CHAPTER 10 OPTIMIZATION OF THE DEVELOPMENT PLAN

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10.1 Alternative Layouts

Following reviews of existing Study Reports, prepared by the NEA in 2001 and 2004 respectively, topographical survey maps collected in a site survey, site reconnaissance, and discussions with NEA, 5 alternatives for layout study were chosen. Due to the topographic conditions and NEA conducting precedent geological investigation, the dam axis is the same as that of NEA for all alternatives, and only the waterway layouts were reviewed.

Basic considerations for each alternative layout are described as follows:

10.1.1 Option I

The intake and waterway are to be embodied in the dam, and the powerhouse is to be located on the downstream left side of the dam. In addition to the spillway, which shall have sufficient capacity for design flood discharge, the powerhouse shall be located in parallel to the spillway. The dam crest length shall be longer than in the other layout alternatives. A switchyard will be constructed on the roof of the powerhouse.

As the powerhouse is to be constructed simultaneously with the dam, diversion tunnels should have sufficient capacity for floods in the rainy season to avoid the dam becoming flooded during construction. Therefore, a 20-year periodical flood discharge is adopted for a diversion tunnel design capacity equivalent to that of a rockfill dam, although the concrete gravity type is applied to the Project. The general plan and longitudinal waterway section are shown in **Figs. 10.1.1-1** and **10.1.1-2**.

(1) Road for Construction and Main Service Facilities

The land utilization plan during construction is shown in **Fig. 10.1.1-3**. Access to the construction site is accomplished via existing road improvement and new road construction. For access from Pokhara to the site, visitors will turn right at the entrance to the existing road, located about 600m from the bridge crossing the Nadi river near Damauli on the national highway from Pokarah to Katmandu.. The existing 3 km long road should be improved so that construction vehicles can have access to the site. A new road, 2 km in length, will be constructed from the end of the existing road to the dam crest at the left abutment. Another road branching on the dam crest to the top of the excavated slope on the left abutment will also be constructed.

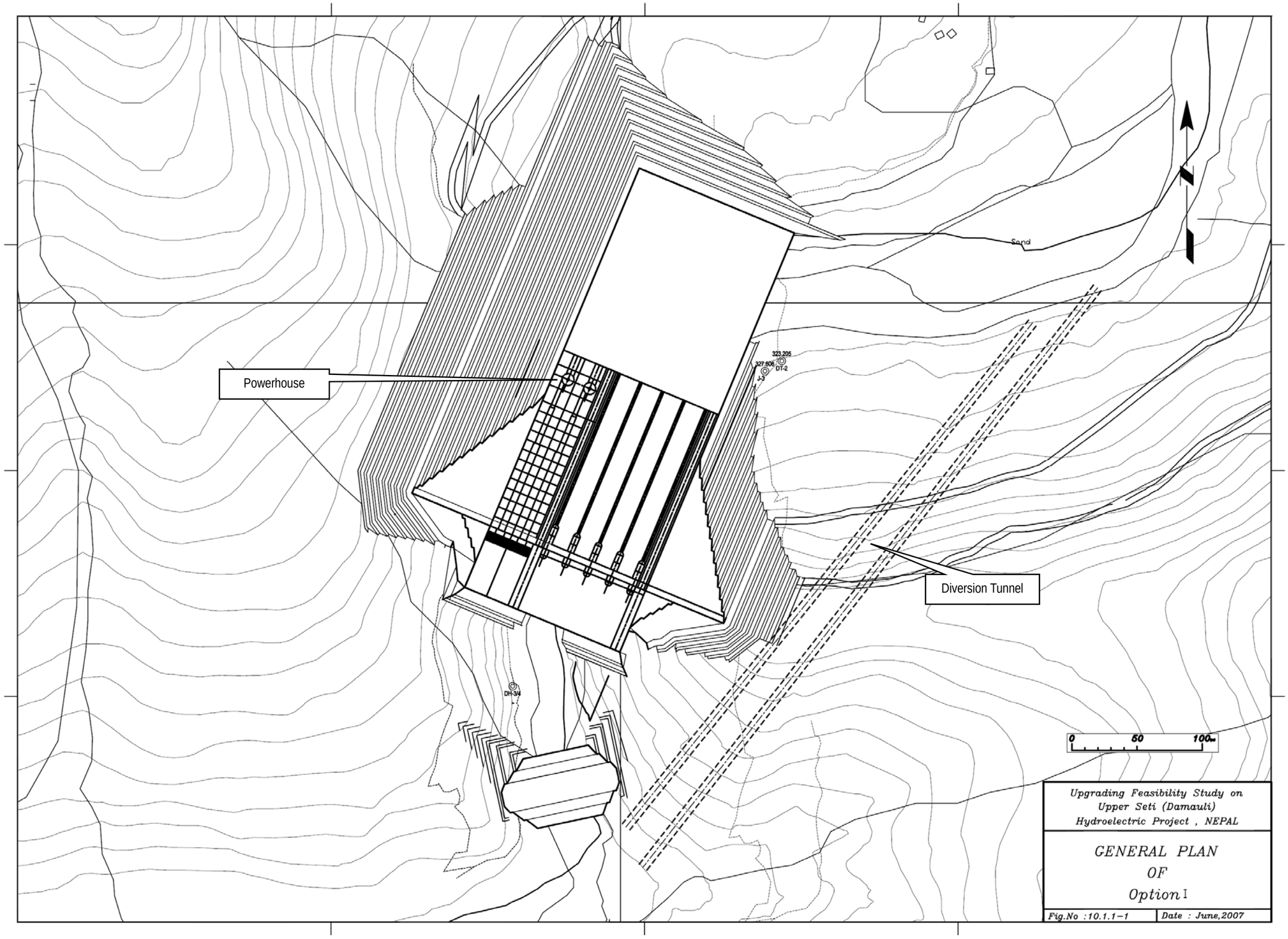
On the above dam access road on the left bank, a new road providing access to the outlet of the diversion tunnel on the right abutment will be constructed, which will branch 700 m from the end of existing road, run down to the riverbed with a 10% inclination, and cross the Seti river via the temporary bridge No. 1.

