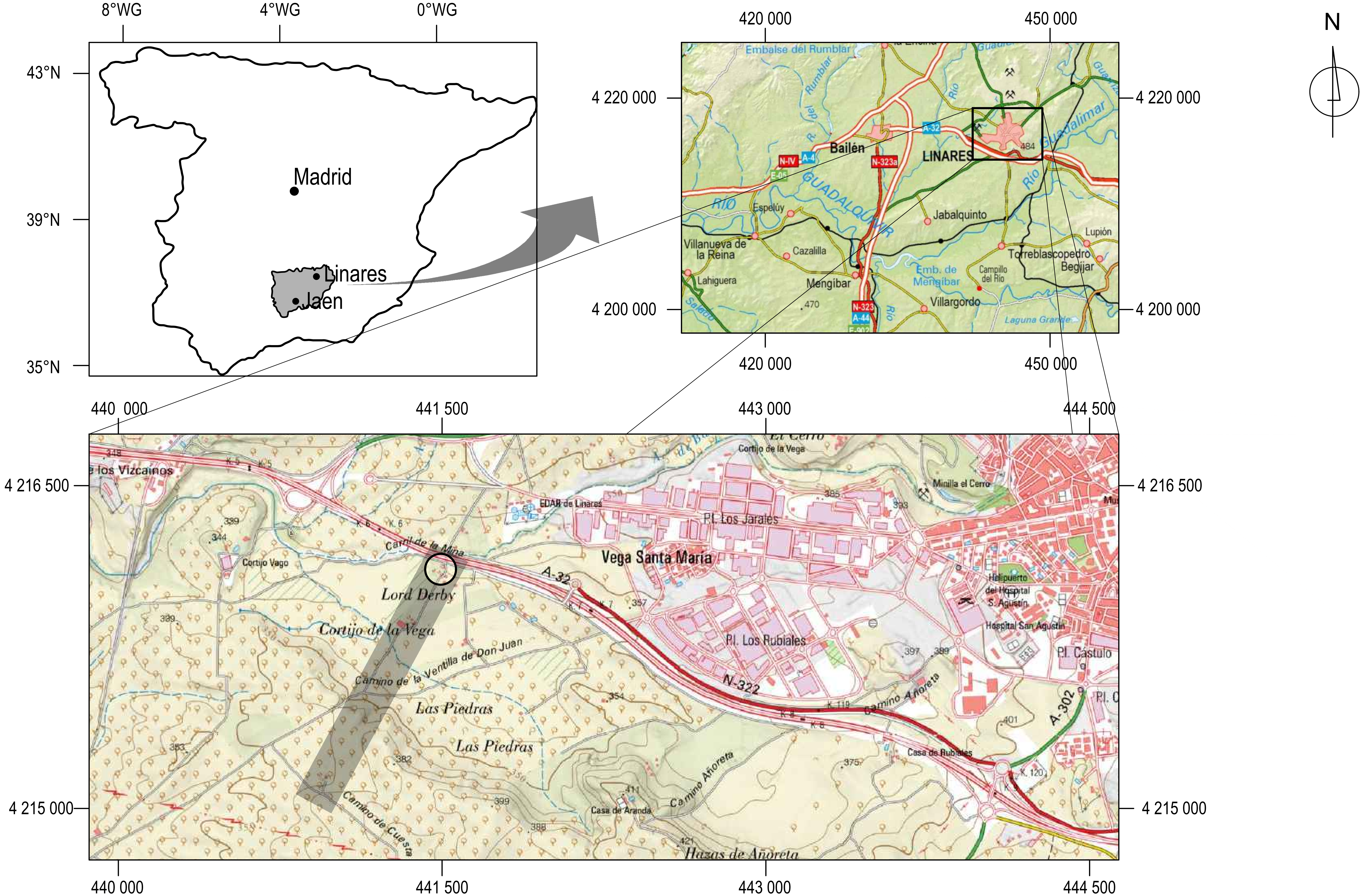


	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				

SCALE: 1 : 200	Pozo San Federico 1 South facade	NUMBER 49/31
		REPLACES:
		REPLACED BY:

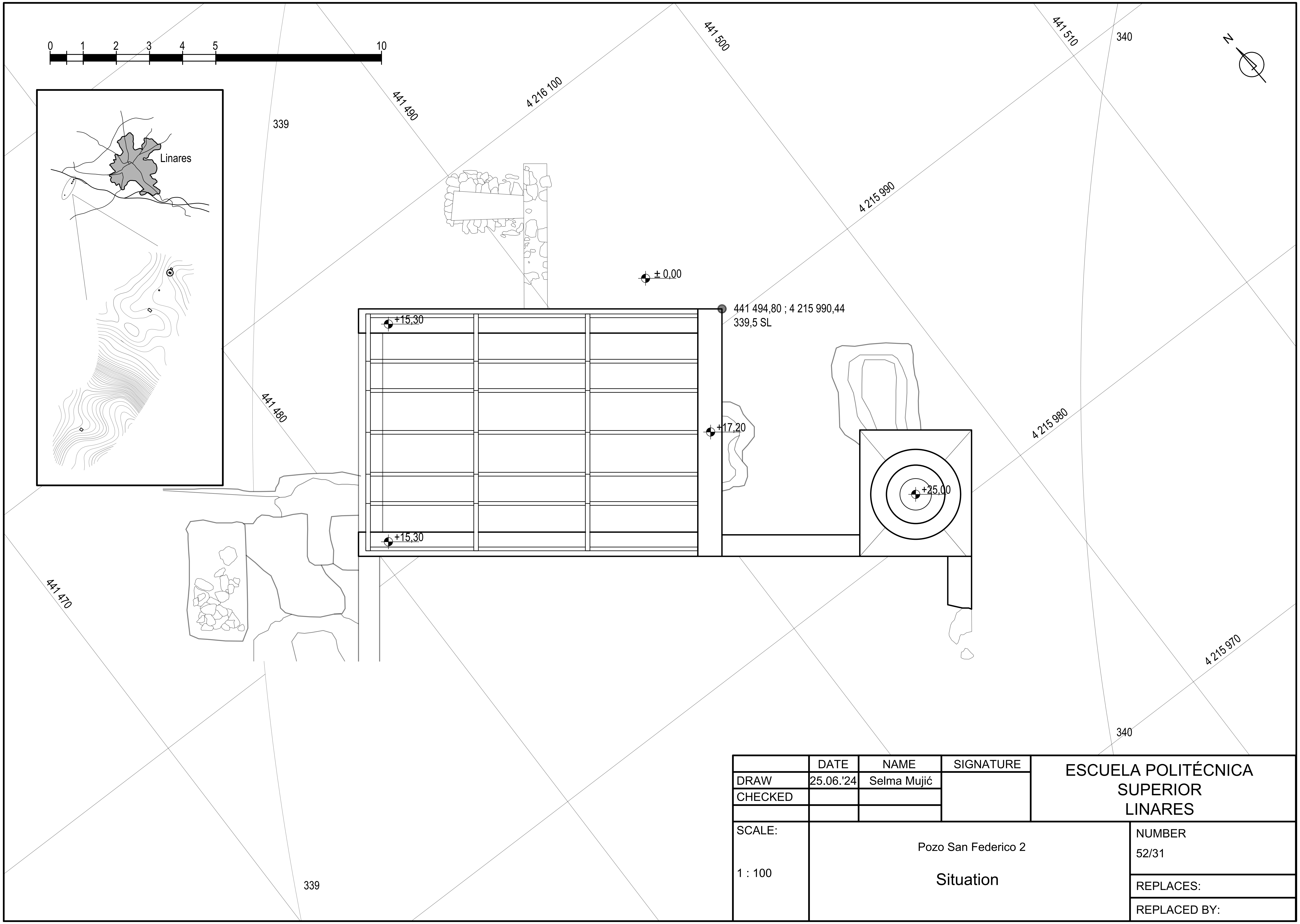


	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				
SCALE: 1 : 200	Pozo San Federico 1 West facade			NUMBER 50/31
				REPLACES:
				REPLACED BY:

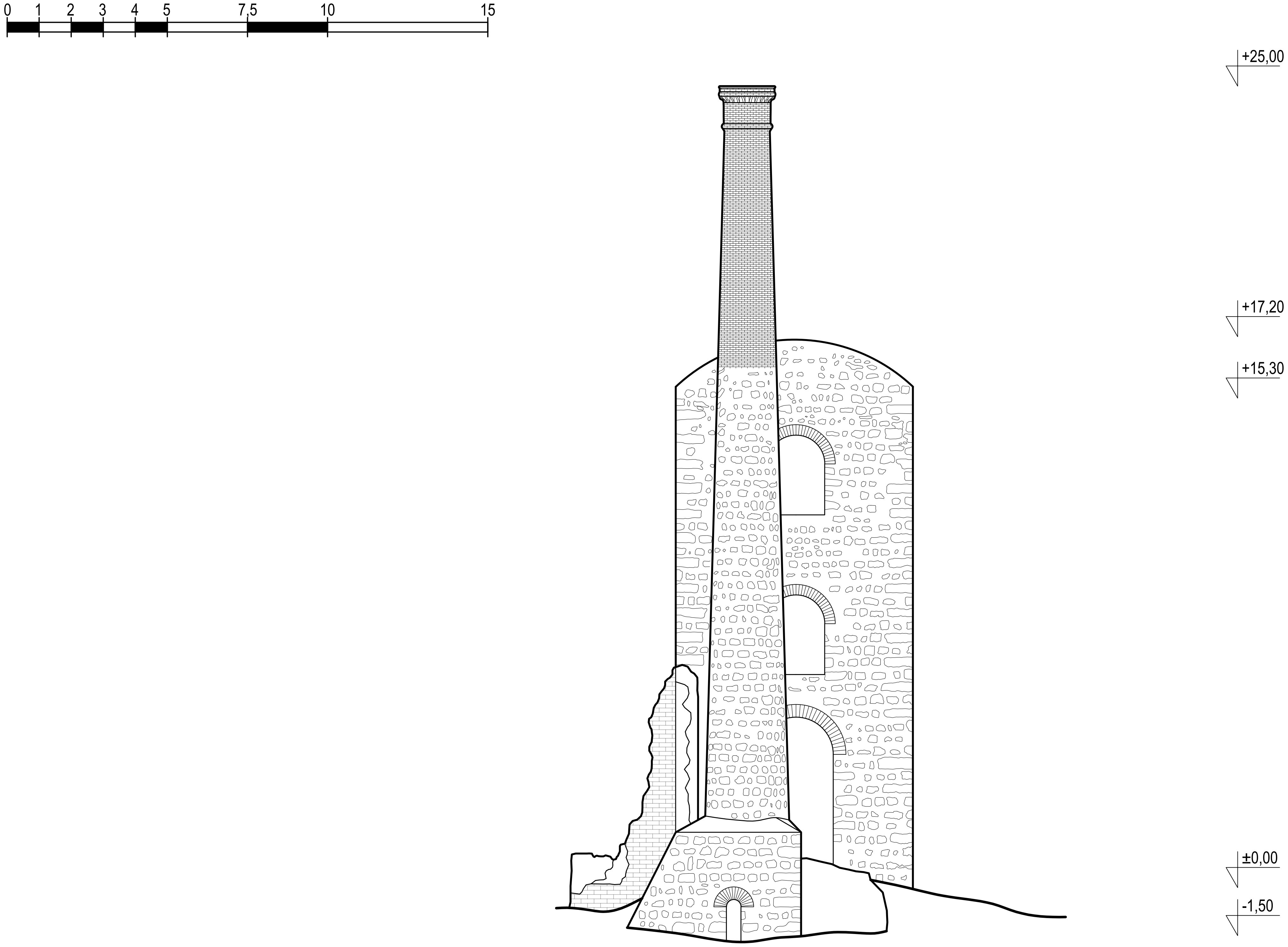


	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				

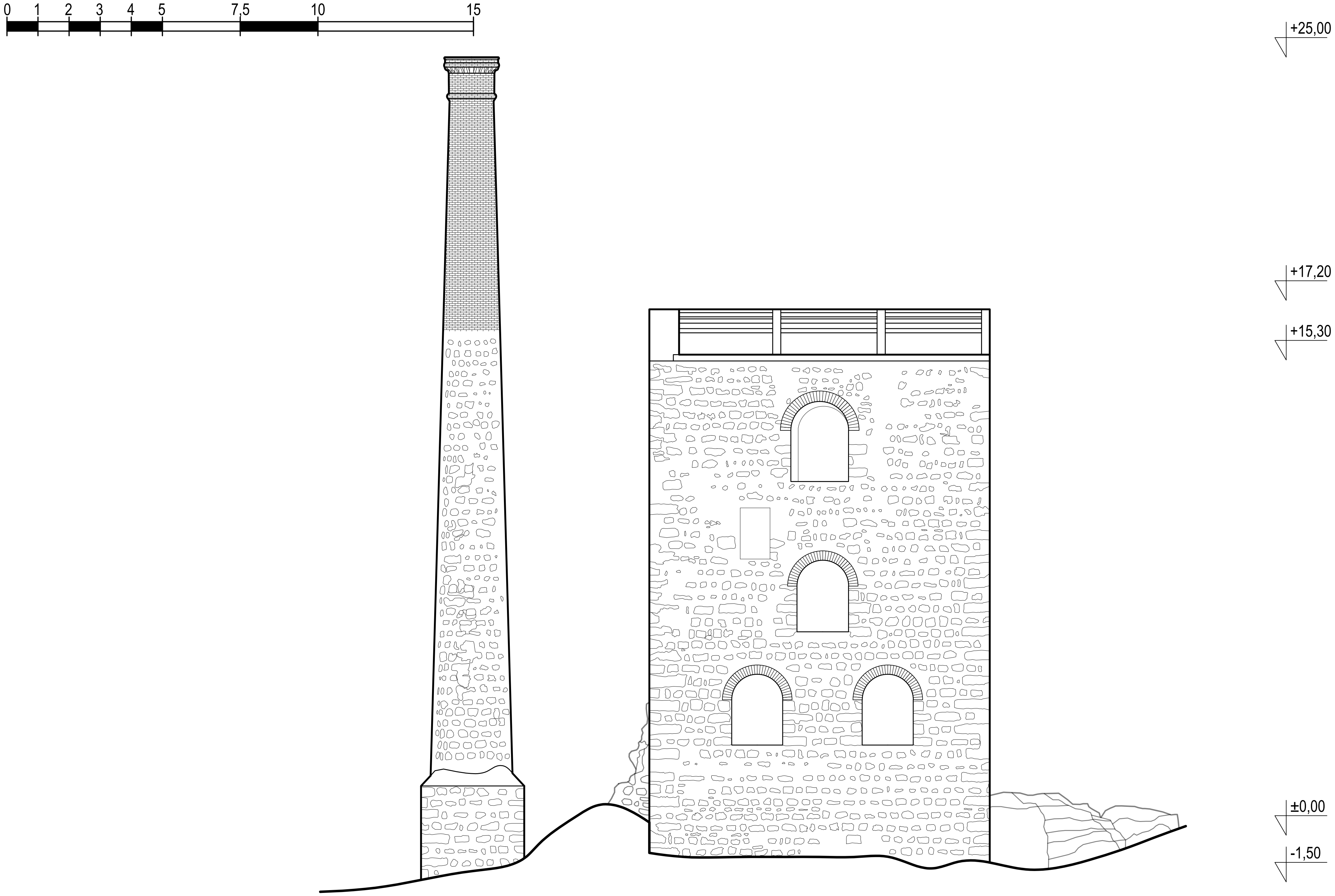
SCALE:	Pozo San Federico 2 Map situation	NUMBER 51/31
		REPLACES:
		REPLACED BY:



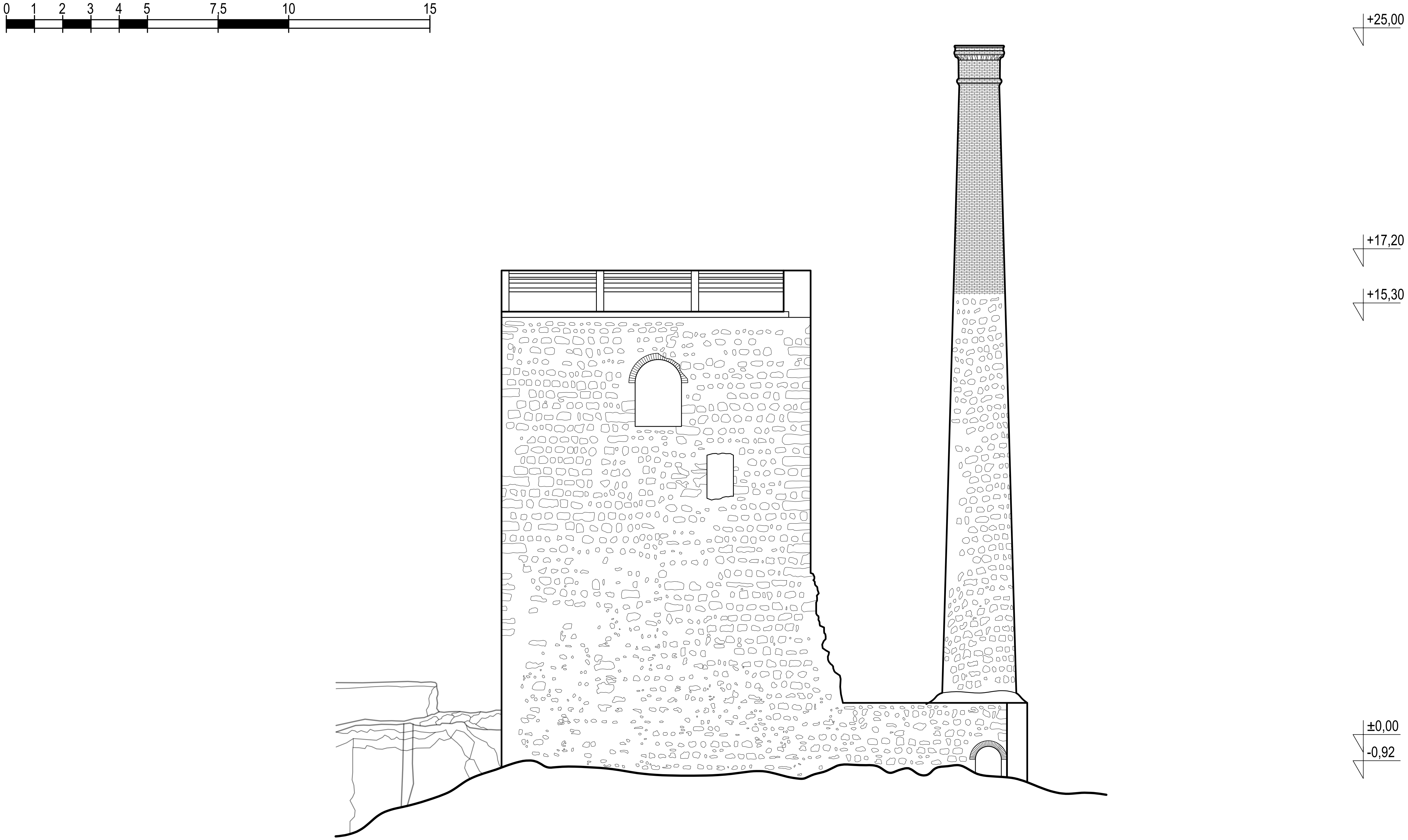
	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				
SCALE: 1 : 100	Pozo San Federico 2 Situation			NUMBER 52/31
				REPLACES:
				REPLACED BY:



	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				
SCALE: 1 : 150	Pozo San Federico 2 East facade			NUMBER 53/31
				REPLACES:
				REPLACED BY:

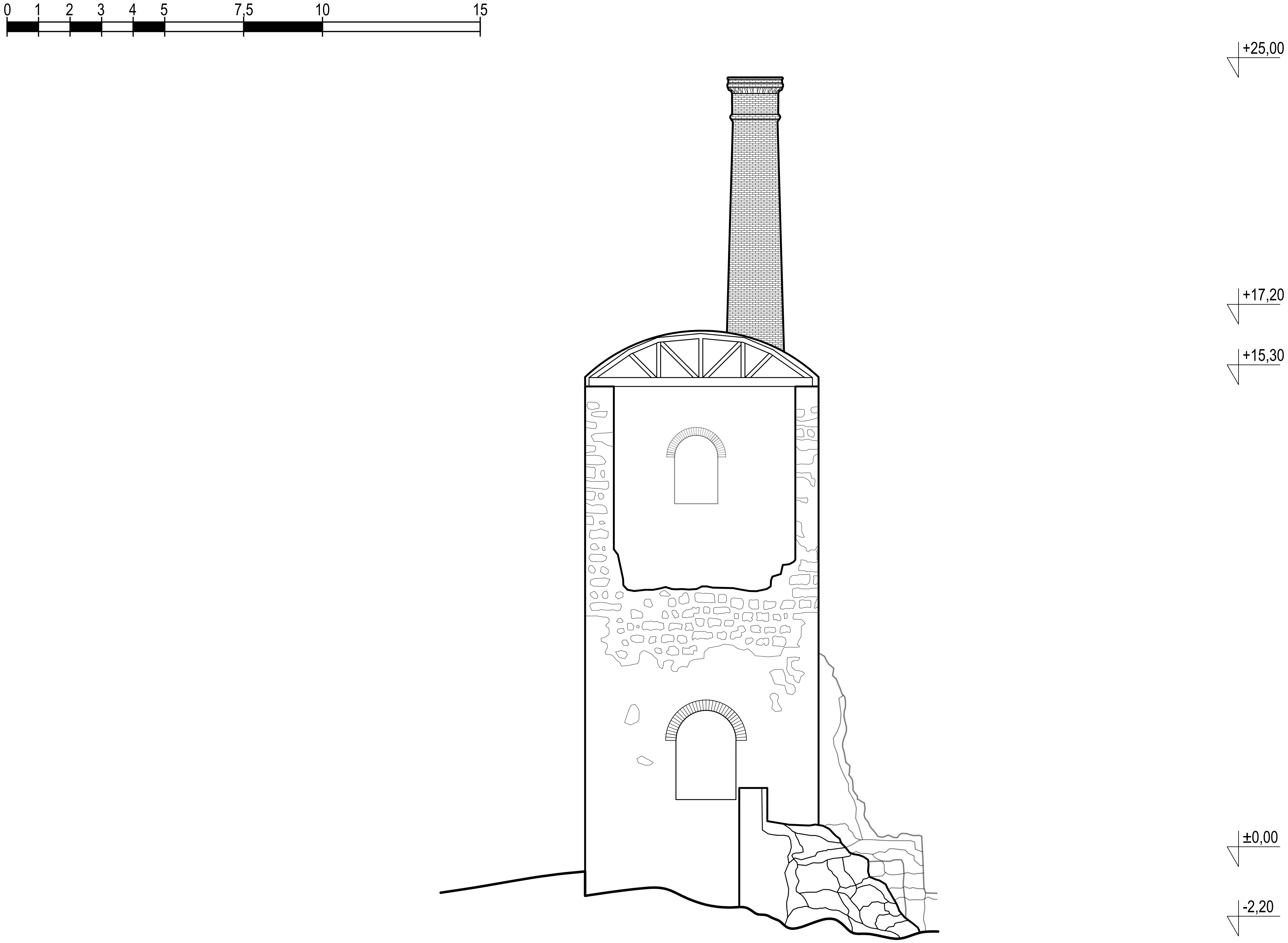


	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				
SCALE: 1 : 150	Pozo San Federico 2 North facade			NUMBER 54/31
				REPLACES:
				REPLACED BY:

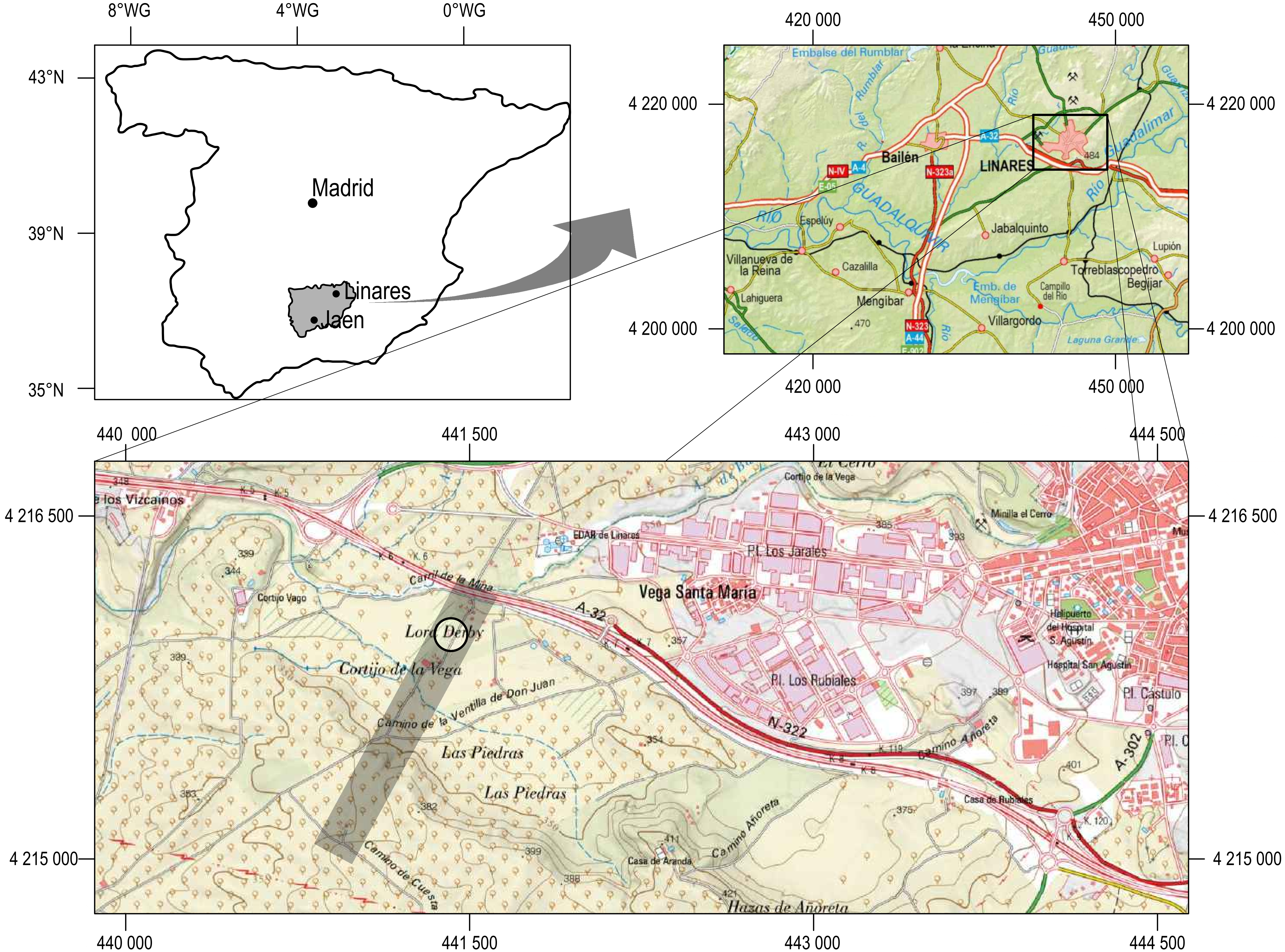


	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				

SCALE:	Pozo San Federico 2	NUMBER
1 : 150	South facade	55/31
		REPLACES:
		REPLACED BY:

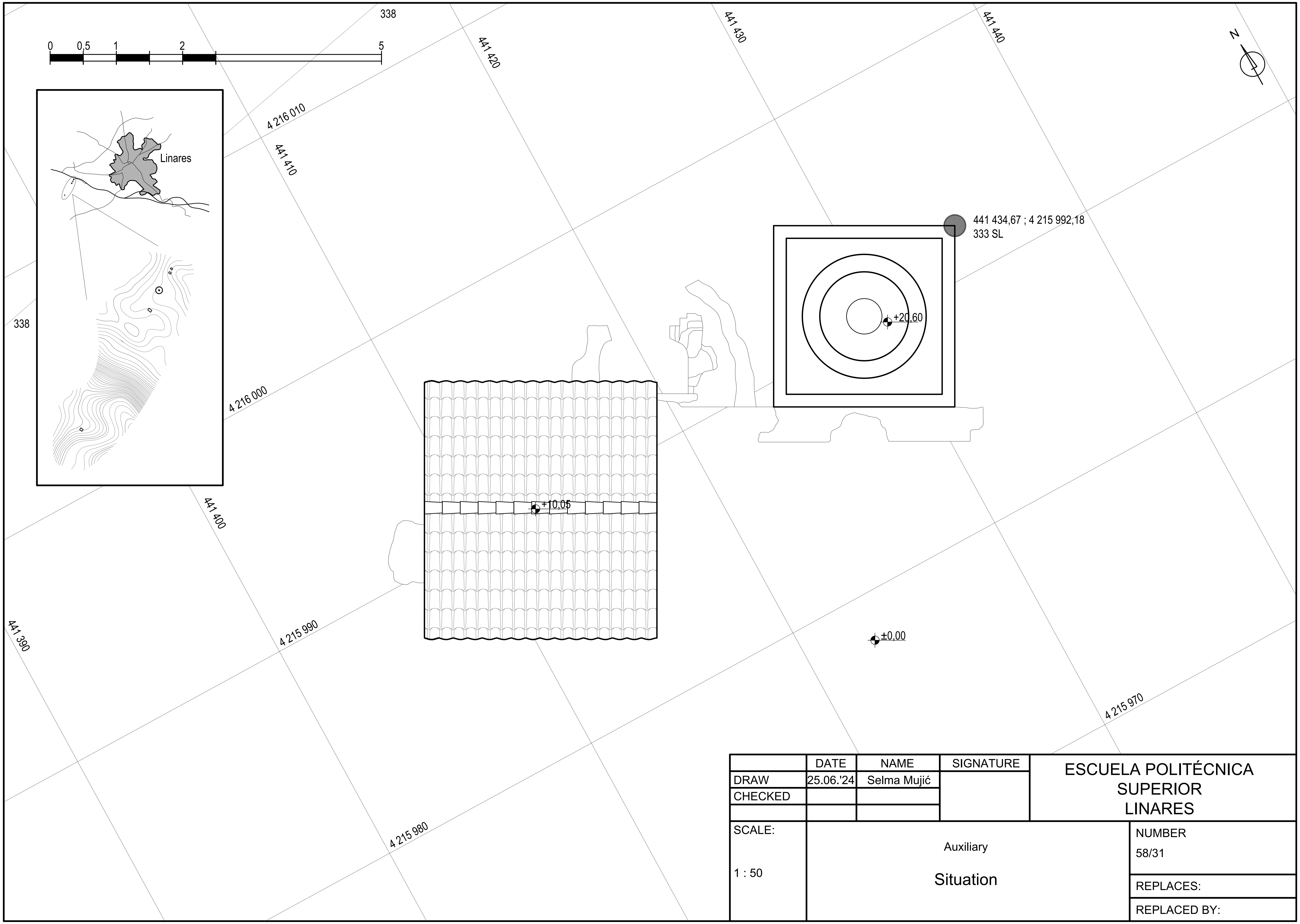


	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				
SCALE: 1 : 150	Pozo San Federico 2 West facade			NUMBER 56/31
				REPLACES:
				REPLACED BY:



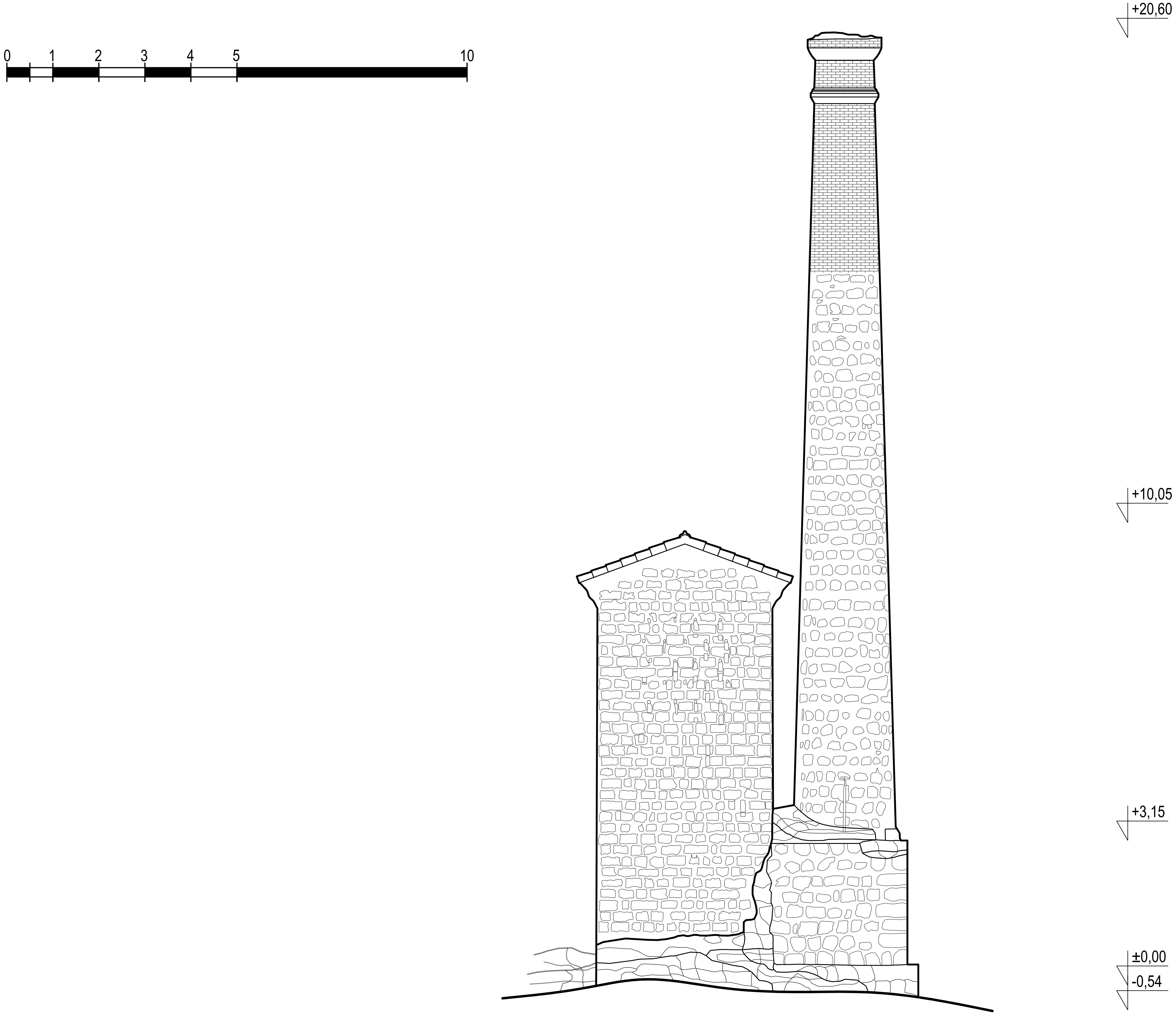
	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				

SCALE:	Auxiliary Map situation	NUMBER 57/31
		REPLACES:
		REPLACED BY:



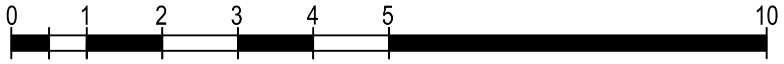
	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				

