METALWORKING INDUSTRIAL PLANT

2015-2016

Location
Aïn Defla, Algeria

Client
Groupe Batimetal

Estimated Cost
35 million EUR

Stage
Detailed Design

Area
10 ha

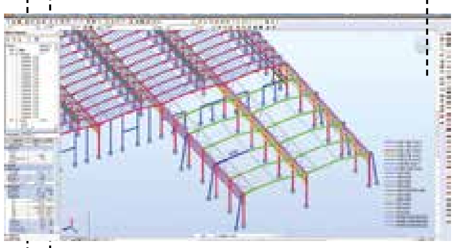
This work is inserted in the context of the expansion and internationalisation of a major Portuguese company of the metal and mechanical industry to the Algerian market. This is a market that presents very promising indexes given the development of the country, particularly in the area of metallic constructions.

The project entailed the design of an industrial unit of heavy metalworking, to manufacture steel structures and hot dip galvanising, located approximately 100 km from the capital city, Algiers. This industrial unit has close to 100 000 m² and comprises the main production buildings and the necessary facilities for the respective labour process, namely shower rooms, a lunchroom, administration facilities, a waste water treatment plant, reservoirs, access roads, networks and all other ancillary works.

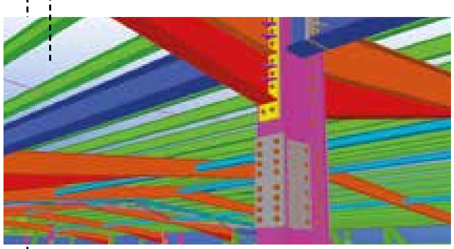
The two main buildings have an area of 21 200 m² and 16 000 m², containing a number of industrial equipment, such as overhead cranes for heavy tonnage operating simultaneously on various levels, hot dip galvanising kettle, and others. The project includes the design of all the buildings in the unit, as well as extensive refurbishing of pre-existing structures.

3D VIEW OF THE INTERIOR OF THE STRUCTURE

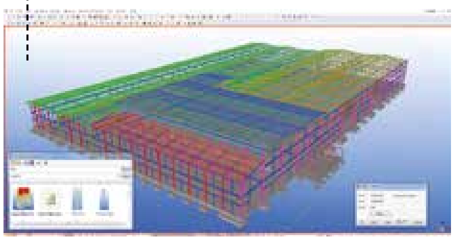
BIM STRUCTURAL MODEL (TEKLA)



DETAIL OF A PORTAL FRAME



FINITE ELEMENT MODEL OF THE STRUCTURE



OVERVIEW

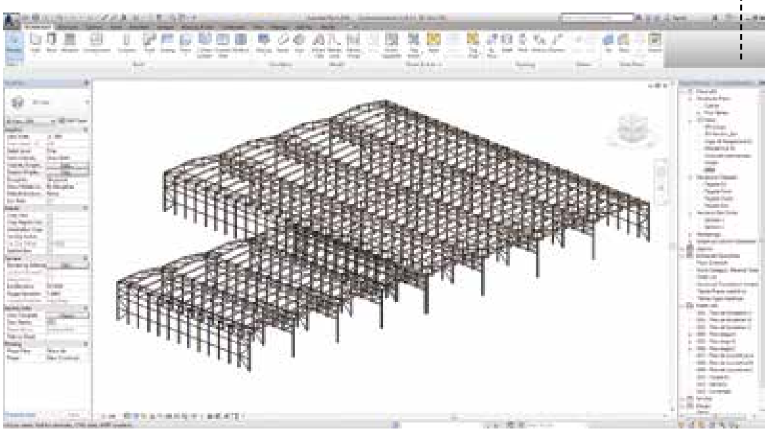
A1V2 accompanied the client from the start, having developed all the stages of the project: APD – *avant Project Sommaire* (scheme design), detailed design, technical assistance and submission to the Algerian authorities.

A1V2 is responsible for all specialties, numbering 17, from architecture, structures, hydraulics, electricity, safety, compressed air, welding gas and natural gas networks and others.

When it comes to the major challenges presented by this project, we highlight the project management itself, with the various specialties, work teams assigned to Portugal and Algeria, totaling over 40 technicians and thousands of documents and communications. Almost every team had to overcome technical challenges: the structural design of highly complex steel structures, the compatibility of the various networks, the particular innovation of hydraulics services, gas tanks, etc.

Finally, we emphasize the work methods and the use of the most recent softwares, being that the project was developed mostly in BIM, including the manufacturing models of the steel structures.

