The drainage prohibition relates to the karstic areas listed below:

1./ Gellért hill
2./ Small Gellért hill
3./ Sas hill
4./ Martinovics hill
5./ Rókus hill
6./ Szemlő hill
7./ Ferenc hill
8./ Eastern slope of Rózsa hill
9./ Mátyás hill

The conditions in the '60s served as a basis for determining hydrogeologically reserved area and drainage prohibition.

Significant constructions have taken place on the area ever since so Environment Protection Inspectorate for Közép-Duna--völgy is planning to elaborate new regulations in compliance with up-to-date conditions.

The Searching Institute for Water Management have been working for years on examinations of processes take place in karst and on preparations for protective measures. As a result a draw-off limit system has been elaborated. Adhering to this limits further damages can be avoided. This limit is to be kept by mining water draw-offs as well therefore some of the mines had to be closed. The limit values are to be respected in Budapest too.

Worthening tendency is expected for another 5-8 years in Budapest therefore new cavern water draw-offs will be permitted over this period only if cavern waters will be saved on other places or the drawn-off quantity will be fed back so the water balance will be kept.

Environment Protection and Water Management Directorate for Közép-Duna-völgy issued a statement on 1989 under No-11.175-3/89 regarding cavern water draw-off possibilities in Budapest city.

We have been informed that more and more enterprises apply for permissions regarding thermal water utilization /thermal hotels, curativ hotels/. Unfortunately these new applications have to be denied due to extreme water draw-offs have been done so far.

At places where karstic rocks come up to the surface but mainly of Rózsa hill's area contaminators get into the karst from couple of hundreds of badly sealed sewage pits and ducts contaminating springs of Császár and Lukács spas. Significant contamination source is the salting of roads and streets in winter time.

The technical conditions of sewerage ducts and the number and location of streets and seal estates having no sewerage system shall be surveyed inthe coming years.

The sections of drinking water ducts which are aged or built of inproper materials are to be surveyed. Our long term goal to lay down sewerage ducts in the entire area, to check it annually and introduce environment frendly salting methods. The improper drinking water conduits shall be reconstructed examining the necessity of public utility tunnels at the same time.

On the roads above caves speed and weight limits shall be introduced but this could only be a temporary solution. The final solution still has to be found.

b/_Oligocene_formations

The hydrogeological role of impermeable oligocene formations near surface is that precipitation can not seep in the depth.

The ground water situated above these formations is kept either in quaternary layers covering older formations or in upper seamy part of oligocene base. In this latter case the sulfate mineral waters and bitter waters are generated in deep-sealed slack water areas. These are known in Lágymányos, Őrmező and Örsöd areas. In Örsöd bitter waters have been dxploited and utilized for a century.

These waters basically are ground water therefore are exposed to the risk of contamination. Its quality should be preserved by proper means.

c/_Miocene_formations

The Miocene formations are differ from each other in view of the hydrogeological features because they can be either impermeable or aquiferous rocks. The major part of miocene formations are of passuse Tarbonian and Sarmatian limestones of Tétényi highland but in places deep-sealed Helvetian rough, detritous, gravelly layers of large water supply can also be found. Being no impermeable covering layers above the supply areas of water-giving base the surface waters, contaminators can seep into it. There are big industrial companies on that area on which a large amount of industrial and even hazardous waste have been accumulated over long time. The most contamination-sensitive part of the area is the Tétényi highland on which miocene limestone is situated on the surface. The inclination of the layers as well as seat rock of impermeable nature together lead the water towards southern, south-eastern part of the highland. This water serves as water supply for the springs and younger sandy, gravelly covering layers from Pleistocene thus influencing its quality.

The Miocene formations occupy larger area than water supply formations in Kőbánya. The porous limestones similar to that of Tétényi highland and rough, detritous basis below are of good aquiferous characteristic but can easily be contaminated.

This served as water base for Kőbánya Brewery and later for other big industrial companies.

d/ Pannonian formations

Stratical water is kept in porouse basis of Pannonian layers but it is of very small quantity having no significant importance on the conditions of the area.

e/ Pleistocene and Holocene formations

The gravel deposits of the Danube from Pleistocene era are of high importance in view of hydrogeology, having large amount of water mainly near the river. These are siginificant water bases supplied basically by Danube. These water basis called bank-filtered water basis. The incontaminated parts of it serve as most important drinking water basis for Budapest, meanwhile the contaminated ones supply industrial companies.

This excellent aquiferous base is covered by a thin and also aquiferous Holocene formations therefore its contamination--sensitivity is high. As a result Pleistocene water basis have been contaminated in industrial areas due to lack of sewerage system near outskirt or late construction of the system even in residential areas.

The contamination of bank-filtered water basis is being taken place not only through soil but also through Danube, so water quality assurance of the Danube protects bank-filtered water basis as well.

On areas at a distance from Danube significant ground water basis is situated. These are also contamination-sensitive areas as that of bank zones therefore these waters are considerably contaminated too mainly on industrial zones and on residential areas without sewerage system. It is advisable to utilize these water basis primarily as industrial water supply.

1.3. Surface waters

1.3.1 Hydrological characteristics

Danube

The present bed of the Danube became the sole mainstream in the latest period of Holocene era. The vast floods of the river both destroyed the surface of the flooded area and deposited materials after its withdrawal. The weakening, silting beds could carry fine deposits at high water but later as mortlakes or back-waters became collectors of stagnating waters. These facts determine of course seep-in and subsurface flow - thus also contamination - conditions. The Holocene flood area was filled up during rapid growth of thecity. The bed of the river had been narrowed. The width of the bed which is split by islands and bordered by artificial banks varies within wide limits. At Gellért hill the width is just 300 m, between the lower end of Szentendre Island and higher end of Palotai Island it is 650 m. During river regulations the river branches had been totally or partly blocked away the mainstream. The Újpest bay is closed upstream, its fresh water supply can be provided by damed up from downstream. The Ráckevei /Soroksári/ river branch with its 60 km length is locked off both upstream and downstream thus became an artificial channel with fresh water flow of maximum 30m^3/sec. The average water level drop is 8 cm per kilometres. The average surface velocity of water measured in main current is 0.6 m/sec at low water and 2.5 m/sec at high water.

The material of bed bottom ranges from fine floating silt through grain diameter of 60-70 mm/sometimes 90 mm/.

The average size of grains of shallows is 15 mm.

The water catchment area measured at water-gauge joint in Budapest /1646.5 rkm/ is 184,993 km^2. This is 23 percent of total catchment area of 816,000 km^2.

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/Some data regarding Danube i.e. water level, fluctuation, water current, quantity, ice conditions, water temperature, silt, floods, low waters, Ráckeve river branch

- Streams in Budapest
- Various soil types
- Climate: - Temperature
  - Precipitation
  - Wind Clouds
    etc.
  - Air pollution/

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2. Settlement characteristics

2.1. Relationship between Budapest and its catchment area /See Annex 2/

There is a very close interrelation between Budapest and the 43 settlements in its catchment area therefore we consider both as one unit in view of environment protection - in accordance with regional development plans. 21% of total fixed means in the country is concentrated in this area. The centrum of radiant national main roads and rail tracks is in Budapest. Due to uneven distribution of bridges over the Danube almost the entire national and international cross-traffic passes through Budapest. The noise emission of the three airport in the area means another burden on the region. As a consequence the harmful effects on environment are of difficult correlation and carry load to a greater extent.

There has been a close relationship between Budapest and its catchment area in respect of water supply and waste water drainage. The water supply of the capital is provided mainly by wells in Csepel Island and Szentendre Island. /This means 95% of total water consumption/. The neighbouring settlements receive 10,440 m^3/day water from the network of Budapest. Some 2300 m^3/day waste water are conducted from these settlements into Budapest's sewerage system and there are plans to conduct waste water from other settlements as well in the near future.

As the result of concentrated industry and the high ratio of built in areas most of the factories do not have facilities to store temporarily its hazardous wastes.

There isn't any hazardous waste incineration plant in Budapest. The first hazardous waste disposal site of the country started to operate in 1989 in Aszód with capacity of 10.000 tonnes per annum.

The incineration plant in Dorog city and the final disposal site in Aszód would be able to receive hazardous wastes generated by the capital but many of the companies can not afford to pay for this service. The number of interim storage facilities has not increased meanwhile the capacity of hazardous waste collecting facilities in the companies has decreased.

The most quantity of waste is generated in district X., XI., XIV and XVI.

The most quantity of waste is generated in district X., XI., XIV and XVI. The majority of production waste was disposed or conducted into final disposal sites for municipal solid wastes and waste water discharg facilities, respectively of Göd, Fót, Csomád, Mogyoród, Kerepestarcsa. A significant amount of hazardous waste was also transported to these places in the recent years. /E.g. chrome sludge from tanneries into waste water discharge facility of Göd, Galvanic sludge into disposal site of Csomád, Galvanic waste water and oily waste into waste water discharge facility of Kerepestarcs/

It can be assumed that other hazardous wastes have also been transported into these areas. The exact quantity of these waste can not be identified. As a result it can be stated that the neighbourhood of Budapest is strongly affected by the city. These effects appear as air pollution, noise emission from the traffic, as municipal solid wastes and hazardous wastes deposited in these areas and as waste water sludge.

2.2 Ratio of built-in areas to total territory

Budapest's area: 52.510.0 ha = 525.1 km^2
Number of residents: 2.016.131 /in 1991/

Budapest consists of residential, holiday areas, historical areas, institutional, industrial areas, areas of public utilities, traffic areas, green areas, agricultural and other areas.

The structure of the capital is determined by location of these elements, by the ratio of built in areas to the territory of these areas, by distribution location, connection of "centrums".

The territory of Budapest can be divided into four ring-sharped zones.

The autumn of the city which is the first working place zone belongs to the Zone No.1.

The centrum is surrounded by a narrower - in Buda - and a broader - in Pest - ring which is Zone No.2. The working and dwelling function is quite mixed in this zone. /Dwelling zone No.1/.

The shape of Zone No.3 is not completely ring-shaped. Industrial premises dominate this area. /Working zone No.2/ The ring is interrupted by Budai Mountains. The industrial zone is interrupted by sector-shaped dwelling areas. /Dwelling zone No. 2/. The area is the most mixed in view of activities and density of built-in areas.

