The program of geological exploration
speed hydropower plant on the river Chilik Kazakhstan

(Preliminary design)

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Table of contents
1. Introduction

1.1 Outline of the facility

Stepped Chilik HPP located on the territory of Almaty region of Kazakhstan, 160 km from Almaty city and is a tributary of the Ili River. This river originates from the glacier Ile Alatau south-east of the city of Almaty. The source of water is basically the melting of ice and snow. The river flows from west to east over a distance of about 160 km, turns from south to north and empties into the Kapchagai reservoir on the Ili River (built reservoir USSR), the total length of about 245 km. In the period from 22.11.09 till 28.11.09, the experts conducted a reconnaissance at the site, collected data, exchanged views, pre-planned and chose a place for mountain areas to the upper reaches to the lower reaches of the river Chilik (1 HPP-6) after these have made the option of the design. Stepped hydropower plant on the river Chilik is mainly located in the area of the middle reaches of the river (in the stretch of river length of about 80 km. To place water-supply HPP), a total of 6 levels of water-supply hydroelectric power station. Among them, the geographical coordinates of the gate of the dam 1 HPP-speed upstream: east longitude 77 ° 54'32 " , north latitude 43 ° 03'00" , the geographical coordinates of the sixth space hydroelectric cascade: east longitude 78 ° 30'52 " , north latitude 43 ° 18'09 " . The main objective of the construction project - the production of electric power generation. GES various stages consist of diversion unit, diversion channel, diversion tunnel, the primary retention basin, the well pressure control, a steel pipe pressure station unit HPP tailrace canal and other structures, the total loading of step 6 hydroelectric -254MW, object category - medium and small a type.

1.2 Status of this work

Previously, no one engages in any exploration of the object. From the Customer Project in Kazakhstan collected zoning maps, seismic activity in the area of the facility, geomorphological map scale of 1: 50 000, topographic map of the scale 1: 100 000 scale topographic maps .i 1: 25 000, geological materials are insufficient. This exploration program is inaccurate preliminary design phase.

2. Brief information about the topography and geology, working conditions

2.1 Brief information about the topography and geology

The water basin of the river Chilik is located in Almaty region in the south-east of Kazakhstan, in the south bordered by Kirgizstan. Chilik river is the river with domestic effluent from Glacier Zaili-Alatau Alatau Mountain and flows into the river Or, the water source is mainly composed of water ice and melt snow. The western and southern parts of the area are mainly composed of layers of Proterozoic and Paleozoic
era and are a mountainous area with medium and high altitude through the ablation structure. Normal altitude is 2500 ~ 3500 m, the relative height difference - 880-1000m, middle and eastern parts of the layers consist of Paleozoic and Mesozoic, are hilly plain with the erosion of the structure, the usual altitude of 1400 ~ 2000m, relative height difference - 250 ~ 500 m. The construction area is located in a zone of mountains of medium to high altitude and hilly area of low plains of the northern part of which is an inclined plain, which consists of a reservoir Neozoic era, the usual altitude of 500 ~ 1100m the relative height difference - 50 ~ 100 m.

The facility is located in the mountain area with medium and high altitude in the south of the pool or, in the low hilly plains in the middle of the river (that is, the turning point of the river to the west-east direction to the north-south direction) - intra-cavity, around the basin surround high mountains, elevation mountain peak usually is 1700 ~ 1900 m, Inner elevation depression usually within 1280 ~ 1360 m. Due to the fact that the speed hydropower plant at this facility is in the area barranco mountainous part of medium and high altitude, and low rolling plains in the area of the upper reaches of the glacier is developed on the banks of the river in the area of the 6-speed hydropower plant developed about 120 ravines, gullies within large round runoff.

Outgoing layers in the construction zone are basically different types of schist, gneiss, tuff Proterozoic and Paleozoic sandstone and mudstone third of the Cenozoic, the fourth layer of the system (Q), and the granite intrusive early and late Paleozoic era. Construction zone is in a descending pool Sat structural unit of the second degree in the area of Chilik, southern neighbor with dipping pool Kalakeer (in Kyrgyzstan) border break on the southern edge of the mountain Kungeyalatao (razryvF2), on the north by dipping pool between the mountains of the Ili River border gap on the southern edge of the valley or (razryvF1), in the area of the development of regional discontinuous break on the southern edge of the valley or (gap F1), a break on the southern edge of the mountain Kungeyalatao (F2), discontinuity of the second degree - F3, F4, F5, etc. According to the zoning map of the intensity of the earthquake in Kazakhstan, the main strength of the earthquake in the construction zone - IX points unstable regional stability.

2.1 Working conditions

Chilik river is mainly in the mountainous area of the underlying rock. In pools of between 3-speed hub hydropower stations and the station over the top - diversion unit located settlements and there is a road, except on the right bank of the river at the site of the station unit 6-speed hydroelectric power station on the downstream of the same there is road traffic is very convenient. But in other parts of the river valley, there are no roads, conditions more difficult posts. In general working conditions in the area of construction is satisfactory.
3. The task of intelligence work content, methods, and planned amount of work

Under this project, the river Chilik is located just 6 steps HPS, the main content of intelligence at this stage see. The following:

3.1. The task of intelligence

According to a feature of the object, this geological exploration includes the exploration of regional geology, geotechnical conditions of location area diversion unit, the supply of the tunnel, the supply diversion canal to generate electricity, hydroelectric station unit and the exploration of natural building materials. The task of geological exploration at this stage mainly consists of the following:

① Determine the position of the placement, size, properties, shape and activity of the regional gap, to conduct a study of stability of the regional structure, to evaluate the stability of the structure of the construction site and the danger of earthquakes;

② Determine hydro geographic and engineering-geological conditions in the area of water submerged the headwater diversion unit at different levels, analyzing geotechnical issues, forecasting changes after the research;

③ Determine hydro geographic and engineering-geological conditions of facilities in the area locations diversion unit at different levels, analyzing geotechnical issues and assessment;

④ Determine engineering-geological conditions of the site of water-supply tunnel, diversion channel, to generate electricity, the well pressure control, pool control, pipe pressure and location of the station unit hydroelectric and other structures, to assess the respective major geotechnical issues present geological materials and suggestions for selection and the definition of the axis structures and subgrade treatment options;

⑤ Carry out detailed inspection of the natural building material.

3.2. The content of the exploration work, methods of work and the amount of work planned

3.2.1. Regional Geology

1) The content of the exploration work: conduct a study of the regional structure of the background, to explore an active break near plochaki HPP at different levels and their impact on the object to evaluate the stability of the structure and earthquake hazard on a construction site.

2) Methods of investigation: conduct decoding and analysis of the material about the earthquake and other geological data corresponding to the construction zone, in the ways of crossing through a connection and passage to conduct regional exploration break by adding certain structural debarking soil.
3) Planned amount of work see next: collection, decoding and analysis of regional geology and other documentation, conduct research and analysis on the spot for a structure with regional faults, to assess regional stability. 100 Group / day.

② Determine position of placing the structure of faults, bandwidth fragmentation and their activity, it is necessary to conduct structural debarking ground 800 m³

③ Measurement of the year reset (to reset the vicinity of the construction site using a C14 or thermo luminescence to measure the year) 2 groups

④ Rate structural stability and the risk of earthquakes in the construction site.

⑤ Regional-geological survey 1/50000 (based on the topographic map 1/25000) 250 km²

3.2.2. Area water upstream water diversion unit

1) The content of the exploration work: find out sections in the area of water headwater diversion unit, which may arise serious leak, carry out exploration work in accordance to the respective properties of matter; clarify the scope of placement, volume, geological structure, the boundary condition of unstable slopes, to present a proposal on the prevention; to find out the thickness of the soil layer in the submerged zone, the physical properties, penetration coefficient, critical depth submerged groundwater.

2) A method of exploration: in the manner necessary to carry out a geological survey, exploration borehole, tests, etc.

3) The planned amount of work. See the following:

① Geological survey area water upstream water diversion unit 1/10000 (1, 2, 3 and 6, a graduated HPP) 40 km².

② Geological survey and measurement of the profile of the slope 1/2000 (1, 2, 3 and 6, a graduated GES) 3.2 km / 8 lanes.

③ Geological survey immersed profile and measuring 1/2000 (3 and 6 speed GES) 2.0 km / 4 lanes.

④ Excavating submerged zone of 75 m / 15 pcs.
⑤ Test powder soil on the slope in the submerged area density (natural and dry), the division of grains and water absorption of 8 groups.

3.2.3. Location shutter diversion unit

1) The content of exploration: The content of exploration locations shutter diversion unit at different stages mainly includes the following:

① Determine the characteristics of the reservoir rock in the location of the gate diversion unit geological structure, rock weathering, physical and geological phenomenon, hydro-geographic conditions, the physical and mechanical properties of rocks, etc.

② Determine placement, thickness, hierarchy, structure of matter, physical and mechanical properties and permeability of the base of the fourth diversion unit in line and on both coasts, especially the need to investigate, where there is a layer of powder-fine sand.

③ Determine placement, size, shape formation, characteristics, activity, permeability, penetration and deformation conditions of kink bands and fragmentation affecting the base and shoulder bolt diversion unit.

④ Determine hydro geographical conditions of the base bolt diversion unit, permeable formation characteristics and relative waterproofing, changes in the thickness and placement, corrosive groundwater and surface water for the concrete to present a proposal for treatment against seepage.

⑤ Determine the scope of placement of the weathering zone and unloading of coastal slope, to evaluate the scope of the placement and stability of the discharge area on the left and right banks, to present an opinion on the decision. Spend quality body grouping of rock foundation diversion unit, to produce physical and mechanical parameters of rock and soil and the opinion of the handling of a base.

⑦ Determine geotechnical conditions jet guide open channel tunnel and jet guide and evaluate.

⑧ Determine geotechnical conditions waterproof bridge upstream and downstream and evaluate.

2) Method of intelligence: according to design requirements for the preliminary design phase, 1, 2, 3 and 6, a graduated power plant for the barrage of the river and damming, placed shutter diversion unit, power generation waste water 3 - steps to the 4 - level 5 - stage and 6 - stage. For each step location shutter diversion unit. The method of exploration work mainly involves geological survey, exploration drilling, borehole prospecting, exploration and physical test.

3) The planned amount of work. See the following:

(1) Geology
(1) Geological survey plane shutter 1/1000 space diversion unit (1,2,3 and 6 speed GES) 2.4 km²

(2) Geological survey and profile measurement axis 1/1000 shutter diversion unit (1,2,3 and 6 speed GES) 3.0 km / 4 lanes.

(3) Geological survey and measurement of the longitudinal profile of a jet guide open channel, tunnel, water intake valve assembly 1/1000 3.0 km / 4

(4) Geological survey and measurement of the profile waterproof jumper upstream and downstream diversion unit shutter 1/1000 2.4 km / 8

(5) Measurement of elevation and coordinates reconnaissance points shutter diversion unit 54 points.

(2) Exploration drilling

(1) Boreholes (mainly located on the axis line 1, 2, 3, and 6-speed hydroelectric and on the two banks, on the line of the axis of each stage HPP 3 wells of 12 wells, the depth of each well 40-50 m) to 600 m / 12 wells

(2) Test pressure water borehole (within all of the underlying rocks boreholes to test pressure) 60 portions / 12 wells

(3) Test for pumping borehole (hold on the axis line 1, 2, 3 and 6 speed HPP) 4 times / 4 wells.

(3) Excavation

Planned on the two banks 1, 2, 3 and 6 and the shutter speed hydroelectric diversion unit separately positioned to 8 pieces. exploration well, a total of 32 pieces, plan each hole depth of 5-6 m. 190 m / 32 pieces.

(4) Physical exploration

Applying electric mode, a plane wave or earthquake and other ways 8 to find out the thickness of the coating channel gate at the location of the water intake site and on the two banks, as their situation layer present wave velocity and rock cover.

(1) Across the river or along the river alone arrange the profiles in the area of physical exploration 1,2,3 and 6 speeds hydroelectric and other locations shutter (dam) 5.0 km.

(2) Complex measuring well borehole 500 m / 12 wells.
(5) The test is carried out in zone 1, 2, 3 and 6 speeds HPP and other locations shutter diversion unit.

① Breed: density (natural and dry), specific gravity, water absorption, compression strength (wet and dry), the coefficient of softening, shear strength, modulus and strain etc. (step 3 for each group) in 12 groups

② Evaluation of polished sections of rock 10 groups

③ Coverage address diversion unit: the division of the grain, the natural density, water absorption, specific gravity, relative density (the characteristics of two types of rocks for each stage of 6 groups) to 24 groups

④ A simple analysis of the quality of water: underground water-8 groups, surface water - 4 in all 12 groups.

(6) Armored volume of work

① Armored drilling 200 m / 4skvazhiny.

3.2.4. Flume and underwater cave to generate electricity

1) The content of exploration:

Exploration of the supply channel and tailrace tunnel for power mainly includes the following:

① Determine the linear terrain along the approach channel and the supply of the cave for power generation characteristics rock formation, geological structure, physical and geological phenomenon, hydro-geographic conditions, to assess the conditions for the formation of channels and caves, to assess the areas of intersection of the groove caves and underground areas, standing near mountain;

② Determine the characteristics of the breed in the area of the tunnel for power generation, it is important that if there is a soft interlayer;

③ Determine the position, shape formation, size, characteristics, and the ratio of Raman bands major faults, fragmentation and sealing strip of tectonic fractures;

④ Determination of parameters of physic-mechanical properties of different types of rock and soil, to conduct geological grouping intervene rock tunnel stability evaluation of rock slope intervene tunnel entry and exit, the presentation of opinions solutions.

2) A method of exploration: exploration tailrace tunnel and supply for power generation mainly includes geological survey, exploration drilling, exploration tunnel, borehole prospecting, exploration and physical test.

3) The planned amount of work. See the following: Work is mainly carried out on 1, 2, 3, 4, 5 and 6 hydroelectric and other lines and the feed supply channel tunnel to generate electricity.
(1) Geology

① Geological survey plane 1/10000 supply channel and supply tunnel for power 80km²

② Geological surveying the longitudinal profile of 1/10000 of the supply channel and the supply of electricity to the tunnel of 80 km / 6 lanes.

③ Geological survey of the transverse profile 1/1000 of the supply channel and the supply of electricity to the tunnel 8.0 km / 40 bands.

④ Measurement of elevation and coordinates reconnaissance points of the supply channel and the supply tunnel for power generation 75 points.

(2) Exploration drilling

① borehole (generally placed at the entrance of the tunnel power generation in linear gullies, only 10 wells, the well depth of 30-60 m) to 500 m / 10 wells

② Test of water pressure wellbore portions 30/10 wells

(3) Flat tunnel

(Basically positioned at the entrance and exit of the tunnel to generate electricity different stages of the well 1, total 7 pcs. The well depth of 40 m) 280 m / 7 wells.

(4) Excavation

( Mostly located along the supply channel of different stages, one exploration well is planned every 500-800 m, the total length of the supply channel 6 different stages of 40 km, only to place 60 pieces, each hole depth of 5 m) 300 m / 60 pc/

(5) Physical Intelligence

Applying an electrical method, a plane wave or earthquake are other ways to find out the thickness of the coating along the supply channel, the entrance tunnel to the supply of electricity, linear gully and other places, their environment layer present wave velocity and cover rocks and soil.

① Location profiles of physical exploration along the supply channel, at the entrance of the cave for the supply of electricity, the linear gullies and other places 10 km

② Comprehensive measurement of the well to drill a well 400 m / 10 holes

③ Measurement of wave velocity flat cave 280 m / 7 caves

(6) Test

① Breed: density (natural and dry), specific gravity, water absorption, compression strength (wet and dry), the coefficient of softening, shear strength, modulus, strain, etc. 20 groups.
2) Evaluation of polished sections of rock 10 groups

3) Cover: Grain division, the natural density, water absorption, specific gravity, relative density (the characteristics of two types of rocks) in 24 groups

4) Simple analysis of water quality: 10 groups of groundwater, surface water 8 groups of 18 groups.

(7) Armored volume of work.

1) Reinforced flat Cave.

8. 1) Armored drilling of 100 m / 2 wells 0 m / 2 caves.

3.2.5 Zone Improvement

1) The content of exploration: The content of exploration work in the area of space mainly includes the following:

Determine the characteristics of the reservoir rock, the geological structure, the phenomenon rock weathering, physical and geological phenomenon, a condition Hydro geography, physical and mehanichekuyu characterization of rocks and soil well to control the pressure, the primary pool, a steel pipe pressure, facilities and tailrace; to evaluate the stability of the slope and subgrade, submit opinions on the parameters of physical and mechanical properties of rock and soil and exercise for the treatment of a base to evaluate the possibility of the release of water during the excavation of the pit;

2) Determine the characteristics of the breed in the area of the cave underground premises, it is important is there a soft interlayer, conduct geological project grouping enclosing breed, to assess the sustainability of the cave.

2) A method of exploration: exploration in the area of space mainly includes geological survey, exploration drilling, exploration cave exploration wells, physical exploration and testing. 3) The planned amount of work see next: mainly produces 1, 2, 3, 4, 5 and 6 hydroelectric and other areas of the room.

1) Geology

1) Geological survey plane 1/1000 3.0 km2

2) Geological survey and measurement of the longitudinal profile of the project in the area of premises 1/1000 6.0 km / 6polos.

3) Geological survey and measurement of the transverse profile of the project in the area of premises 1/1000 2.4km / 12 bands.

4) Measurement of elevations and coordinate points of space exploration in the area of the dam premises 42 points.
(2) Exploration drilling

① borehole (mainly located in the room in place of the pressure control of the well and the primary well the basin 1, a total of 12 wells, the depth of each well 30-50 m) 480M / 12 wells.
② Test pressure of the water by drilling 28 sites / 12.

(3) Excavation
Planned location of 4 exploratory wells in the areas of rooms of different levels, in the three primary pools is located exploratory whole 2 pcs. Only 30 pieces. Well, it was planned pit depth of 5-6 m each. 180 m / 30 pcs.

(4) Physical Intelligence
Applying an electrical method, a plane wave or earthquake and other ways to explore the thickness of the coating in the area of the room and its furnishings layer, and to cover the wave velocity and rock.
① On the premises of various zones are 2 separate stages Profile Physical Intelligence 3.0 km.
② Comprehensive measurement well drilling 400m / 12 wells.

5) Test
① Breed: density (natural and dry), specific gravity, water absorption, compression strength (wet and dry), the coefficient of softening, shear strength, modulus, strain fashion etc. 12 groups
② Evaluation of polished sections of rock groups 6
③ Coatings in the area of the room and swimming pool control: the division of the grain, the natural density, water absorption, specific gravity, relative density (the two types of characteristics of the breed) in 30 groups
④ Simple analysis of water quality: 6 groups of underground water in all 6 groups.

3.2.6 Природные строительные материалы
1) The content of exploration:
The facility includes a water intake valve assembly, supply channel, inlet tunnel for power generation, hydroelectric station node, etc. To carry out a detailed inspection of natural building materials, to find accommodation, stocks, applicable thickness and worthless Stockyard formation (including sandy gravel and explosive artificial filler), the conditions of production and transportation, to present the results of physical and mechanical tests of building materials.

2) Methods of exploration:
Mainly used geological survey, exploration of the cave, exploration wells and test tools for work.

3) The planned amount of work see next:
Mainly produces close to 1, 2, 3, 4, 5 and 6-speed HPP.

(1) Geology
① Geological survey plane 1/10000 12 km 2
② Geological survey profile and izmerenie1 / 2000 (including Stockyard sandy gravel and artificial explosive filler) 20 km.
③ Measurement of elevations and coordinate points of space exploration in the area of the dam premises 83 points.
(2) Flat Cave
There are three caves in the flat Stockyard explosive artificial filler 90m / 3 caves.
(3) Excavation
8 Stockyard in sandy gravel planned location of 80 exploration wells, the depth of exploration wells 5-6 m to 480 m / 80 holes.
4) Physical exploration
Measuring the speed of a plane wave cave 90 m / 3 caves.
(5) Test
① Coarse and fine aggregate concrete More choose 8 Stockyard natural sandy gravel as coarse and fine aggregate concrete, a full analysis of 40 group b, a simple analysis of 40 groups c, component and the active filler 16 groups individually selected three Stockyard Stone artificial filler: the content of the test includes density (natural, dry and wet), nasyschénnoe water absorption, porosity, compressive strength (dry and nasyschénnaya), a component of the mineral, chemical composition, sulfate content and sulfide species (translation into SO3) Test on Activity alkali rocks, tensile strength, elastic modulus, Poisson’s ratio, etc. 9 groups
② Aggregate Near supply channel select 4 Stockyard natural sandy gravel as filling the dam: a, a full analysis of 20 group’s b, a simple analysis of the 12 groups.
(5) Test
① Coarse and fine aggregate concrete More choose 8 Stockyard natural sandy gravel as coarse and fine aggregate concrete, a full analysis of 40 group b, a simple analysis of 40 groups c, component and the active filler 16 groups individually selected three Stockyard Stone artificial filler: the content of the test includes density (natural, dry and wet), water absorption, porosity, compressive strength (dry and filled), a component of mineral, chemical composition, sulfate content and sulfide species (translation into SO3) Test on Activity alkali rocks, tensile strength, elastic modulus, Poisson’s ratio, etc. 9 groups.
② Aggregate Near supply channel select 4 Stockyard natural sandy gravel as filling the dam: a, a full analysis of 20 group’s b, a simple analysis of 12 groups.

3.2.7 Research on selected social topics
① entrust the department to conduct a study on the earthquake on specific social issues of the hidden dangers of earthquakes.
② Rate danger of geological risk.

3.2.8 Other ancillary work
To perform work on the preliminary design phase, still have to perform the following amounts of auxiliary work:
① Along the slopes of the different stages of building a spiral convenient way to a total length of 15 km.
② Align pad to drill (300m³ soils, stone 200m³) total 500m³
③ Put the wire rope of the well drilling machine pressure control 4 seats
④ In the middle of the river to put a wooden cage 4 seats.

4. Plan to organize and schedule
4.1 The plan for the organization
   (1) Geology
   Responsible of the project - 1 person. Project team members, 4 persons. Devices and
   Equipment: a device for all stations - 1 pc, personal organizer - 4 pcs,
   digital camera, 2 pcs, the printer - 1 pc. GPS - 2 pcs., the car service to
   construction site - 1 pc.

   (2) With a degree in Physical Intelligence
   Responsible of the project - 1 pers., A member of the project team - 3 people.
   Instruments and equipment:
   multi-function digital instrument DC, one set of seismograph slianiya signal ES-1210F,
   one set of the control device of the sound wave type SD, one set of the device of a plane
   wave SWS-1G, complete with computer and other equipment.

   3) Special tests
   Responsible of the project - 1 pers., A member of the project team - 3 people. Machinery
   and equipment on the spot: equipment division coarse and fine grain for 1 set, oven-1
   pcs. Scale 1/10 - 1 pcs., the sampler - 5 sets, the relative density of the device – 1 kit,
   compression device - 1 pc.

   (4) According to the Special Intelligence
   Speciality exploration includes special drilling and exploration of the cave (excavation),
   it is necessary to appoint a Director General of the project - 1 person., General charge of
   drilling - 1 person., General responsible for the exploration of the cave (excavation) - 1
   person.

   a, with a degree in drilling:
   Brigade rig - 2 pcs., Workers in the brigade Position: foreman - 2 persons. A leading -4
   people. Technician - 12 people. In the brigade machines equipped with rotating drilling
   machine XY-2 (type 300) - 2 pcs. Water pump 250 - 3 pcs., other manned exploration
   tools.

   The specialty of the cave exploration (excavation):
   b, for excavating the drill holes - 10 people., cave excavation plane - 10 people.,
   sufficient staffing tools excavation and safety equipment.
   All employees on the above specialties and have dinner together used car. Works 4
   cooks in the kitchen, three-car service at the construction site for the application.
4.2 Schedule

(1) According to the requirement to sign a contract, our Institute will be fully deploy in the field geological survey, exploration drilling, exploration cave exploration wells, physical exploration and testing. Planned overall exploration period - 150 days, 100 days after the signing of the contract to submit interim geological materials, during the 180 days to present the final achievements. Speciality measurements must within 60 days submit a topographic map of the dam area, the supply channel, the supply of electricity to the cave and zone facilities to geological specialties used; the physical exploration and the test should be within 85 to submit data on the intermediate achievements, for 150 to present the final data on the achievements of the geological profession.

(2) Due to the fact that the period of work is very busy, all specialties should work closely together and mutually agree upon the geological testing and special physical exploration should hold the layout of materials in place to ensure the timely submission of interim results.

(3) The submission of different specialties interdependence, if the previous operation delays redstavlenie data because of this, cannot achieve the geological time redstavitsya, the previous operation will be responsible for the consequences.

5. Summary of the volume of exploration work

Table 5.1 Summary table of the volume of exploration work in different specialties at different stages of HPP on the river Chilik

<table>
<thead>
<tr>
<th>Specialist.</th>
<th>The content of the work</th>
<th>Scale</th>
<th>Unit</th>
<th>Quant</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geology</td>
<td>Exploration of regional geology and regional gap analysis</td>
<td>Group / ’day</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regional geological shooting</td>
<td>1/50000</td>
<td>km²</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Area dammed water gate of the dam headrace</td>
<td>1/10000</td>
<td>km²</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Building material</td>
<td>1/10000</td>
<td>km²</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flume and underwater cave to generate electricity</td>
<td>1/10000</td>
<td>km²</td>
<td>SO</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Zone dam locations</td>
<td>1/1000</td>
<td>km²</td>
<td>2.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Area facilities</td>
<td>1/1000</td>
<td>km²</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stable and submerged slope profile</td>
<td>Jan-00</td>
<td>km / band</td>
<td>5.2/12</td>
<td></td>
</tr>
<tr>
<td>Task</td>
<td>Units</td>
<td>Measurement Method</td>
<td>Location</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>----------------</td>
<td>-------------------------</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Axis Shutter (dam) and the different structures</td>
<td>1/1000 km / band</td>
<td>8.4/16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The longitudinal profile of the supply channel and underwater caves to produce elektrozernigii</td>
<td>1/10000 km / band</td>
<td>80/6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geological survey and profile measurement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The transverse profile under in one channel and underwater caves to produce elektrozernigii</td>
<td>1/1000 km / band</td>
<td>Aug-40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The longitudinal and transverse profile of the zone premises</td>
<td>1/1000 km / band</td>
<td>8.4/18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural building material</td>
<td>Jan-00</td>
<td>Km</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measurement of elevation and coordinate exploration points</td>
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<td>dot</td>
<td>254</td>
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<td>Borehole</td>
<td>m / squad.</td>
<td>1550/34 Armored 300/6</td>
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<td>Test water pressure</td>
<td>Plot / wells.</td>
<td>118/34</td>
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<td>Test pumping</td>
<td>Time / well</td>
<td>4-Apr</td>
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<tr>
<td>Flat cave</td>
<td>m / cave</td>
<td>370/10 Armored 80/2</td>
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<td>Debarking ground regional structure</td>
<td>T³</td>
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<td>Excavating submerged area</td>
<td>m / pc.</td>
<td>75/15</td>
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<td>Exploration wells in the area of the dam axis of the channel and flat</td>
<td>m / pc.</td>
<td>670/122</td>
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<td>Exploration wells in the Stockyard</td>
<td>m / pc.</td>
<td>480/80</td>
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<td>Profile Physical Intelligence (electric method, a plane wave or a way)</td>
<td>Km</td>
<td>18</td>
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<td>Comprehensive measurement of well drilling</td>
<td>m / wells.</td>
<td>1300/34</td>
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<td>wave velocity measurement flat cave</td>
<td>m / cave</td>
<td>3/0/10</td>
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6 Types of submissions
① Report on geological exploration
② Geological plan view of the supply channel and the supply of electricity to the cave
3. Geological longitudinal and transverse profile of the supply channel and the supply of electricity to the cave
1. Geological plan view of the zone of diversion unit
5. Geological profile structures in the area of diversion unit
6. Geological plan view of the zone of the station unit
7. Geological longitudinal and transverse profile of the zone of the station unit
8. Map the spread of origin of natural building materials
9. Geological profile Stockyard natural building materials