BIM STRUCTURAL MODEL
(REVIT)



METALWORKING INDUSTRIAL PLANT

2015-2016

Location
Aïn Defla, Algeria

Client
Groupe Batimetal

Estimated Cost
35 million EUR

Stage
Detailed Design

Area
10 ha

The development of the Detailed Design of this industrial plant presented several technical challenges to all 17 specialties involved. In the structural and foundations design, these challenges resulted from the size of the two main buildings of the industrial unit of heavy metalworking, manufacturing and hot-dip galvanising, of 21 200 m^2 and 16 000 m^2, where industrial machinery, a hot dip galvanising kettle and other pieces of equipment are to be installed. The design includes all the buildings in the plant, as well as the rehabilitation of pre-existing structures.

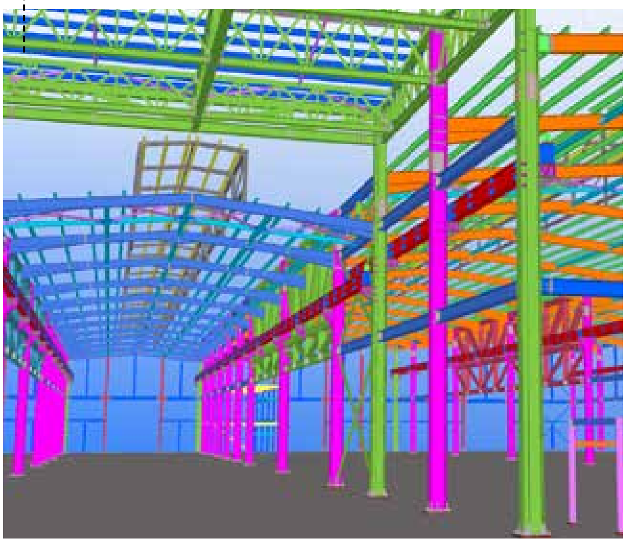
The large industrial buildings are comprised of steel portal frames with spans up to 25 m and heights up to 16 m. The structural complexity was imposed by exploration needs, allowing for up to three levels of overhead cranes for heavy tonnage, monorails, suspended structures and long clear spans.

The solutions adopted in each building illustrate the complexity of the basis of the structural design, such as imposed deflection limits, necessary to ensure machinery operability, the suppression of vertical supports to facilitate traffic flow, high temperature gradients, high level of seismic activity in the region and poor quality clay soils.

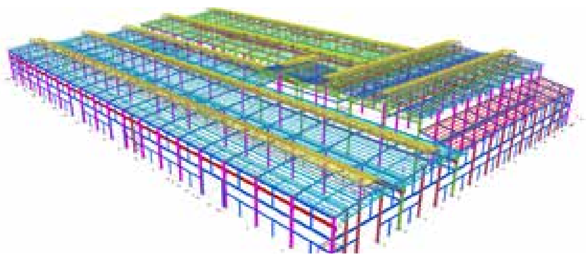
Global and small scale models were calculated for each building to assess the effects of live loads and the effects of fatigue on the superstructure and on connections. For all existing loads to be properly transmitted to the ground, direct foundations up to 2 m in depth were incorporated into the design, as well as spread and grade beam footings, thus ensuring acceptable levels of soil settling.

The remaining buildings, smaller in scale, adopted reinforced concrete solutions. These accomodate facilities that are necessary to the labour process, such as a waste water treatment plant, water storage tank and groundwater abstraction chamber.

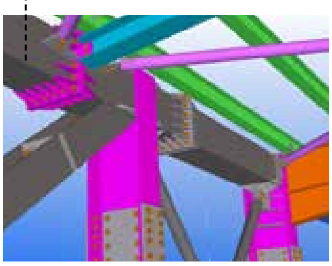
BIM STRUCTURAL MODEL (TEKLA)

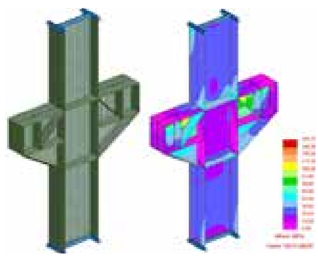


STRUCTURAL MODEL (SAP)



DETAILS OF CONNECTIONS





METALWORKING INDUSTRIAL PLANT

2015-2016

Location
Aïn Defla, Algeria

Client
Groupe Batimetal

Estimated Cost
35 million EUR

Stage
Detailed Design

Area
10 ha

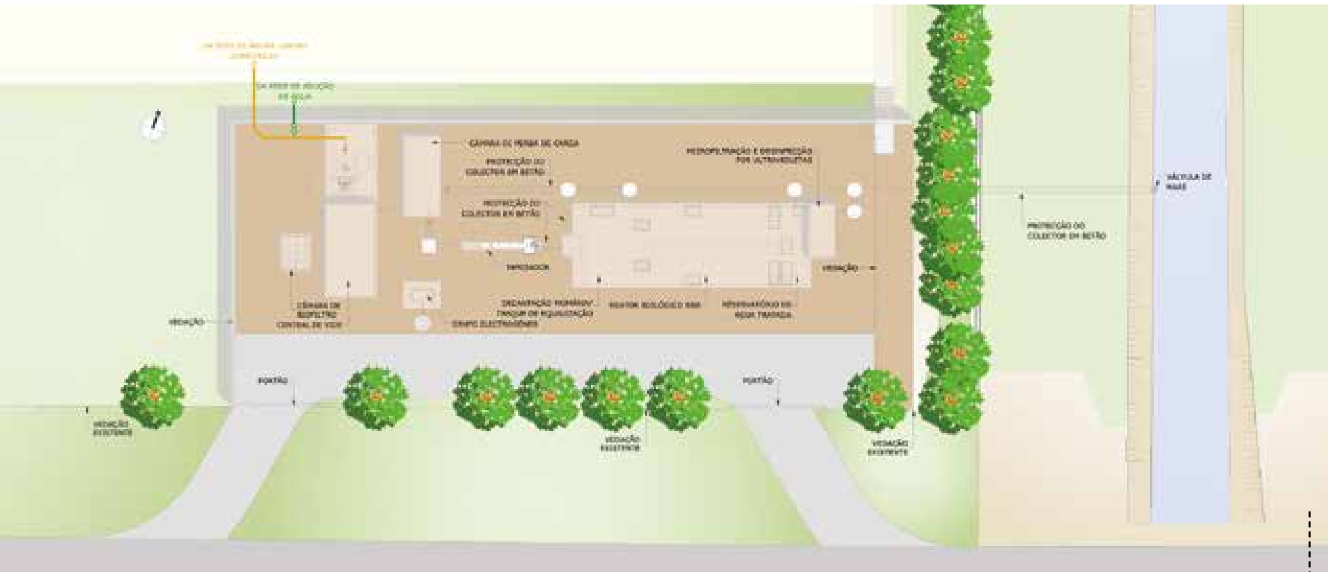
The development of the Detailed Design of this industrial plant presented several technical challenges to all 17 specialties involved. These challenges resulted from the size of the two main buildings of the industrial unit of heavy metalworking, manufacturing and hot-dip galvanising, of 21 200 m2 and 16 000 m2, where industrial machinery, a hot dip galvanising kettle and other pieces of equipment are to be installed. The "*Projet pour les bâtiments industriels d'un métallo mécanique lourd et une ligne de galvanisation à chaud*" detailed design, in Aïn Defla, Algeria, included the study of a waste water treatment plant, wastewater network, rainwater sewer network, water storage tank and groundwater abstraction.

The wastewater treatment plant (WWTP) is destined to the treatment of the effluent produced in the industrial areas. It is based on a biological treatment process.

The treatment line includes the following stages: screening, primary sedimentation, equalisation, biological treatment (biological removal of carbon, nitrogen and phosphates), secondary sedimentation, treated water discharge into storage tank, pressurisation, microfiltration, ultraviolet radiation disinfection, discharge to final destination, primary and secondary sludges storage and digestion.

The budget for this design was of approximately 256 000 EUR.

OVERVIEW OF THE COMPLEX



WWTP GROUND PLAN

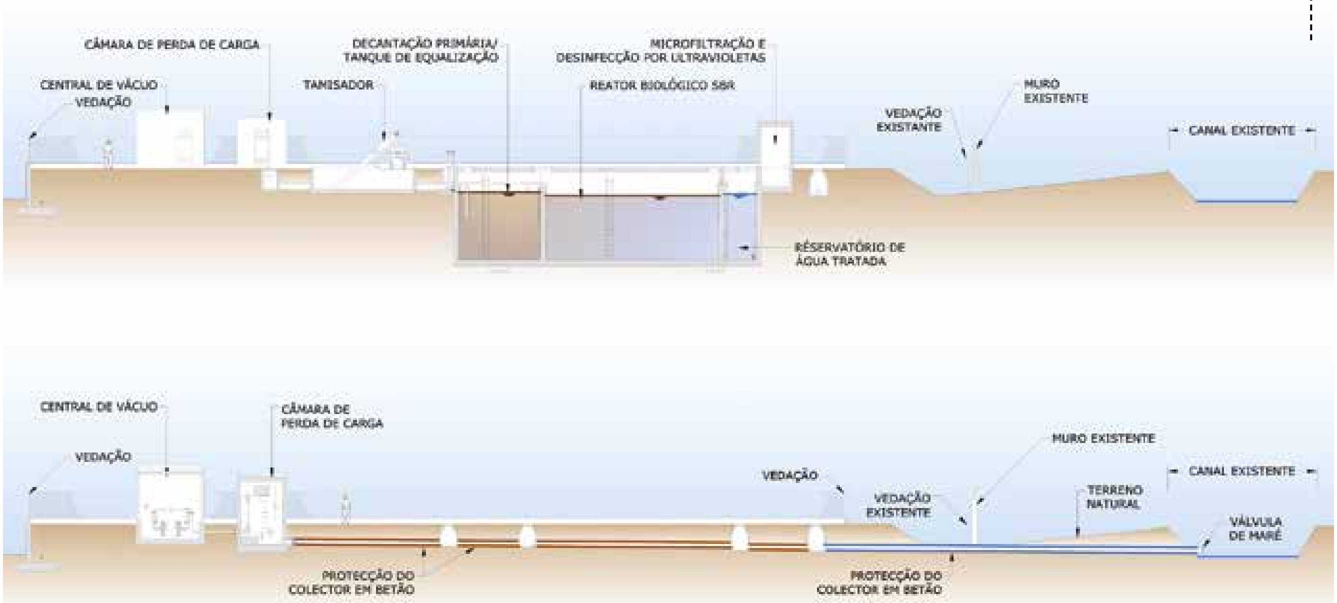
This system promotes the equalisation of the affluents and routes them to treatment throughout the day, equalising not only the flow rates but also the amount of contaminating discharges, a fundamental step towards ensuring good treatment results.

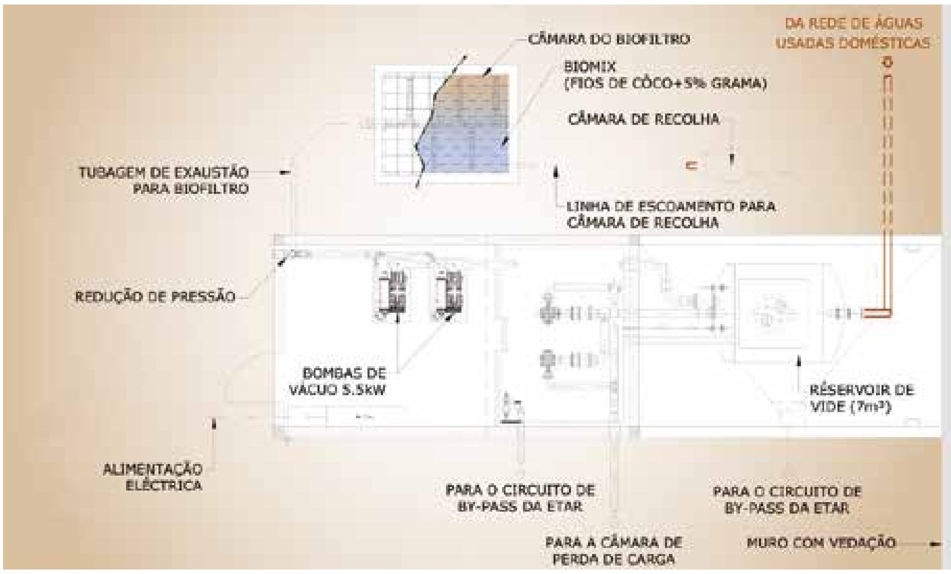
The sludges resulting from the treatment process are stabilised and subjected to anaerobic digestion, allowing for their volume to be reduced by approximately 90 %. Periodically, they will be removed through suction from the digesting/storage tank and directed to a controlled disposal site for final treatment in a municipal WWTP or to be used in agriculture as liquid fertiliser.

The final destination of the waste water after treatment is a canal that exists in the proximity of the industrial area.

The estimated cost for the hydraulic engineering project of this WWTP was of 144 628 EUR.

WWTP CROSS-SECTIONS



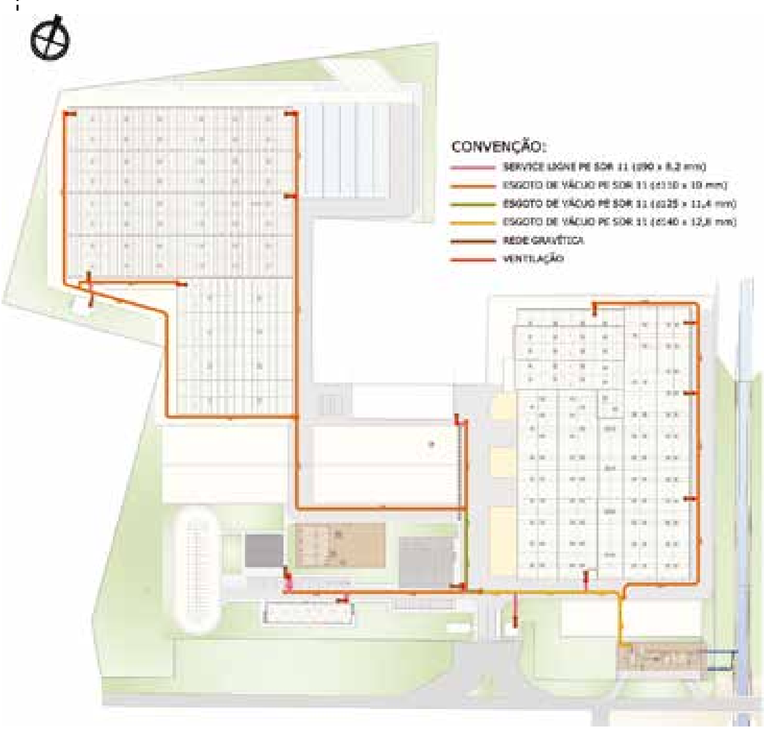


VACUUM CENTRAL SCHEMATIC

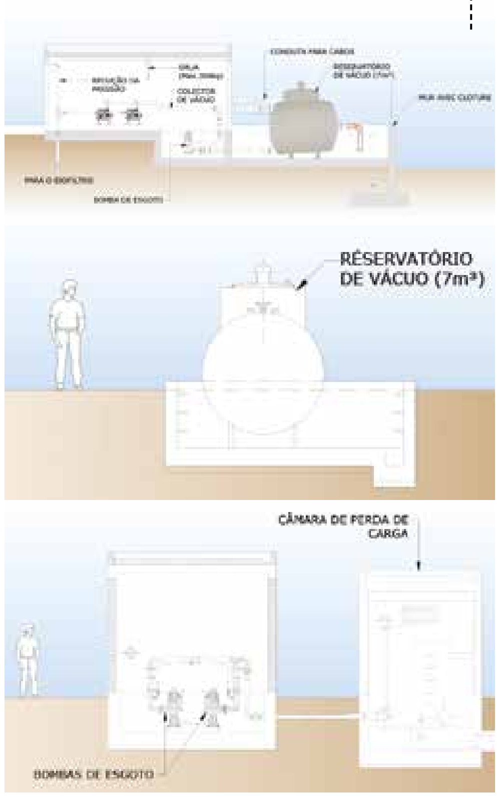
Due to the features of the terrain, a vacuum drainage system was used. What determined this choice was the possibility to circumvent any infrastructure through descending and lift pipe sections as well as the use of shallow trenches, forgoing the need for a lift station to deliver the waste to the WWTP.

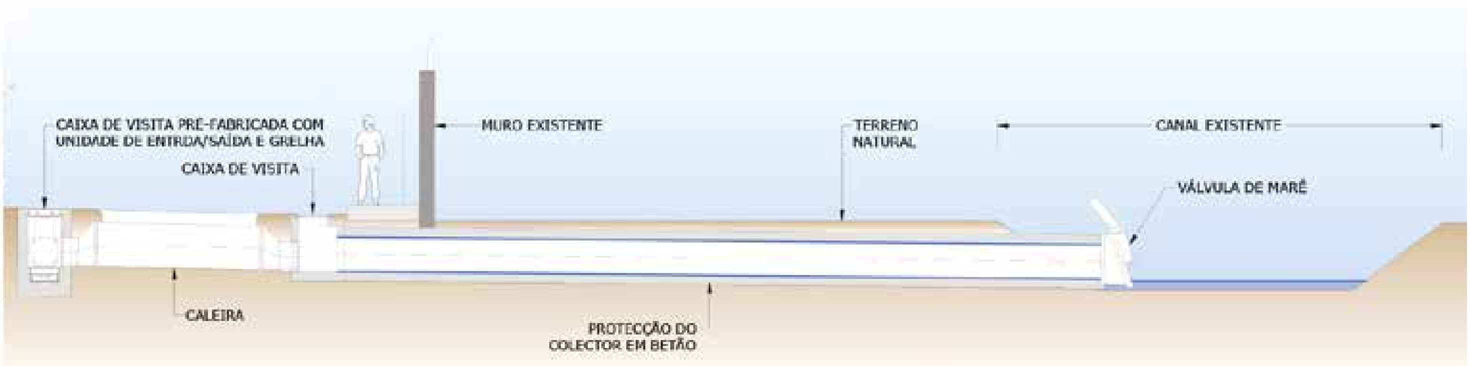
The estimated cost of this waste water vacuum drainage network was of approximately 345 000 EUR.