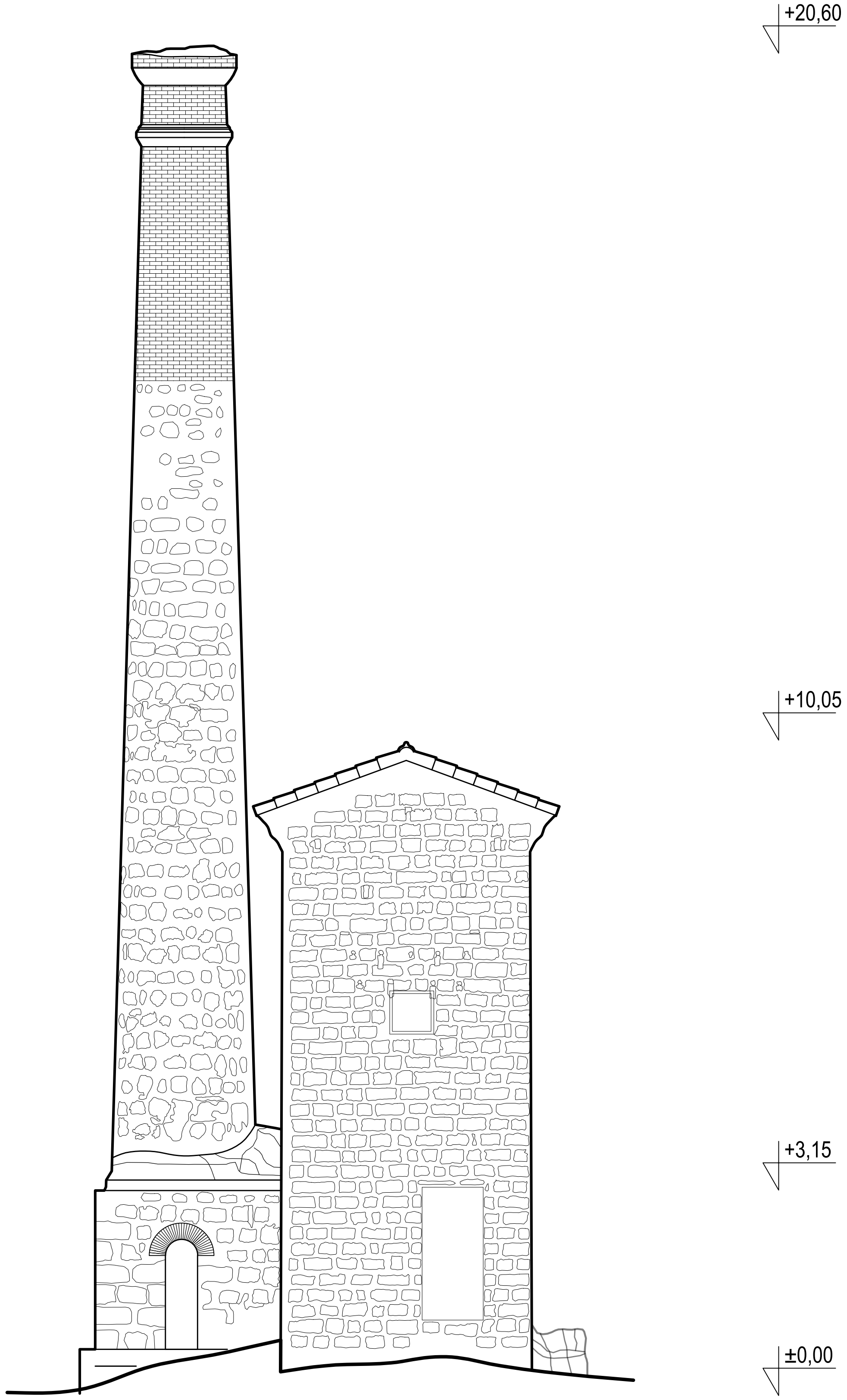
SCALE: 1 : 50	Auxiliary Situation	NUMBER 58/31
		REPLACES:
		REPLACED BY:



	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				

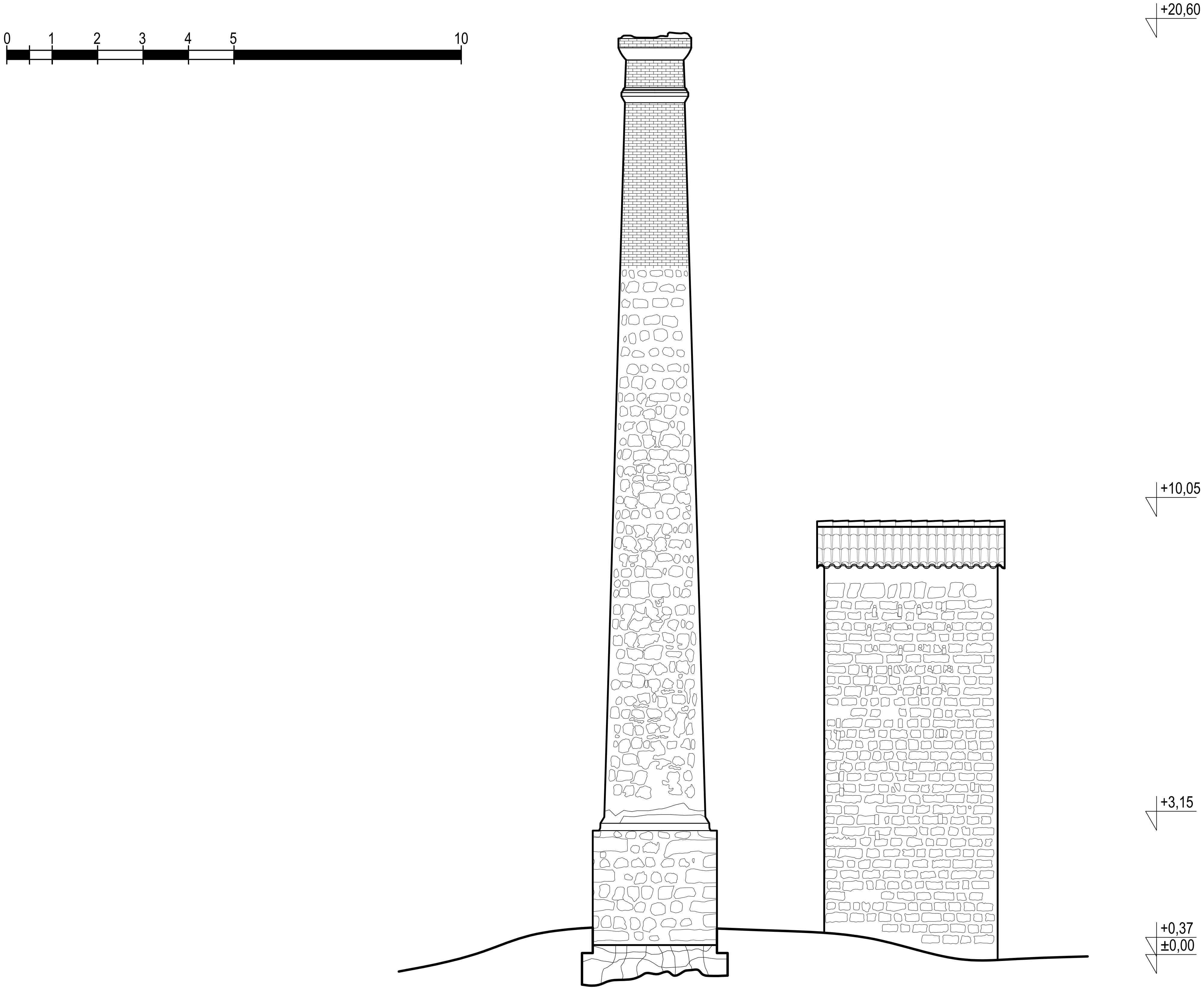
SCALE: 1 : 100	Auxiliary East facade	NUMBER 59/31
		REPLACES:
		REPLACED BY:



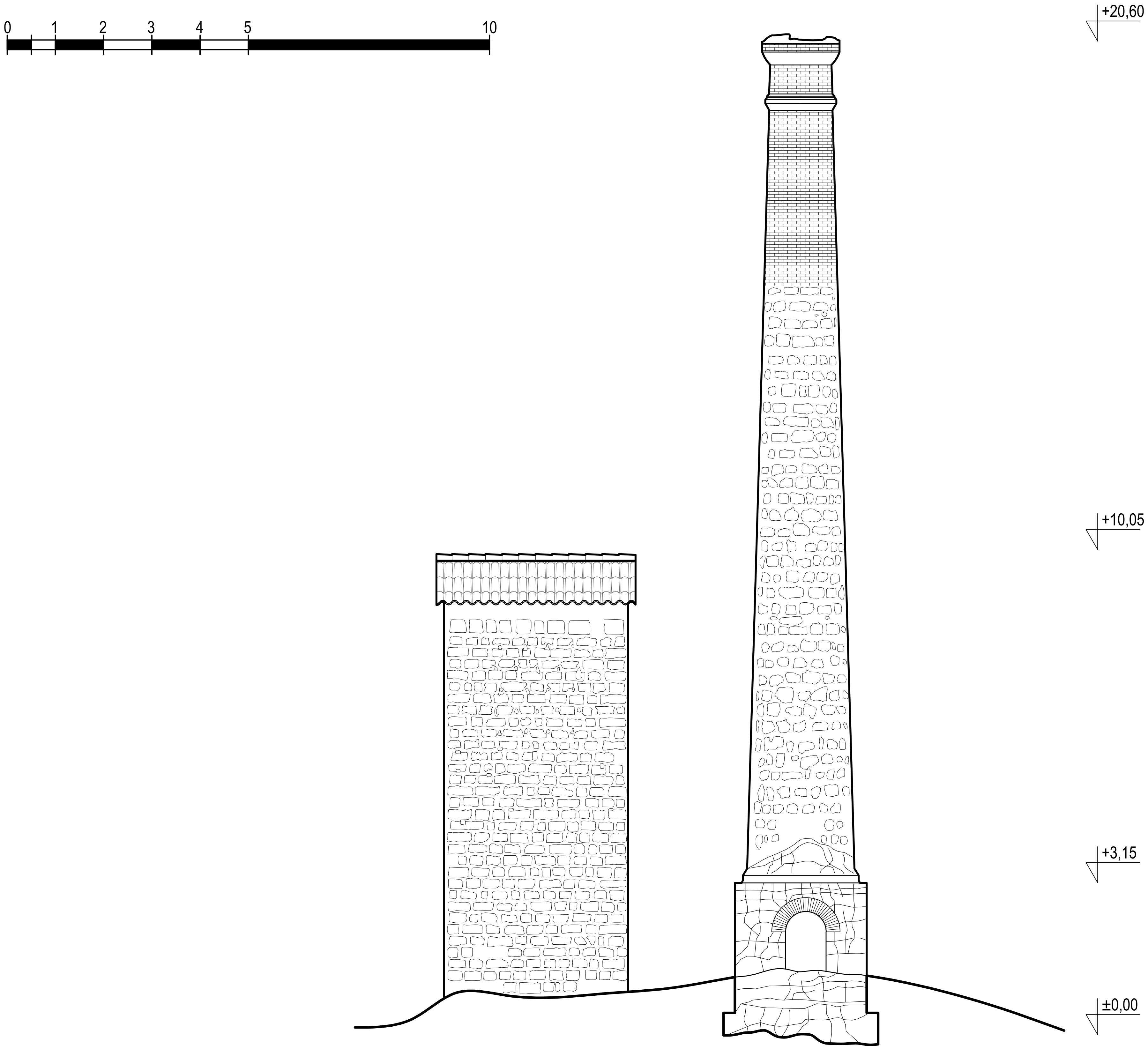


	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				

SCALE: 1 : 100	Auxiliary West facade	NUMBER 60/31
		REPLACES:
		REPLACED BY:

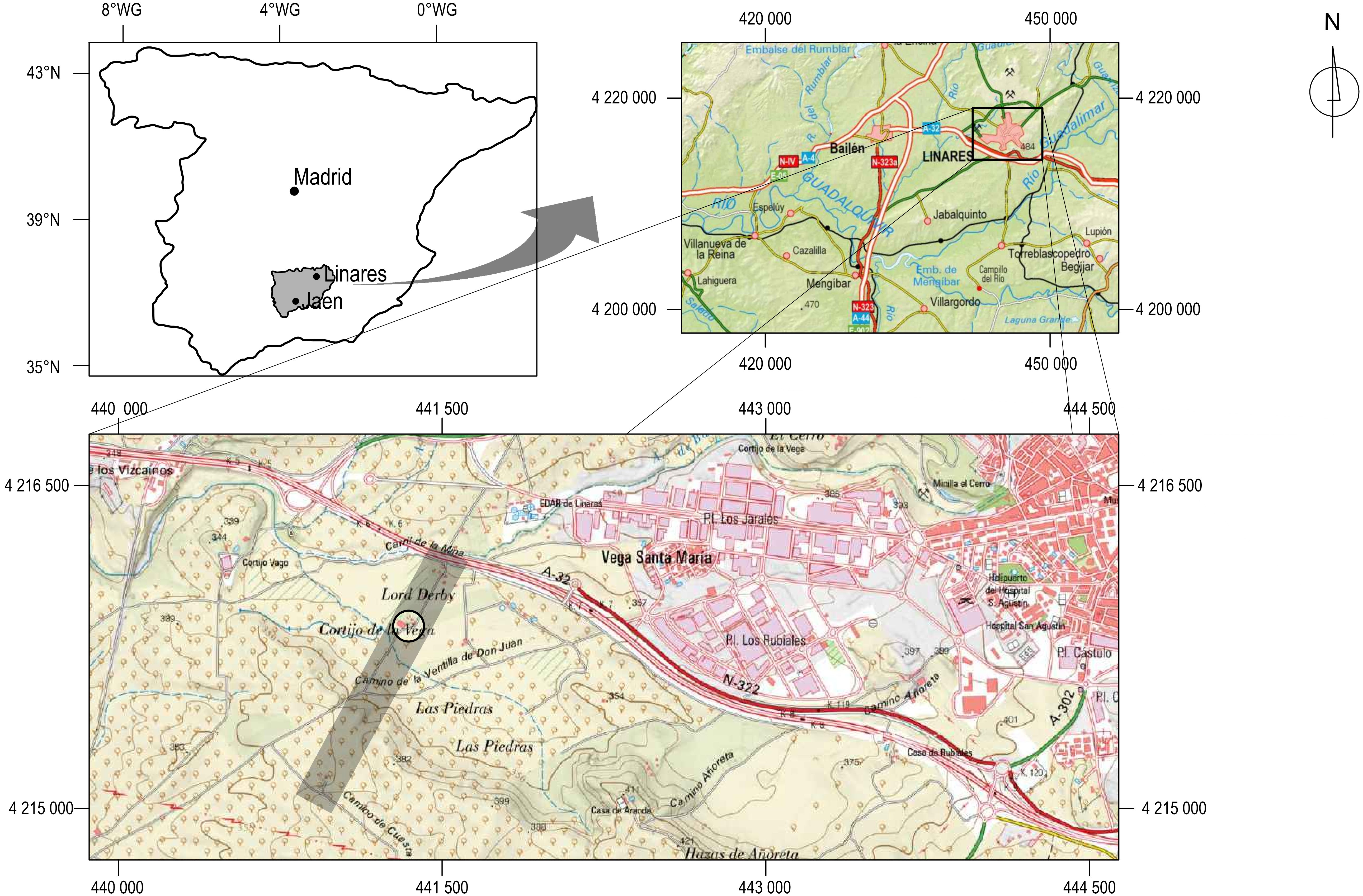


	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				
SCALE: 1 : 100	Auxiliary North facade			NUMBER 61/31
				REPLACES:
				REPLACED BY:



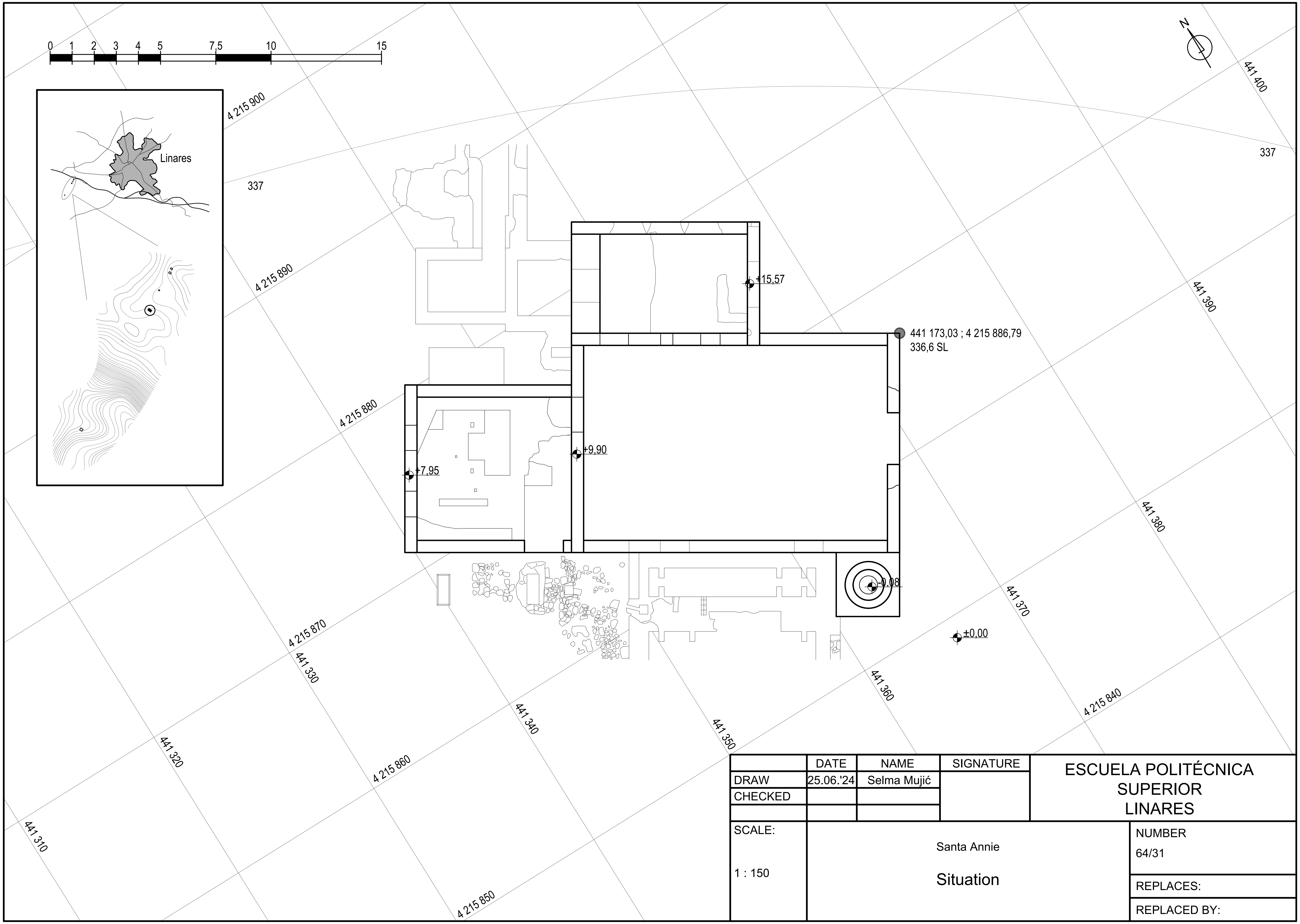
	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				

SCALE: 1 : 100	Auxiliary South facade	NUMBER 62/31
		REPLACES:
		REPLACED BY:



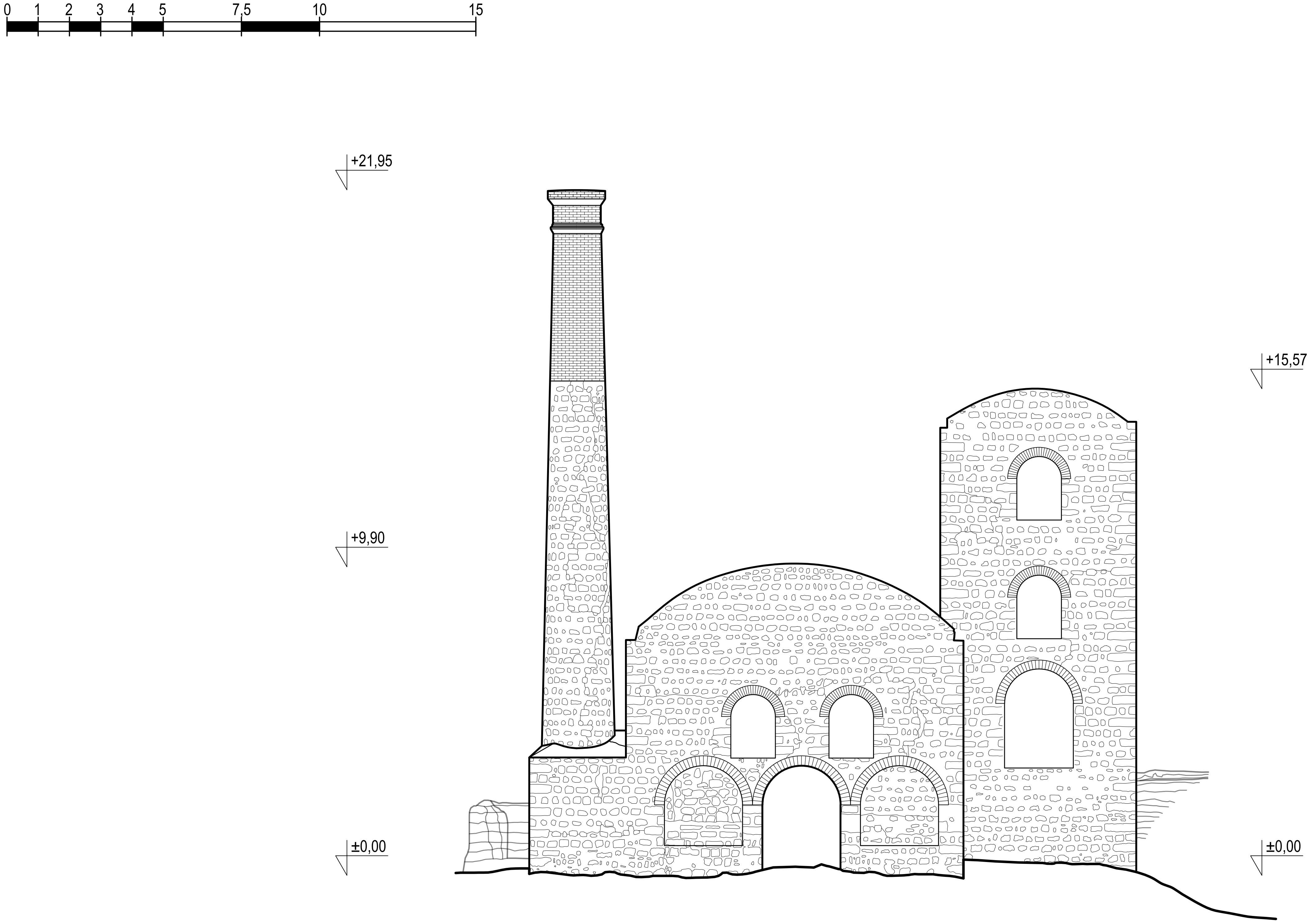
	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				

SCALE:	Pozo Santa Annie Map situation	NUMBER 63/31
		REPLACES:
		REPLACED BY:



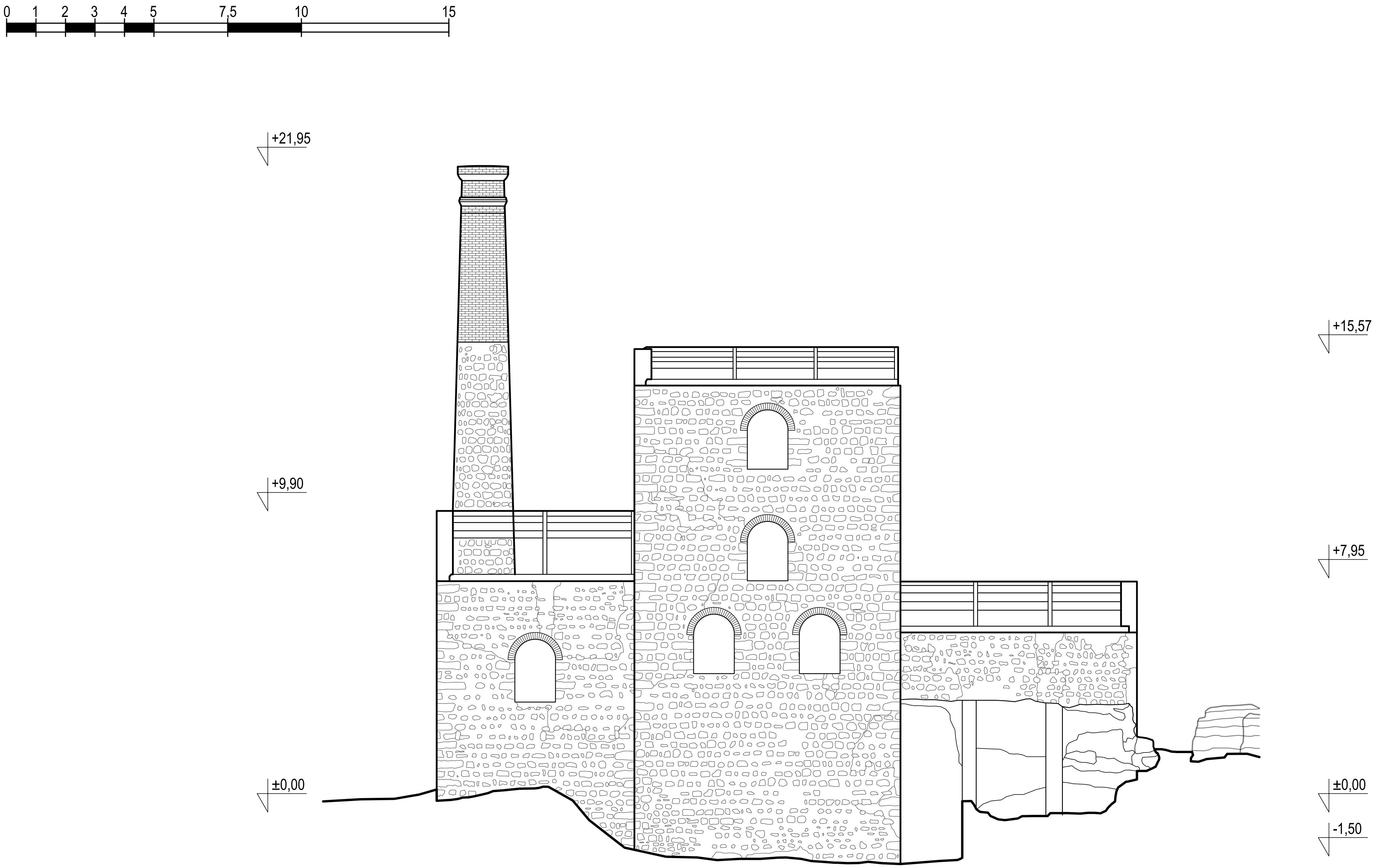
	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				

SCALE: 1 : 150	Santa Annie Situation	NUMBER 64/31
		REPLACES:
		REPLACED BY:



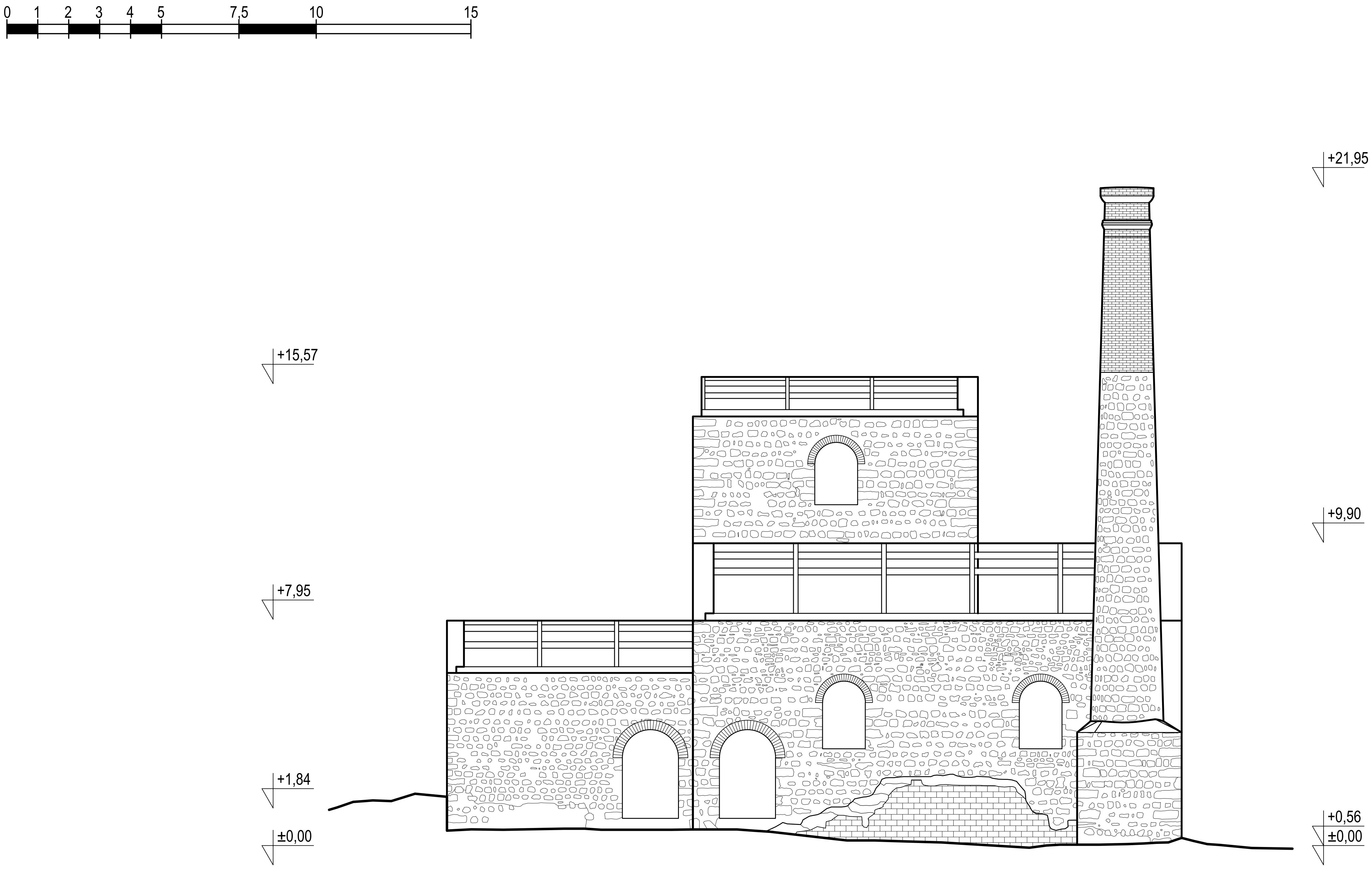
	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				

SCALE: 1 : 150	Santa Annie East Facade	NUMBER 65/31
		REPLACES:
		REPLACED BY:

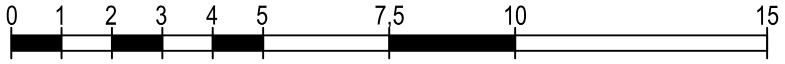


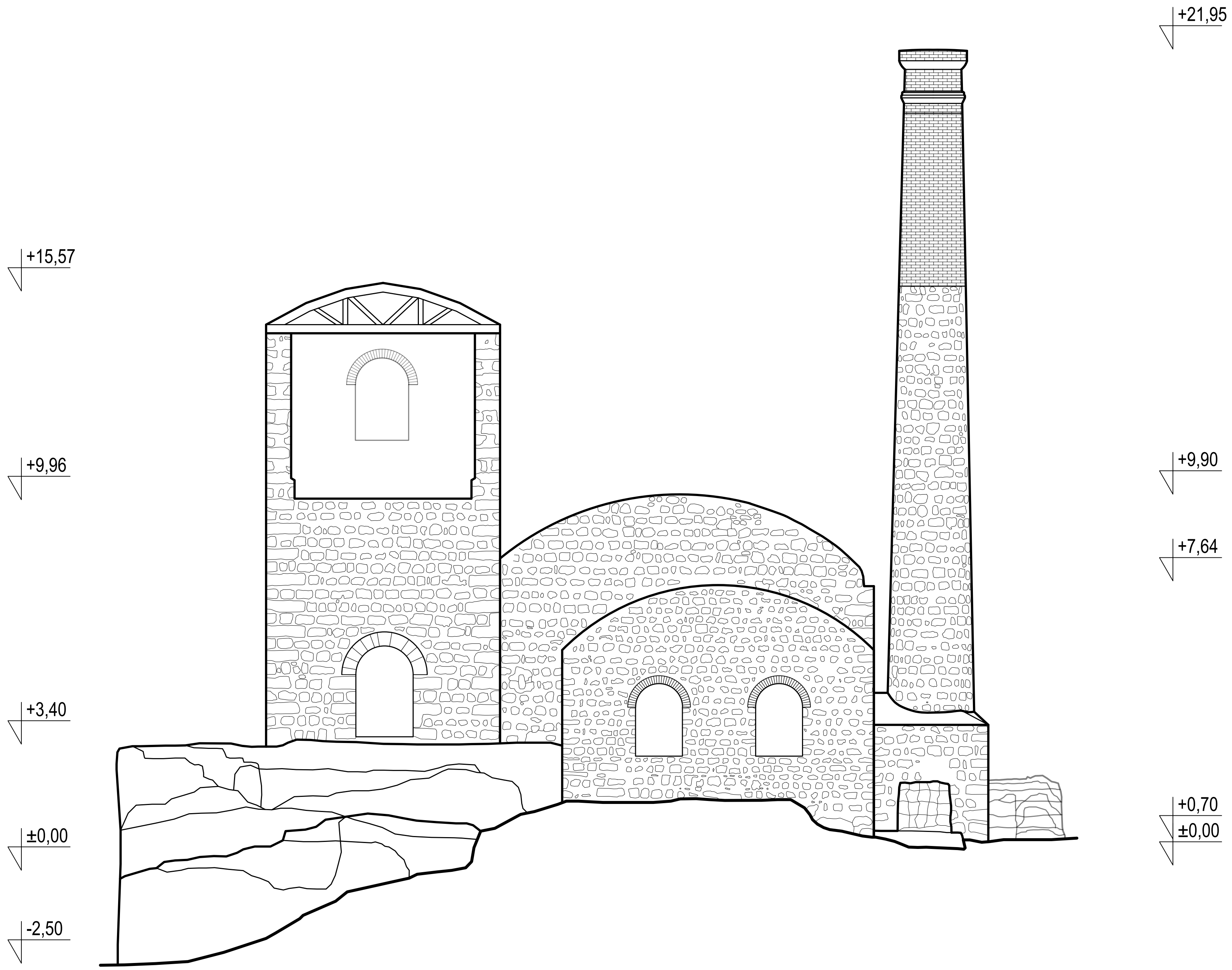
	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				

SCALE:		NUMBER
1 : 150	Santa Annie North Facade	66/31
		REPLACES:
		REPLACED BY:

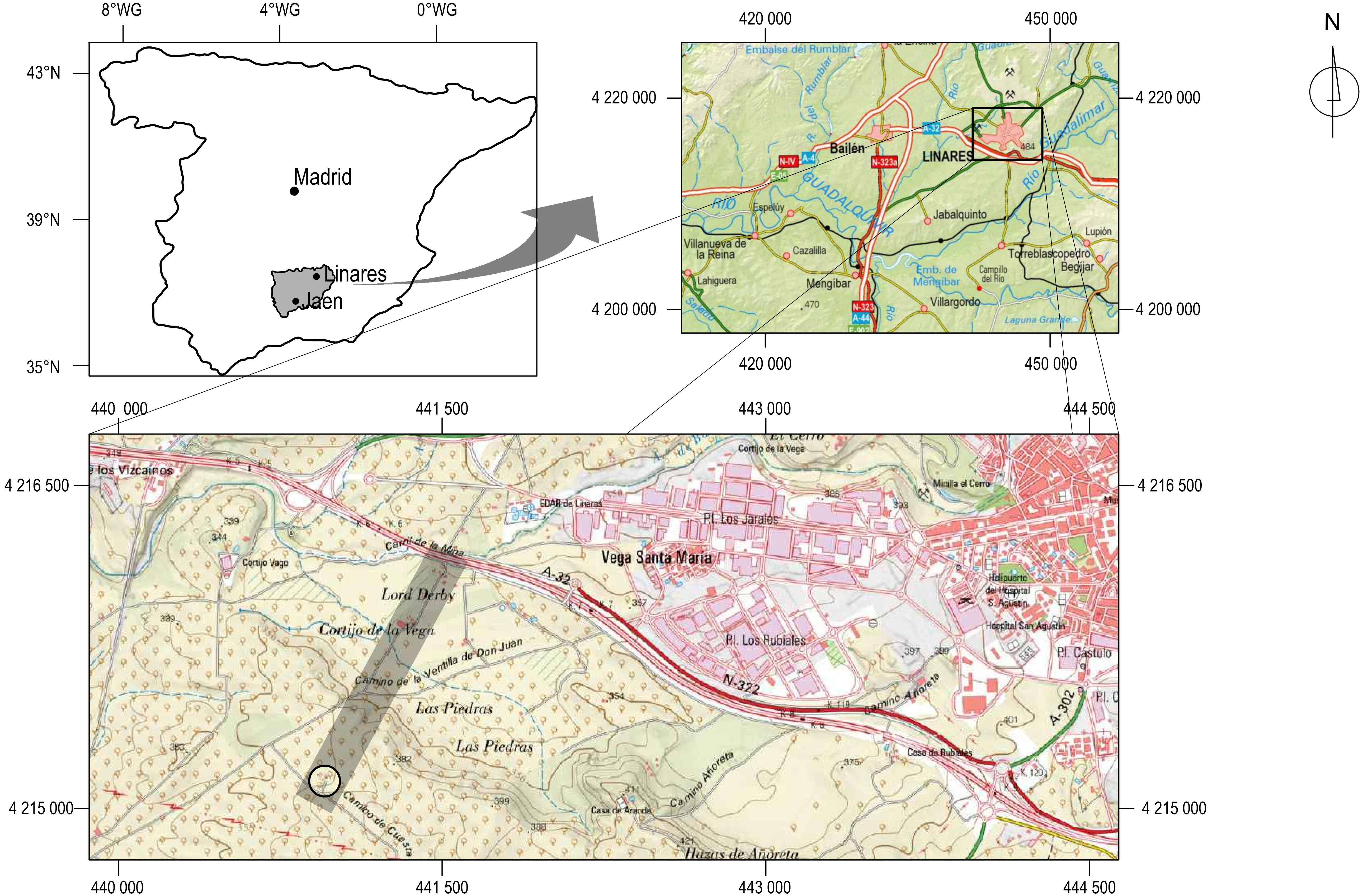


	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				
SCALE: 1 : 150	Santa Annie South Facade			NUMBER 67/31
				REPLACES:
				REPLACED BY:



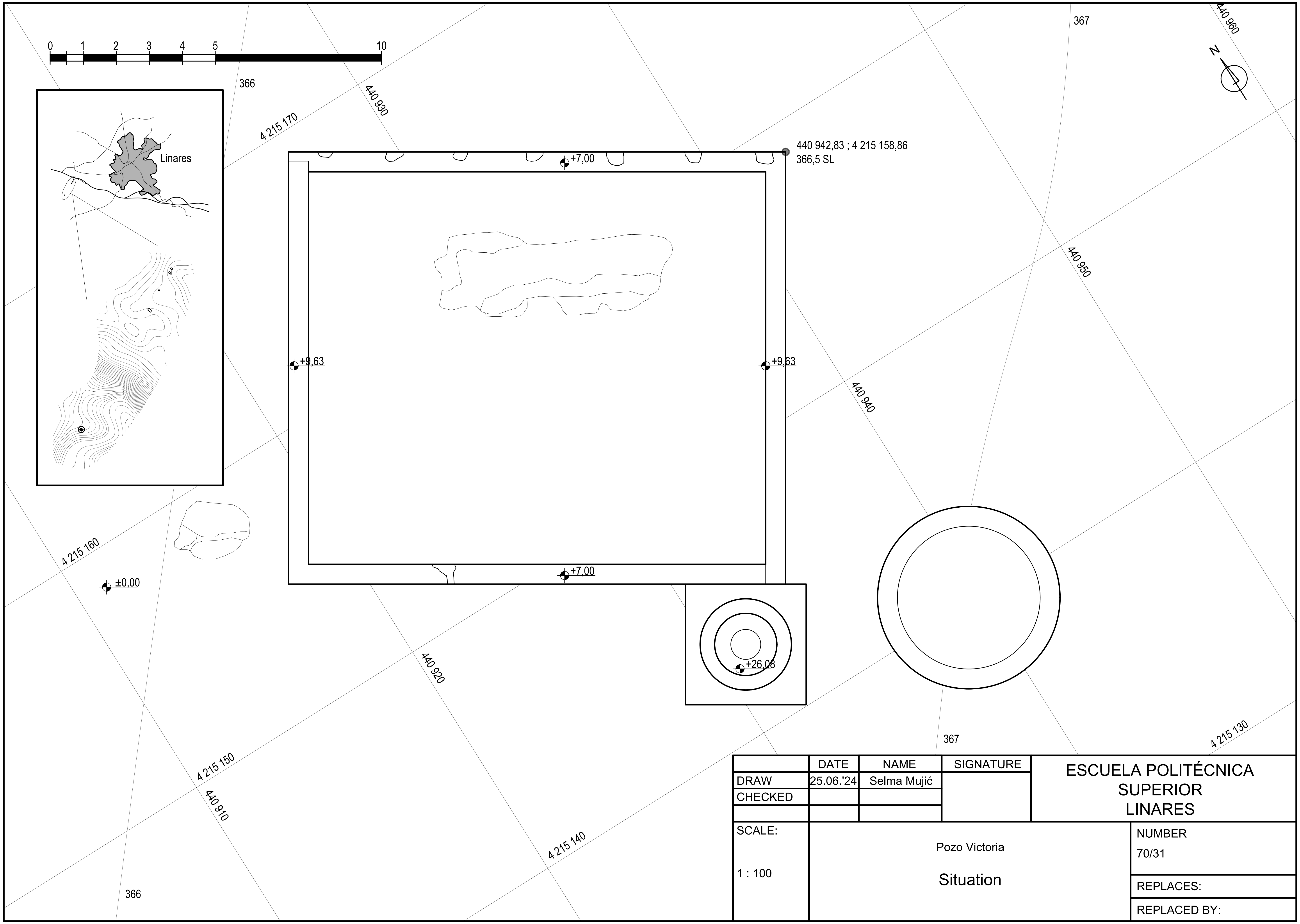


	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				
SCALE: 1 : 150	Santa Annie West Facade			NUMBER 68/31
				REPLACES:
				REPLACED BY:



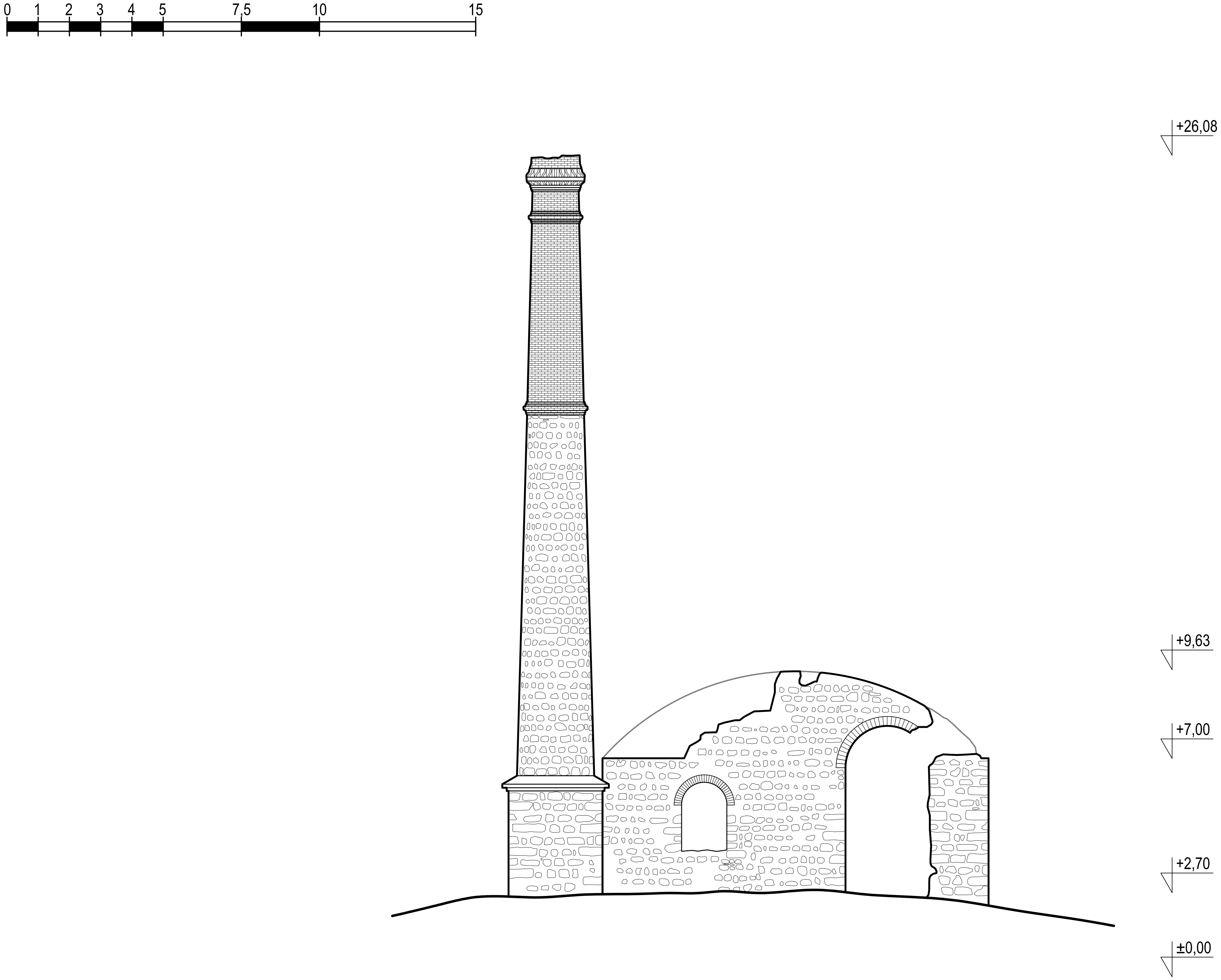
	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				

SCALE:	Pozo La Victoria Map situation	NUMBER 69/31
		REPLACES:
		REPLACED BY:

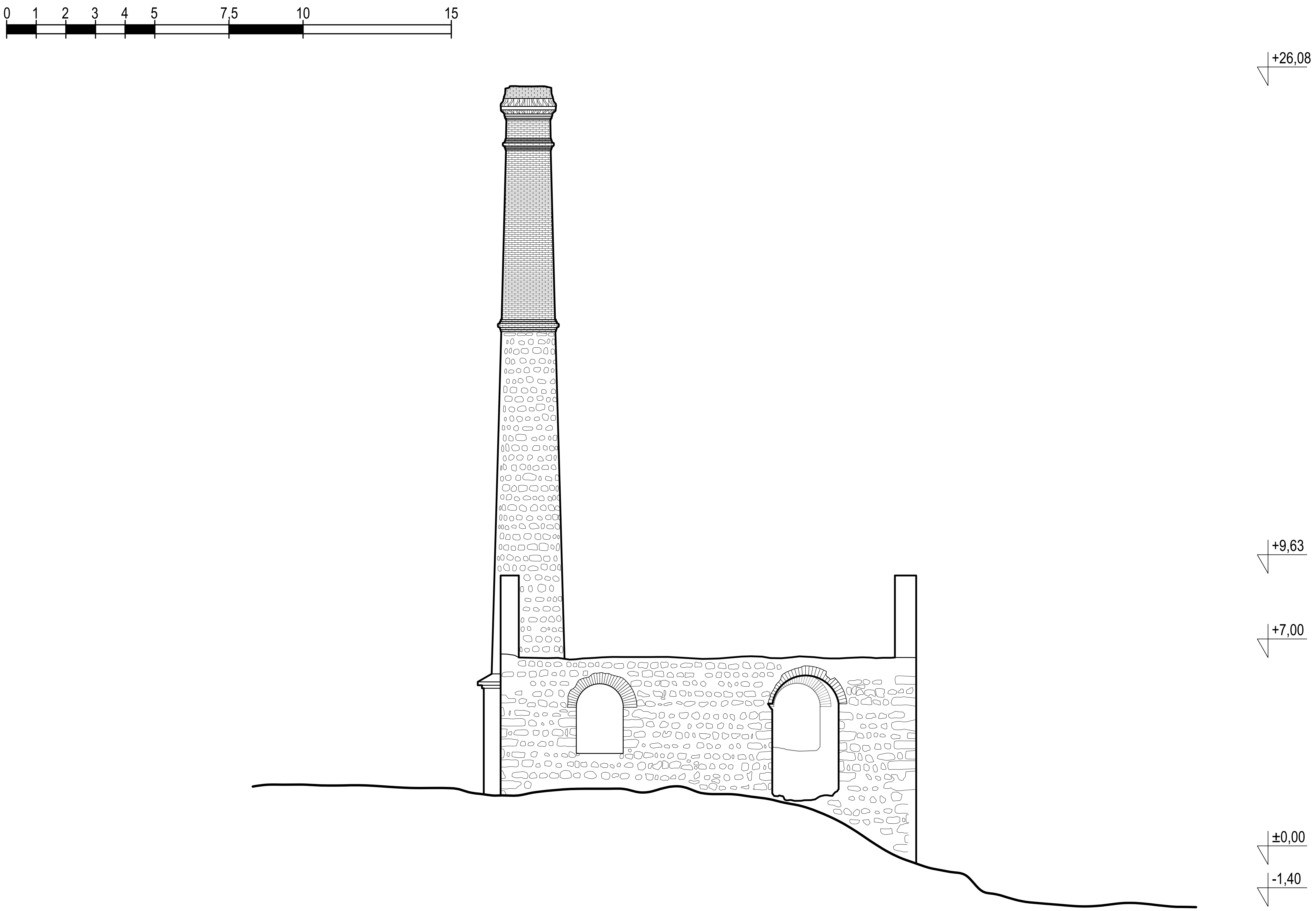


	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				

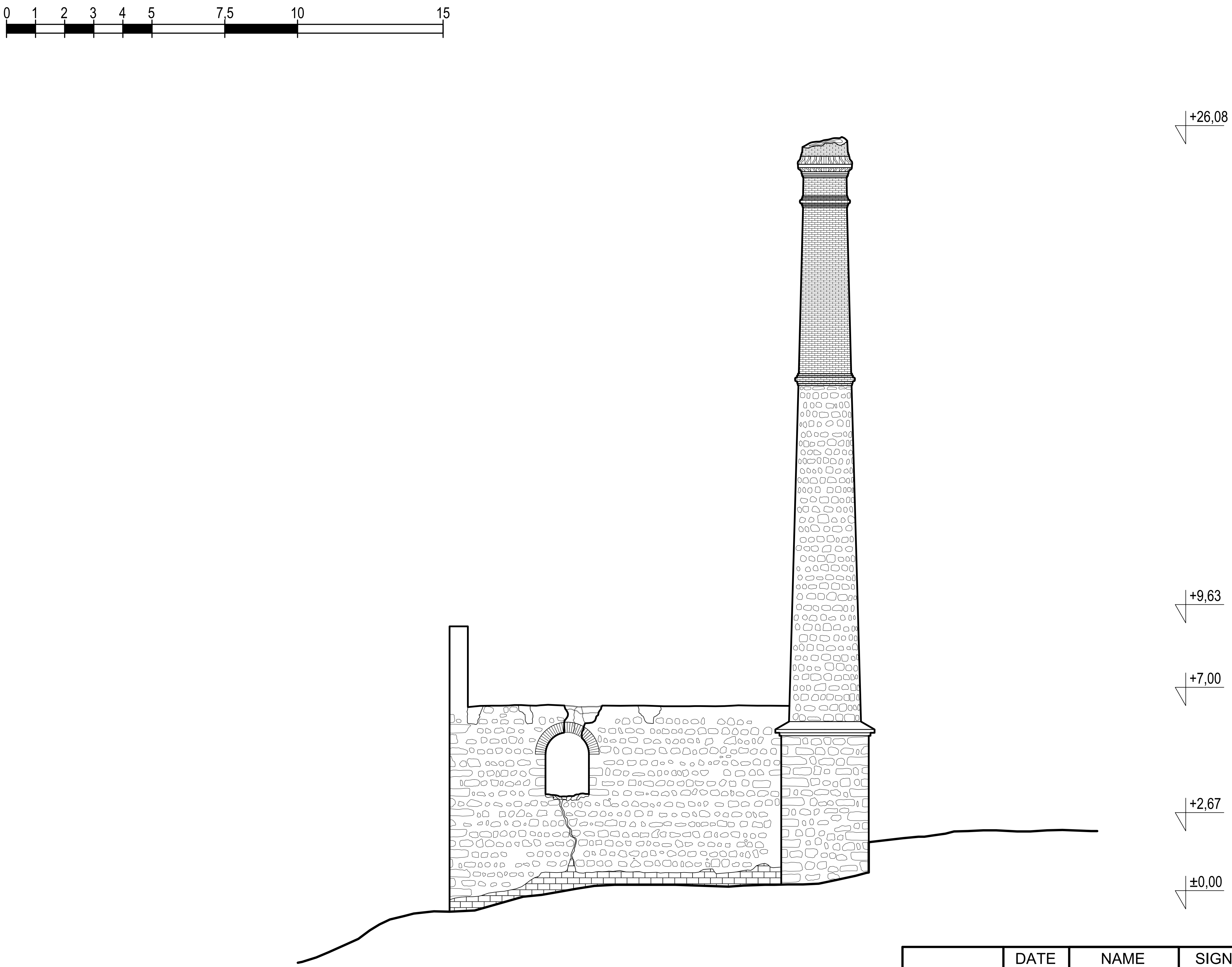
SCALE:		NUMBER
1 : 100	Pozo Victoria	70/31
	Situation	REPLACES:
		REPLACED BY:



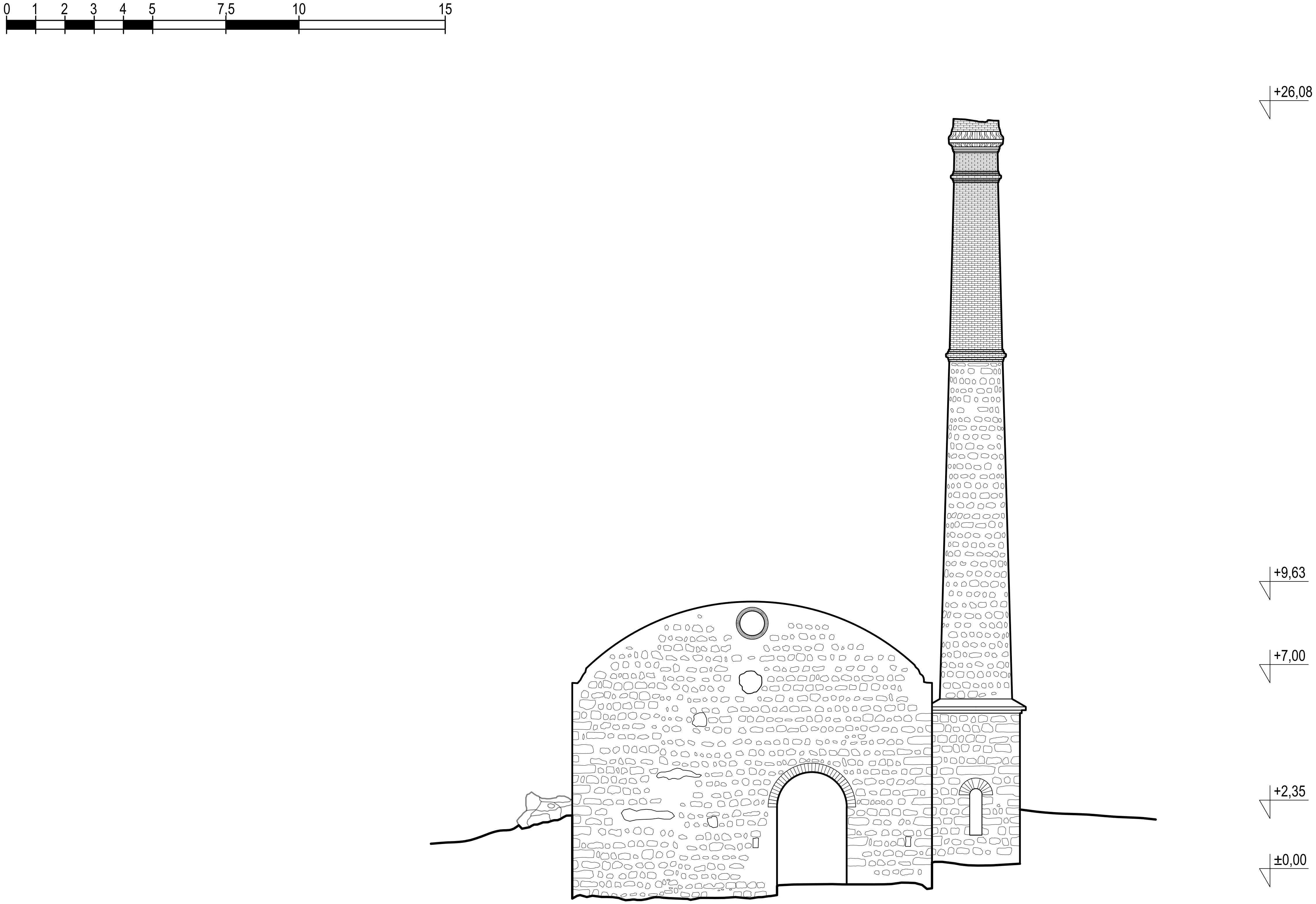
	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				
SCALE: 1 : 150	Pozo Victoria East facade			NUMBER 71/31
				REPLACES:
				REPLACED BY:



	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				
SCALE: 1 : 150	Pozo Victoria North facade			NUMBER 72/31
				REPLACES:
				REPLACED BY:



	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				
SCALE: 1 : 150	Pozo Victoria South facade			NUMBER 73/31
				REPLACES:
				REPLACED BY:



	DATE	NAME	SIGNATURE	ESCUELA POLITÉCNICA SUPERIOR LINARES
DRAW	25.06.'24	Selma Mujić		
CHECKED				
SCALE: 1 : 150	Pozo Victoria West facade			NUMBER 74/31
				REPLACES:
				REPLACED BY: