

Requirements for the Automation Design of a Water Supply Pumping Station

1. Date of Requirement:

Date: 04 / July / 2025

2. Project Title:

Automation Design of Water Pumping Station

Station Name: Funicular II

3. Project Objective:

The objective of the project is to develop an automation design for the existing pumping station, which will provide automatic control of the pumps, remote monitoring, and data logging. Additionally, it is necessary to design and develop protection systems for the station, including fire safety, surveillance, and flood protection.

4. Description of the Current Situation:

The station currently operates in manual mode. The pumps are controlled manually by operators, which increases the risk of errors and inefficient operation of the pumping station.

5. Scope of Design:

- Technical assessment of the current condition of the station.
- Development of the automation solution architecture.
- Planning of the SCADA/HMI system.
- Selection and placement of sensors and control elements.
- Definition of communication channels and protocols.
- Development of electrical/control system plans (CAD/schematics).

- Specification of required devices and materials for the project.
 - Determination of the project budget.
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6. Expected Outcomes:

- Completed project documentation.
 - System block diagram and technical drawings.
 - Creation of SCADA/HMI architecture design.
 - Definition of the list of materials required for automation.
 - Specification of technical requirements.
 - Development of the project implementation plan.
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7. Estimated Completion Time:

8. Technical and Contact Persons:

- Project Manager: Valeri Khachidze
 - Technical Coordinator: Levan Jamagidze: +995 558 33 17 33 / Erekle Matiashvili: +995 591 97 72 77
 - Company/Department Name: GWP / Pumping Stations Department
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9. Notes and Additional Requirements:

10. Annexes:

- Location of the station.

- Situational layout of the station.
- Technical assignment.

Google Maps

41°41'38.3"N 44°46'40.5"E

Location of the station



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41°41'38.3"N 44°46'40.5"E

მიმართულე
ბეზი

შენახვა



ახლომდებარე

ტელეფონზე
გაგზავნა

გაზიარება



MQVH+H5M თბილისი

Live ტრაფიკი

სწრაფი  ნელი

Situation layout of the station

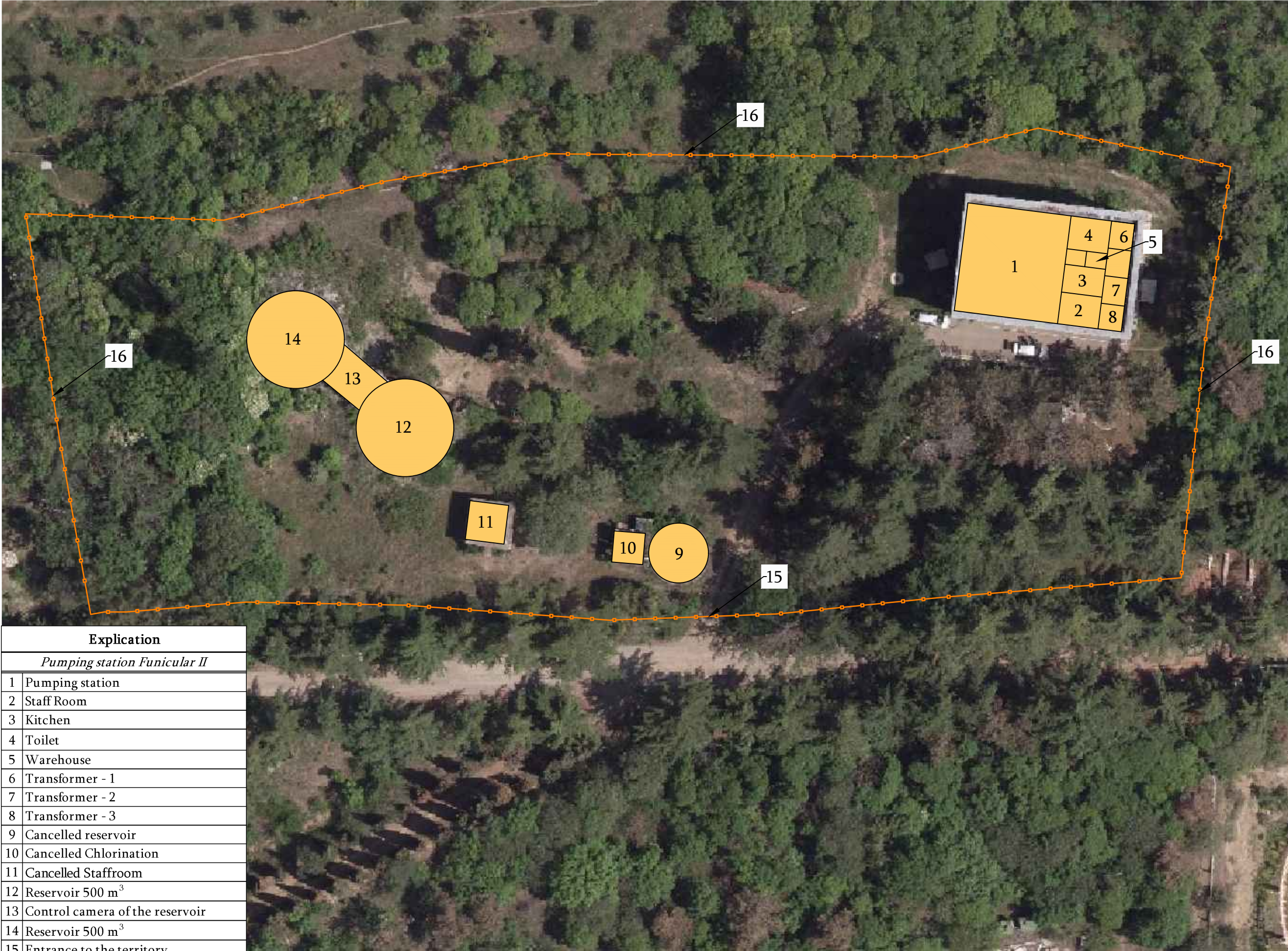
Pumping station "Funicular II"

Situational part




Pumping station "Funicular II"