WASTE WATER DRAINAGE NETWORK SCHEMATIC



VACUUM CENTRAL CROSS-SECTIONS





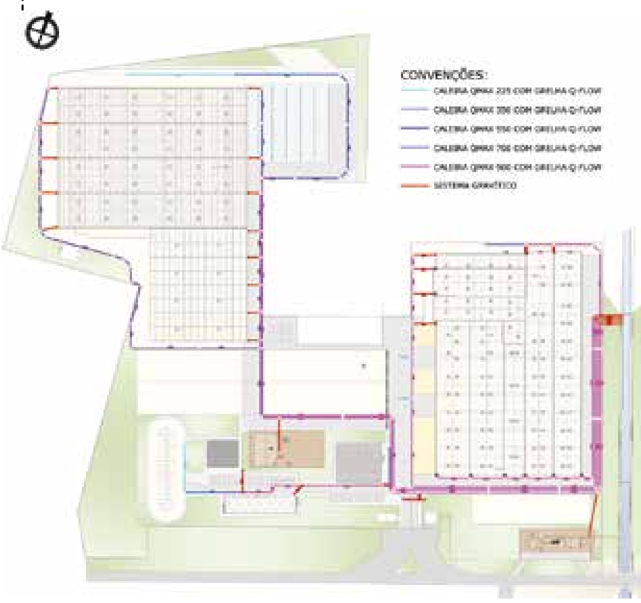
CANAL OUTLET PROFILE

Building a traditional gravity network in a flat terrain would have required the construction of deep trenches and a lift station. In order to reduce the network's execution and maintenance costs, the solution instead proposed the use of gutters with an integrated stream flow regulator.

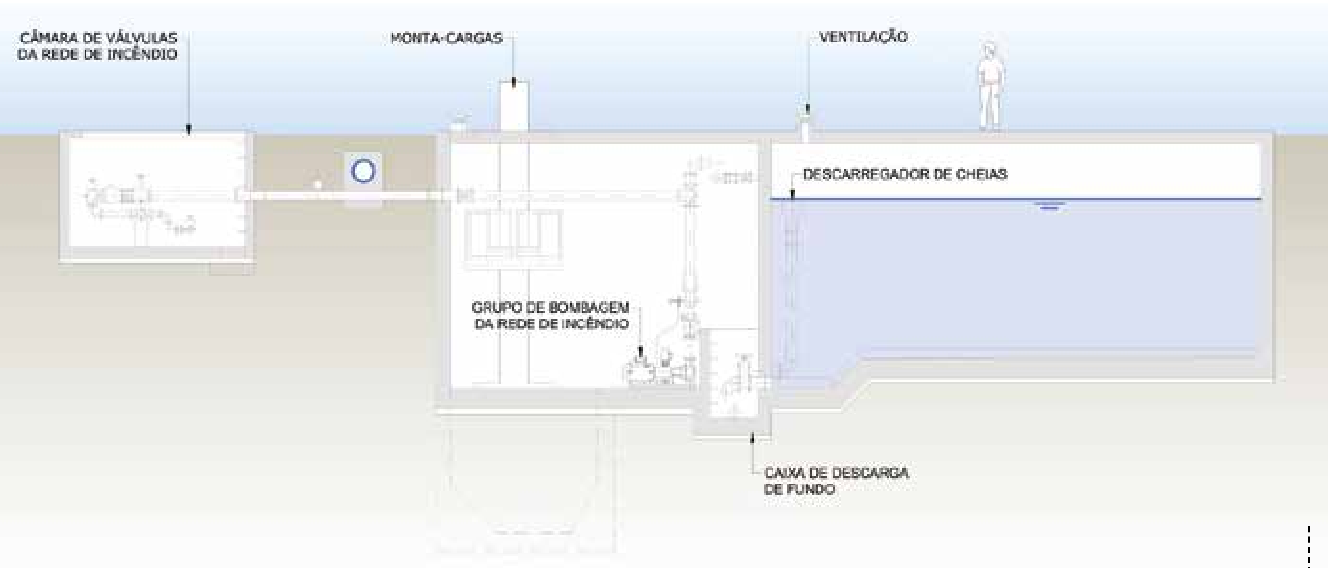
This technique allows the system to temporarily store rainwaters, enhancing the network's hydraulic capacity and simultaneously discharging the water downstream at a controlled rate. The system works as a set of small stormwater detention ponds, without the need for pumping facilities or other command devices.

The estimated cost was of approximately 1.63 million EUR.

RAINWATER SEWER SYSTEM PLAN



OUTLET TO THE CANAL



STORAGE TANK CROSS-SECTION

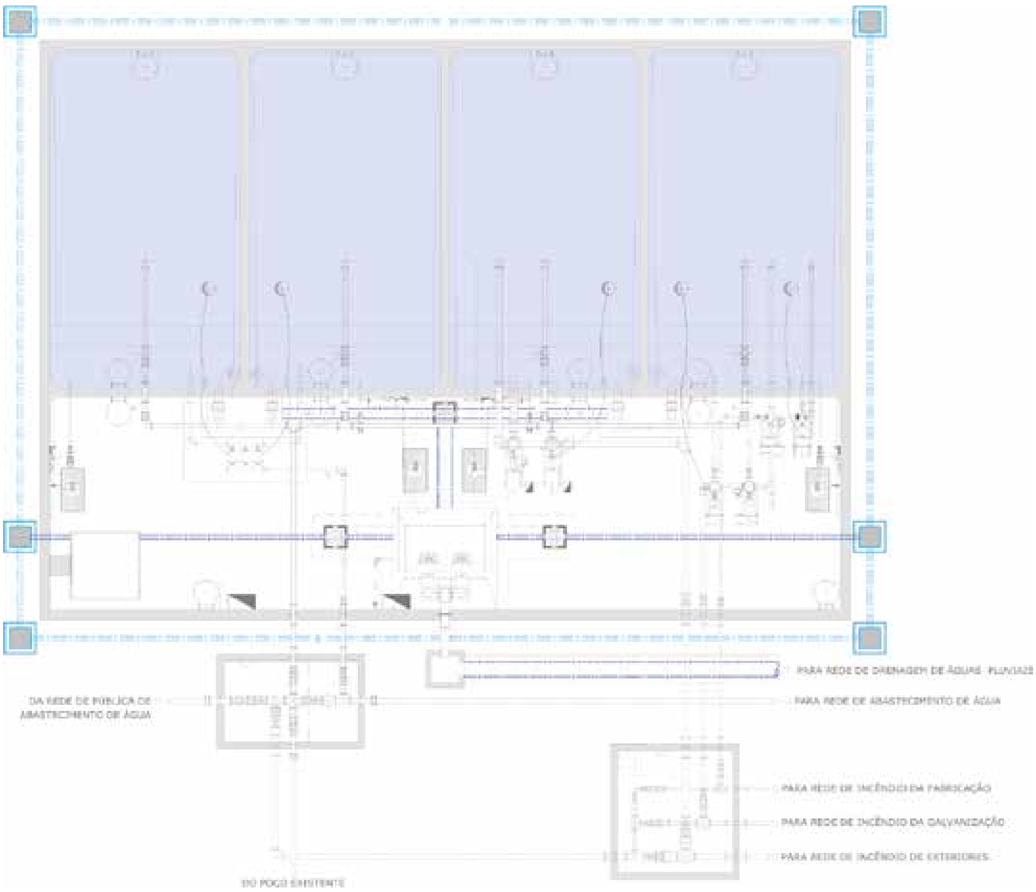
The storage tank solution was adapted to the constraints present in the available water sources as well as the drinking water and fire prevention and extinction requirements for the industrial plant. The storage tank's water supply originates in the public network and in a borehole, via by-pass. A sewage network for surface and bottom discharge flows was also included in the layout.