The part three zone is surrounded by the zone No. 4 as a ring. The present structure of Budapest has formed during a long process. The results of this process are found below:

Residential areas

There are virtually no more flat constructions in large numbers in Budapest. At the time when the locations of housing estates were selected the environmental aspects were ignored. There are many housing estates which have small green areas. The air pollution and noise emission at that areas are beyond all bearings.

Industrial areas

Some cases they are situated among areas with different functions. There are residential areas nearby even purly industrial areas.

The technology of the factories are far from up-to-date resulting contaminating effects on environment. Its design does not match the overall city view. Air pollution, noise emission, waste generation of these areas are siginificant.

Green areas

1/ Uninterrupted green areas remained at the edge of Pest downtown, on the islands, on Római bank, some parts of Budai Mountains and along previous border of the city.

2/ As a result of activities for building housing estates, industrial areas the homogenous green areas have been disrupted or simply vanished.

3/ The system of green areas consists of green patches. One can not string them on lines of a network, they can not be found on enclaves of areas with different functions.

4/ Its protection and development are very important tasks.

When a new concept on regional development and environmental protection is elaborated the following fact among others should be considered: One fifth of the population of Hungary live on a territory which is 1/177 of the countries total area.

The environmental issues should primarily be of first priority.

A political decision should be made on whether city development would mean the growth of the number of dwelling or just its reconstruction.
The function of various parts of the town should also be determined within the framework of this political decision meanwhile the decision on optimum number of residents in these districts should be a part of a development plan.

If the extent and direction of city development will be decided in the light of the abovementioned aspects and the sensibility of the area /dominating wind direction,cross -draught, distribution of precipitation, hydrogeological conditions/ this would allow a more cost-effective utilization of financial resources available for that kind of purposes.

We have come to the conclusion that the ratio of built-in areas to the total territory is higher than it should be.

The growth of built-in areas, the growing number of paved roads, by-passes, car parks as well as the weakening flora and shrinking area of natural soil surfaces together have harmful impact on subsurface water-balance and air humidity and contribute to micro and mezo climate forming process and to mist smog generation.

These factors have direct or indirect deleterious effects on human health.

The question whether we should increase the buil-in ratio has nothing to do with political decisions because the answer is definitely no.

However there is no dispute on whether investigations should be made regarding city development notions i.e. reducing built-in ratio thus improving cross-draught effect in the city and refloating industrial companies hereby increasing the number of residents.

2.3. Transport and its areas

Primary road network

The stage of development of primary roads does not meet the requirements of up-to-date traffic. During rush hours the load on most of the primary roads of on intersections exceeds the limit which they were designed for bringing the traffic to a halt /traffic jams/. 26% of the road network of Budapest belong to national primary road network so these roads carry significant national traffic too.

Railroad network

It consists of 11 MÁV /Hungarian Railways/ and 7 BKV-HÉV /Suburban Railways belong to Budapest Public Transport Company/. Approximately one third óf passangers transported by MÁV travel through, from,or to the railway stations in Budapest. The capacity of these stations is insufficient.

Public Transport

The problems of public transport are caused by crowdy streets - a result of gradually growing traffic - and intersections of roads on same level.

Water transport

The most significant facility of water transport is the freeport in Csepel. MAHART /Hungarian Shipping Ltd./ have liners on the Danube between Budapest and Esztergom.

There are some local ferry-boats.

Civil airport

The civil airport of Budapest is called Ferihegy I-II. The sport, ambulance, agricultural airports are not in the scope of our study.

Bridges

The number of bridges over the Danube is insufficient.

Subways

Our opinion is that the number of subway lines /3/ is not sufficient.

Problems:

The growth of the capacity of private vehicles is bigger in the the capital that of public transport vehicles. The growing capacity of forwarding means increasing number of trucks and vans driven by internal combustion engines. As for the BKV's /Budapest Public Transport Company/ capacity conernes there have been a very moderate growth in the ratio of electrically-driven vehicles. The trans-traffic through Budapest have grown intensively.

The negative environmental impacts of the traffic are significant. Considerable part of air pollution and noise emission is generated by traffic.
The present bad conditions are created by - besides historical reasons - the industrial policy which was followed by governments after 2nd World War notably to encourage the concentration of over-grown heavy industry in Budapest. As a result of this policy the demand for new flats grew and these constructions were carried out without any city development concept. This is the reason why there is a big demand on public transport ahich could transport masses between their dwellings and work places. Although it is inevitable to construct more bridges over the Danube in order to reduce load on the roads, the crodedness - and pollution at the same time - would considerably be lower if the motorway MO by-passing Budapest could really fulfill its function.

Cost-effectiveness calculations should be made on whether international truck traffic from Vienna-Bratislava to Belgrad could be even partially directed on boards of river barges thus substituting traffic across Budapest for a more environment friendly way of transport.

We may not take over the tasks of traffic-designers but we should express our opinion that nord-western extension of motorway MO would result harmful effect on the environment. We think that further reduction of Buda-Pilis forest is unacceptable. A motorway crossing the forest on any track would endanger the living-space of wildlife through air pollution, noise emission and by cutting living-space in two. Further harmful impact on forests would be salt and heavy metall accumulation and the alteration of water conditions. And what is more this is the area which Budapest's fresh air comes from. Elaboration of other alternatives would be desirable which could ensure connection of the areas with different function and could provide with better draught across the city /E.g. to utilize more effectively the roads with N-S direction and roads by the riversides.

Besides environmental aspects we would like to point out whether it is necessary to construct a linking road between motorway M1 and highway No. 10 because majority of cross traffic goes from west to south and east /and back/ requiring a pass between motorways M1-M5 and M3. The most important task is to construct a motorway between M1 and MO and then between highway No. 51 and motorway M5 and between M5 and M3. Upon completion of abovementioned construction and only after examining its traffic reducing effect we could decide on planning, effect or even on necessity of a northern by-pass motorway.

We agree with the endeavours of the Municipality to introduce different parking-fee cathegories thereby reducing privat car's traffic in the downtown but we think that it is inevitable to improve public transport services and to elaborate a traffic development concent which would not ignore environmental impacts either.

We propose to ensure priority for development of metro tram and trolley-bus traffic rather than that of bus traffic. It is desirable to extend the number and length of bycicle roads towards roads lead to holiday destinations.

2.4 Water supply, Sewerage system, Cleanness of the city

2.4.1. Water supply

The Danube crossing Budapest plays very important role in water supply of the city.

There have been a downward trend of water quality.

The water quality in view of bacteriology and virology is of declining tendency since the beginning of the 80's. There have been a slow rise in chemical parameters.

The quality of subsurface and surface water of Budapest and its surroundings is crucial for healthy water supply of the city.

Major part of drinking water is coming from the wells of Csepel Island and Szentendre Island. The most significant difference between the water quality of the wells of these areas is experienced through its chemical components. The ammonia and nitrate content of the wells on Szentendre Island has been slightly grown over the last few years.

On Csepel Island similar growth can be identified on iron and manganese content of the water of the wells. These higher than normal iron and manganese contents have caused in some cases feculance problems in the southern part of water network. Upon installing a deironising-demanganising plant in Ráckeve the water quality has gradually improved and the output water of the plant is new clean in view of abovementioned components.

State of water supply

- 99% of the population is supplied by water conduits
- 96/ of the flats and connected into drinking water network.

There are some differences between the water supply of various districts. It can be measured by the number of flats having water conduit connections and by the number of minor failures in water supply.

The ratio of flats connected to the water system and the total number of the flats varies from 90 upto 100 percentages. The areas with detached houses can be characterised by lower figures.

Minor water supply failures /lack of water in local network/ take place occassionally in the secondary districts with disadvantageous potentials. These failures are due to insufficient capacity of the network and low storage capacity.

Water consumption of Budapest is 240 l/day per capita /It was 164 l/day in 1975/.

2.4.2 Sewerage system, water treatment

The density of sewerage network is quite different in various parts of the capital. The area with ditached houses, gardens and overwhelmingly without sewerage system.

The percentage ratio of flats linked to sewerage system and the total number of flats /see Figure 1/

District	Percentage
I.	100
II.	96
III.	93
IV.	99
V.	100
VI.	100
VII.	100
VIII.	100
IX.	100
X.	98-100
XI.	96
XII.	96
XIII.	100
XIV.	98
XV.	79
XVI.	39

XVII.	51
XVIII.	48
XIX.	94
XX.	60
XXI.	78
XXII.	57

Approximately 85-90% of flats are connected to the publis sewerage system.
The length of sewerage system in Budapest is 500-600 km.
The total length of conduits including ducts for precipitation in Budapest is 3500 km.

There are two water treatment facilities for the waste water of Budapest and for a part of waste waters of outskirts.

The capacity of water treatment plant on Nord-Pest and South-Pest is 85.000 m^3/day and 42.000 m^3/day, respectively. Approximately 15-18% of waste water generated in Budapest are treated.

2.4.3 Cleanness of the city

2.4.3.1 Municipal solid and fluid waste

The volume of municipal solid waste generated in Budapest is 5 million m^3 per annum. The majority of the waste is collected and transported by FKFV.

3.9 million m^3 municipal waste is transported by FKFV annually. 1.7-1.8 million m^3 thereof is incinerated in the incineration plant operated by FKFV. The rest of the municipal solid waste is disposed. The major problem of waste management is the bad condition of final disposal sites and its inproper operation. The lack of guarding and fence attracts illegal disposers and makes hazardous waste disposal possible. The operators usually fail to cover the waste by soil thus causing epidemic risks and resulting huge areas scattered by waste.

The solution for this problem would be the construction of a new incineration plant or extension of existing final disposal sites. By the time of completion of the new HHM the selective waste collection should be introduced in Budapest.

Many problems have been occurred regarding location and design of discharging places for municipal fluid wastes transported by snifting trucks. These trucks some cases discharge its load in illegal places because of the long distance between legal discharge places.

As for Budapest concerns the illegal places are opening of the sewerage system thus these activities contaminates the roads resulting risk of infection.

2.5. Industrial areas

There are limited possibilities on setting up new industrial facilities in the capital. The existing and the recently selected industrial areas are virtually full so there is no room for new industrial facilities.

The older factories have been surrounded with other facilities or buildings so they can not expand any more. The ratio of built-in areas within the industrial sites is high these places are tightly packed with buildings.

Due to economical changes taking **place** these years the big industrial factories stop their operation, split into many smaller units.

These industrial sites had been developed parallel to the development of the city. /The number of industrial sites per districts are shown in Table 1/.

Óbuda zone is situated along the Danube and along Szentendrei road. Its major industries are cotton, telecommunication, chemical industries and building elements production.

Ujpest zone can be divided in two sub-zone. The first is called the Western-zone along outer Váci road as the following industries can be found over there: Telecommuniaation, vacuum technology, leather and fur industries and many other plants of light and chemical industries. The second zone is called the Eastern-zone consists of chemical, textile companies and railroad's vehicles separation factory.

Angyalföldi zone consists of factories situated along Váci road, Lehel road and Béke road. Its main industries are machine building, telecommunication, instrument and hardware industries and hemp, jute, knitwear factories.

Kőbánya zone has two sub-zones. The northern one consists of breveries, refrigerating, medical industries, canneries, brick-works, porcelain works along Jászberényi road. The huger southern sub-zone is situated on both sides of Gyömrői road and near Ceglédi and Bihari roads. Its main industries are electrical machines, equipment manufacturing, chemical industry, machine building for oil and food industry, instrument, hard-ware manufacturing, weaving and spinning industries medical and ceramic industries.

Ferencváros zone can be found along Soroksári and Gubacsi roads and near Ferencváros railway station. The main activity is food processing. Machine tool engineering and chemical industries play also important role in this area.

Csepel zone's major industries are machine building, machine--tool engineering, textile and paper industries.

Lágymányos zone includes factories on Budaфoki and Fehérvári roads. Main activities are: electronics, telecommunication and instrument manufacturing, electric machines production, textile and building units production.

Budafok zone's main industry is the food industry including metal industry but chemical industry also plays an important role.

There are some other industrial zones mainly on Pest side but they are of less importance so not listed here.

The fresh water of industrial companies are partly supplied by Budapest Sewerage Works but some of these companies have its own superficial and subsurface water works.

The waste water of these companies are discharged partly through sewerage system and water treatment plant of Budapest Sewerage Works and partly through the companies' own discharge system to the receiver facility.

Most of the big factories discharge its waste water into public sewerage network. Some of them discharge it waste water into the Danube.

Table 1

Number of industrial sites per districts
/1991/

District	Number
I.	59
II.	195
III.	233
IV.	156
V.	125
VI.	161
VII.	223
VIII.	234
IX.	207
X.	261
XI.	392
XII.	150
XIII.	393
XIV.	259
XV.	91
XVI.	150
XVII.	89
XVIII.	106
XIX.	91
XX.	144
XXI.	106
XXII.	115

2.6 Mining in Budapest

The area of Budapest is well explored in view of geology. The mining activities relate to construction industry /E.g. mining of quarrystone and mining for concrete, gravel and brick industries./

The construction materials were extracted from the mines near the city so as to reduce transport costs.

As the city had been expanded these mines were recultivated and the new mines were opened on farther locations.

Three categories can be set up for mines in Budapest:

1. Mines in operation
   - The gravel mines on Pest side

2. Mines out of operation which have not been recultivated
   These are the mines of high importance in view of environmental issues /Csillag hill, Hárs hill, Róka hill, Csepel etc./

3. Closed and recultivated mines
   /Clay mines in Óbuda and Kiscell/

Four catehegories can be set up according to extracted materials:
- Gravel mine /gravel for concrete/
- Clay mine /ceramic industry/
- Carbonate rocks /shingle, lime-burning/
- Stone mines /cyclopean stone - limestone from Hárs hill/

As a result of mining activities - besides the spoilt landscape - the remaining pits are being filled either legally or illegally by wastes.

At clay mining it can happen that the bottom of the pit is still covered with thick clay layer therefore waste disposal does not cause significant harmful effect on environment.

On carbonate rock and gravel mines the extent of damages caused by extraction is so huge that self-protection ability of environment is greatly reduced i.e. cavern water or drinking water base in gravel terrace could immediately be contaminated.

The Act on Mining Activities /1960, No 3 still in force/ ordains that those who perform mining activities shall recultivate the area on a regular basis or at latest upon completion of mining activities in the mine /Section 8/45/. In spite of this regulation there are still many abandoned, not-recultivated mines in Budapest.

The evaluation of present conditions is hindered by the fact that some mining pits had been filled by miscellaneouse waste over the last 40 years and were covered by lean materials so we even do not know where these places are.

VII. Guide for Systematic Disposal of the Municipal Solid Waste

Ministry for Construction and City Planning
Housing and public Services Division

GUIDE FOR SYSTEMATIC DISPOSAL OF THE MUNICIPAL SOLID WASTE

Infromation Centre for Construction, Budapest 1978

Table of contents

Introduction

Introduction

The last phase of municipal solid waste* management is the disposal of the wastes. The growing amount of generated wastes sets the organizations deal with public sanitary services and the supervising councils more and more complex and responsable tasks.

Many settlements do not have disposal sites which can meet the environmental protective and public health regulations. Due to its relatively low budget the waste disposal remains the sole significant method for treating waste in the country. The up-to-date methods can be introduced step by step.

In our study these facts have been taken into account. Our aim is to provide the organisations and councils deal with public hygiene with a summary on most important requirements regarding systematic disposal of MSW.

Within this framework the guide outlines the deleterious effects of non-systematic disposals - applied in many places -, the aspects of potential site selection, authorization procedure and the requirements in terms of technology, health, and environment protection.

In the Annex attached to this Guide you will find the various disposal technologies, the operational matters and the general economical aspects of systematic disposal.

* The materials considered as MSW in this study are listed in Public Sanitary Code Section 3, Para /3/ as household waste, and in Section 5, 6 as not household waste together with household.like industrial waste.

56

1. Deleterious effects of non-systematic disposal

The deleterious, harmful effects of non-systematic disposal for public health and environment are summarized as follows:

1.1 Air pollution

During waste disposal process and from the surface of uncovered waste a great deal of dust gets into the air due to the wind and this dust is the carrier medium for pathogenic microorganisms which are in the waste. These organisms directly or indirectly could infect humans and animals through foods, plants and soil.

These floating substances have low specific weight and large surface and could cause temporary air pollution effect. After its deposit it contaminates the ground surface.

The characteristical, stinky gases originated from waste's decomposition can be smelt even in long distances.

1.2 Water contamination

The deleterious materials originated from physical, chemical and biological decomposition of disposed waste get directly into surface waters by means of leaching caused by precipitation or indirectly into ground water by means of seewage waters. The physical characteristics /i.e. conductivity, temperature/, the chemical characteristics /pH value, ion concentration - could have corrosion impact -, hardness, organic content/ and the biological characteristics /e.g. BOI_5 and KO I values/ of the water are changed by these decomposition products happen to be contaminators.

The waste deposited near water or onto surface water contaminates the waters not only by its decomposition product but by its "waste" as well.

1.3 Soil contamination

The self-cleaning ability of the soil is reduced by the contaminators originated from waste's decomposition /e.g. some of the toxical materials could hill the micro-organisms in the soil or at least could hinder its activity./

1.4 Other adverse effects

- Proliferation of rodents
- Proliferation of insects
- Potencial risk of infections
  - Direct: through scavengers
  - Indirect: through animals
- Not an appetizing sight

Due to its deleterious and contamnating effects the non--systematic disposal do not meet the health and environment portection regulations therefore this method of disposal should be stopped. /According to the Act II. 1976/

2. Set up conditions and construction aspects of well-managed disposal sites

The Act II in 1976 ordains that in settlement's area the waste may be disposed only on a place rendered for this purpose and only by a stipulated method.

According to the decree 9/1970 /5th September/ EüM - ÉVM the Council of the settlement should arrange the establishment of thece final disposal sites.

The selection and the establishment of the site should be carried out according to the land use authorization procedure and to the public health, water management and environment protection regulation and in compliance with National Construction Standard.

2.1 Procedure for selection and establishment of a disposal site

The establishment of a disposal site and its auxiliary facilities which are necessary for the operation /roads, social welfare buildings, stocks/ requires territory therefore the relating regulations should be followed.

2.11 Land-use permission

The decree 34/1974 /August/ MT Section 5, Para /5/ on investments together with the decree 3/1974 /6 August/ OT-PM Section 4 for the execution of the previous decree deal with the regulations controlling agreements between the council and contractor on employment and land-use of a territory suitable for investmen. According to these decrees the agreement may not substitute the land-use authorization just precedes it.

The exchange value - mentioned in the Section 4 Para /1/, Item a/ of 3/1974 decree - means the employment fee for the land as it is regulated by the decree 50/1975 /22 November/ PM-ÉVM-ÁH.According to this decree the contractor should pay only this fee because companies deal with public services shall not pay annual land use fee. The amount of the land employment fee is set in the agreement mentioned above. Contractor should not pay even land employment fee if the right of disposal obtained by purchase, exchange or expropriation.

However the prerequisite for obtaining the right of disposal is to have a land use permission given by construction authority to the contractor.

The contractor shall apply for land use permission as per decree 1/1968 /11 January/ ÉVM deal with applying procedure.

2.12 Annexes to be attached to the land use application

The followings should be attached to the application for land use besides the documents listed in this decree Section 5, Para /2/, Item a/,b/,c/, d./, e./ f/g//j/.

- Detailed report from experts on hydrological, hydrogeological, topographical and meteorological conditions of the disposal site and its surroundings. Relevant maps are to be enclosed to it.
- Engineering report and capacity calculations
- Recultivation plan

Among other authorities mentioned in Item j/ it is very important to have the concurrent opinion of Water Management Directorate for that area as it is mentioned in regulation 4/1970 /18 December/ OVH.

Other wastes then MSW must not be hauled into the site unless it is permitted by public health and water management authorities.

If some parts of the area are owned by the state, the construction authority will apply to the relevant administrative body for utilisation right which will be given to the constructor. The authority will enclose the permission for land use and the body will start the procedure officially.

If the right of disposal obtained through expropriation then the regulations concerning this procedure - see Annex - shall be followed. The establishment of a final disposal site is of common concern therefore according to the regulation No. 24, 1976 the expropriation has legal basis.

If plot boundary modifications are needed when establishing the site, the following regulations should be followed: Decree 29/1971 /29 December/ ÉVM and 1/1968 /11 January/ ÉVM.

We would like to point out that if the case explained in decree 1/1968 /11 January/ ÉVM, Section 19 prevails - i.e. not necessary to apply for land-use permission - it is recommended that contractor takes out certificate or principle permission for construction mentioned in the decree from construction authority because this will make easier to get final permission for construction /establishment/.

Both preparatory works for selecting disposal site as well as the elaboration of plans for waste disposal are complex engineering - geological tasks. It is recommended to have these tasks done by institutes having proper expertise and experience. /It is better to assign only one institute/.

The following institutes are recommended for these jobs:

- Magyar Állami Földtani Intézet Területi Földtani Szolgálata /State Geologycal Institute Regional Office/
- Földmérő és Talajvizsgáló Vállalat /Geodetic and Topographic Company/
- MÉLYÉPTERV /Stuctural Construction Engineering Office/
- VIZITERV /Hydraulic Engineering Office/
- KEVITERV
- Területi Vizügyi Igazgatóságok /Regional Water Management Directories/
- Geofizikai Intézet /Geographical Institute/

2.2 Aspects of disposal sites' selection

The following data should be collected prior to select the area for disposal sites.

2.21 Preliminary data:

a/ Amount of waste transported in /m^3/day, t/day, m^3/year, t/year/

- The size of residential area from which the waste is collected, number of residents, projected changes
- Characteristic data on other waste generators served by the disposal site.

  e.g. industry, commercial sector, waste amount generated by these companies /m^3/day, t/day, m^3/yegr, t/year/
- Vehicles used for collection /type, method of discharge/
- Collection characteristics /time, distance, frequency, time of go and back trip/
- Discharge frequency on site /vehicle/hour/

b/ Disposed waste's characteristics
- Composition
- Specific weight
- Shrinkage features

Projected changes in Items a/ and b/

c/ Accessability of disposal site:
- Route /length, condition of the pavement, traffic/
- Projected changes

The following aspects should be taken into consideration when selecting disposal site.

2.22 The size and capacity of the area, possible extensions

The items in the title determine the amount of waste to be disposed. It is recommended to select an area of a capacity and size that will ensure the MSW disposal for the settlement and its catchment area for at least 10-15 years.

It is important to know extension possibilities respecting the size and capacity of the area.

2.23. Location of the site, its accessibility with the view of its distance from its catchment area

The accessability /road, rail/ and traffic conditions /road loadability, traffic, width of the roads, traffic disturbing factors/ can be studied by using topopgraphicical maps and surveys.

Becoming familiar with traffic conditions it should be decided whether the road network' condition is good enough to bear projected load or modifications are to be done.

The extent and nature of modifications are to be enclosed to the documents to be approved. /This would cost a lot of money in some cases./

Having more than one potencial site it is recommended to elaborate a study on optimum expenses on the basis of information on collecting system, transport costs, traffic conditions in order to reduce expenses. /Short transporting distances are more cost effective than long ones/.

The transport costs of covering materials extracted elsewhere than on site should also be incorporated into the study.

2.24 Distances between the site and settlements or infrastructural establishments.

It is compulsory to meet regulations of OÉSZ, Annex 2 saying that minimum distances between final disposal sites and residential, holiday, communal establishment are to be 500 m - if the population of the settlement is less than 10,000 - or 1000 m - if the population of the settlement is over 10000.

The protective area situated between the site and any other establishments should be at least 500 m thick. If the area is a forest the distance can be reduced upto 300 m. At least 100 m distance should be kept from national road.

2.25 Other aspects /environmental requirements/

The linkability to public utilities should separately be examined with view of cost effectiveness of the project.

- Electric supply
- Drinking and washing water supply
- Telephon lines
- Drainage system

The agricultural and silvicultura value of the territory shall always be determined.

According to the decree 38/1977 /12 October/ MT Section 11, Para /1/ Item d, "The area selected for establishing final disposal site should be of low quality or unlift for agricultural activities." The notions stated in regional development plans for the area should be taken into account when selecting the site. The meteorological characteristics of the area shall be determined through topographical maps and statistics from National Meteorologycal Institute. /e.g. dominating wind direction, velocity of wind, frequency of mist at bigger disposal sites/. The OÉSZ Book 1, Chapter 5, Section 93 is saying that it is recommended to place final disposal site on the least frequent wind direction toward the settlement.

The disposal site is a diffuse source of pollution in view of air quality protection. The site may be established on areas either of other cathegory or of protected cathegory but the emission standards are always be met. The projected emission data of the site - i.e. dust, aerosols, stinky materials, dicomposition products /e.g. methane/ - can be forecast according to the emission data measured at other disposal sites operated by similar technology.

The requirements of relating air quality assurance regulations shall also be followed when establishing disposal sites. / Decrees 1/1973 (9 January) MT, 11/1973 (18 April) ÉVM, 19/1974 /27 December/ ÉVM; communiqué 58/1974 /Ép. Ért. 1975 No. 1/ ÉVM, 59/1974 /Ép. Ért. 1975 No. 1/ ÉVM-EüM, and decree 3/1976 /16 Janary/ ÉVM/.

2.26 Geological, hydrological and hydrogeological characteristics of the disposal site and its surroundings. These data shall be incorporated into the expert's report.

It is very important to know morphological characteristics of the surface for planning and scheduling ground works and preliminary field-works to be done in the first phase of establishment. The various morphological features - i.e. flat parts, low-level areas, slope categories, slope evenness; miscallenous field formations and its linkage - can be identified by using topographical contour maps, geomorphological maps and by ranging overs.

The information obtained through topographic survey are also very important:

- Description on pedology and statigraphic conditions of the area, evaluation of technical-topographic features
- Determination of location, thickness and depth of impermeable layers.
- Presentation of dynamical geological processes which take place in the area of the site /erosion, deflation/ - if there are any.

The hydrogeological and water balance characteristics of the area shall be evaluated together with topographical features. Data should be collected on water balances of various soil layers (e.g. permeability, adsorptive capacity, run-off/ the location of ponding in the layers, location of ground water its fluctuation, direction and velocity, ground water flow, location of ground water catchment area. These data can be obtained either through calculations or through groundwater maps.

In view of topography the site is recommended to be established onto loamy or loessy formations.

Having all the topographical and hydrogeological data is important to judge whether it is necessary to perform sub-soil compacting, insulation or preliminary fill-up; and whether there is sufficient amount available on site for covering materials.

If no covering materials are available on site the place of its extraction should be selected. No establishing disposal site on area flooded by ground water!

OÉSZ Book 2, Chapter 21, Section 49 ordains that between the maximum expected ground water level and the bottom of waste should be a soil or filter layer of at least 1.5 m thickness. In case of higher ground water level the pit should be filled with construction debris or soil having no organic content.

The information on water balance of the area can be obtained from hydrographic maps. The informationsare as follows:

- Sources of drinking, mineral, curative water and waters for public and industrial use and their protective areas.
- Protective areas for water treatment, water drainage works and equippments
- Ground water storage and catchment areas which are preserved
- Surface water flow and catchment areas to be protected
- Fish hatcheries, open baths
- Areas with risk of flood and inland water

It is not allowed to establish disposal site on the above-mentioned areas.

If the collection of precipitation running off the site are separated from the collection of sewage water, surface water flows shall be found nearby the site for drinking in precipitation. The intake capacity of it should be calculated as well. /On the basis of information given by VIZIG and/or KÖJÁL/

2.27 Recultivation of the site

The superficial morphological features of the site and its surroundings as well as the nature of plants determine the recultivation method. The following aspects should be taken into account when preparing recultivation plan:

- function /the land will be used for agricultural, sylvicultural or other purposes/
- aesthetic /to fit superficial formations, landscape/

Efforts should be made that disposal results as small damage as possible on environment. During authorization process the negative environmental effects of the operation should also be evaluated.

According to the aspects mentioned above you will find below some typical examples of areas which are unconditionally, conditionally or not at all suitable for establishing disposal sites on it.

Suitable areas:

- Areas that can not be utilized by agriculture, sylviculture
- Sandmines, gravelmines, claymines of permanently dry nature
- Worthless areas remained after mining activities /open-cut/
- Hill-sides, slopes

Conditionally suitable areas
- Pits, trenches
- Agricultural areas with low furtility
- Valleys
- Wood cleanings
- Stone mines

Unsuitable areas:

- Protected areas in view of water management
- Protective areas for public hydrologycal plants
- Areas with risk of flood and inland water
- Reserved areas
- Forests for protection and for holiday purpose
- Sandmines, gravelmines, claymines etc, flooded by water.

2.3 Aspects to be taken into account when planning and establishing disposal sites.

2.31. Field and soil preparation

The field-works should be carried out accomodating to the surface formations and topographic characteristics of the area. Field-works include clearing works - root out bushes, shrubs, individual trees - as well as superficial works.

Superficial works should be performed in a way that the water polling is avoided, seepage is averted, surface and seepage waters are drained under controll.

Smaller superficial unevenness should be eliminated, slack waters, smaller puddles are to be filled with ground, the waters of smaller streams running across the area are to be conducted into a new bed. On inclined areas the field-works should be done crossing the direction of slope.

2.32 Water conservation

In order to prevent any seepage to the area of the disposal site from surrounding surface waters, a proper ditch system should be formed. It can be a belt-ditch around the site or just a brim-ditch protecting some parts of the area. The ditch should be located at a distance that the operation is not disturbed and there is no need to repair it frequently during operation. The water accumulated in the ditch can be drained into the surface reservoire appointed by authorizing authority. One of the most important environmental protective aspects is to protect surface waters and ground water. There are two types of water to be taken into consideration during site's operation in terms of impurity: the less contaminated precipitation flowing off the surface and seepage water seeping through disposed materials.

The latter water is contaminated by soluble materials /e.g. nitrates, sulfates, chlorides etc./

Surface waters should be stored and drained in proper drainage ditches. Typically the ditch is open at the top but it can be closed too. If ditch system is closed, sludge and drift deposit may occur thus requiring periodic cleansing.

Proper accumulation and treatment of seepage water is of high importance. Seepage waters get directly from waste into the soil or ground water.

Methods of avoiding damages caused by seepage waters are as follows:

- Utilize self-purifying ability of soil
- Compress naturally or artificially the soil layer underneath the site and drain seepage waters through drain-pipe

In the first case information should be collected on types and quantity of pollutants probably seeping together with seepage water, on stratigraphic structure and hydrogeological status of the site's sub-soil, and on other relevant soil characteristics /e.g. Adsorptive capacity, ion substitution, mikrobiological decomposition, chemical interactivities, mechanism of leaching, degree of dilution caused by ground water/.

It is recommended to apply this method, if it is possible. /To cut down project costs, first of all./

In this case surface waters can be treated either together with seepage waters or can be drained into a surface reservoir through a sludge-trap. The place for reservoir is determined by the authority who issues permission for the project.

The quality of superficial water drainable directly into surface water is determined by Water Management Directorate of the areas.

If it is not possible to conduct seepage water into a soil layer which can filter /clean/ it, then the second method shall be selected. The bottom part of disposal site shall be compacted if there is not any filter layer. During fill-up the sides are to be compacted too.

Compacting methods are:
- to compact sub-soil
- to seal sub-soil /by chemicals,bitumen, tar or plastic foils/

During soil compression the loamy parts of the surface are compressed by rollers or by vibration. The compression should be done by using clay, sandy clay or cledgy soils transported from other plans if there can no loamy parts be found on site.

The source of these materials should be as near as possible. The thickness of compressed layer is to be at least 20-30 cm.

If no loamy soil available near the site, it is recommended to seal the sub-soil by plastic foil. The foils can be welded impermeably to each other. Disadvantage of this method is that foil can be damaged when it is laid down. It is recommended to use foils of 1-1.5 mm thickness /e.g. PVC, butyl caoutchook etc./ Before laying the foils down level the surface, spread 15-20cm thick fine sand on it and roll evenly. Then lay the foils down, put another layer of 20-30 cm of sand. The first waste layer should be disposed with care in order to keep foil undamaged.

Sealing methods using chemicals /lime, synthetic resin/ are used for sealing disposal sites for special industrial wastes.

When applying sub soil compression and seal care should be taken of accumulation and drainage of seepage waters.

In this case the drained seeping waste water can be treated together with contaminated surface water. The amount of surface water is a function of disposal site's dimension and annual precipitation. The amount of seepage water is a function of precipitation, waste's thickness and compactness. According to ,experiences from practice the amount of seepage water is 0.05-0.1 l/sec/ha /?/ /Taking 700-800 mm yearly precipitation for the basis of calculations/ i.e. 4-5% as minimum and 20-25% as maximum of yearly precipitation may be taken into account when designing the plant.

When waste waters of disposal site are collected and drained it can be treated as follows:

- Discharged directly to public severage system
- Discharged into sealed water basin, from which it can be transported into municipal waste water treatment plant by special trucks.
- Treated in severage treatment plant built near disposal site, and then led into surface reservoire

- Treated in aerating ponds
- Led into drainage bed below surface

Select the method which is most suitable for the area.

Either you apply the method using filtering ability of soil or compressing method for water protection the regulation mentioned previously /OÉSZ, Book 2, Chapter 21, Section 49/ shall be met for both cases. The area may have to be filled-up preliminary /by construction debris for example/ especially when filling up the pit. In order to get information on ground water polluting effect of the disposal site sampling wells shall be bored. To select the place for the wells, the ground water flow direction should be taken into account. This is especially immortant when the applied waste water treatment method is which utilize soil's self purifying ability. Water management authority should also be involved at finding the place and deciding the number of wells. The establishment of the wells shall be permitted by Water Management Directorate for the area.

2.33 To reduce air pollution

In order to reduce air pollution and noise emission it is recommended to plant a wood-belt around the site with a thickness of at least 8 m. The site must be surrounded by fence in order to keep away unauthorized persons and animals. The height of the fence shall be 2 m, and shall be interrupted by a lift gate allowing track traffic.

2.34. To ensure covering materials

At the selection of disposal site it should also be examined whether tere are sufficient covering materials nearby -

which are necessary for normal operation of the site. If there is a lack of slag or debris, the geological examinations should determine the place of this materials to be extracted. It is crucial in view of operatinnal costs to reduce costs of extraction and transport for these covering materials. The source should be as close as possible to the site.

The waste disposed should be covered continuously or at least in the end of the day by porous stuff. The thickness of it should be at least 10-15 cm, but it is not important to have a layer of more than 25 cm thickness.

Applicable covering materials are as follows: slag, construction debris, sand, gravelly sand, superficial soil layers /loessy soils, loessy loams/. Application of heavy, cledgy soils should be avoided /The tyres of the trucks would slip on it/.

Upon completion of disposing activities the entire surface of the site shall be covered by humic fertile soil. The source of this soil and post-disposal activities are stated in recultivation plan.

2.35 Utility, auxiliary establishments

Roads

A link road should be built between the site and the nearest national road. This road must have sufficient width and must bear the load of trucks. Some of the internal roads will be operating until the site is closed, but some of them will be gradually eliminated during fill-up activities. The length and layout of the internal roads is a function of site's nature. The width and loadability of it is a function of projected traffic and types of vehicles. It is recommended to design roads with the width of 6.5-7.5 m and of average radius of 12.5 m. Visibility also should be taken into consideration. For roads with one track by-passes should be formed for emptied vehicles. The inlet road and the site's permanent road can be made from concrete or asphalt. The maximum longitudinal inclination can be 10%.

Transversal inclination shall be 1.5-2.5%. The line of the roads should be perpendicular to the direction of the slope. The inlet road shall be fitted with tyre washer tray of 25 m length, 4 m width, 40 cm depth full of water. Alongside the roads water drainage ditches should be dug. The drained water should be accumulated and treated together with waste waters of the site. Regular road maintenance is also a must.

The material of road surface should be selected on the basis of financial resources.

Truck scale

In order to measure the quantity of waste transported into the site a truck scale should be set up which will measure the weight of trucks coming in and out. The scale is very important for disposal sites receiving waste amount of more than 100-150 t/day. Typical scales can measure upto 20-30 t, its system is mechanical or electro-mechanical. /A concrete by-pass of a surface big enough to drive on is to be built as a supplement to the scale/. A scale house is also to be built which will serve also as social welfare building. This scale-house should be closable, heatable, fitted with electric supply.

Social welfare and storage building

According to OÉBSZ regulations a social welfare building should also be built in which the workers can have a wash, warm meals etc. A store house and a vehicle wash building /to clean vehicles, containers/ should also be connected to that building. A room should also be built for storing utensils too. Waste water generated by vehicle cleansing should be discharged into a depositing shaft and after its deposit it should be treated together with other waste waters of the site.

Public utilities connected

Electrical supply lines, telephon lines, drinking water supply tubes are also to be connected to these buildings. /Water supplycan be provided through water containers in case./ Street lighting system should also be erected for winter periods or for 2nd, 3rd shifts. If the poles are of 5-9 m height the distance between each other should be 40-60 m. /Light flux is to be 5000-7000 lumen for each light source./

It is possible the severage ducts should be linked to public severage system.

The design and construction of supplementary and auxiliary abilities shall be done in accordance with relevant OÉSZ regulations and in compliance with Labour Safety and Fire Prevention Codes.

3. Acts, regulations relating to construction and operation of final disposal sites

- Act No. 2, 1976 on human environment protection
- Decree 9/1970 /5 September/ EüM-ÉVM on public hygiene
- Decree 5/1974 /24 May/ ÉVM on publishing OÉSZ
- Decree 34/1974 /6 August/ MT on projects
- Decree 3/1974 /6 August/ OT-PM on execution of MT decree on projects.

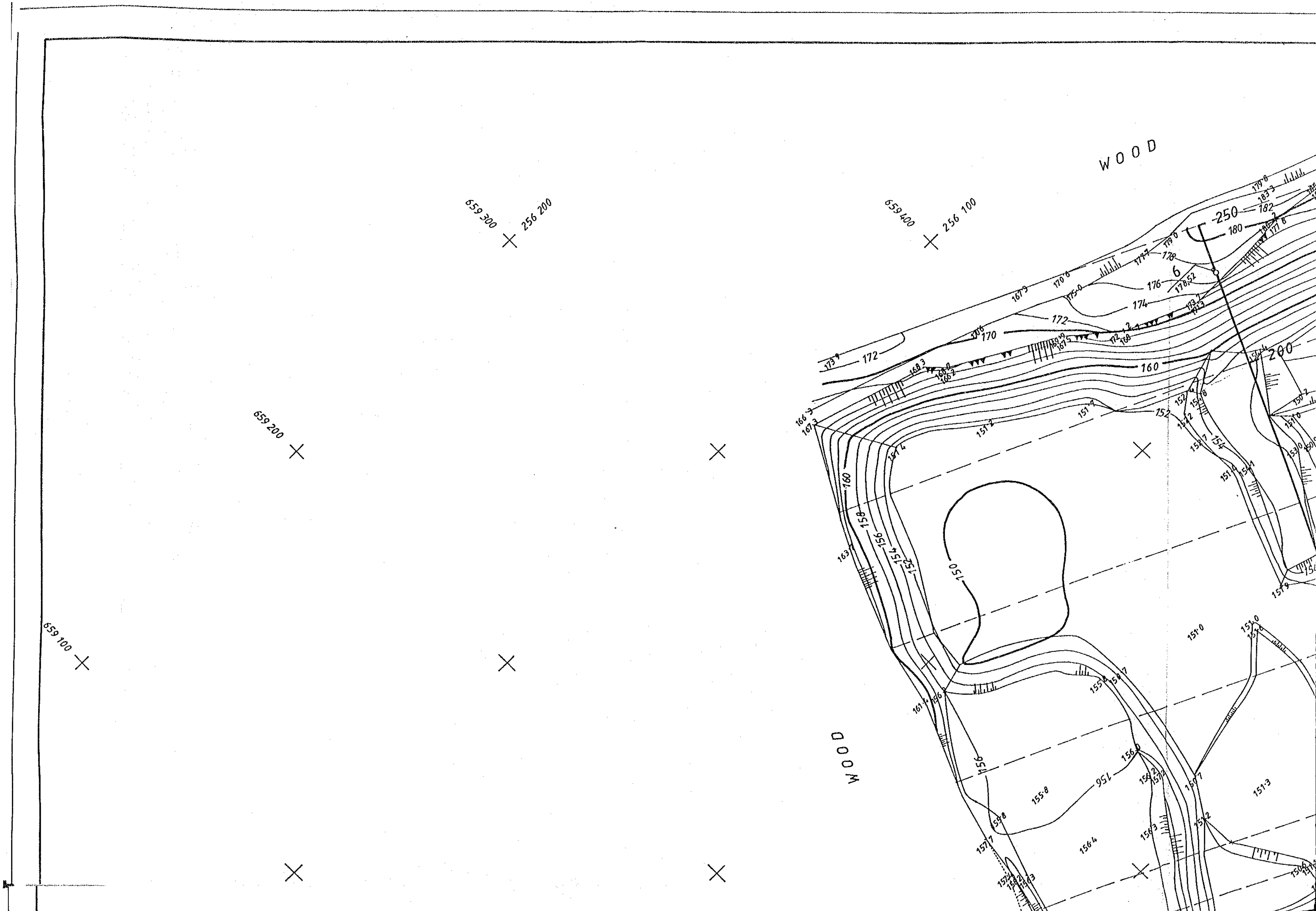
- Decree 50/1975 /22 November/ PM-ÉVM-Ált on usage and employment fees for state owned plots.
- Decree 1/1968 /11 January/ on land use permission procedure
- Regulation 4/1970/17 March/ OVH on authorizations concerning water management
- Decree with legal force No 24, 1976 on expropriations
- Decree 29/1971 /29 December/ ÉVM on plot modifications
- Decree 2/1977 /18 January/ ÉVM on construction authorization procedure
- Decree 38/1977 /12 October/ MT on execution Act No 6 in 1961 for protection of lands
- Decree 1/1973 /9 January/ MT on air quality protection
- Decree 11/1973 /18 April/ ÉVM on execution of decree 1/1973 /9 January/ MT.
- Decree 19/1974 /17 December/ ÉVM on air pollution penalty and Communiqué 58/1974 /Ép. Ért. 1975 No. 1/ ÉVM on publishing Annex of Decree 19/1974 /17 December/ ÉVM.
- Communiqué 59/1974 /Ép. Ért. 1975. No 1/ ÉVM-EüM [illegible] air pollution of settlements

Abbreviations used in the Guide

1. MT = Ministerial Council
2. ÉVM = Ministry for Construction and Regional Development
3. OÉSZ = National Construction Standard
4. EüM = Ministry of Health
5. Ép. Ért.= Construction Bulletin
6. VIZIG = Water Management Directorate
7. KÖJÁL = Public Health and Epidemiology Institute
8. PM = Ministry of Finance

VIII. Topographical Survey

- Dunakeszi Final Disposal Site -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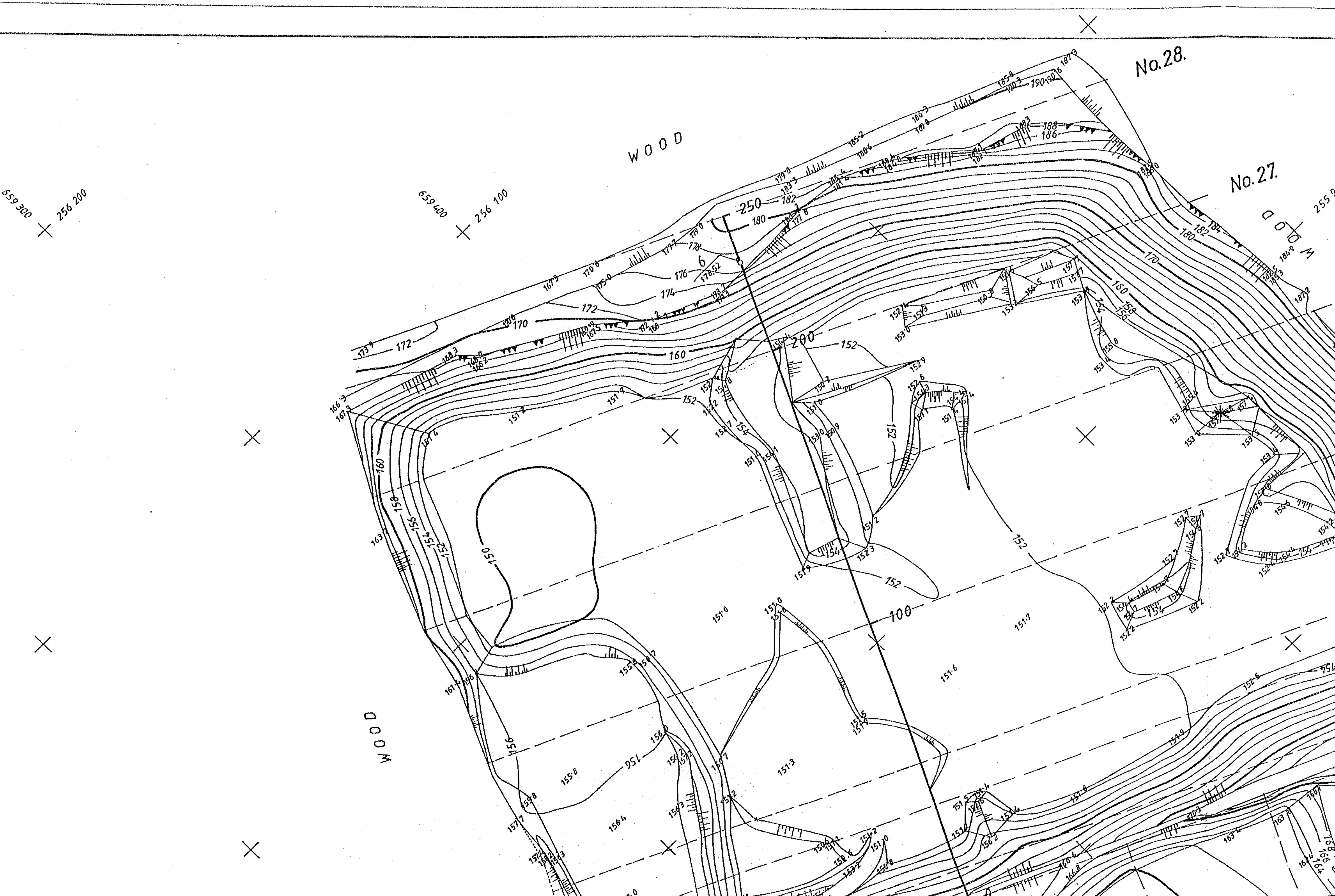
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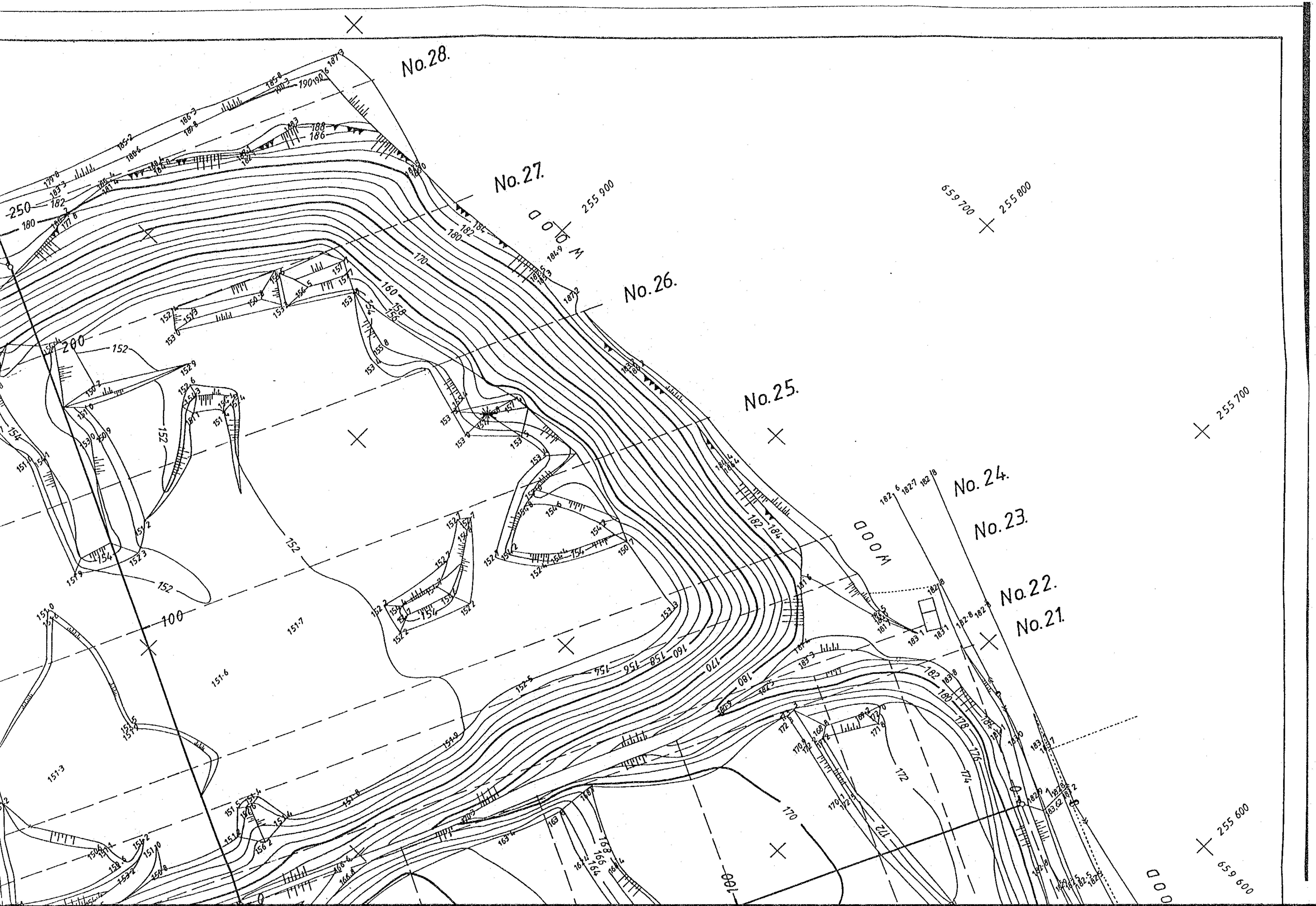
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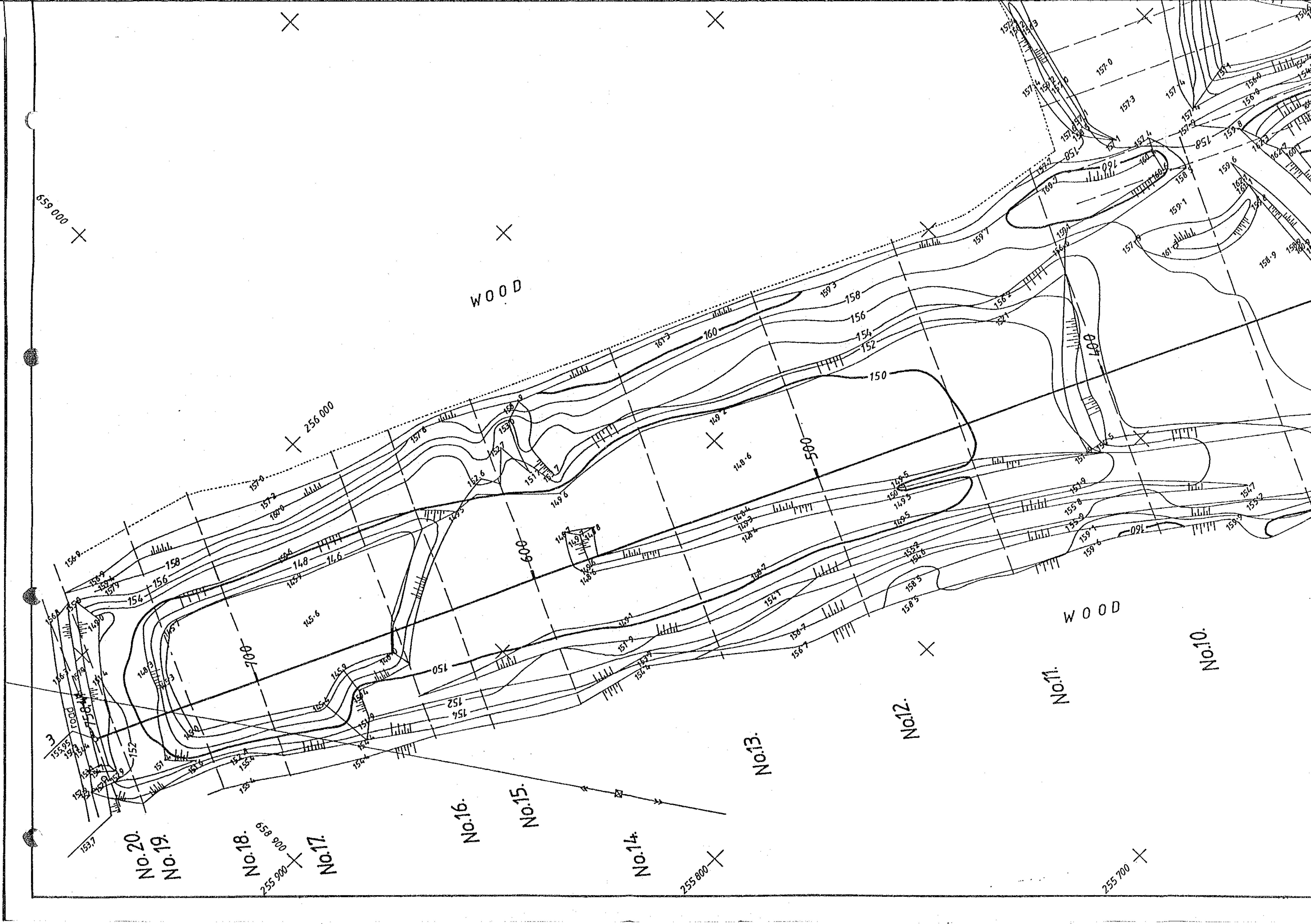

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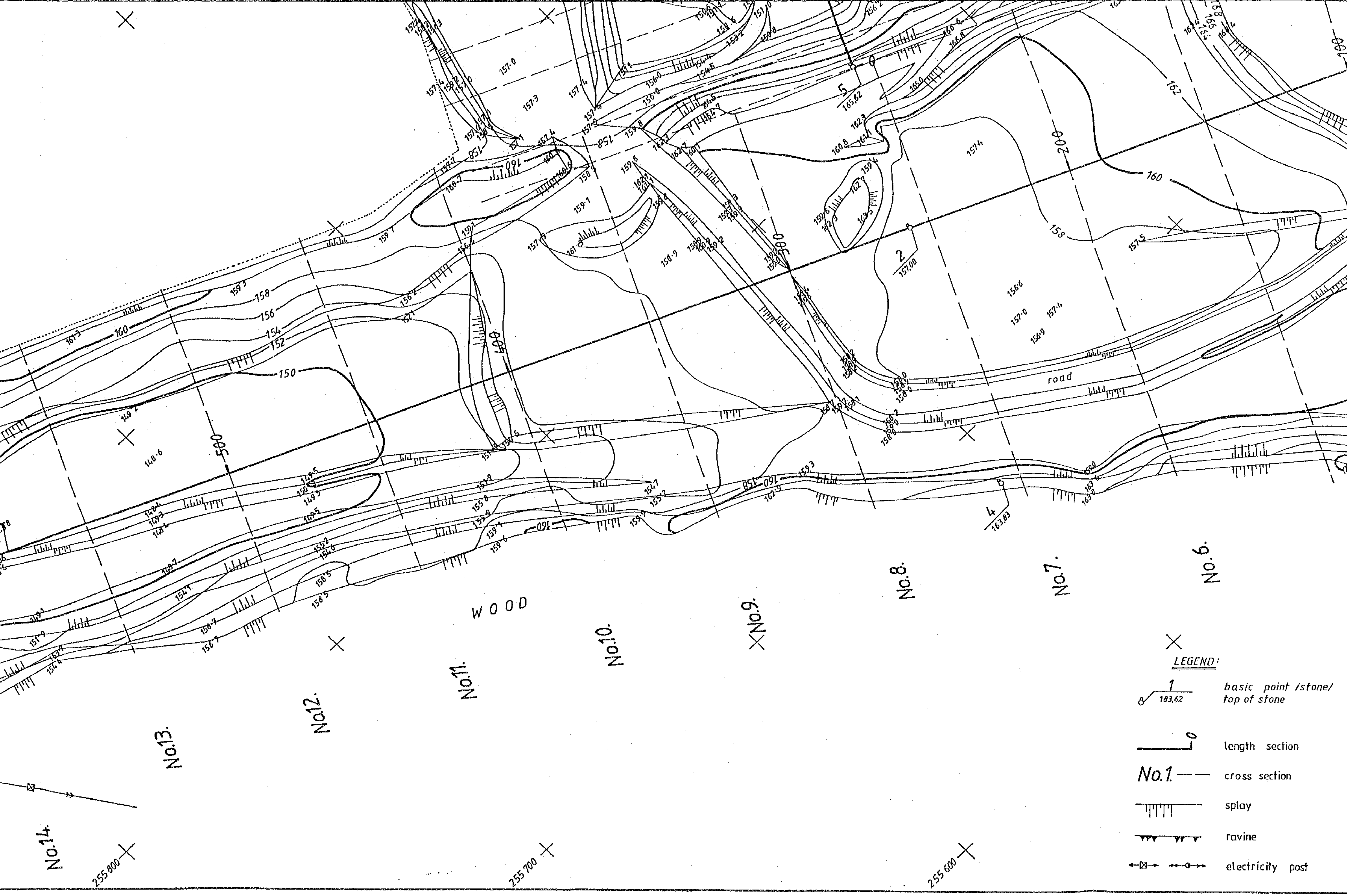
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LEGEND:
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length section
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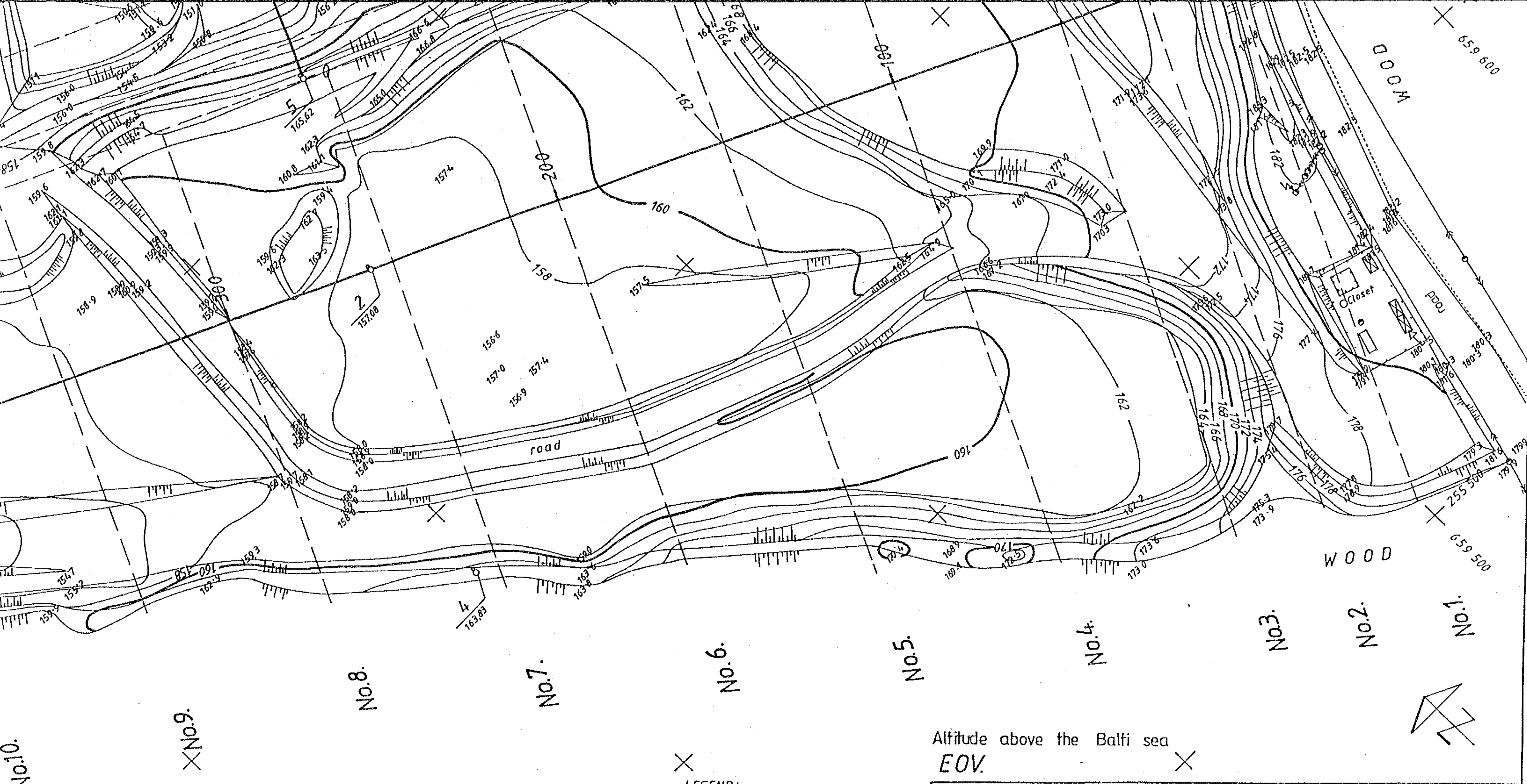

Altitude above the Balti sea
EOV.

LEGEND:

1 / 183,62	*basic point /stone/ top of stone*
	length section
No.1. — —	cross section
	splay
	ravine
	electricity post

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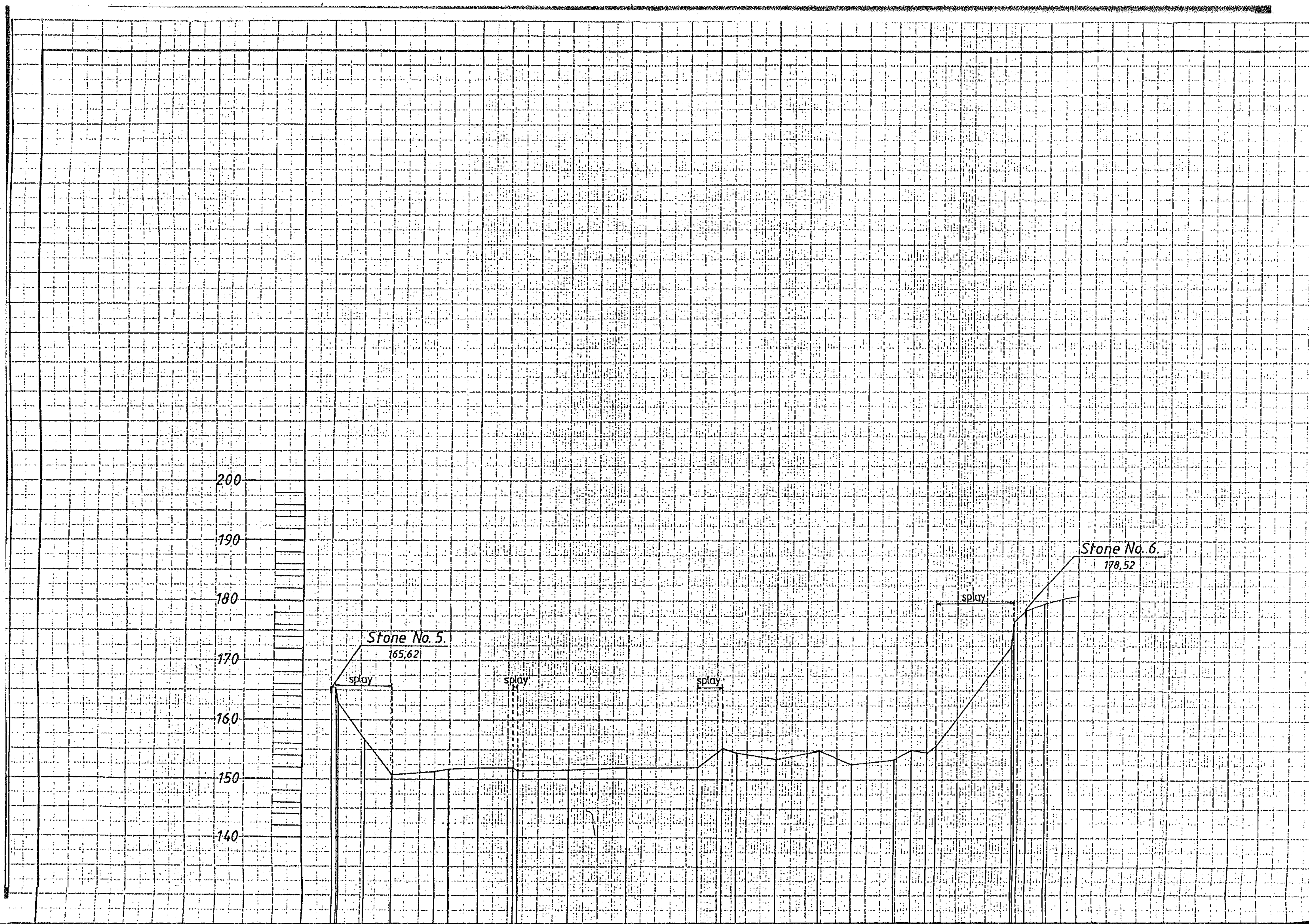
Principal: J. I. C. A.	6 — 1
Subject: Geodetic examination of the Dunakeszi sand quarry (Hungary)	Drawing No: 3
Site plan	Scale: 1:1000
Man. Director: Egerszegi / Vice Manager: Járomi / Designer: Soós	Date: 1992. 06.



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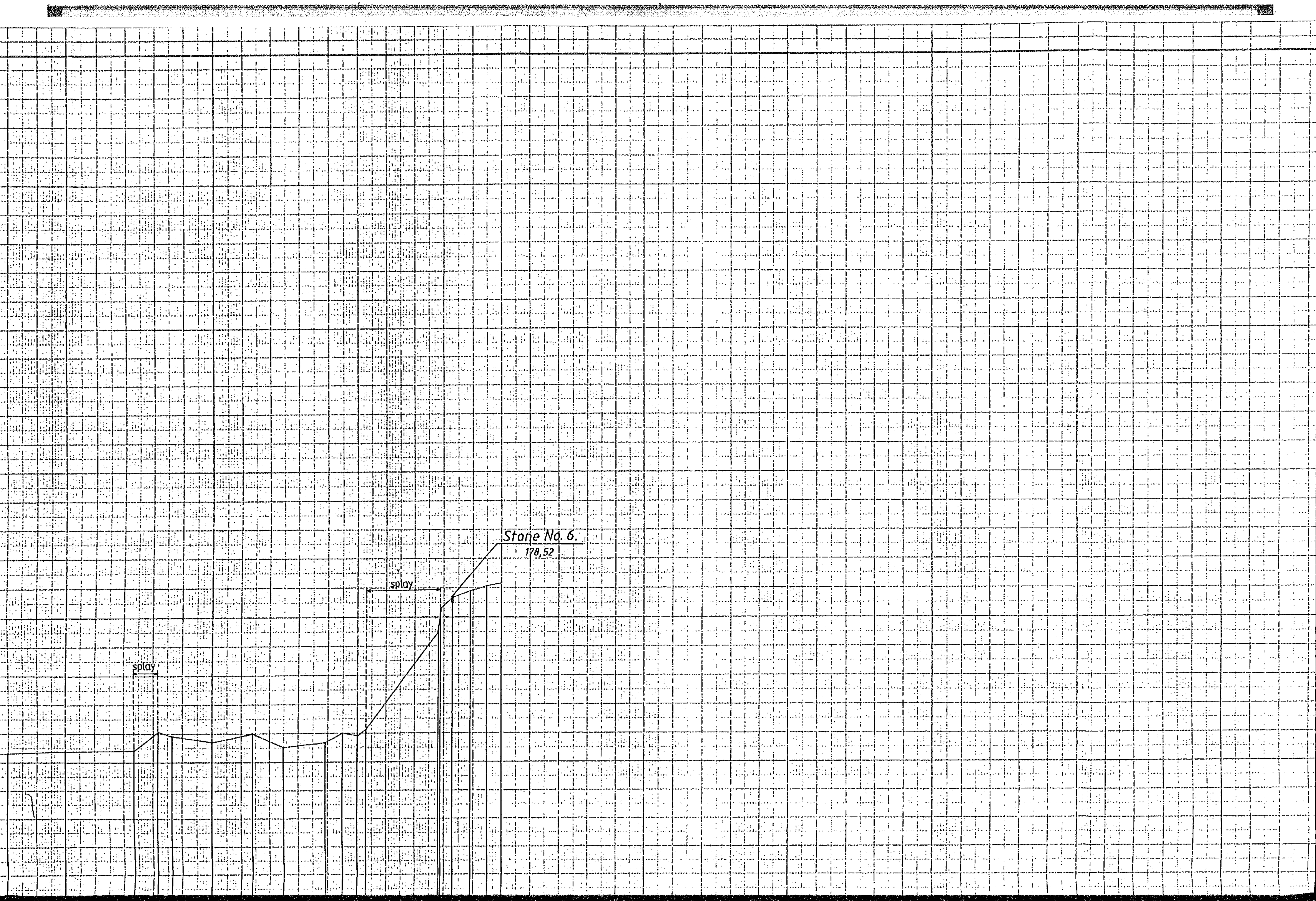
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