Situation scheme of the territory

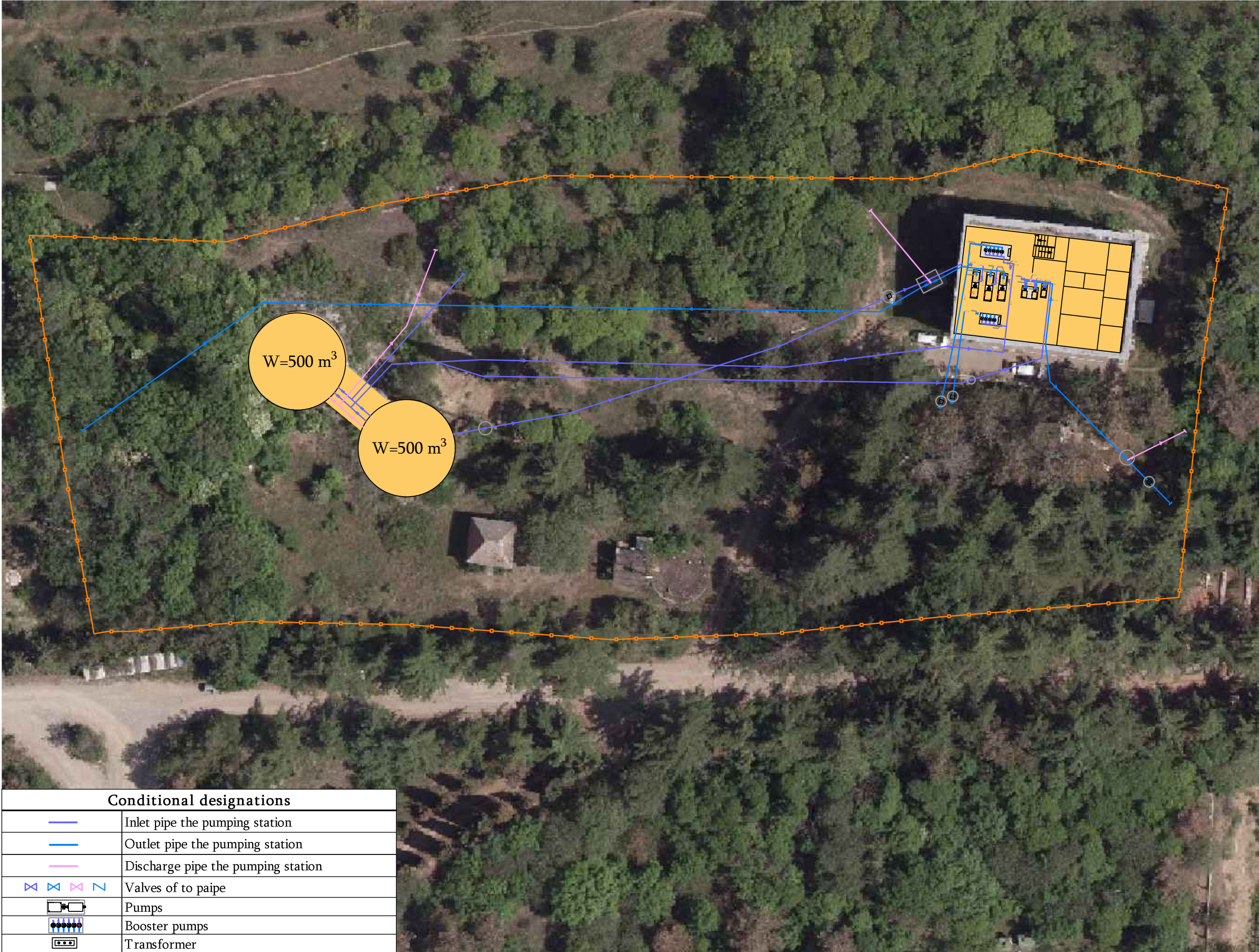


| Explication | |
|------------------------------|---------------------------------|
| Pumping station Funicular II | |
| 1 | Pumping station |
| 2 | Staff Room |
| 3 | Kitchen |
| 4 | Toilet |
| 5 | Warehouse |
| 6 | Transformer - 1 |
| 7 | Transformer - 2 |
| 8 | Transformer - 3 |
| 9 | Cancelled reservoir |
| 10 | Cancelled Chlorination |
| 11 | Cancelled Staffroom |
| 12 | Reservoir 500 m ³ |
| 13 | Control camera of the reservoir |
| 14 | Reservoir 500 m ³ |
| 15 | Entrance to the territory |
| 16 | Fence of the territory |


| | | | |
|--|--------|------------------------|--|
| Project code | | GWP - 0006 | |
| Cadastral code | | N 01.15.01.003.006 | |
| Address | | Nearby Mtatsminda Park | |
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| Performer | | | |
| Ltd. Georgian Water and Power | | | |
| Tbilisi, Kostava I Turn #33 | | | |
| Operations Planning and Budgeting Division | | | |
| Notes | | | |
| Project Name | | | |
| To make situation scheme of pumping station "Funicular II" | | | |
| Drawing Name | | | |
| Situation scheme of the territory | | | |
| Performer | | Shota Metreveli | |
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Pumping station "Funicular II"

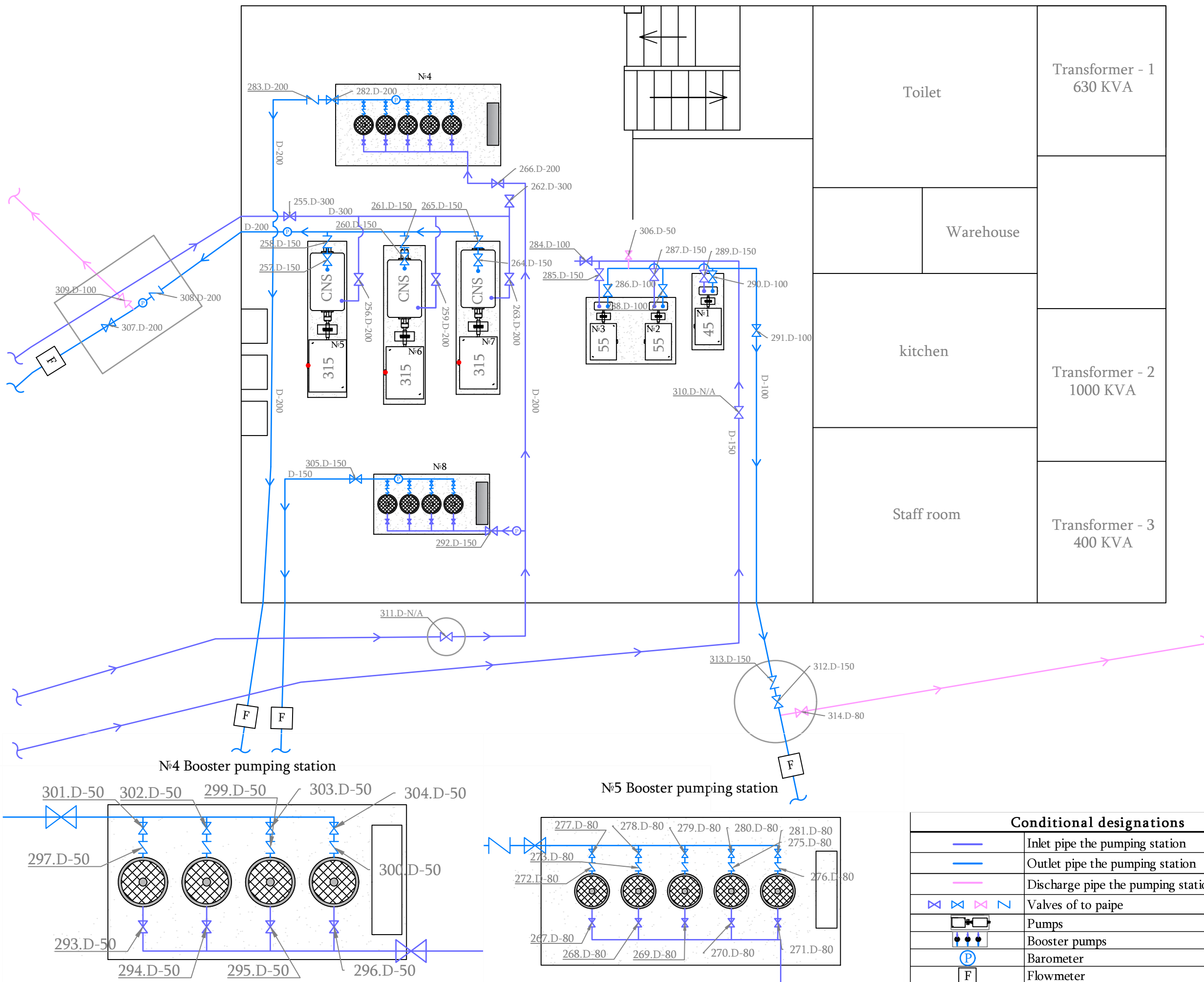
Situation scheme of the PipeLine




| Conditional designations | |
|--------------------------|------------------------------------|
| | Inlet pipe the pumping station |
| | Outlet pipe the pumping station |
| | Discharge pipe the pumping station |
| | Valves of to paipe |
| | Pumps |
| | Booster pumps |
| | Transformer |

| | | | |
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| Project code | | GWP - 0006 | |
| Cadastral code | | N 01.15.01.003.006 | |
| Address | | Nearby Mtatsminda Park | |
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| Drawing Name | | | |
| Situation scheme of the territory | | | |
| Performer | | Shota Metreveli | |
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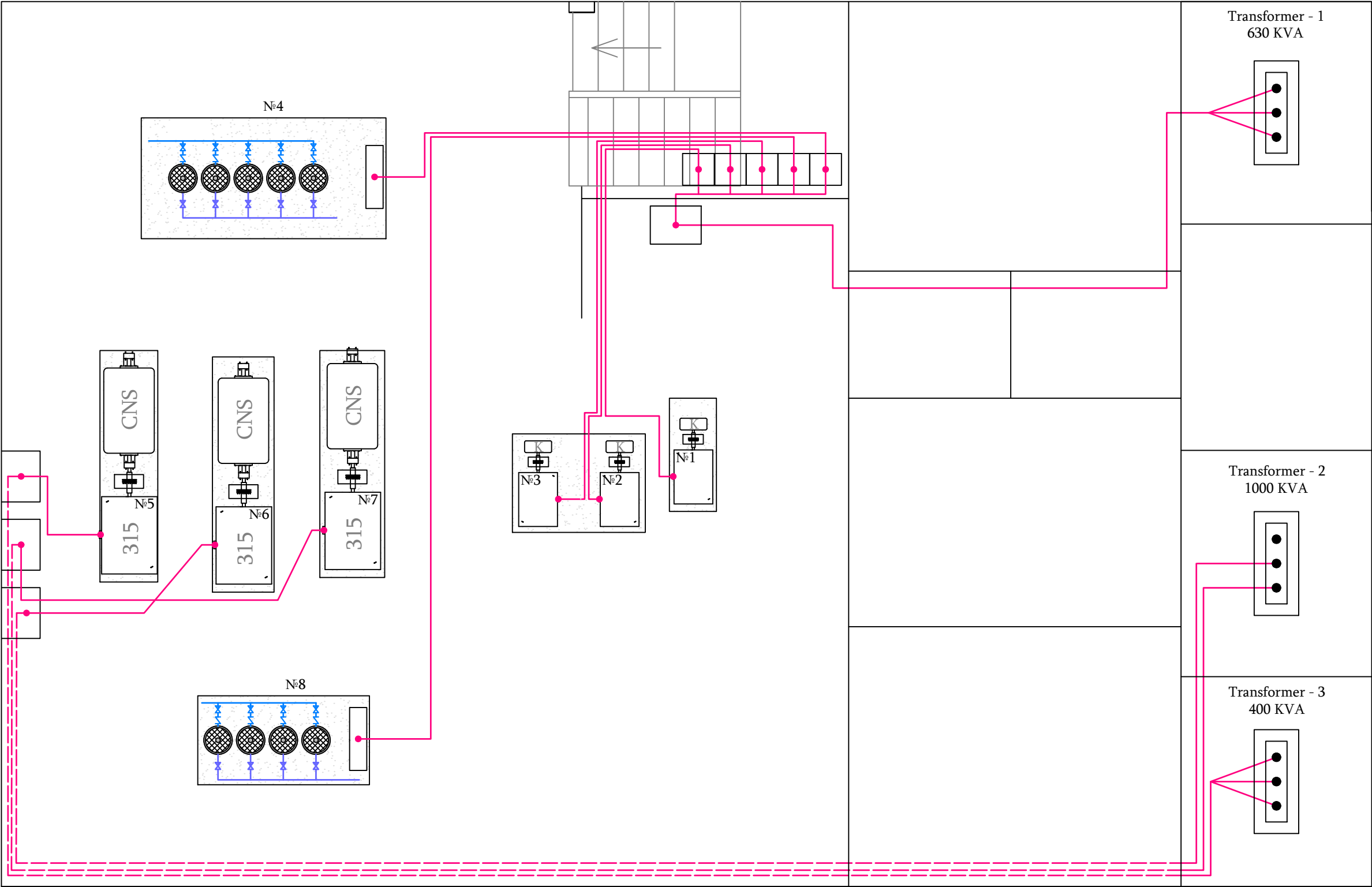
Situation scheme of the pumping station



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|---|------------------------|-----------------|
| Project code | GWP - 0006 | |
| Cadastral code | N 01.15.01.003.006 | |
| Address | Nearby Mtatsminda Park | |
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| Performer | | |
| <p>Ltd. Georgian Water and Power</p> <p>Tbilisi, Kostava I Turn #33</p> <p>Operations Planning and Budgeting Division</p> | | |
| Notes | | |
| <p>Project Name</p> <p>To make situation scheme of pumping station "Funicular II"</p> | | |
| Drawing Name | | |
| <p>Situation scheme of the pumping station</p> | | |
| Performer | | Shota Metreveli |
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Pumping station "Funicular II"

Electrical Situation scheme of the
pumping station



| Conditional designations | |
|--------------------------|------------------|
| | Low voltage line |
| | Pumps |
| | Booster pumps |
| | Transformer |

| | |
|----------------|------------------------|
| Project code | GWP - 0006 |
| Cadastral code | N 01.15.01.003.006 |
| Address | Nearby Mtatsminda Park |



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| Performer |
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| Tbilisi, Kostava I Turn #33 |
| Operations Planning and Budgeting Division |

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| Project Name |
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To make situation scheme of
pumping station "Funicular II"

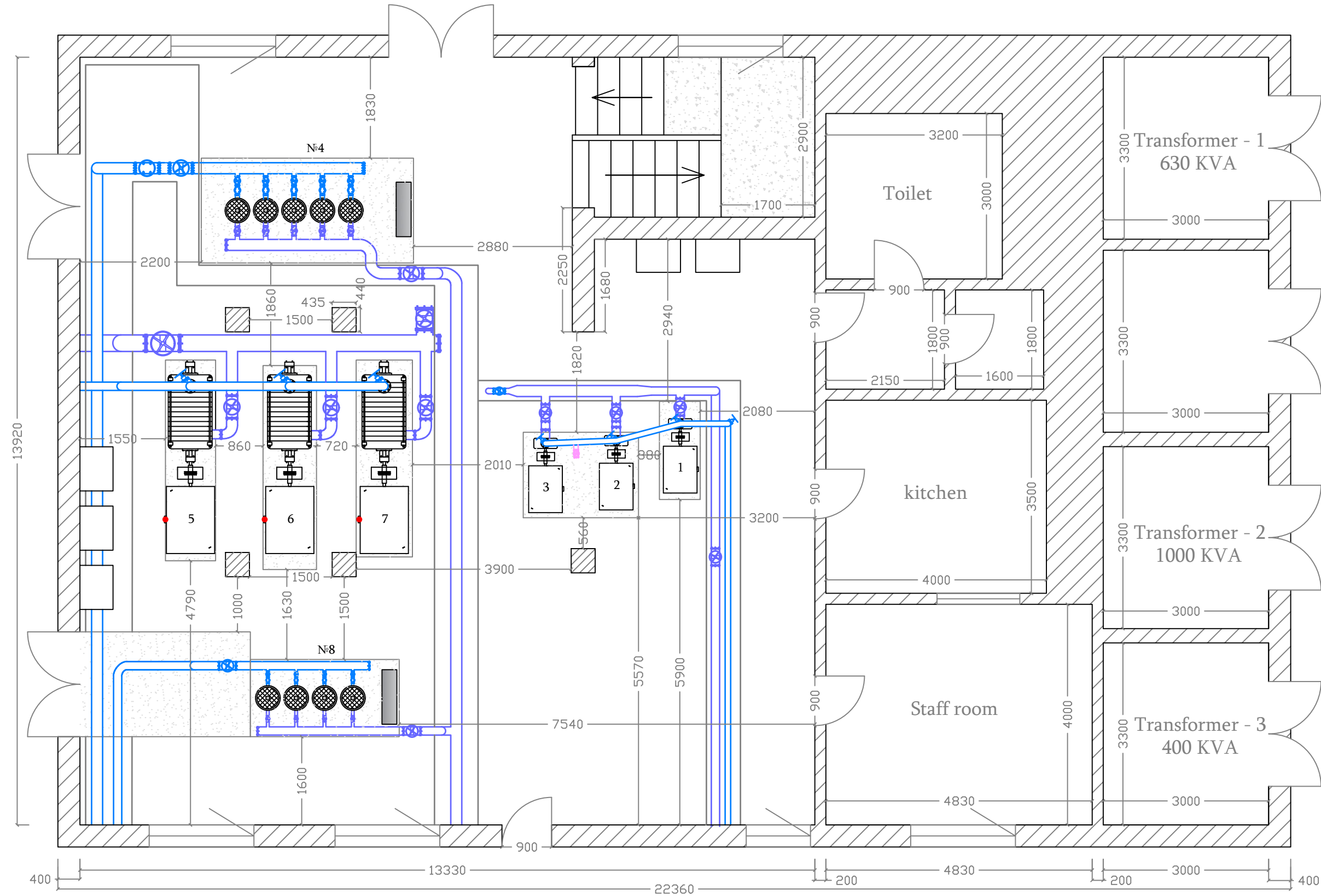
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| Drawing Name |
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Electrical Situation
scheme of the pumping
station

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| Performer | Shota Metreveli | |
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Pumping station "Funicular II"

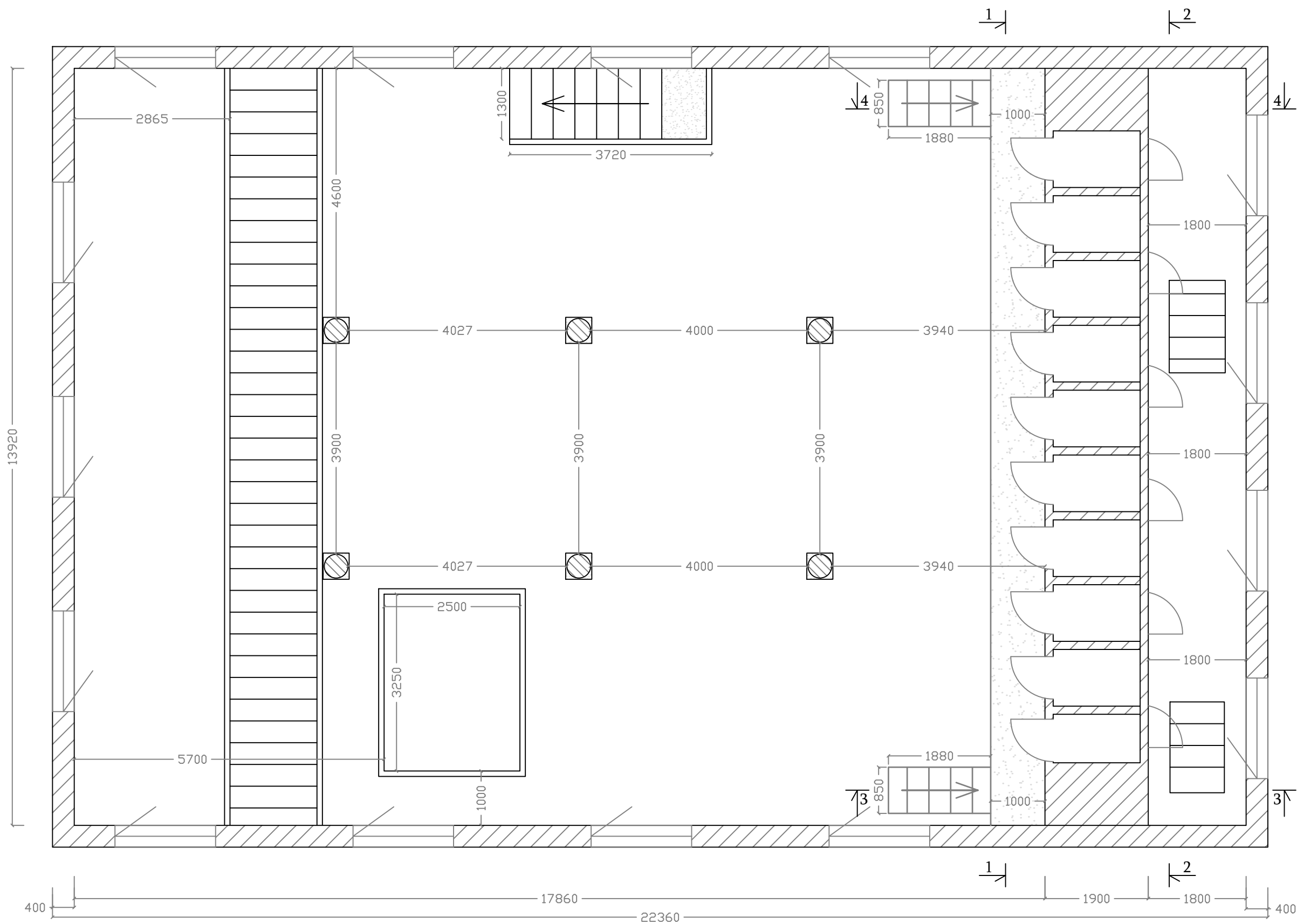
First floor plan of the pumping station



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| Project code | GWP - 0006 | | |
| Cadastral code | N 01.15.01.003.006 | | |
| Address | Nearby Mtatsminda Park | | |
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| Performer | | | |
| Ltd. Georgian Water and Power | | | |
| Tbilisi, Kostava I Turn #33 | | | |
| Operations Planning and Budgeting Division | | | |
| Notes | | | |
| Project Name | | | |
| To make situation scheme of pumping station "Funicular II" | | | |
| Drawing Name | | | |
| First floor plan of the pumping station | | | |
| Performer | | Shota Metreveli | |
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Pumping station "Funicular II"

Second floor plan of the pumping station



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| Address | Nearby Mtatsminda Park |



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| Performer | Ltd. Georgian Water and Power |
| | Tbilisi, Kostava I Turn #33 |
| | Operations Planning and Budgeting Division |
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| Project Name | To make situation scheme of pumping station "Funicular II" |
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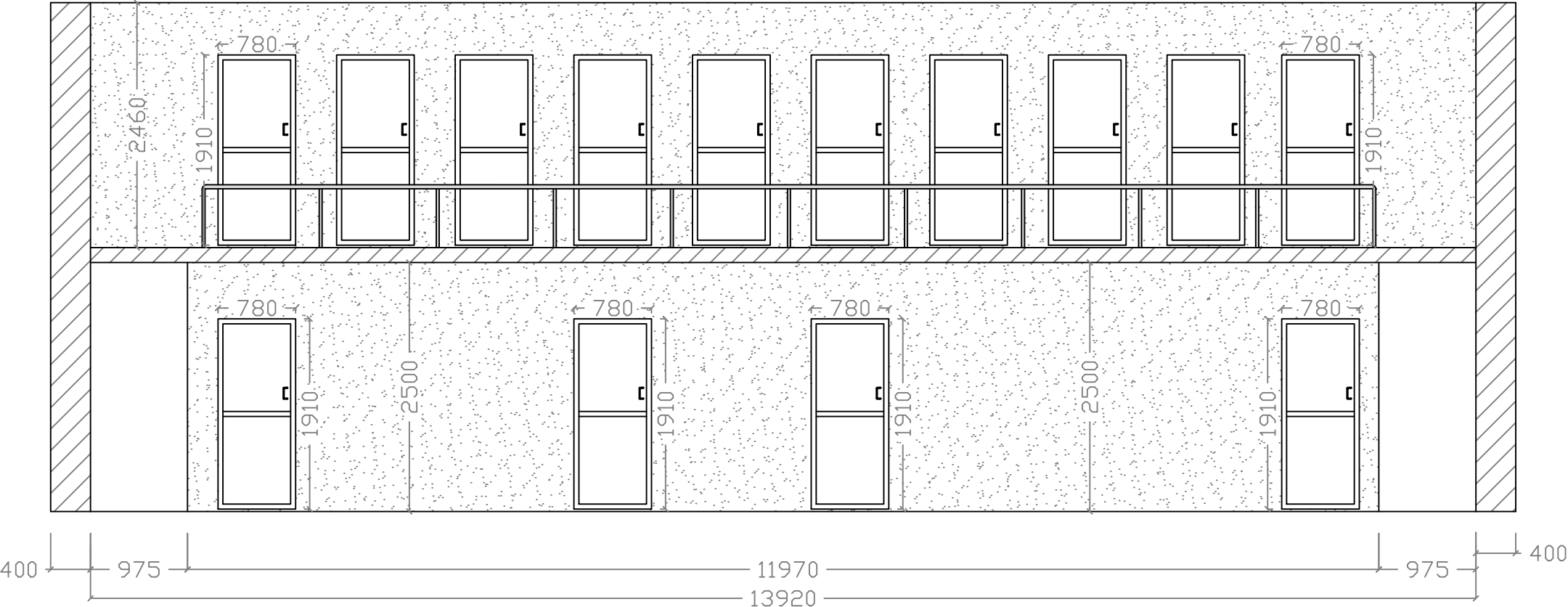
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| Drawing Name | Second floor plan of the pumping station |
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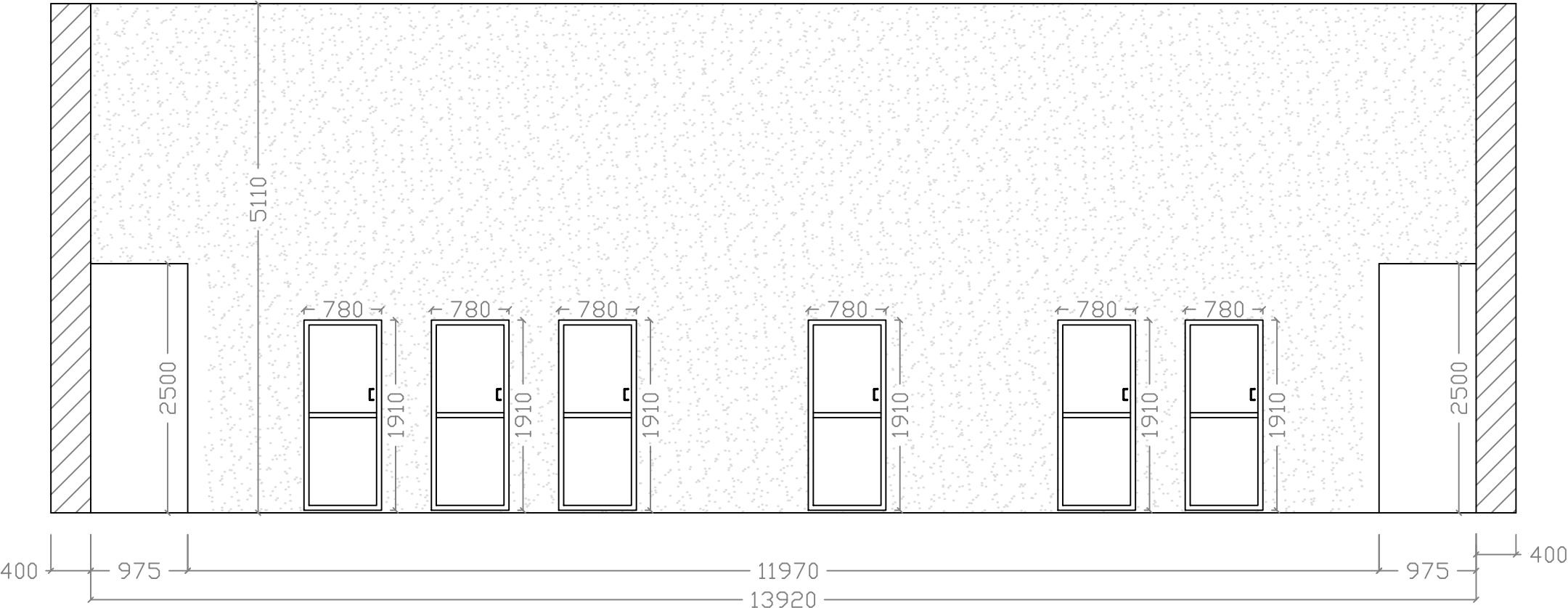
Pumping station "Funicular II"


longitudinal sections

longitudinal section 1 - 1



longitudinal section 2 - 2

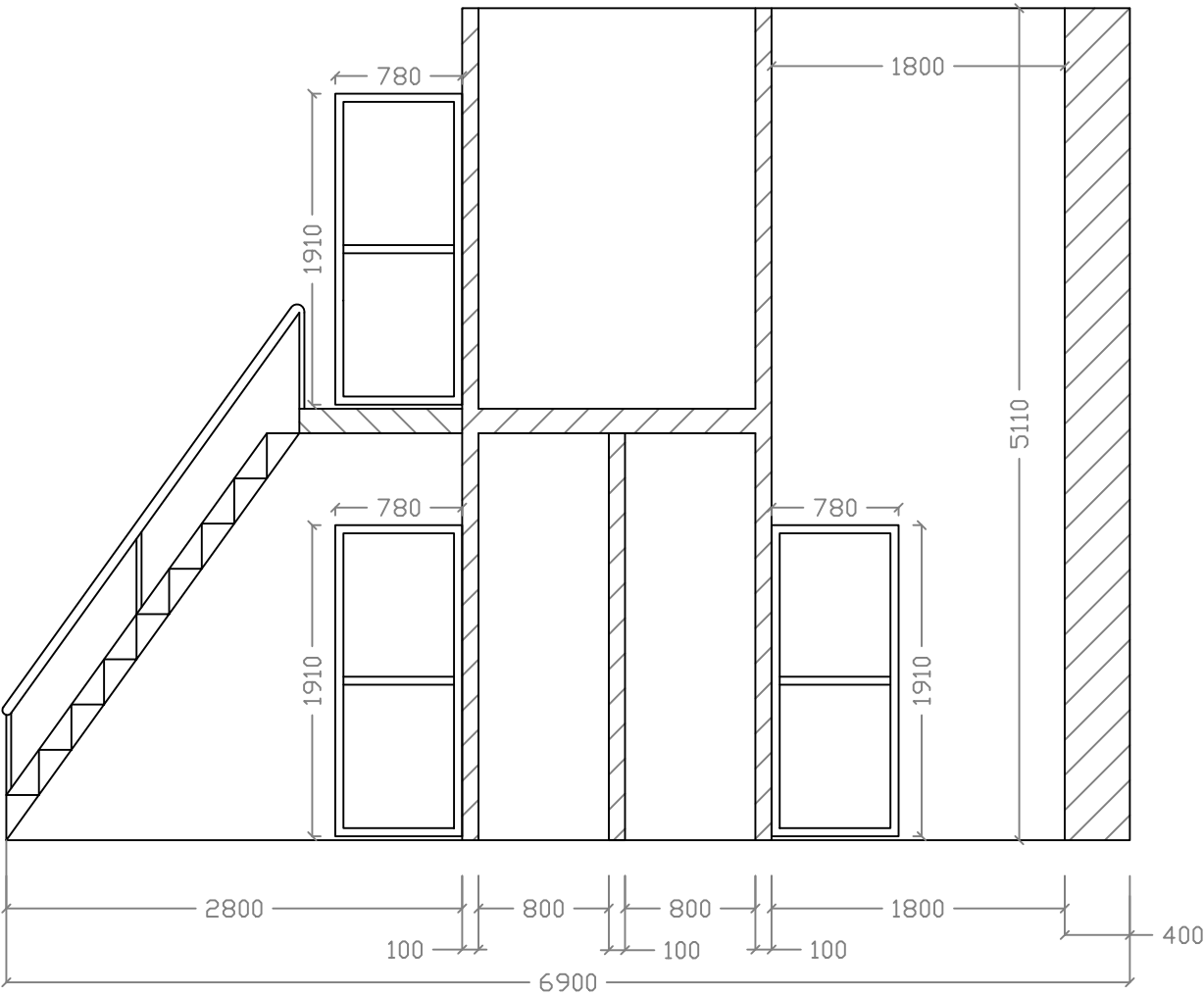


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| Project code | GWP - 0006 | | |
| Cadastral code | N 01.15.01.003.006 | | |
| Address | Nearby Mtatsminda Park | | |
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| Ltd. Georgian Water and Power Tbilisi, Kostava I Turn #33 Operations Planning and Budgeting Division | | | |
| Notes | | | |
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| Project Name | | | |
| To make situation scheme of pumping station "Funicular II" | | | |
| Drawing Name | | | |
| longitudinal section 1 - 1 longitudinal section 2 - 2 | | | |
| Performer | | Shota Metreveli | |
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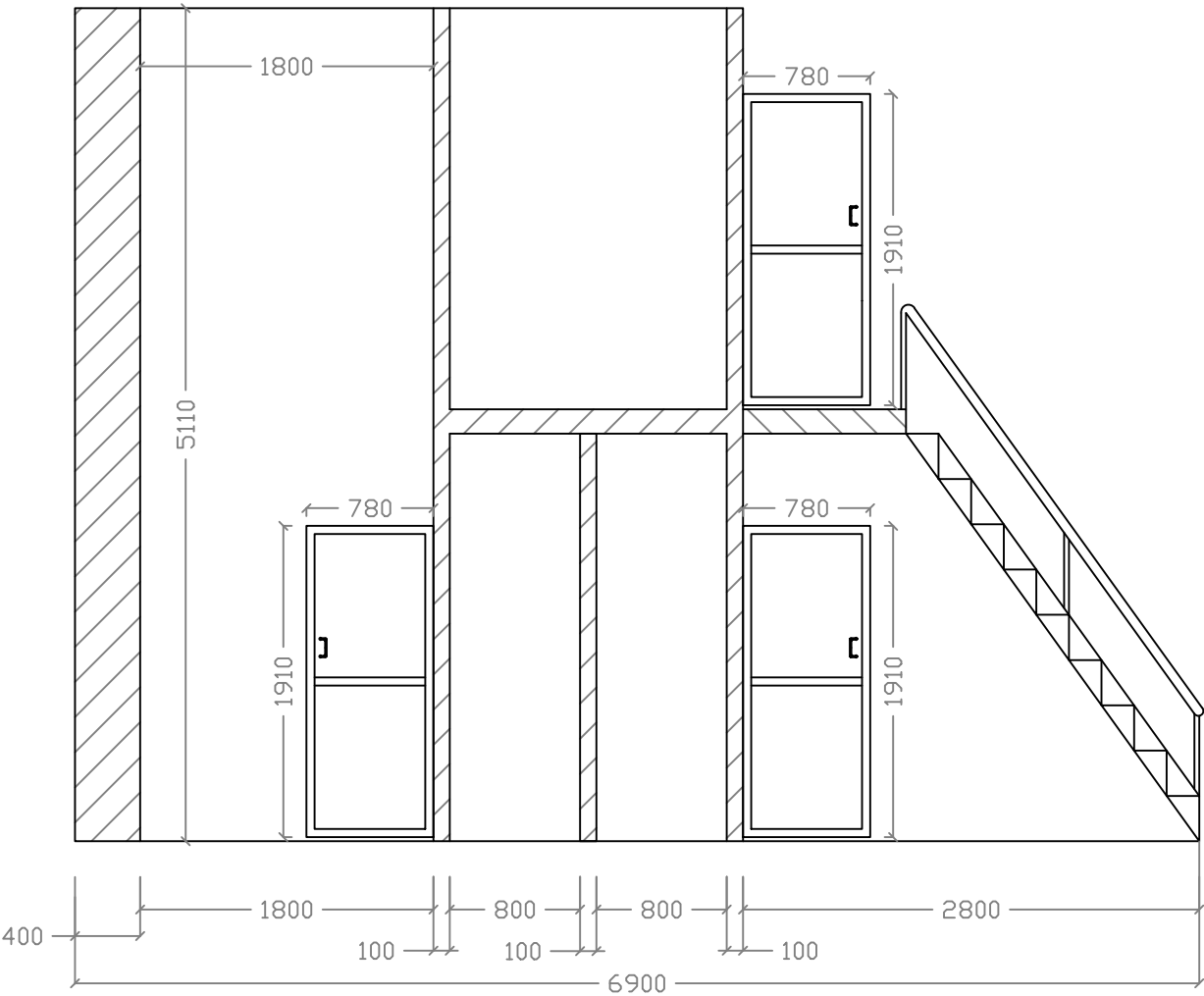
Pumping station "Funicular II"


lateral sections

lateral section 3 - 3



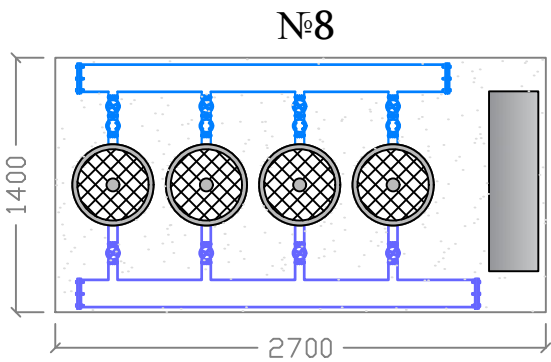
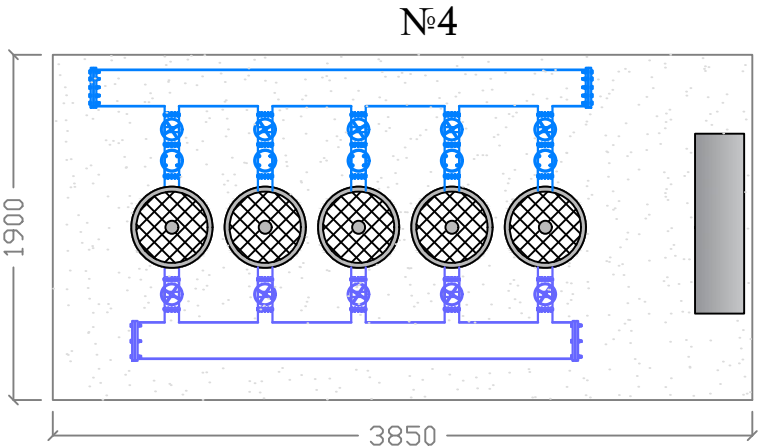
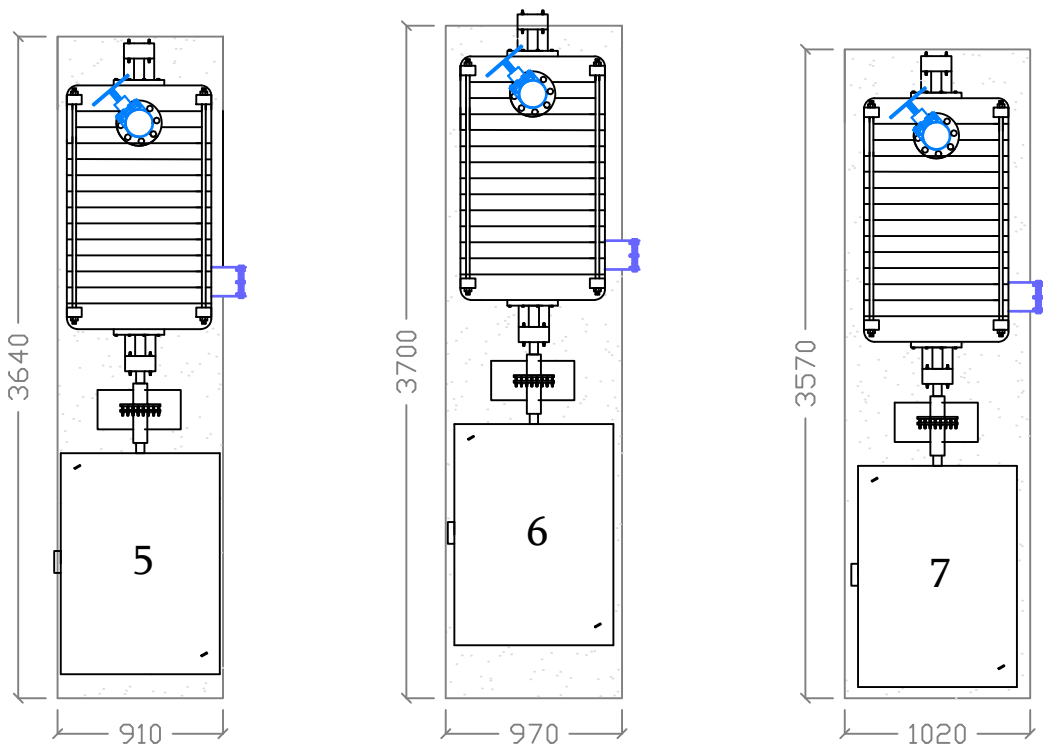
lateral section 4 - 4



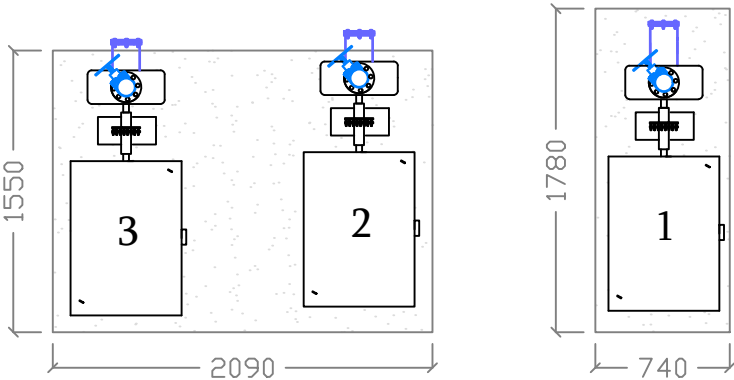
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| Address | Nearby Mtatsminda Park | |
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| Tbilisi, Kostava I Turn #33 | | |
| Operations Planning and Budgeting Division | | |
| Notes | | |
| Project Name | | |
| To make situation scheme of pumping station "Funicular II" | | |
| Drawing Name | | |
| lateral sections 3 - 3 | | |
| lateral sections 4 - 4 | | |
| Performer | | |
| Shota Metreveli | | |
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Pumping station "Funicular II"

Pumps units



| The Volumes | | |
|--------------------------|----------|-----------|
| Name | Quantity | Dimension |
| 7.5 KVT Pump unit | 4 | PCS |
| 11 KVT Pump unit | 5 | PCS |
| 45 KVT Pump unit | 1 | PCS |
| 55 KVT booster Pump unit | 2 | PCS |
| 315 KVT Pump unit | 3 | PCS |
| Valve D=50 mm | 9 | PCS |
| Valve D=80 mm | 11 | PCS |
| Valve D=100 mm | 6 | PCS |
| Valve D=150 mm | 10 | PCS |
| Valve D=200 mm | 7 | PCS |
| Valve D=300 mm | 2 | PCS |
| Check valve D=50 mm | 4 | PCS |
| Check valve D=80 mm | 5 | PCS |
| Check valve D=150 mm | 4 | PCS |
| Check valve D=200 mm | 2 | PCS |



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|--|------------------------|-----------------|--|
| Project code | GWP - 0006 | | |
| Cadastral code | N 01.15.01.003.006 | | |
| Address | Nearby Mtatsminda Park | | |
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| Tbilisi, Kostava I Turn #33 | | | |
| Operations Planning and Budgeting Division | | | |
| Notes | | | |
| Project Name | | | |
| To make situation scheme of pumping station "Funicular II" | | | |
| Drawing Name | | | |
| Pumps units | | | |
| Performer | | Shota Metreveli | |
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Description and Main Parameters of the Pumping Station

Pumping Station Name: **Funicular II**

Water Pumping Direction:

- Funicular II _ Tsavkisi
- Funicular II _ Okroqana, Zone A
- Funicular II _ Okroqana, Zone B
- Funicular II _ Okroqana, Zone C

Funicular II _ Tsavkisi

Number of Installed Pump Aggregates: 3

Pumping Capacity and Lifting Height:

| | Q (m ³ /h) | H (m) | P (kw) |
|---------|-----------------------|-------|--------|
| PUMP N1 | 180 | 425 | 315 |
| PUMP N2 | 180 | 425 | 315 |
| PUMP N3 | 180 | 425 | 315 |

Pressure on the Suction Collector: (1 Bar)

Pressure on the Discharge Collector: (40 Bar)

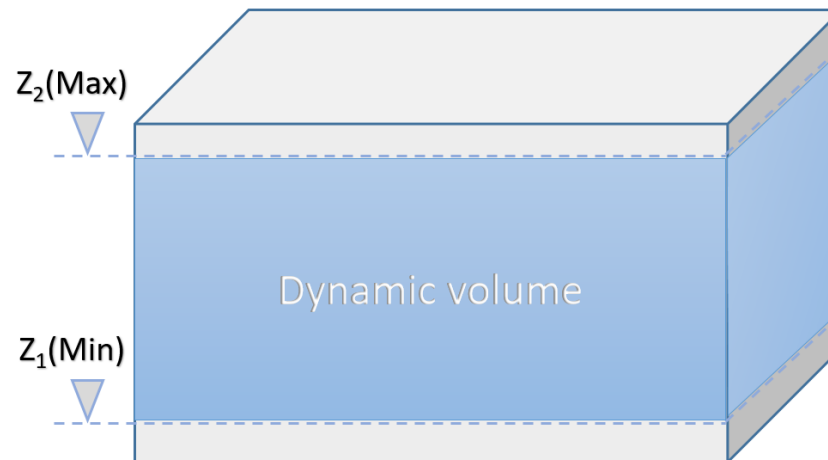
Direction: Tsavkisi Reservoirs;

- Reservoir Bottom Mark: 1124 m above sea level;
- Reservoir Maximum Mark: 3.9 m;
- Reservoir Minimum Mark: 0.5 m;

Existing Equipment:

- Analog Pressure Sensor 4-20 mA: 2 units
- Ultrasonic Flow Meter: 1 unit
- Dry Run Protection Sensor with Dry Contact: 1 unit
- Pump Power Control Panel: 3 units
- Electrically Controlled Valves: 2 units
- Regulator: 1 unit
- VFD: 1 unit
- Electrical Parameter Measuring Instrument (Multimeter): 3 units
- SOFT STARTER : 2 units

Operating Principle of the Pumping Station:



Operating Principle of the Pumping Station "Funicular II":

The supply of the Tsavkisi reservoirs by the "Funicular II" pumping station is carried out year-round. Due to the station's specifics, operation is managed mechanically, based on the direct instructions of the dispatcher.

$Z_1(\text{Min}) = 0.5\text{m}$;

$Z_2(\text{Max}) = 3.9\text{m}$;

In case of demand for flow, the operating principle of the pumping station is 0-1, during which the station ensures the filling of the reservoirs using 1 pump.

After automation, a mechanical/remote control mode is required, which will allow the dispatcher to remotely start/stop any pump at the pumping station. The pump start/stop process should follow the following principle: Additionally, we need to be informed about the management process, including:

- Pressure on the suction pipe
- Pressure on the discharge pipe
- Number of active pump aggregates
- Warnings and alarms

Funicular II _ Okroqana, Zone A

Number of Installed Pump Aggregates: **4**

Pumping Capacity and Lifting Height:

| | Q (m ³ /h) | H (m) | P (kw) |
|---------|-----------------------|-------|--------|
| PUMP N1 | 21 | 81.7 | 7.5 |
| PUMP N2 | 21 | 81.7 | 7.5 |
| PUMP N3 | 21 | 81.7 | 7.5 |
| PUMP N4 | 21 | 81.7 | 7.5 |

Pressure on the Suction Collector: (1 Bar)

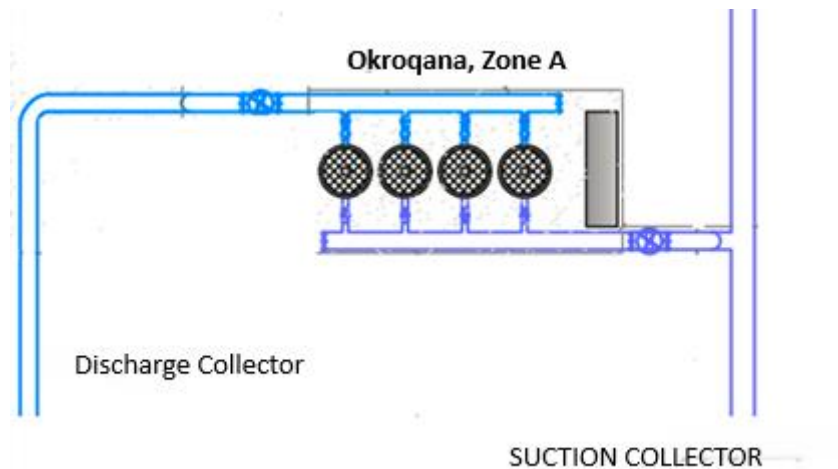
Pressure on the Discharge Collector: (3.5 Bar)

Direction: Supplies the population of the "Okroqana, Zone A" network.

Existing Equipment:

- Analog Pressure Sensor 4-20 mA: 2 units
- Ultrasonic Flow Meter: 1 unit
- Dry Run Protection Sensor with Dry Contact: 1 unit
- Pump Power Control Panel: 1 unit
- Electrically Controlled Valves: 2 units
- Regulator: 0 units
- VFD: 1 unit
- Electrical Parameter Measuring Instrument (Multimeter): 0 units
- SOFT STARTER: 0 unit

Operating Principle of the Pumping Station:



The "**Funicular II**" **Pumping Station** supplies the population of the "**Okroqana, Zone A**" network. The station is controlled by an automatic control panel produced by "**Grundfos**", which maintains constant pressure in the discharge network. The control process is fully automated.

After the automation of the pumping station, a mechanical/remote control mode is required, which will allow us to start/stop the pumping station and also remotely reset it if needed. Additionally, it is necessary to have information about the control process, including:

- Pressure on the suction pipe
- Pressure on the discharge pipe
- Number of active pump aggregates
- Warnings and alarm

Funicular II _ Okroqana, Zone B

Number of Installed Pump Aggregates: 5

Pumping Capacity and Lifting Height:

| | Q (m ³ /h) | H (m) | P (kw) |
|---------|-----------------------|-------|--------|
| PUMP N1 | 45 | 59.4 | 11 |
| PUMP N2 | 45 | 59.4 | 11 |
| PUMP N3 | 45 | 59.4 | 11 |
| PUMP N4 | 45 | 59.4 | 11 |
| PUMP N5 | 45 | 59.4 | 11 |

Pressure on the Suction Collector: (1 Bar)

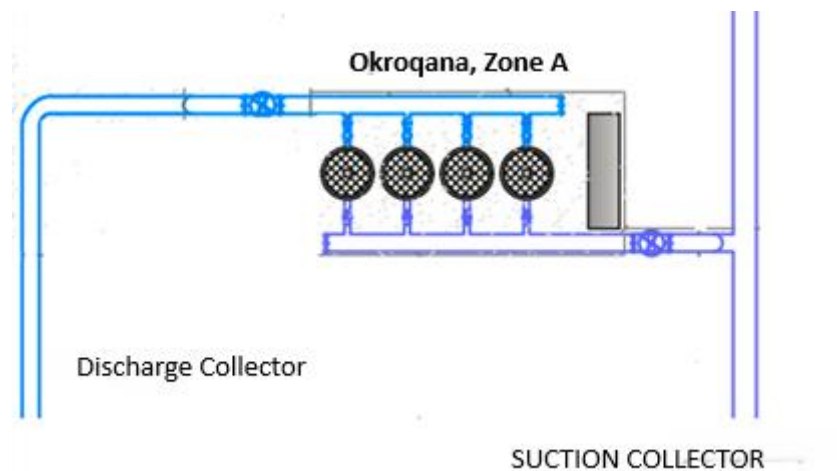
Pressure on the Discharge Collector: (3.5 Bar)

Direction: Supplies the population of the "Okroqana, Zone B" network.

Existing Equipment:

- Analog Pressure Sensor 4-20 mA: 1 unit
- Ultrasonic Flow Meter: 1 unit
- Dry Run Protection Sensor with Dry Contact: 1 unit
- Pump Power Control Panel: 1 unit
- Electrically Controlled Valves: 2 units
- Regulator: 0 units
- VFD: 1 unit
- Electrical Parameter Measuring Instrument (Multimeter): 0 units
- SOFT STARTER: 0 units

Operating Principle of the Pumping Station:



The "**Funicular II**" **Pumping Station** supplies the population of the "**Okroqana, Zone B**" network. The station is controlled by an automatic control panel produced by "**Grundfos**", which maintains constant pressure in the discharge network. The control process is fully automated.

After the automation of the pumping station, a mechanical/remote control mode is required, which will allow us to start/stop the pumping station and also remotely reset it if needed. Additionally, it is necessary to have information about the control process, including:

- Pressure on the suction pipe
- Pressure on the discharge pipe
- Number of active pump aggregates
- Warnings and alarm

Funicular II _ Okroqana, Zone G

Number of Installed Pump Aggregates: 2

Pumping Capacity and Lifting Height:

| | Q (m ³ /h) | H (m) | P (kw) |
|---------|-----------------------|-------|--------|
| PUMP N1 | 100 | 80 | 45 |
| PUMP N2 | 100 | 80 | 45 |

Pressure on the Suction Collector: (1 Bar)

Pressure on the Discharge Collector: (9 Bar)

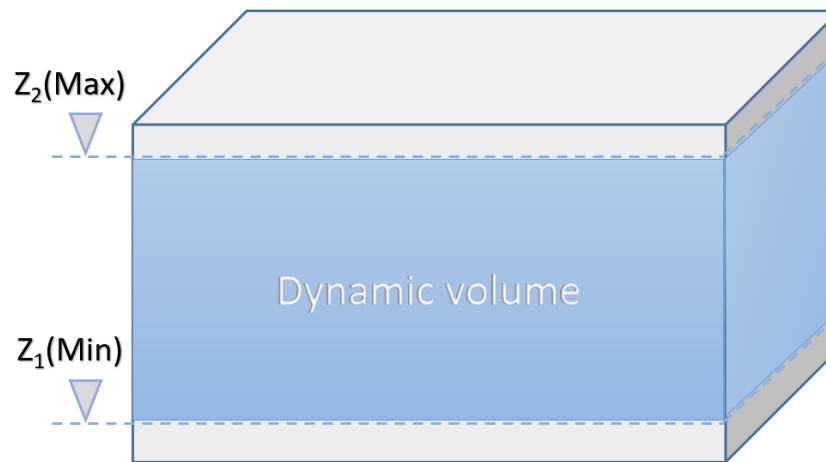
Direction: Tsavkisi Reservoirs;

- Reservoir Bottom Mark: 830 m above sea level;
- Reservoir Maximum Mark: 3.15 m;
- Reservoir Minimum Mark: 1.0 m;

Existing Equipment:

- Analog Pressure Sensor 4-20 mA: 2 unit
- Ultrasonic Flow Meter: 1 unit
- Dry Run Protection Sensor with Dry Contact: 1 unit
- Pump Power Control Panel: 1 unit
- Electrically Controlled Valves: 2 units
- Regulator: 1 units
- VFD: 0 unit
- Electrical Parameter Measuring Instrument (Multimeter): 2 units
- SOFT STARTER: 2 units

Operating Principle of the Pumping Station:



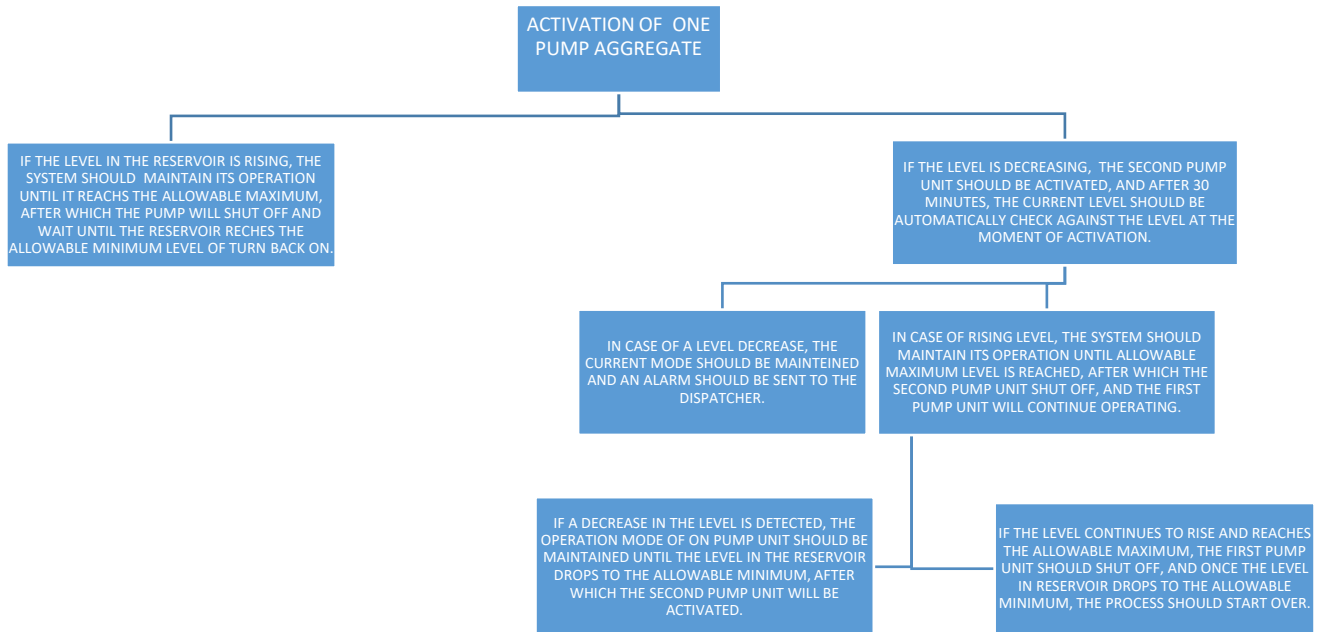
The "**Funicular II**" Pumping Station supplies the "**Okroqana, Zone G**" reservoirs year-round. However, based on the demand for flow, two main modes are designated: summer and winter.

Z1 (Min) = 1.0 m

Z2 (Max) = 3.15 m

In winter mode, due to the lower demand for flow, the pumping station operates in a variable mode, based on the principle 0-1. During this mode, the station ensures the filling of the reservoirs using one pump, and after filling, the pumping station ceases operation until the **minimum level** of the "**Okroqana, Zone G**" reservoirs is reached. In winter operation, the pumps must work alternately, sequentially.

In summer mode, the demand for flow is relatively higher. The pumping station operates in a variable mode, based on the principle 1-2, where the filling of the reservoirs requires the **parallel operation** of two pumps. After filling, one pump remains in operation. In the case of the maximum emergency level, the last pump aggregate will also stop.



Afterward, the pump is restarted, and the process repeats continuously. In summer mode, for filling purposes, the pumps must operate alternately

data exchange

Local Control:

A main control cabinet must be installed at the “Funicular II” pumping station, equipped with a controller (PLC/RTU device), through which the rest of the equipment will be managed using a **Master & Slave** configuration. The control cabinet must include an **HMI panel**.

In addition to remote control via the **SCADA system**, it must also be possible to operate and monitor all control devices locally through the panel.

Communication Protocols:

- MODBUS
 - Profibus
 - Ethernet/IP
-

Telemetry:

Data transmission must be performed via both **SIM card** and **LAN** (GSM/GPRS or Ethernet). The information must be sent to the company’s server, and communication must be secured using **certificates issued by a Certification Authority**.

- GSM/GPRS
 - Ethernet
 - SMS / Email / Call
-

Database:

Data must be stored on an **SQL Server**, and there must also be **Backup Servers**, where information will also be stored. During the data or server update process, information must be transmitted to the backup server.

- SQL Server
 - Backup Server
 - RDBMS – MySQL
-

SCADA System:

Information processing and visualization must be carried out through the **central SCADA system**. Every department that requires access to specific data will be given **user accounts with passwords**. Users will be able to view information through the **web server**.

The SCADA system must include all necessary functions: **alarm, control, monitoring, and data analysis**.

- All control devices installed in the pumping station must be **integrated** with the central SCADA system.

General Principles of Pumping Station Control:

Control of the pumping station must be performed either remotely or locally, according to the operating principles described above.

Remote Control:

- Automatic control
- Manual (mechanical) control

Local Control:

- Automatic control
- Manual control

Remote Automatic Control:

This type of control involves automatic management of all devices participating in the process (pumps, electrically controlled valves, regulators, etc.) based on signals received from various sensors and control devices, following the required operating principles. Remotely, it must be possible to:

- Select the number of operating pumps
- Change the minimum/maximum level settings in the reservoir

Selection between local and remote modes must be made via the main control panel located at the station.

Emergency full stop conditions for the pumping station:

In the presence of any of the following conditions, all operating pumps must immediately stop:

- Critically low pressure detected on the suction pipeline of the pumping station
- Loss or phase failure in the electrical power supply network
- Fire safety system alarm signal
- Flood protection system alarm signal

Note: During any emergency or complete shutdown of the pumping station, it is mandatory to close both the discharge and suction electrically controlled valves.

Remote Mechanical Control:

Remote mechanical control means that all devices involved in the control process (pumps, electrically controlled valves, etc.) are managed manually by a SCADA operator. Signals from sensors or other control devices are ignored, and the operator has full responsibility for control. This mode must allow the following operations:

- Start/stop the pumping station
- Restart the pumping station
- Start/stop individual pumps
- Regulate motor speed (if VFD is available)

The selection between local and remote modes must be made via the main control panel at the station.

Emergency full stop conditions are identical to those described in remote automatic control.

Local Automatic Control:

This control type involves automatic management of all devices based on signals from sensors and control devices, following the required operating principles. Locally, it must be possible to:

- Select the number of operating pumps
- Change minimum/maximum reservoir level settings

Mode selection (local or remote) must be done via the main control panel at the station.

Emergency stop conditions are the same as above.

Local Mechanical Control:

Local mechanical control means that all devices are controlled manually by an on-duty operator or qualified maintenance personnel. Signals from sensors or other control devices are ignored, and the operator is fully responsible. This mode must allow:

- Start/stop the pumping station
 - Restart the pumping station
 - Start/stop individual pumps
 - Regulate motor speed (if VFD is available)
-

Mode selection must be done via the main control panel at the station.

Emergency full stop condition:

- Activation of the mechanical emergency stop button

Note: During any emergency or complete shutdown of the pumping station, it is mandatory to close both the discharge and suction electrically controlled valves

Principle of Pump Unit Start/Stop Operation:

When starting the pump, the pressure on the suction pipe must be checked. If the pressure is below the allowable norm, the pump must not start. If the pressure is within the acceptable range, the pump will start. At the moment of startup, the discharge valve and/or regulator must be in the closed position. After this, they should be gradually opened according to the motor overload protection settings.

To protect the motor from overload, the main controller on the control panel must monitor the motor's current (amperage) or flow rate, based on which the valve(s) or regulator opening/closing process will be managed.

When stopping the pump, the discharge valve and/or regulator must close, and the motor must stop.

Safety:

To ensure safe operation of the station, the following systems must be installed:

- **Flood Protection System:**

At the lowest point inside the building, a sump pit must be installed along with a drainage pump.

The flood protection system should operate based on two water levels:

Lower Level: Defined for normal operation. When this level is reached, the drainage pump must activate and pump the accumulated water into the stormwater system.

Upper Level: Defined for emergency operation. If water reaches this level, the electrically controlled valves on the pump's suction and discharge pipelines must close. Information about the emergency must be sent to the company server and an SMS notification sent to authorized personnel.

- **Fire Safety System:**

This system is for fire detection only. Upon fire detection, electrically controlled valves on the

pump's suction and discharge pipelines must close. Emergency information must be sent to the company server, and SMS alerts sent to authorized personnel.

- **Video Surveillance System:**

Cameras must be installed inside the building to monitor the pump units. Cameras should be positioned so that all pump units can be easily monitored.

- **Temperature and Noise Level Monitoring:**

Temperature sensors must be installed at two locations inside the building and one outside. For noise monitoring, one sensor must be installed inside the building.

Notes:

- A project design is required to implement the safety systems.
- The project must consider backup power generators for the following devices: drainage pump, seven electrically controlled valves, surveillance cameras, and the PLC/RTU control panel.
- Any disorder or irregularity at the station must trigger a text message notification to the responsible technical personnel.
- The technical solution must utilize devices produced by the company listed below in the control/transmission section.

- **SOFREL**