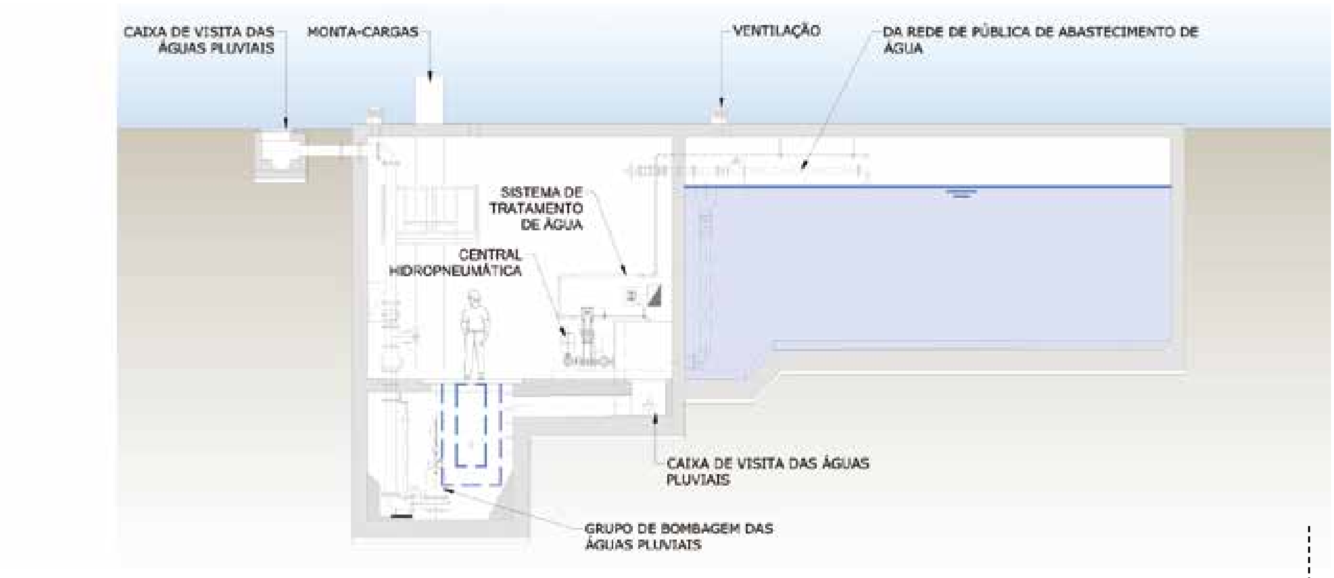
In order to keep the storage tank's maintenance and cleaning operations from interfering with the regular water supply, the tank was divided into four cells: two for drinking water supply and two for fire prevention and extinction networks.

Considering the number of employees in the industrial plant, the amount of water necessary for the preparation of meals and the specific volume of water consumed in the hot dip galvanising building, we estimated that 355 m^3 needed to be allocated to drinking water.

The estimated cost was of 569 000 EUR.

STORAGE TANK SCHEMATIC





STORAGE TANK CROSS-SECTION

According to the number and characteristics of the fire prevention and extinction devices, our estimated volume for the fire prevention portion of the storage tank was of 350 m³, amounting the full water storage tank volume to 705 m³.

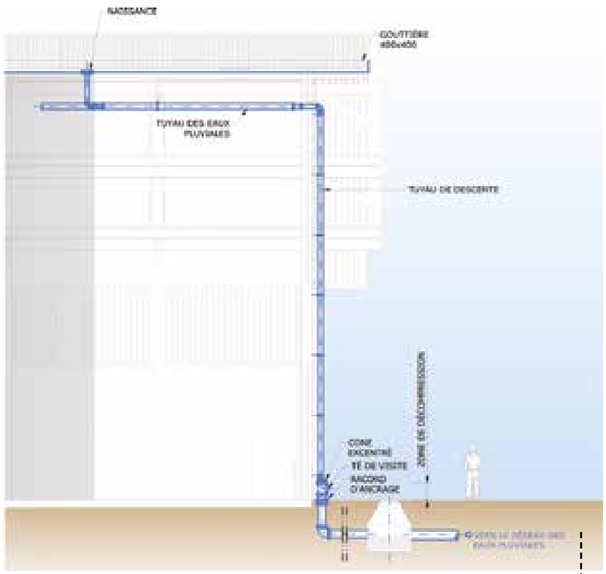
Given the parameter analysis results of the water from the borehole, a treatment system with chlorine disinfection and filtering was also projected.

To ensure water quality, the storage tank was buried underground and included all the necessary equipment: hydropneumatic central, fire suppression centrals, pumping station, access stairways, hydraulic lift platform for load elevation and manipulation, cage ladders, subsoil and storage tank wall drainage, and ventilation.

The treatment systems were installed on the storage tank, one per cell, each containing a disinfection and a filtration unit.

The estimated cost for the hydraulic engineering design of this water storage tank was of 419 709.50 EUR.

3D PREVIEW OF THE WWTP



DETAILS OF THE SYPHONIC DRAINAGE SYSTEM

A syphonic drainage system, rather than a gravity drainage system, was implemented on the roof of the "Fabrication" building, which covers an area of 19 073 m^2.

In this system, the air is prevented from entering the pipes by means of a special roof outlet with an anti-vortex mechanism that creates negative pressure and subsequent suction effect, facilitating flow and accelerating the draining process. The absence of air allows the pipes to run completely full. It also allows for a reduction in their diameters.

The estimated cost was of 59 000 EUR.

The solution developed for the rehabilitation of groundwater abstraction kept the location of the original borehole, renovating the remaining infrastructures and equipment.

The borehole was cased with 225 mm diameter PVC pipes with blind flanges. Between the preexisting hole (internal diameter of 320 mm) and the new pipes (external diameter of 250 mm) grout was applied with the approximate length of the casing. The space between the designed case and the preexisting one was filled with cement.

GROUNDWATER ABSTRACTION