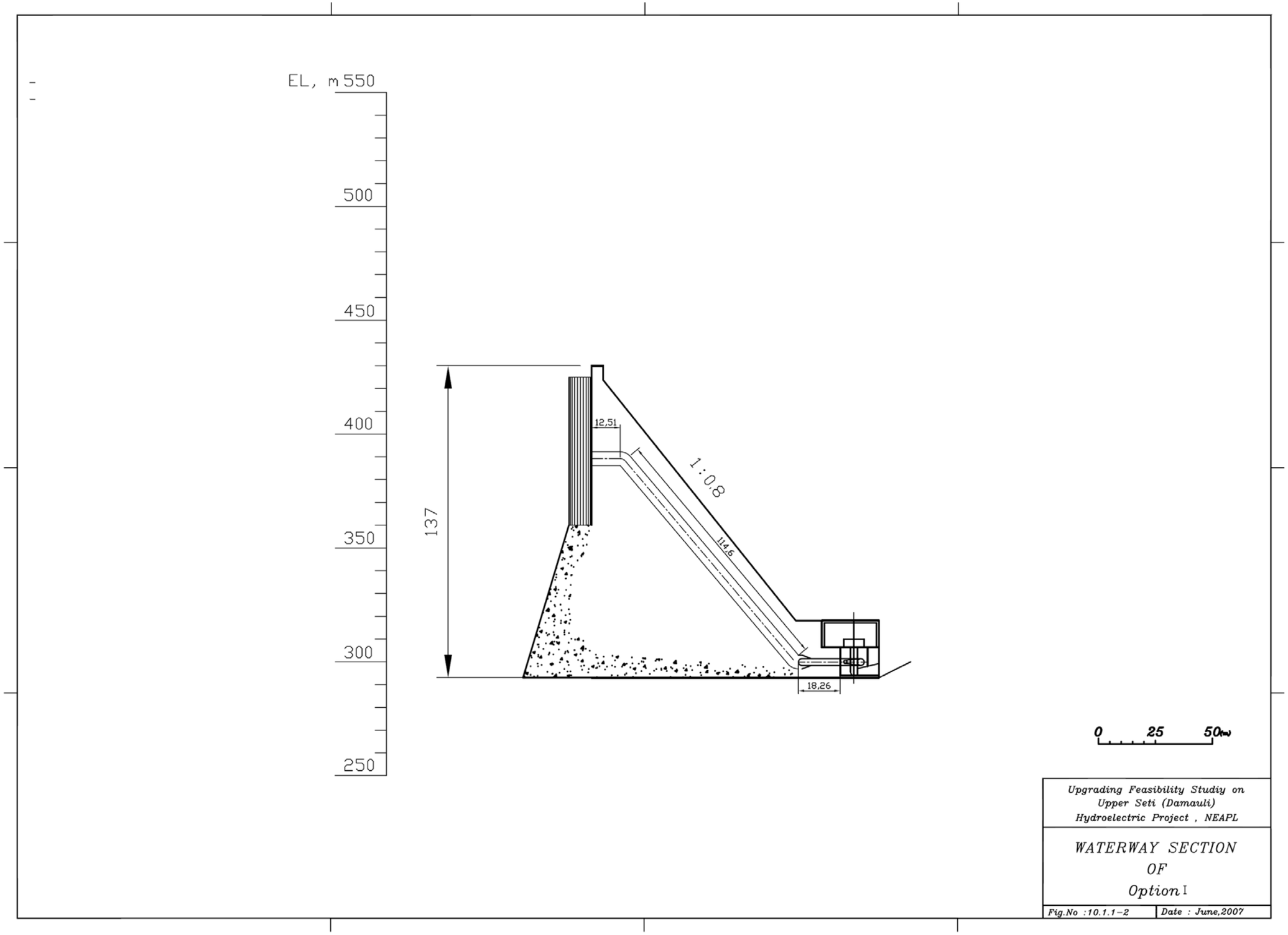
In the vicinity of the gauging station, located downstream of the dam, a temporary bridge No. 2 will be constructed. A new 1-km road from this bridge on the right abutment will also be constructed to a wide area, in the downstream direction along the river. Spoil banks, site camps, penstock factories, motor pools etc. will be installed in the wide area along the Seti river. Another road, about 500 m distance from the temporary bridge No. 2, will be constructed in the upstream direction on the right bank. At the end of this access road, an access road to the dam crest and the top of the slope excavation area for the dam will be constructed. Given the existence of a flat field along the 500-m-long road, this will be used to house an aggregates production plant, aggregates stock yard, and concrete batching plant, etc.. Though the use of riverbed gravel and sands on the Madi river was recommended for concrete aggregates in the NEA Feasibility Study, it is recommended in this study that excavated rocks at dam and tunnels should be used as materials for concrete aggregates, with environmental considerations in mind.

(2) Dam, Waterway, and Powerhouse

In this alternative, the main structures are embodied in the dam. Before the commencement of dam construction, 2 diversion tunnels with different inlet elevations will be excavated. The diversion tunnel with the higher inlet will be used for the connecting road between the upstream and downstream sides of the dam. As powerhouse construction work will be performed just downstream of the dam, the capacity of the diversion tunnels should be sufficient to discharge the same design flood as that for the rockfill dam, in order to avoid the work fronts becoming flooded. Upon completion of the diversion tunnel, the coffer dams will be constructed by excavated soil and rock materials by about 160m on the upstream side and about 300 m on the downstream side of the dam axis respectively.

Abutment slopes for the dam will be excavated from the top on both banks, mainly by blasting. After abutment excavations, dam foundation treatment works will be carried out, before the dam itself is subsequently constructed. Dam concrete will be supplied from the batching plant to the top of the abutment via a tire type transfer car, then placed by cable crane. In parallel to the dam concreting progress, powerhouse works will be executed.


Powerhouse
Diversion Tunnel
Sand
323.205
327.606
DT-2
DH-3/4
0
50
100m
Upgrading Feasibility Study on
Upper Seti (Damauli)
Hydroelectric Project , NEPAL
GENERAL PLAN
OF
Option I
Fig.No :10.1.1-1
Date : June,2007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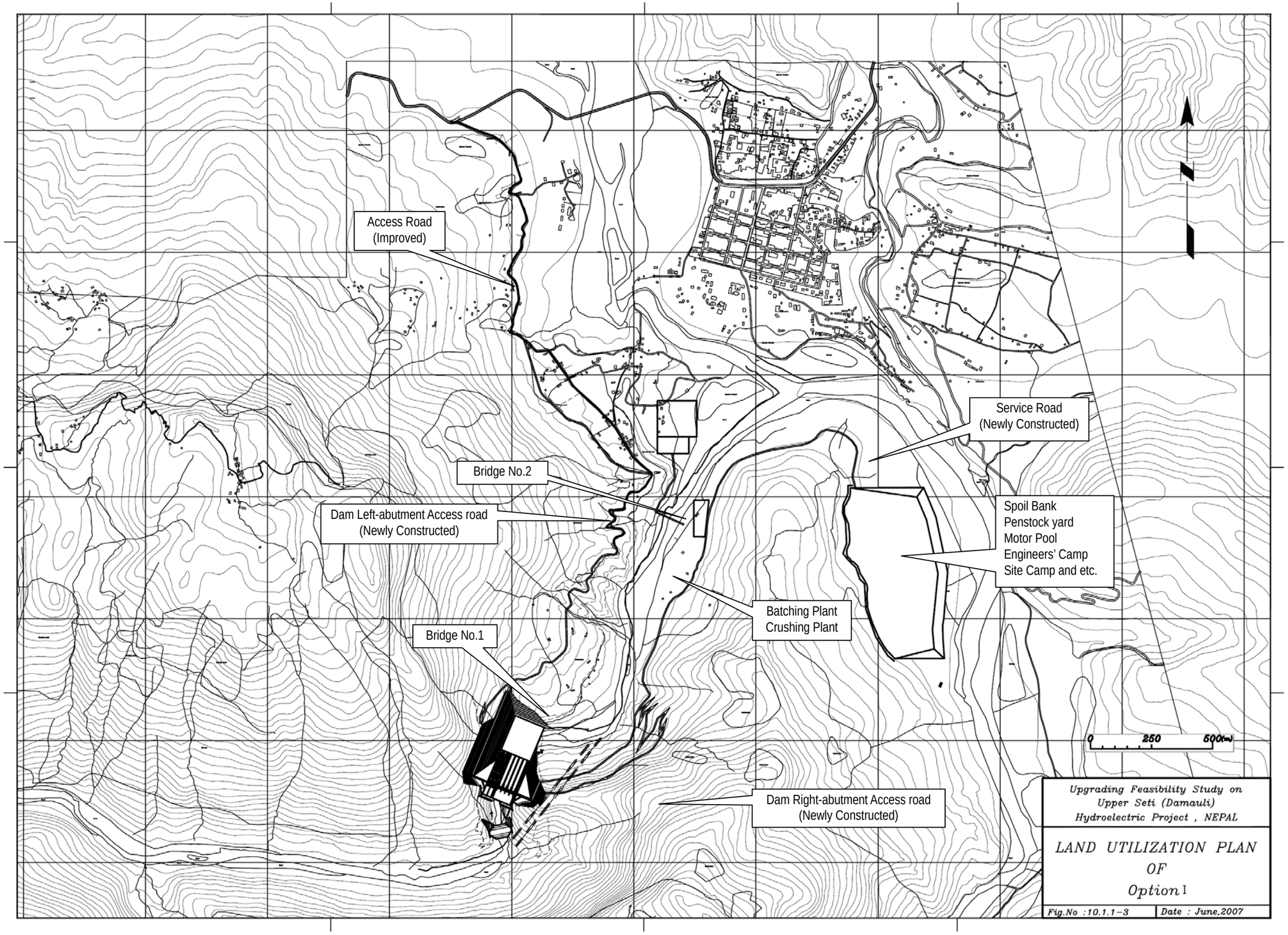
500
450
400
350
300
250
137
12,51
1:0.8
114,6
18,26
0 25 50m
Upgrading Feasibility Studiy on
Upper Seti (Damauli)
Hydroelectric Project , NEAPL
WATERWAY SECTION
OF
Option I
Fig.No :10.1.1-2
Date : June,2007


Access Road
(Improved)
Service Road
(Newly Constructed)
Bridge No.2
Dam Left-abutment Access road
(Newly Constructed)
Spoil Bank
Penstock yard
Motor Pool
Engineers' Camp
Site Camp and etc.
Batching Plant
Crushing Plant
Bridge No.1
0 250 500(m)
Dam Right-abutment Access road
(Newly Constructed)
Upgrading Feasibility Study on
Upper Seti (Damauli)
Hydroelectric Project , NEPAL
LAND UTILIZATION PLAN
OF
Option I
Fig.No :10.1.1-3
Date : June,2007

10.1.2 Option II

In Option II, the intake structure will be constructed just upstream of the dam on the right abutment. Water will go downstream, traversing a headrace tunnel, penstocks, an underground type powerhouse, and a tailrace tunnel. Because the dam is independent of the waterway, the dam crest length will be shorter than that of Option I. With geological and topographical conditions taken into consideration, a surface type powerhouse will not be considered feasible. The general plan and longitudinal waterway section are shown in F**igs. 10.1.2-1** and **10.1.2-2**.

(1) Road for Construction and the Main Service Facilities

The land utilization plan during construction is shown in **Fig. 10.1.2-3**. Though it is basically same as Option I, two access adits should be newly constructed for penstock installation and powerhouse access.

The penstock installation adit will initially be used for the headrace and penstock tunnel excavation, followed by the penstock steel pipe installation. Its portal will be located at about EL. 387 m along the access road to the dam crest on the right abutment. The adit will then end in the vicinity of the end of the headrace tunnel. The dam right abutment forms a thin ridge, the area near the tailrace is created by a landslide which took place previously, and the talus cone is mainly distributed in this area. For these reasons, the adit route is necessarily subject to a detour so that it runs through the core of the ridge for stable tunnel excavation, giving it a horizontal length of around 1,150 m. The diameter of the adit will be the same as that of the headrace tunnel, but the adit will not be concrete-lined because of the service facility.

The portal of the powerhouse access tunnel will be located in the area near the temporary bridge No. 2, and the powerhouse access tunnel will reach the top of the cavern. This adit will also branch at some location into the erection bay and the branch will be used for carrying rocks and soil out of the cavern during excavation, hauling electro-mechanical equipment during installation works, and a cable tunnel after commissioning. A switchyard will also be constructed near the adit portal and for the same reason as the penstock installation adit, the total length of the adit will be about 1,670 m.

(2) Dam

Same as Option I.

(3) Waterway and Powerhouse

An intake structure is to be located about 200 m upstream from the dam on the right bank. A new road will be constructed from the dam crest, following which open excavation for the intake structure will start. During the term, headrace tunnel excavation will commence at the end of the penstock installation adit in the intake direction. After open excavation of the intake structure is finished, the headrace tunnel excavation should also be started from the

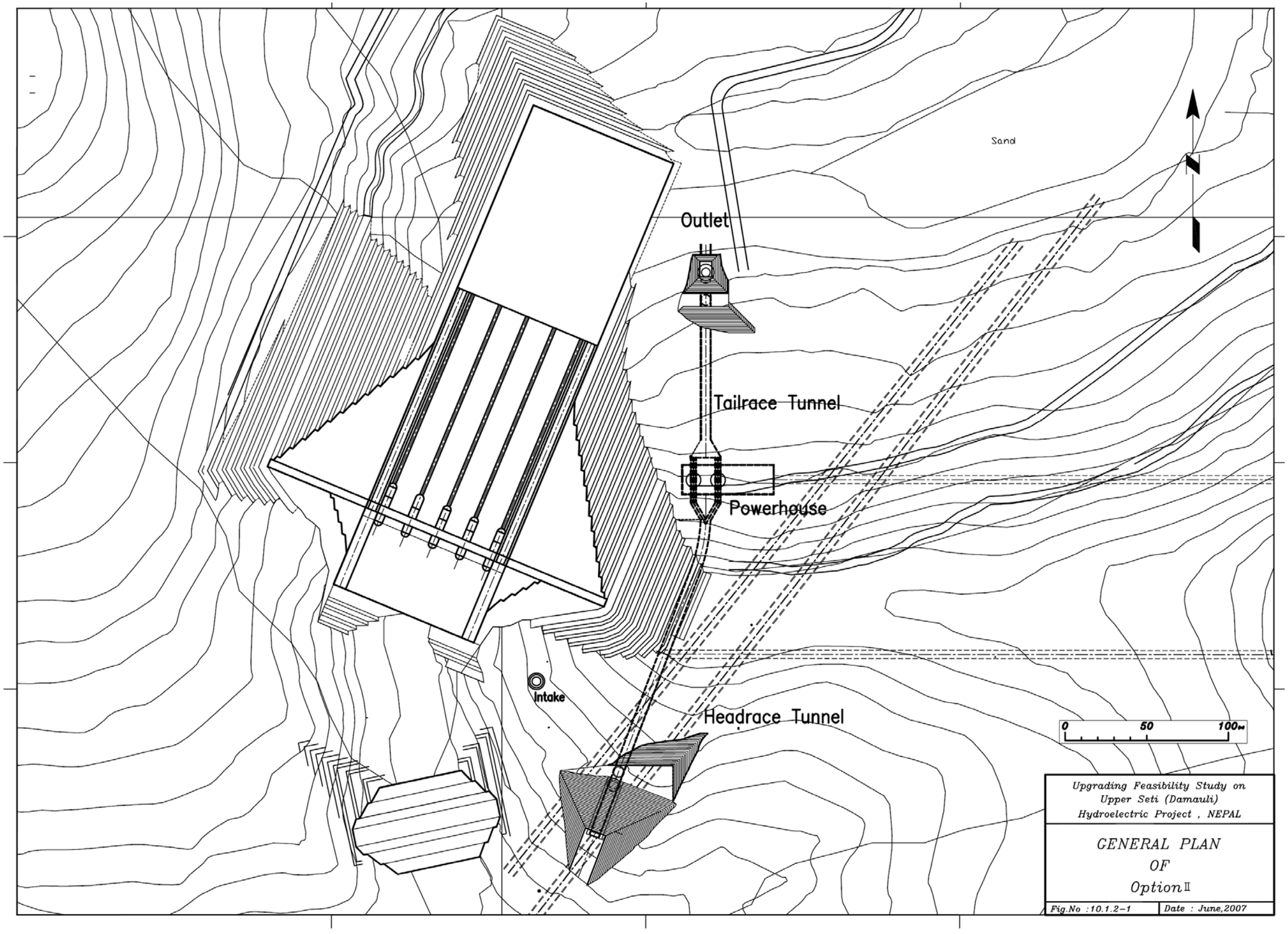
intake. The headrace tunnel length is about 90 m and following the tunnel excavation, concrete lining work and consolidation grouting will be done, which should be accompanied by intake structure concrete work.

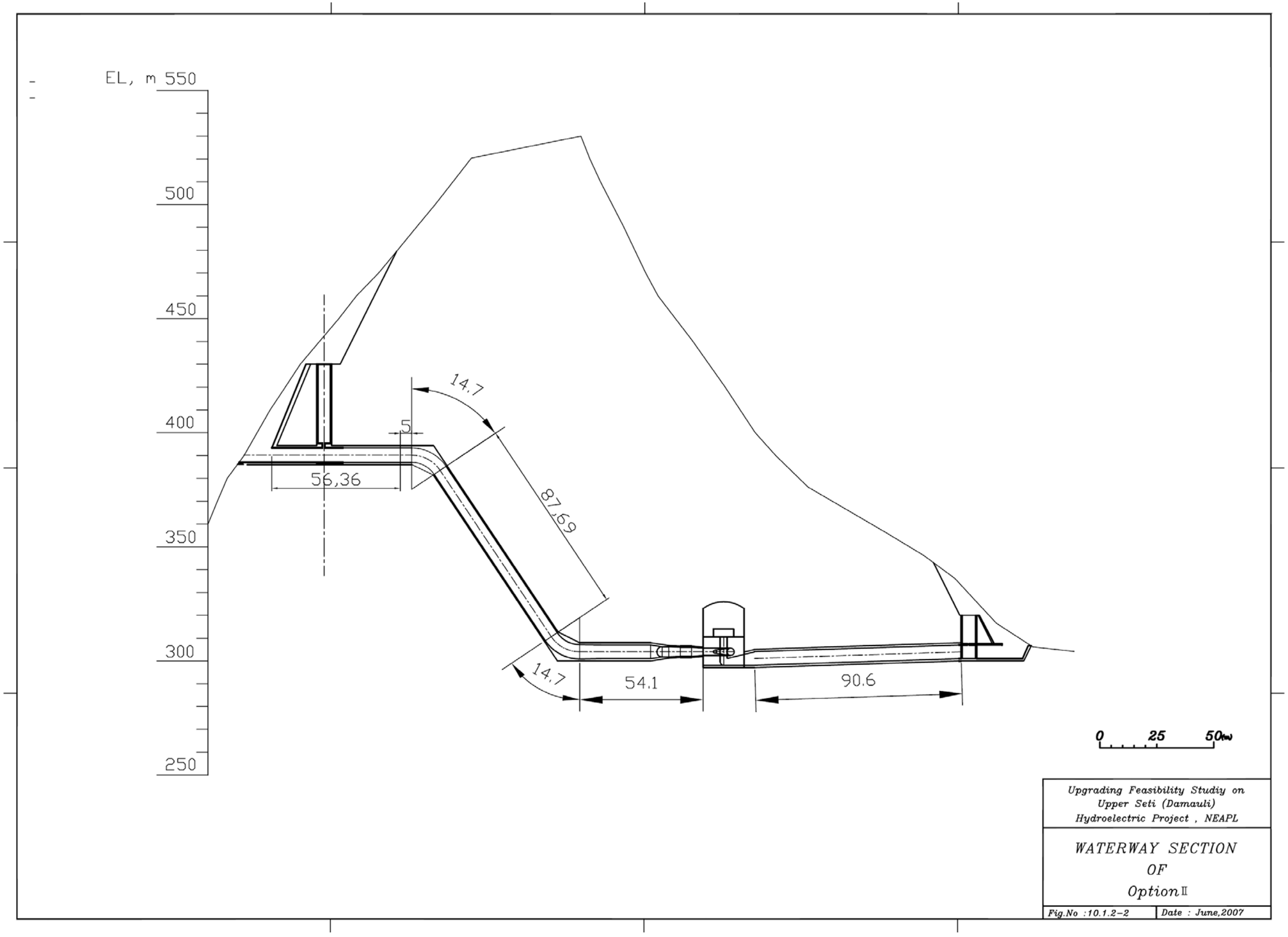
A penstock inclined shaft of around 130 m in length will be excavated using a climber machine or a raise borer for the pilot tunnel, before it is subsequently enlarged. The application of excavation equipment may depend, however, on the geological conditions of the shaft. Excavated rocks for enlargement will fall through the pilot tunnel and be carried to the spoil bank from the cavern, via the powerhouse access adit. Therefore, penstock inclined shaft excavation work should be executed once the cavern excavation works are almost completed, whereupon penstock steel pipes will be installed through the installation adit, and backfill concrete will be poured in.

The powerhouse cavern excavation will be conducted by bench cut method from the arch part of the cavern. The excavated arch part of the cavern will be connected with the powerhouse access adit via a shaft, through which excavated rocks will be allowed to fall. These will then be cleared from the cavern via the powerhouse access adit.

In parallel with the cavern excavation works above the erection bay, a tailrace tunnel of about 110 m in length, will be excavated. Tailrace tunnel excavation works will be started at tailrace side after open excavation for tailrace following coffer dam construction. Beside that, a tailrace tunnel access adit branching from powerhouse access adit should be excavated, and then tailrace tunnel should be excavated from upstream, when required.

After the cavern is excavated up to the erection bay, a vertical shaft will be excavated to connect the cavern to the tailrace tunnel. Then cavern excavation works will be recommenced by allowing excavated rocks to fall through the shaft and clearing through the cavern, tailrace access adit and powerhouse access adit. The tailrace tunnel can be also used for this purpose. Following excavation, the powerhouse concrete and tailrace tunnel lining works will be executed.


Sand
Outlet
Tailrace Tunnel
Powerhouse
Intake
Headrace Tunnel
0
50
100m
Upgrading Feasibility Study on
Upper Seti (Damauli)
Hydroelectric Project , NEPAL
GENERAL PLAN
OF
Option II
Fig.No :10.1.2-1
Date : June,2007


EL, m 550
500
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400
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300
250
14.7
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14.7
54.1
90.6
0 25 50m
Upgrading Feasibility Studiy on
Upper Seti (Damauli)
Hydroelectric Project , NEAPL
WATERWAY SECTION
OF
OptionII
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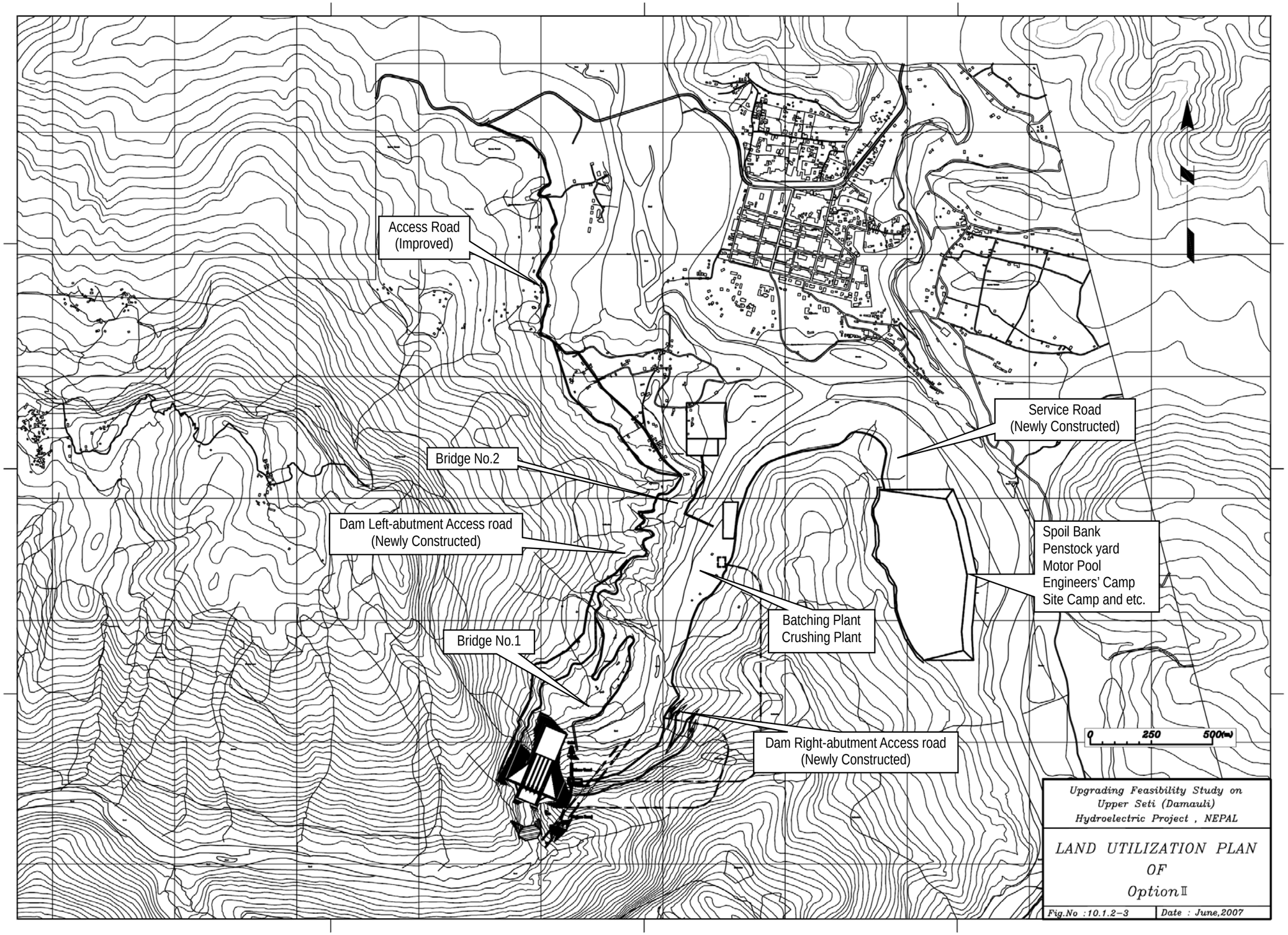
Date : June,2007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Upgrading Feasibility Study on
Upper Seti (Damauli)
Hydroelectric Project , NEPAL
LAND UTILIZATION PLAN
OF
OptionⅡ
Fig.No : 10.1.2-3
Date : June,2007