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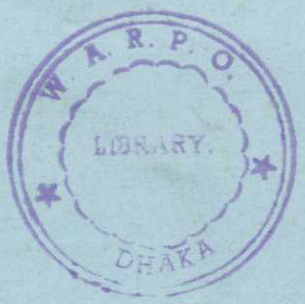
BANGLADESH WATER DEVELOPMENT BOARD



MEGHNA ESTUARY STUDY

TECHNICAL NOTE MES-025

MONITORING OF HAIMCHAR EROSION CONTROL WORKS

TECHNICAL NOTE MES-026

MONITORING OF KHORKI EROSION CONTROL WORKS

May 1999

DHV CONSULTANTS BV

in association with

KAMPSAX INTERNATIONAL
DANISH HYDRAULIC INSTITUTE

DEVELOPMENT DESIGN CONSULTANTS
SURFACE WATER MODELLING CENTRE
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TABLE OF CONTENTS

SUMMARY

Under Surveys and Studies described in the Terms of Reference for the Meghna Estuary Study, the following items have been included:

- Develop appropriate measures to accelerate accretion and decelerate erosion, by means of a low cost approach using indigenous materials and labor intensive measures
- Implement small scale interventions. As an example small cross dams constructed by the people of Manpura are mentioned

For this purpose an amount of NLG 1,000,000 had been included in the Financial Assistance budget component of MES. Construction would be the responsibility of BWDB with advice from the Consultant.

During the course of MES the idea of implementing small scale interventions by BWDB, as envisaged in the TOR, has been abandoned. Instead it was proposed by the Consultant and accepted by BWDB to implement pilot schemes for cross dam construction at Char Montaz and for erosion control along the Northeast coast of Bhola. Because of the innovative nature of the pilot scheme, the works were to be executed jointly by BWDB and the Consultant, under the direct responsibility of the Consultant.

Budget and time constraints necessitated a limitation to one erosion control pilot scheme at Khorki. However upon repeated and urgent requests by BWDB it was decided to include Haimchar site in the erosion control pilot scheme. The main aim was to prevent the imminent breaching of the protective embankment of the Chandpur Irrigation Scheme.

Preparations for implementation of the works started in October 1997. These preparations included the design and manufacturing of a special Twin Hull Pontoon (THP) to be used for installation of under water works like bed protection, caissons and bottom screens. Actual execution of the works started at the end of March 1998 due to delays in completion of the THP; the works have been completed by the end of June 1998.

Details on the design and design criteria as well as on the installation of the erosion control works are provided in Technical Report MES-019, MES-020 and MES-21. Details on monitoring and evaluation are provided in the reports in hand.

The main conclusions and recommendations from monitoring are:

- the materials used should be more durable than bamboo and bullahs
- the size of the bed protection has to be increased to reduce overlapping joints
- the design of reinforcement of several concrete components has to be adjusted to avoid damage
- the sealing of float pipes of bottom screens has to be improved in order to ensure that the buoyancy of the pipes is not lost
- at Haimchar the erosion control works were not sufficient to withstand the strong currents that developed when the very heavy flooding of the 1998 monsoon receded in September 1998. More extensive works as well as improved design will be required under such conditions. In particular outflanking of the spurs should be prevented.
- at Khorki the erosion in between and upstream of the three spurs was stopped; sand was deposited along the banks. Downstream of the spurs erosion continued due to strong tidal current attack of the river bank.
- until the permeable spurs at Haimchar were washed by strong currents during recession of the 1998 flood, the local scour around the nose of the spurs was limited. Local scour at Khorki has been limited throughout the monsoon season except downstream of spur no 3.
- the effectiveness of bottom screens could not be ascertained sufficiently because of weaknesses in the design. However before the strong currents of the 1998 flooding damaged the screens, the effect could be observed at Khorki. The number of screens installed at Haimchar was too small to have discernable effect on the movement of sediment; however the effect on the current was clearly visible at the surface during period without waves.

HAIMCHAR EROSION CONTROL PILOT SCHEME

Haimchar is located on the left bank of the Meghna river about 20 km south of Chandpur town. The area has suffered severe erosion for a long time (picture 1). A series of islands have been formed parallel to the bank line creating a secondary channel (figure 1). This channel has aggravated the erosive problems threatening the Chandpur Irrigation Project Embankment. The embankment has been retired several times and present erosion has reached up to its toe line. To find out a low cost proven technology to combat the problems a pilot project was taken up and executed during March-April 1998. The project consists of the following works.

1. Construction of 2 nos. permeable spur caissons with bed mattress underneath.
2. Installation of 12 nos. bottom vane screens.
3. Placing of a Profix system for bank protection.

1. Spur Caissons

1.1 Formation

Spur caissons are prepared by connecting 2 nos. of panels made by Shil Barak bamboo and Sal Bullah. Each panel is 6 m long and 6 m high (figure 2a and 2b). At each panel vertical bullahs are connected to horizontal longitudinal ties 2 meters apart by a nut bolt system, therefore holes through the bullahs are made. Two panels are connected parallel to each other 4 meters apart by cross ties made of bullah. In between vertical bullahs which are 2 meters apart there are vertical bamboos 25 cm center to center distance. The bamboos are tied to the bullahs and also to other bamboos with 12 mm diameter nylon rope and 2 mm diameter G.I. wire. Thus each caisson is 6 meters long, 6 meters high and 4 meters wide. There are diagonal ties across the caisson by bullahs that are also drilled and connected by nut bolt system. The diameter of each galvanized iron nut was 16 mm and lengths varied between 25 cm and 40 cm according to requirements.

At Haimchar two spurs were installed. Spur no. 1 on the downstream side is 12 meters long made by 2 nos. of caissons (picture 2). Spur no. 2 is 18 meters long and consists of 3 caissons in line. Spur no. 2 was installed 130 meters upstream from spur no. 1 (figure 3 and picture 3).

1.2 Bed Mattress

The spur caissons were installed on a sheet of bed mattress made of geotextile material. The width of the mattresses was 20 meters, made out of 4 sheets of geotextile measuring 5 meters width sewn together. The length of the bed mattresses was 30 m. The geotextile sheets were of a composite type made by one non-woven sheet at the bottom to work as a filter and one woven sheet with loops on top to take care of the load. Both sheets were sewn together to work as a composite. Bamboos are tied to the loops of the woven sheet 25 cm centre to centre (figure 2a and 2b). Their purpose is to keep the mattress in a stretched position while lowering it.

The three edges of the bed mattress on the upstream, downstream and river side end were initially anchored to the river bed by tying fishing boat anchors 6 m apart, each of weight of about 14 kg to 16 kg. After anchorage as above two rows of geotextile bags with 1.0 meter length and 25 cm diameter were tied by divers at the edges of the mattress to prevent flapping of the mattress. They were made out of woven geotextile with a non-woven inner layer and were filled with local soil.

The caissons were filled by earthfilled synthetic bags up to a height of 2 m. The shore end of the caisson was connected to the shore by a dyke made of earthfilled synthetic bags. The width

of the top of the dyke was 3 m and the side slope was 1:1. The crest level at the shore side was equal to the shore level and that at the spur side was up to the level of synthetic bags inside the caissons. The top of the connecting dyke and the filled core inside the caissons were covered by a geotextile sheet loaded with scattered concrete blocks and earthfilled geotextile bags.

2. Bottom Vane Screens

2.1 Formation

Bottom vane screens consist out of a geotextile sheet fitted with 3 nos. PVC pipes, functioning as floats at the top and 1 R.C.C. beam on the bottom. The size of the screen is 5.0 meters long and 4.0 meters high (figure 4). The diameter of the PVC float pipes and the R.C.C beam is 20 cm. The float pipes are made by sealing both ends of PVC pipe with a double layer of PVC plates. The plates are double welded at the outer edges. The outer plate sealing is more strengthened by a fiber glass reinforcement system.

2.2 Screen Anchors

The two ends of the screens are attached to anchor slabs made out of reinforced concrete through anchor hooks attached to the R.C.C. beam (figure 5). To give better anchorage to the river bed four legs are made of mild steel angle at the four corners of each bottom slab. The stability of the screen was increased by tying 20 nos. of synthetic bags filled with soil to each anchor slab.

2.3 Configuration

12 nos. of bottom vane screens were installed at the upper side of spur 2 (figure 3) within a distance of 115 m. These were installed in with 5 m parallel distance. Distance between each pair of screens was 20 meters. The idea of these screens was to direct the silt laden bottom flow towards the shore and also to divert the top flow away from the shore to stop erosion.

3. Profix System

The Profix system consists out of two non-woven geotextile sheets sewn together in parallel lines to make long tubes with a 25 cm diameter. These tubes are filled with coarse sand by the water jetting method. The system is placed on the slope of the shore near the spurs. Since the system is quite heavy and durable it is expected to protect the shore slope against erosion.

4. Monitoring

Installation of the project was completed in April, 1998. Just after installation monitoring of the project started.

4.1 Site Surveys from June to September 1998

Deflection of the current was observed near the screens where water turbulence was noted at the surface. However river bank erosion in between the spurs continued and some of the Profix sheets were displaced or damaged by wave and current action. These sheets were repaired as well as new Profix sheets were placed and loaded with scattered concrete blocks. Simultaneously some concrete blocks were dumped in scouring areas. By this action the situation improved, erosion was stopped and silt deposition in between the spurs was indicated.

370 m of block pitching in the entire project area was executed by the Chadpur BWDB in June and July 1998 (figure 6, pictures 4 and 5).

During the last week of July 1998 water levels started rising, current velocities increased and thus the devastating flood of 1998 started.

The flow velocity reached to about 2.0 m/sec. One of the 12 bottom vane screens was washed away due to a broken anchor hook at one end of the R.C.C. beam and a failing D-shackle at the other end (figure 11). By outflanking the connecting dyke of spur 2 a secondary channel was formed in between the spur and river bank through which a strong current force hit the bank angularly at South-East direction in between the spurs. Bank erosion started again and scour holes developed near the toe line of the embankment. Block pitching done near the toe of the embankment started sliding down and thus the Chandpur Irrigation Project was threatened.

To save the embankment from breaching and to save the spurs, 3000 nos. of concrete blocks of size 45 cm x 45 cm x 45 cm were dumped on emergency basis in the damaged connecting dyke portion of both spurs to reduce the hitting force to the embankment. Simultaneously the Chandpur BWDB constructed one retired embankment (picture 6). They also dumped 12000 concrete blocks, branches of trees and gunny bags filled with bricks in the scouring areas. A responsive result was observed, the erosion was controlled and the embankment was saved.

On August 2nd, 1998 an attempt was made to check the position of the spurs. As water was flowing above the top levels of the spurs with a strong current force it was not possible to do so.

Bed levels 25 meters upstream and 25 meters downstream from the center lines of spur 1 and spur 2 and extending up to 50 meters into the river at a 5 meters interval along the shore line and at a 2 meters interval across the river were recorded. This took place before the flood on July 3rd and 4th, 1998 and during the flood on August 13th and 14th, 1998. Soundings around spur 1 are shown in tables 1 and 2 and soundings near spur 2 in tables 3 and 4 respectively. These data indicate the extent of the erosion through strong current forces in the area during flood. Depth of the erosion varies between 2 to 4 meters locally.

Flood level continued rising and during September, 1998 monitoring was limited to recording water levels only. The maximum and minimum water levels in meter PWD were recorded during September:

Date	Maximum Level (meter PWD)	Minimum Level (meter PWD)
09.09.98	+4.61	-
13.09.98	+3.90	+3.27
14.09.98	+3.70	+3.27
15.09.98	+3.56	+3.13
16.09.98	+3.55	+2.95
17.09.98	+3.50	+2.88
18.09.98	+3.50	+2.84

From September 16 to 19, 1998 the following observations were recorded.

1. Turbulence and a change in flow direction is observed on the water surface when it passes the downstream location of the spur indicating existence of the spur under water.
2. But in the upstream location of the spur no change of water flow direction or any turbulence is observed on the water surface.
3. 255 meter out of the 370 m length of block pitching done by the Chandpur BWDB has slided down (figure 6 and picture 7).
4. Bottom levels were measured at some locations as shown in figures 6 and 7.

From September 24 to 26, 1998 the following observations were recorded at site (figure 6):

1. The remaining length of 30 meter of the upstream block pitching by the BWDB as recorded from September 16 to 19, 1998 has slided (figure 6 and picture 8).
2. 85 meter length of block pitching on the downstream side has slided.
3. The erosion area started from the downstream spur towards the north.
4. Turbulence of water movement on top of the bottom vane screen area (figure 6) was recorded.

During October, 1998 flood water receded, water level in the river went down and the flow velocity reduced.

4.2 Site Survey November 1998

From November 21 to 24, 1998 a detailed site investigation was made with the help of divers. The following observations were made.

Spurs

1. The downstream spur (spur 1) was found in place but in damaged condition. Its shore side half (about 6m) was found in tilted position towards the downstream side. But the river side half of the spur was completely damaged and lying on the river bed. Most of the bullahs and bamboos were found in damaged condition. During the flood, the downstream spur was disappeared (Picture 9).
2. The bed protective geotextile mattress on both upstream and downstream sides from the spur was displaced from its position and found in a folded condition along the spur.
3. As the downstream spur was partially damaged, the synthetic bags and concrete blocks came out of the spur core.
4. The upstream spur was completely washed away. Only some concrete blocks were found in the area where the connecting dyke had been. The bed protection was also gone.
5. Connecting dykes of both spurs were washed away.
6. Synthetic bags and geotextile bags filled with local soil were found getting empty due to current and wave action.

Screens

1. Out of 12 nos. of bottom vane screens installed upstream of the upstream spur (spur 2), one screen was washed away during the peak of the flood period. It was salvaged by an MES

2. Out of the remaining 11 screens only 6 nos. were found at the river bed by the diver (figure 8). 5 screens are suspected to be washed away during the flood. In more detail:

- Screen no. 1 was in its original position at 45^0 angle to the flow, but the other one of the pair i.e. number 2 was displaced slightly in orientation to an angle of 30^0 to the flow.
- Screens nos. 5 & 6 were found lying flat on the river bed. The end seals of the PVC float pipes were missing. One top float pipe was found in bruised condition indicating a hit by a river vessel.
- Screens nos. 11 and 12 were found in place but in changed orientation from the installation angle of 45^0, about perpendicular to the flow. One float pipe of screen no. 11 was open at both ends, but other float pipes were OK.
- Around the anchor slabs scouring was observed resulting in settlement of the slabs.
- Fishing nets were found inter winded with numerous screens.

KHORKI BANK PROTECTION PILOT SCHEME

Khorki is at the North East corner of Bhola island (figure 9). During the last two years more than 400 meters have been eroded. About 50% of Kachia Union has gone into the river. This pilot scheme was evolved to find out a low cost proven technology to fight the erosion. It was executed from May to June 1998. The scheme consists of the following works:

1. Installation of 3 nos. permeable spur caissons (KC-1, KC-2 & KC-3) with bottom mattresses.
2. Installation of 108 nos. of bottom vane screens
3. Placing of a Profix system.

1. Spur Caissons

1.1 Formation

The spur caissons were prepared the same way as in Haimchar. Length of each spur caisson was 18 meters. The caissons were filled with concrete blocks up to 2 meters height. The connecting dykes were built out of dumped concrete blocks (picture 10).

The spurs were designed to be installed at a distance of 250 meters from each other. But during installation the bottom profile of the river bed did not permit that distance between spur KC-1 and spur KC-2. The spacing turned out to be 210 meters. Between spurs KC-2 & KC-3 the distance was 250 meters (figure 9).

1.2. Bed Mattress

The bed mattresses are placed underneath the spur, are 20 meters wide and extend into the river about 10 meters beyond the toe line of the spur. The edges of the bed mattresses were anchored to the river bed by fishing boat anchors and geobags filled with soil. Bamboos were tied to the mattress to stretch it properly. Sinking was performed by dumping earth filled synthetic bags and C.C. blocks.

2. Bottom Vane Screens

108 bottom vane screens were installed at Khorki to attract the silt laden under flow of water towards the shore and also to divert the top flow of water away from the shore. In between the spurs and also upstream of KC-1, screens were placed in pairs. Downstream of KC-3 screens were placed in triples.

2.1 Screen Anchors

The screens were attached to the river bed through anchors at both ends. Each anchor consists of 3 nos. R.C.C. anchor blocks measuring 1.5m x 1.5m x 0.125m, on top of each other. There are 4 legs made of mild steel at the 4 corners of the bottom slab. One lifting hook of 1 meter long, made of 24 mm diameter M.S. rod, was attached to the bottom slab.

2.2 Configuration

The installation arrangement of the screens is shown in figure 10. The water depth between KC-1 and KC-3 is relatively limited. South of KC-3 the water depth is more than 13 meters. Screens were installed in pairs with a distance of 20 meters in between each pair from upstream of spur KC-1 up to KC-3. Downstream of KC-3 screens were placed in triples.

3. Profix System

The Profix System like in Haimchar was installed here as well. The bed mattress was extended on shore up to 15 meters and the Profix system up to 5 meters. C.C. blocks were scattered over the Profix sheets.

4. Monitoring

4.1 Site Surveys from June to September 1998

One month after installation, July 11 to 13 1998, some deposition of silt was observed in between and around the spurs. This becomes clear when comparing the soundings from June and July 1998. These are presented in tables 5 & 8 (KC-1), tables 6 & 9 (KC-2) and tables 7 & 10 (KC-3). In most locations the siltation varies between 10 to 50 cm.
The devastating flood started the last week of July. Water levels increased and along the river banks areas inundated. Current velocities increased considerably. However the soundings recorded in the middle of August (tables 11, 12 & 13) still show about the same pattern as in July 1998. In August and September 1998 flood levels were still high with strong current velocities causing much erosion in areas adjacent to the project site. The areas around the spurs also suffered erosion. This becomes obvious when comparing the soundings from August and September: tables 11 & 14 (KC-1), tables 12 & 15 (KC-2) and tables 13 & 16 (KC-3). In between the spurs the extent of the erosion seemed to have decreased and also no shoreline regression has been observed. The combined effect of the bottom vane screens and the spurs proved to be effective. At the downside of the downstream spur (KC-3) the screens were the only protective measures. The increased water depth decreased the screens effective diverting the flow. Also intense scouring is observed at the downside of KC-3. During the flood 4 screens were found being swept away, 3 of them could be rescued. The types of failures are explained in more detail in figure 11.

4.2 Site Survey November 1998

After the flood a detailed survey was performed the end of November to monitor the situation in the area. Divers were engaged and the observations are described next.

Spurs

1. Spurs KC1 and KC2

   Both spurs were found OK (picture 11). Siltation was observed on the geotextile bed mattresses around the spurs. The Profix was in place.

2. Spur KC-3

   It was hit by a big river vessel and was tilted towards north (picture 12). But the spur as a unit was in position. However some of its bullahs and bamboos were damaged. Bank erosion downstream of spur 3 has reached up to the spur. 2 nos. of Profix blankets were washed away exposing the river bank slope near the spur.

30 meters downstream of spur KC-3, 13 meters erosion was recorded (picture 13). No shoreline regression was observed in between the spurs KC-1, KC-2 and KC-3. In picture 14 the unharmed shoreline upstream of the upstream spur (KC-1) is shown. The siltation pattern at the upstream side of the middle spur (KC-2) can be seen in picture 15. Siltation is visible at the upstream side of the downstream spur (KC-3, picture 16).

Screens

One screen was disconnected from the riverbed on November 15th 1998. The one meter long lifting hook was separated from the anchor slab (picture 17). The top float pipe was flattened. It might have been hit by a river vessel which might have dragged the screen causing failure of the lifting hook (picture 18).

An overview:

1. Upstream of KC-1

- 18 nos. bottom vane screens were installed out of which 14 nos. were found.
- 2 screens were lying flat on the river bed.
- 5 nos. float pipes of the above 2 damaged screens were found open, 3 of them at both ends and 2 at one end. The end seals failed.
- Alignments of the screens were found OK.

2. In between spur KC1 and KC2

- 16 nos. bottom vane screens were installed in this area out of which 11 nos. were found existing in place.
- 3 screens were found lying flat on the river bed.
- 4 float pipes of the above 3 screens were found both ends open and 2 float pipes had one open end. The end seals failed.
- One screen was disconnected from the anchor slab at one end. The other connection was found OK.

3. In between spur KC2 and KC3

- 20 nos. bottom vane screens were installed in this zone, out of which 12 nos. were detected to be in place.
- 4 nos. anchor slabs were detected without any screen indicating the screens had been swept away.
- Alignments of all remaining screens were found OK.
- 2 float pipes attached to the screens were found open at both ends.

4. Downstream of Spur KC-3

- 54 nos. bottom vane screens were installed in this zone out of which only 28 nos. were found in place.
- 3 screens were lying flat on the river bed.
- Out of 9 float pipes, from the above 3 screens, 7 were found open at both ends and 2 were open at one end. The end seals failed, both the welding as the glass fiber attachment.
- 2 float pipes were squeezed and flattened partially. They might have been hit by a river vessel.

- 27 nos. screens were found having a proper orientation. 1 was found perpendicular to the flow.
- Over around 70 m near the outfall of the side channel, no screens was found.
- On numerous locations fishing nets were found inter winded with the screens.

During high tide the water levels were recorded as shown in figure 12.

Failures of the screens as observed in the ones rescued are shown in detail in figure 11.

CONCLUSIONS AND RECOMMENDATIONS

Haimchar

The erosion control works installed at Haimchar, together with protective works executed by BWDB Chandpur, have prevented breaching of the main protective embankment of the Chandpur Irrigation Scheme during the very severe flooding of 1998.

During this period additional concrete blocks have been dumped to safeguard the works as well as some other measures like placing brushwood etc. In August 1998 it was noticed that in between the spurs, mainly close to the downstream spur substantial quantities of sand had been deposited in areas with reduced current velocities.

Until early September 1998 the spurs were still in place. However during the recession of the flood, currents must have become much stronger, resulting in deeper scour and outflanking of the spurs.

As a result the river part of the **upstream spur** was destroyed completely. Unfortunately the spur had to be installed in an area where old gabions were present; this will definitely have reduced the stability of the bed protection because the currents could more easily wash away foundation materials. On the land side the additional blocks dumped on geotextile together with the remnants of the spur halted erosion sufficiently to save the main embankment from breaching.

The river side of the **downstream spur** was heavily damaged at that time but in November 1998 the geotextile bed protection was still present though it had been displaced by the currents. Outflanking occurred on the land side of the spur, this caused the spur to become ineffective.

The bottom screens have functioned until the end of August 1998; however the effectiveness could not be ascertained because accurate measurements were not possible due to strong currents. Most of the float pipes of the screens were damaged and as a result lost their buoyancy, some of the connections between screen and anchor blocks broke.

Khorki

The erosion control works at Khorki have functioned as anticipated; the erosion in between the spurs as well as upstream of the spurs has been halted by the combined effect of spurs and bottom screens.

Downstream of the spurs the erosion continued; most probably strong currents at incoming tide caused this. At incoming tide the orientation of the bottom screens will accelerate erosion; this could be the reason why erosion continued downstream of the spurs where 54 screens have been installed.

The caissons of two permeable spurs are still in good condition after one year, the third spur was damaged during collision with a big ship. Notwithstanding 24 hour guarding, a few cuts were made in the geotextile bed protection and small pieces had been taken away.

A diver found back about 60 % of the bottom screens during under water inspection. The diver also found that many fishing nets got entwined around the screens. The reasons for so many missing bottom screens could be the strength of the end closures of the PVC float pipes, the connection of the screens to its anchor blocks and dragging by anchors. It is also possible that the diver could not detect all screens because of poor under water visibility.

The recommendations for improving the bottom screens are as follows:

a) The bullahs and bamboos used to build the spurs proved to be too weak and limited in durability. More durable materials such as galvanized steel members may be used in place.

b) The design of the spur needs to be changed to be more stable to resist the strong current force.

c) The size of the bed protection mattress has to be increased in order to reduce the number of overlaps; the currents may sweep up the edges, exposing the foundation material to scour. The length of the overlap should also be increased taking into account the accuracy of the installation as well as movement due to settlement after installation.

d) The functionality of PROFIX bed protection is doubtful, in particular in relation to the high cost of this system. Instead a thicker non-woven could be selected in case loss of foundation material from underneath the protection is anticipated.

e) Dumping of concrete blocks should be done more accurately, piles of blocks will induce an irregular flow pattern

f) Synthetic bags have to be filled with more coarse material than local soil. Alternatively to reduce the cost, synthetic bags may be filled with local soil with an inner layer of polyethylene sheet so that the fine particles of soil cannot be washed out.

g) The synthetic bags should form the bottom layer of the spur and should be covered by concrete blocks.

h) The geobags should be filled with sand coarser than the local soil.

i) The lifting hooks of the anchor slabs need to be strengthened to handle the pulling force in all directions.

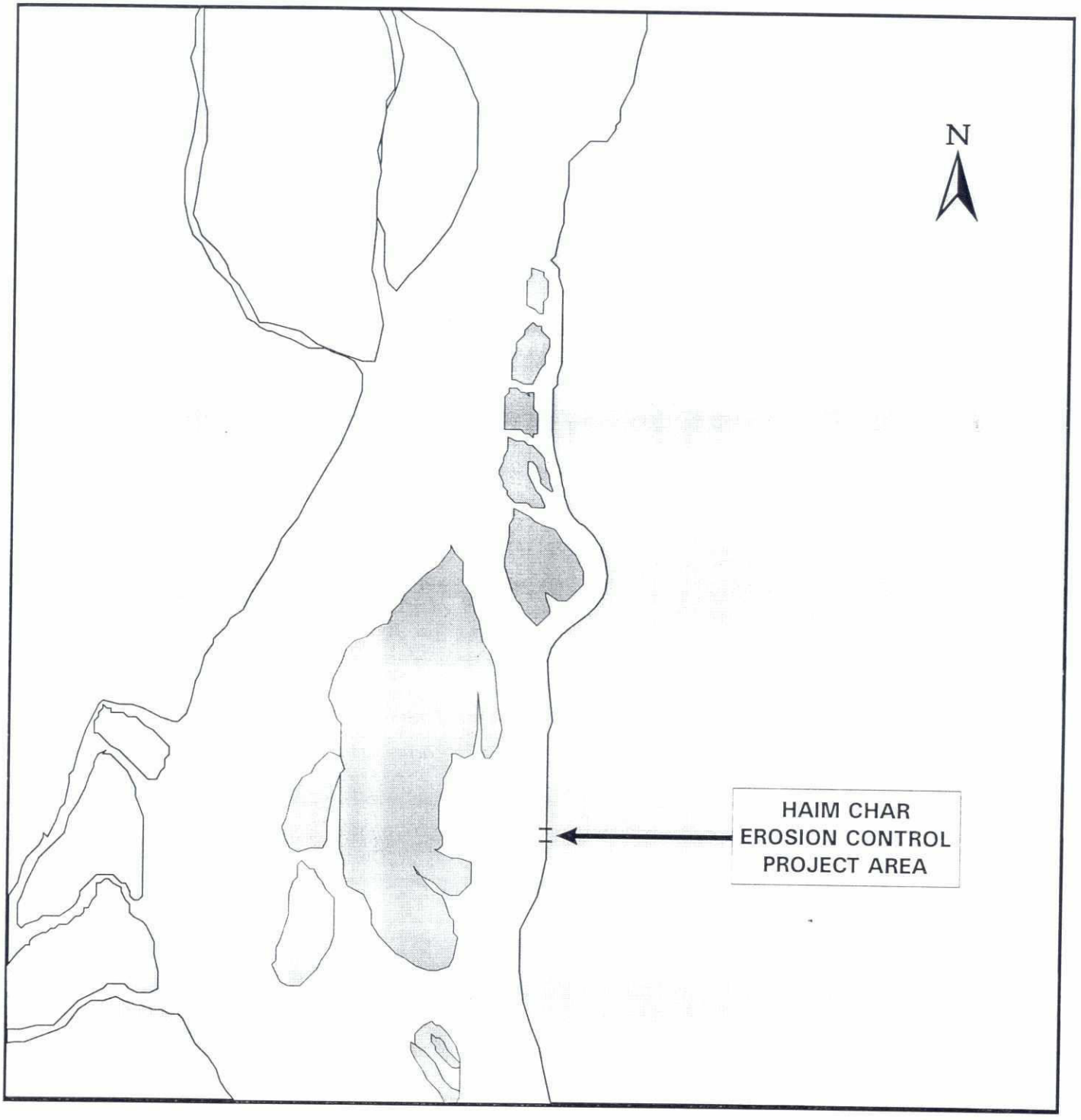
j) The anchor hooks at both ends of the R.C.C. beam need to be strengthened.

k) The length of the lifting hook has to be reduced from 100 cm to 60 cm.

l) The sealing method of the PVC float pipes needs improvement. The end seals were attached to the float pipes through double welding. The outer seal plate was reinforced through fiber-reinforced polyester resin (FRP) system. It is recommended that both the inner and outer end seal plates will be double welded and further reinforced by the FRP system to increase the strength of the float pipes.

FIGURES

Figure 1: Location of erosion control works at Haimchar



LEGEND

STUDY AREA

TIDAL MUD FLATS

WATER BODY

SPURS

MEGHNA ESTUARY STUDY

LOCATION OF EROSION CONTROL WORKS AT HANARCHAR

PROJECTION	BANGLADESH TRANSVERSE MERCATOR
SOURCE	LANDSAT IMAGERY FEBRUARY 1996
PRODUCED BY	MES CE&R, GIS/RS/CAD UNIT
PRODUCED BY	mes MES CE&R, GIS/RS/CAD UNIT

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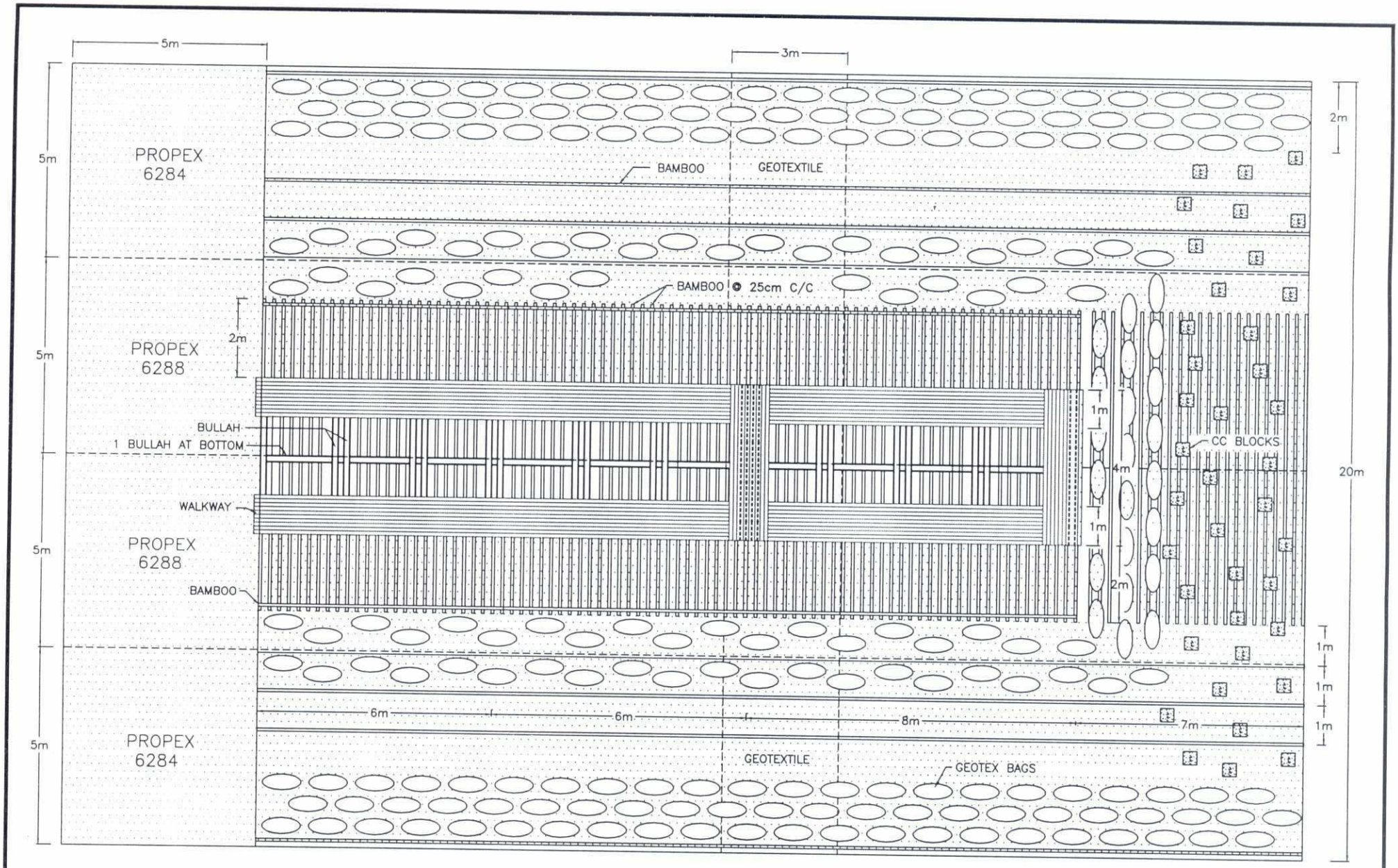

PLAN

Topview of Bamboo Caisson

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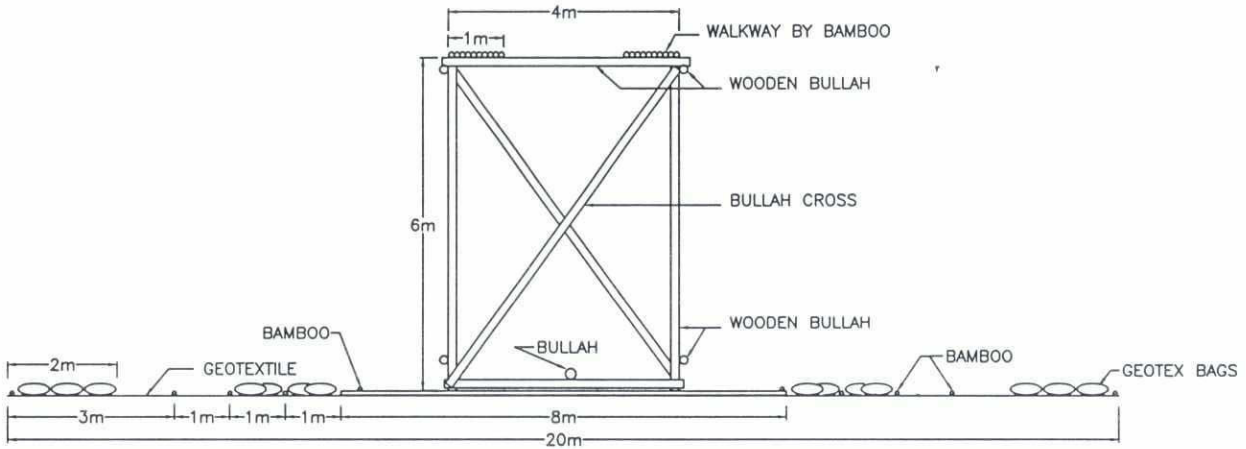
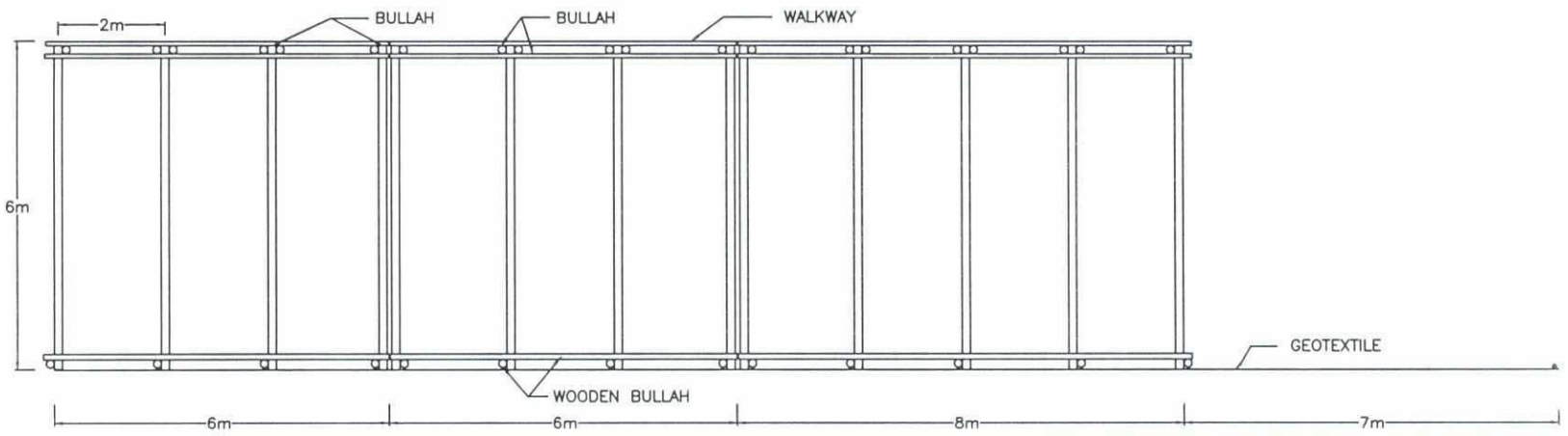
Figure 2(a)

DRAWING OF CAISSON



CROSS SECTION



SIDE VIEW

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Figure 2(b)

Outline Haimchar Bank Protection Pilot Scheme

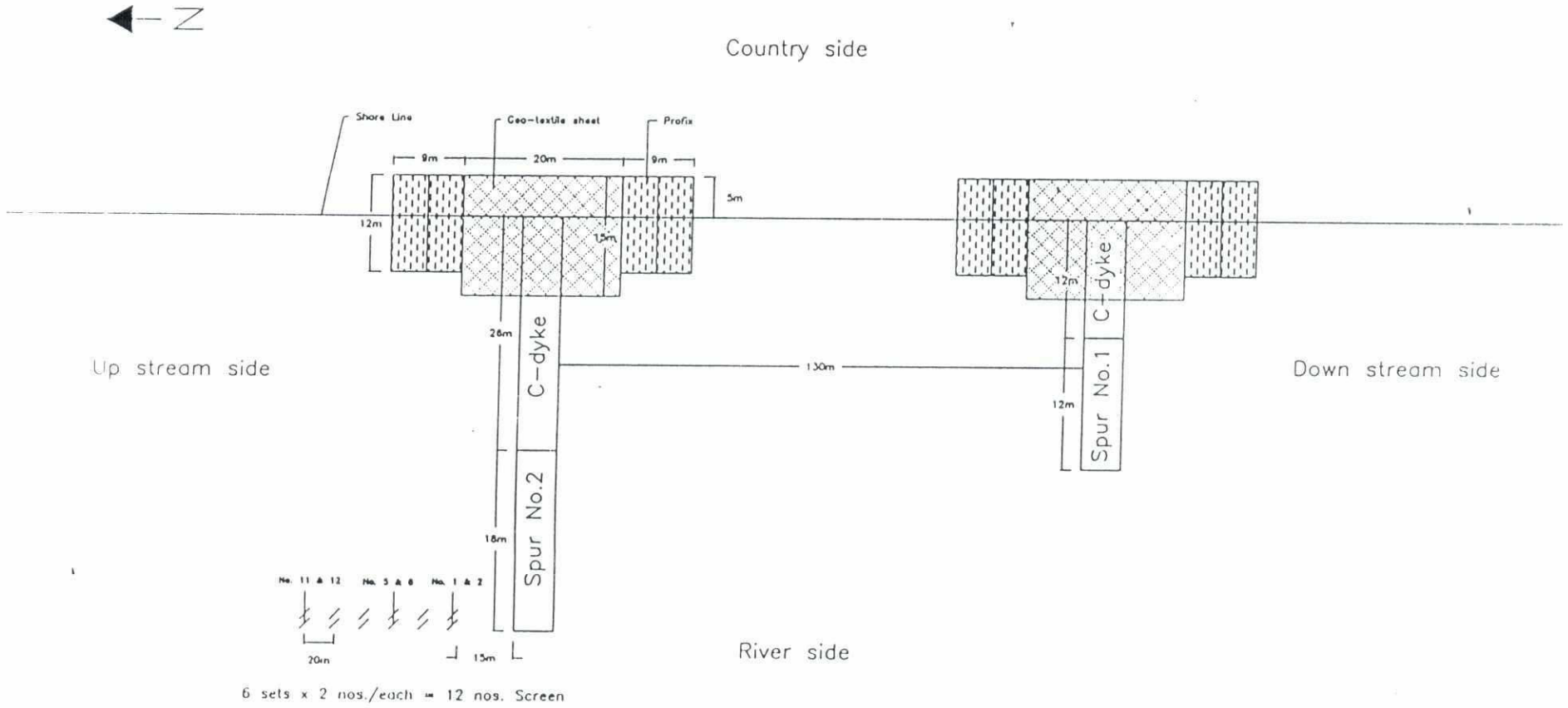
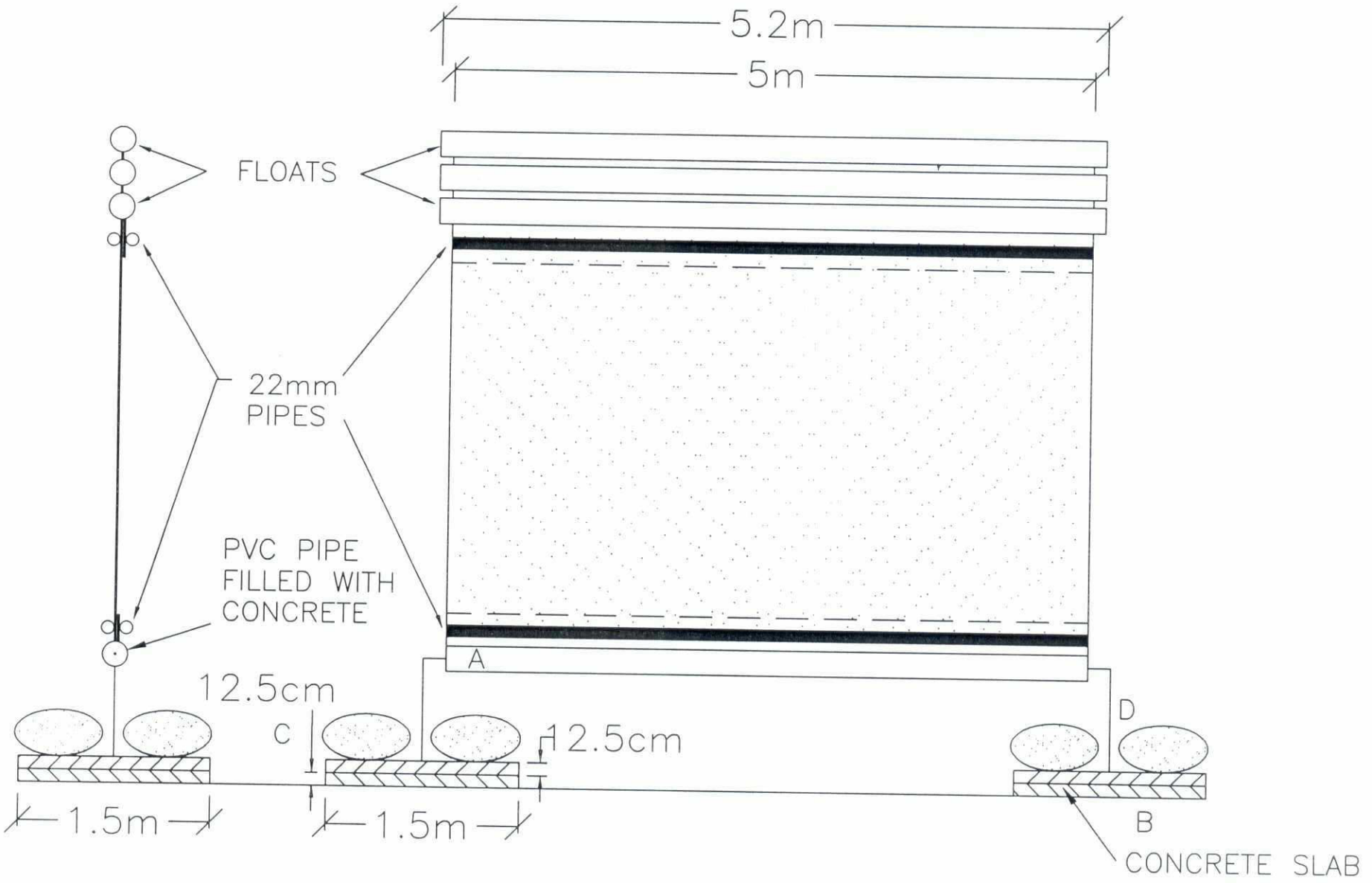


Figure No. 3

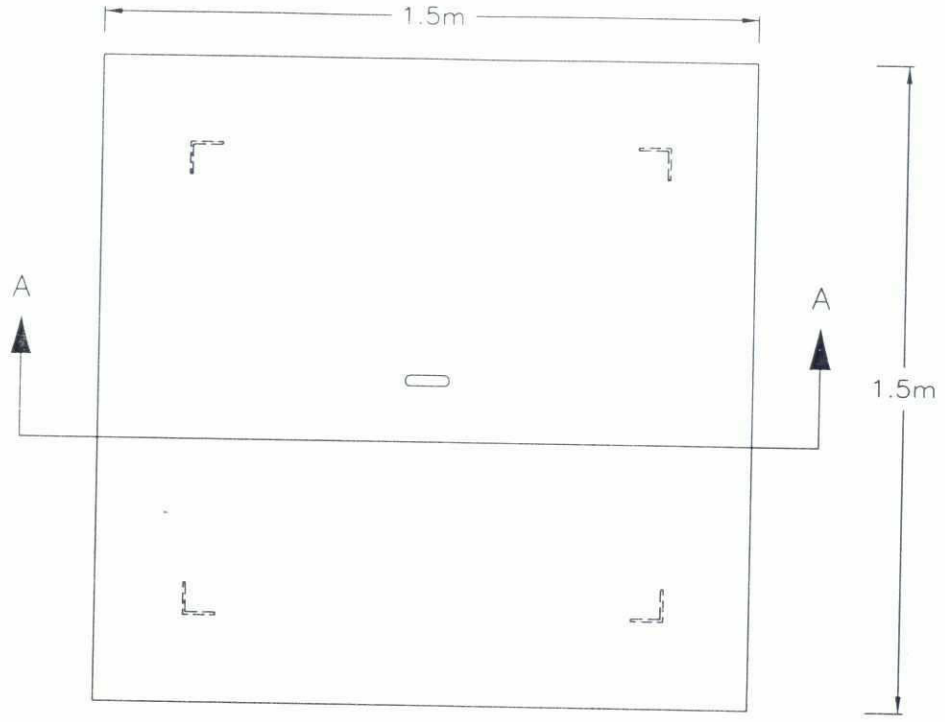


Assembling geo-textile screen

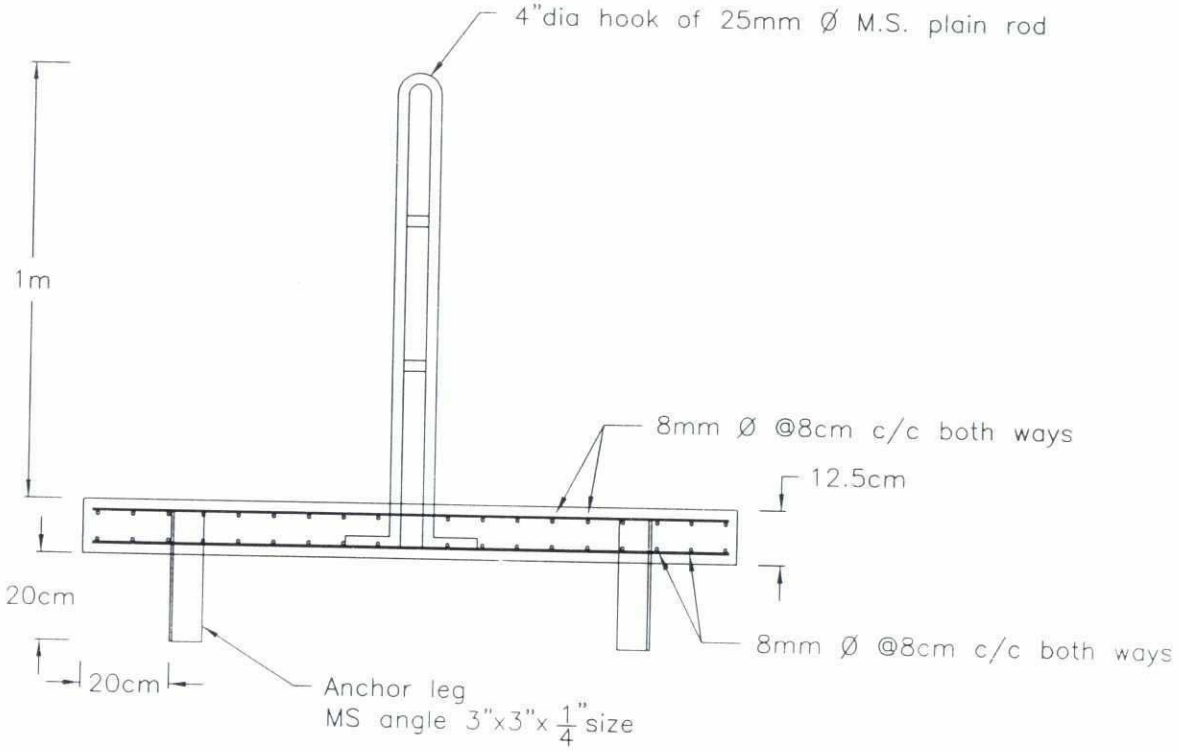
Figure 4

[GIS-01]d:\teamlead\42bp2jun.dwg

DESIGN OF ANCHOR BLOCKS



PLAN

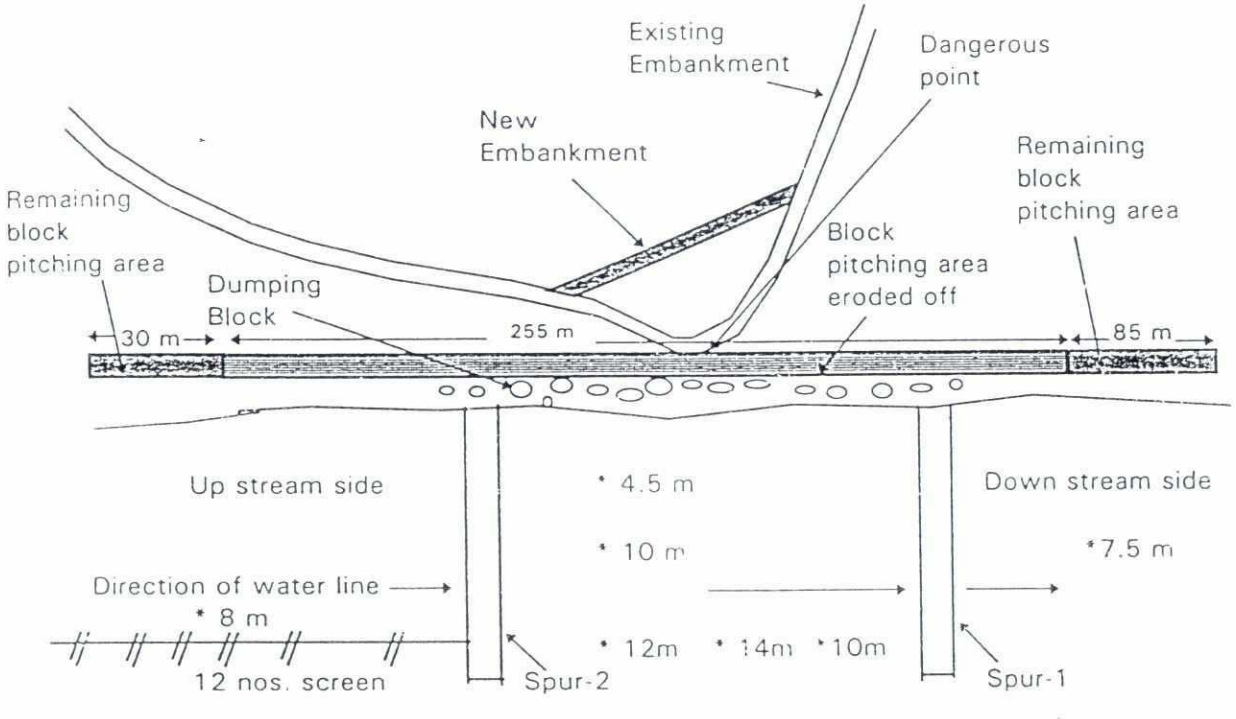


SECTION A–A

FILE (GIS01) D:\CML\A-BLOCK3.dwg

Figure 5

Monitoring September 16-19, 1998



* indicates point of measuring depth

Figure 6

Sounding Report of Haimchar Site, Chandpur as on 25.09.98

FIG - 7

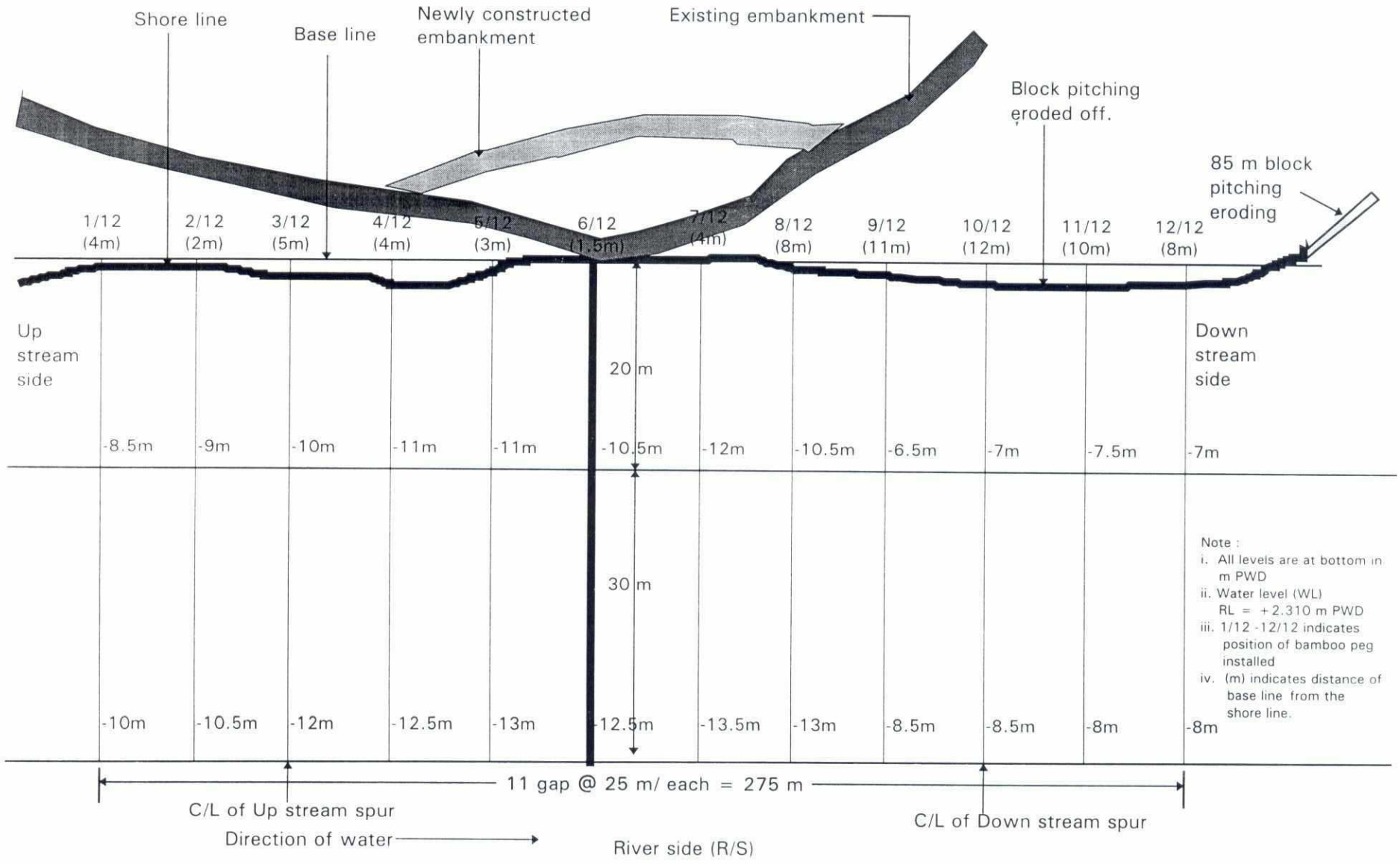


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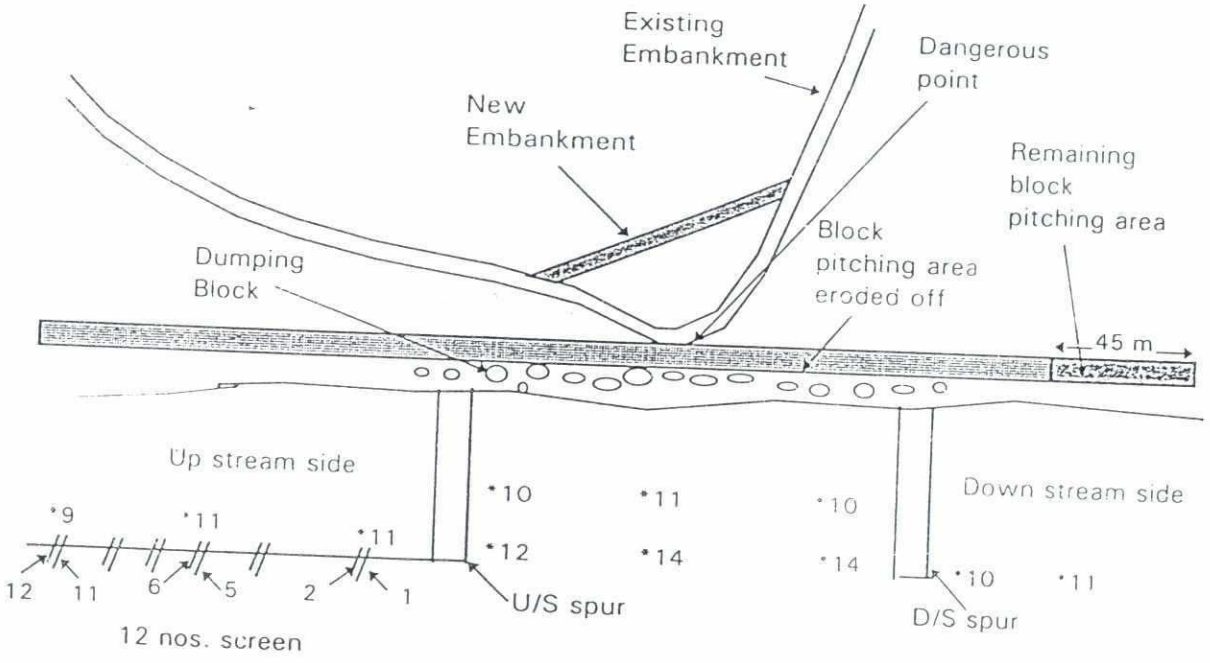
Figure 7

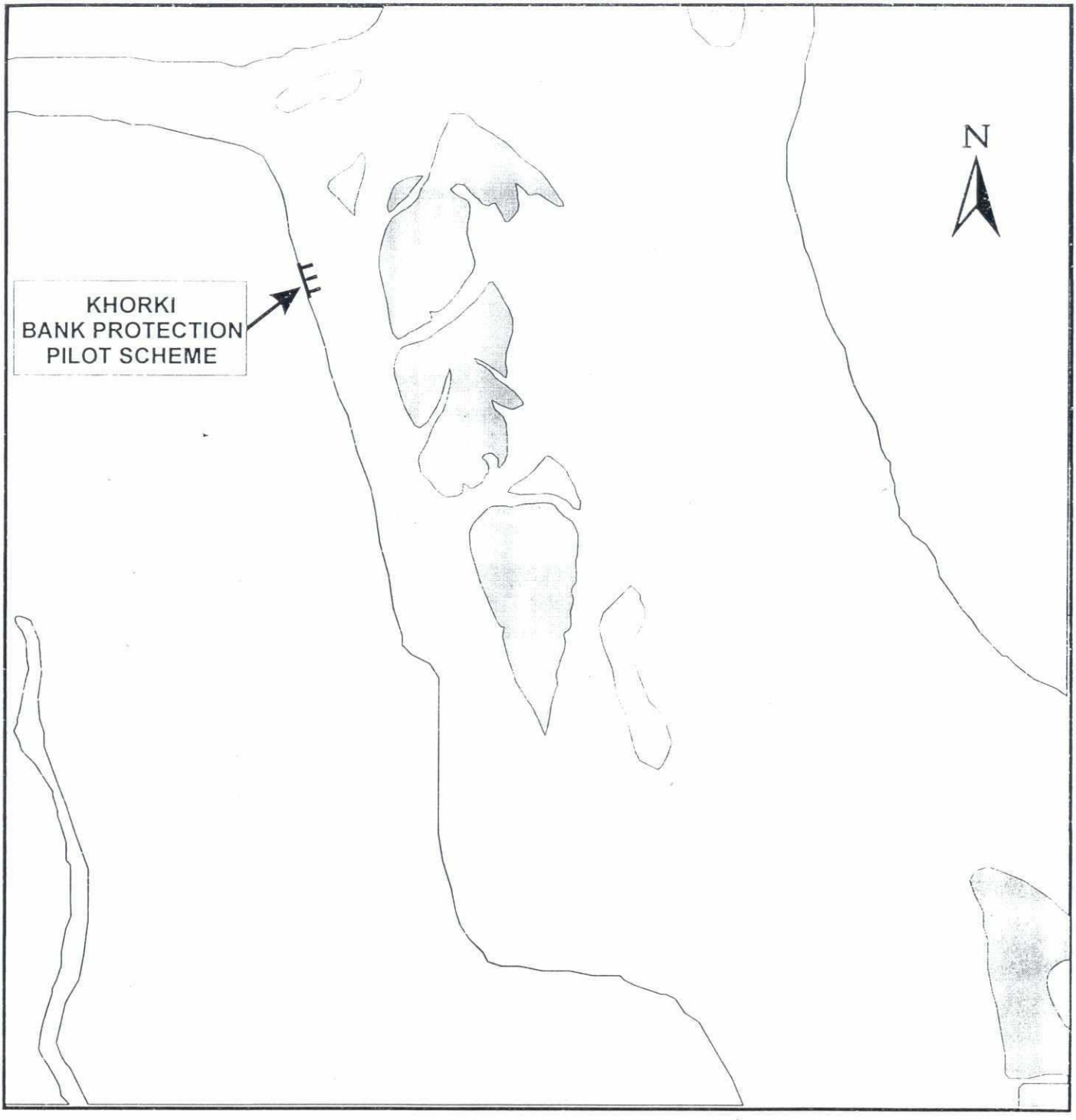
Monitoring September 24-26, 1998



* Indicates water depths measured in meter.

Figure 8

KHORKI BANK PROTECTION PILOT SCHEME



LEGEND

STUDY AREA

SUBMERGED LAND AREA

WATER BODY

SPURS

MEGHNA ESTUARY STUDY	
KHORKI BANK PROTECTION PILOT SCHEME	
PROJECTION:	BANGLADESH TRANSVERSE MERCATOR
SOURCE	LANDSAT IMAGERY FEBRUARY 1996
PRODUCED BY:	MES CE&R, GIS/RS/CAD UNIT

File (GIS-01) D:\Civil\Khorki1.cdr

Figure 9

Outline Khorki Bank Protection Pilot Scheme

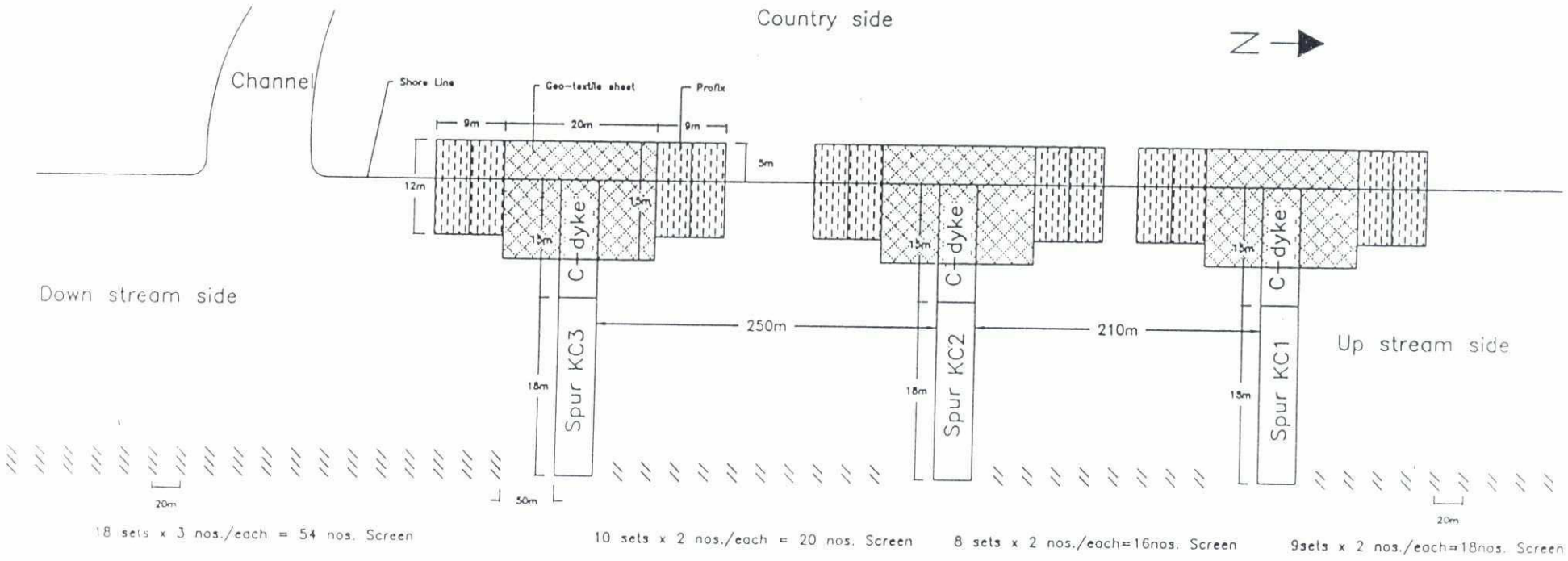


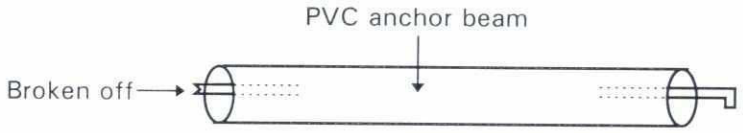
Figure 10

FIG - 11

DETAILS OF DISCONNECTED SCREEN

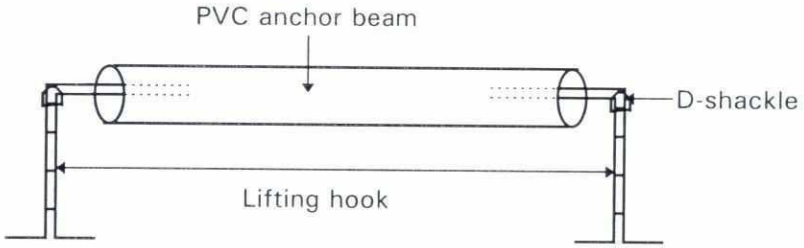
HAIMCHAR, CHANDPUR

1. The screen was disconnected on dt. 26.07.98 by breaking off the anchor beam hook at one end and the other end was found without D-shackle.

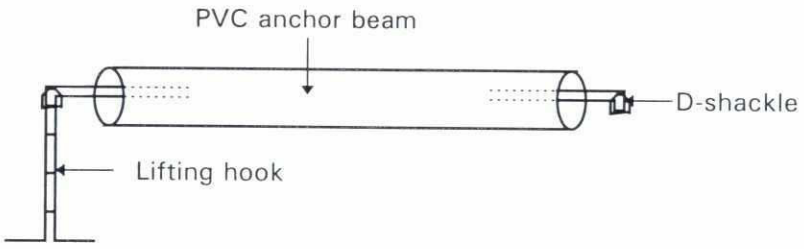


KHORKI, BHOLA

1. The screen was disconnected on dt. 11.08.98 by disconnecting both the lifting hooks at bottom from the anchor slabs.

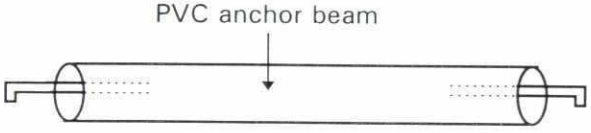


2. The screen was disconnected on dt. 23.09.98 by disconnecting the lifting hook from one anchor slab at bottom but on the other side the anchor beam hook was found with D-shackle.



3. The screen was disconnected on dt. 23.09.98, some fishermen has seen it being swept away but it could not be rescued.

4. The screen was disconnected on dt. 25.09.98 but D-shackles with the anchor beam hook of both sides were absent.



Monitoring November 15, 1998

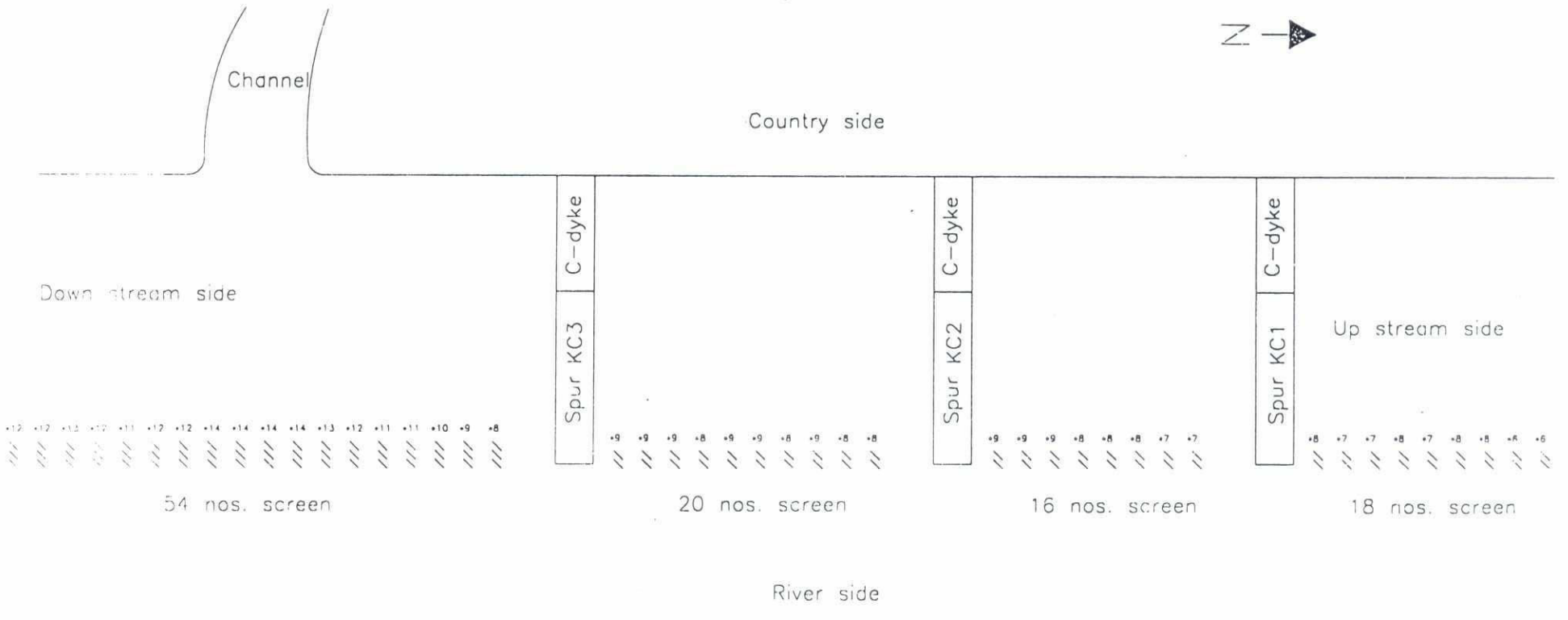
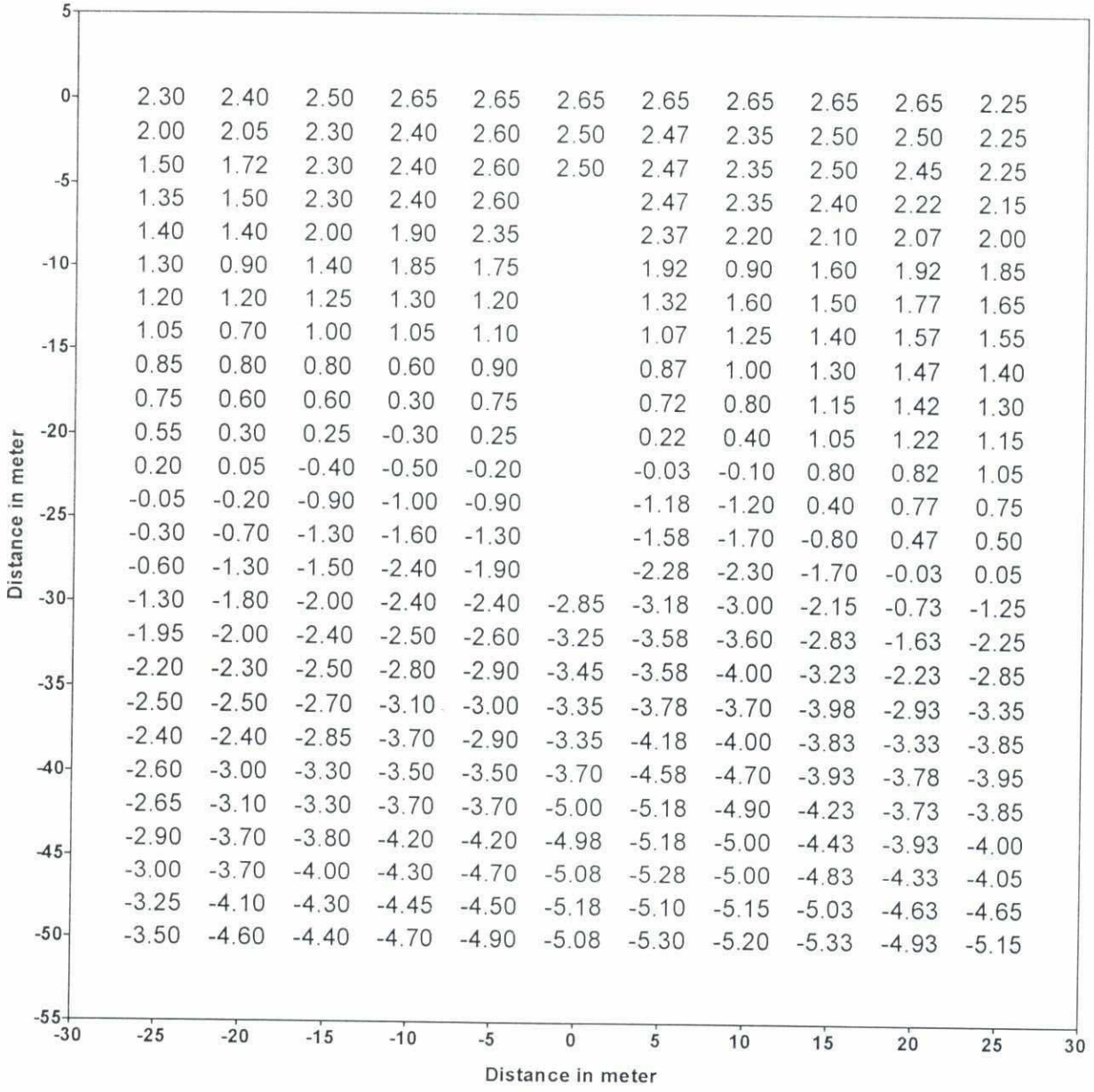


Figure 12

GD

RESULTS BATHYMETRIC SURVEYS

Haimchar Erosion Control Pilot Scheme

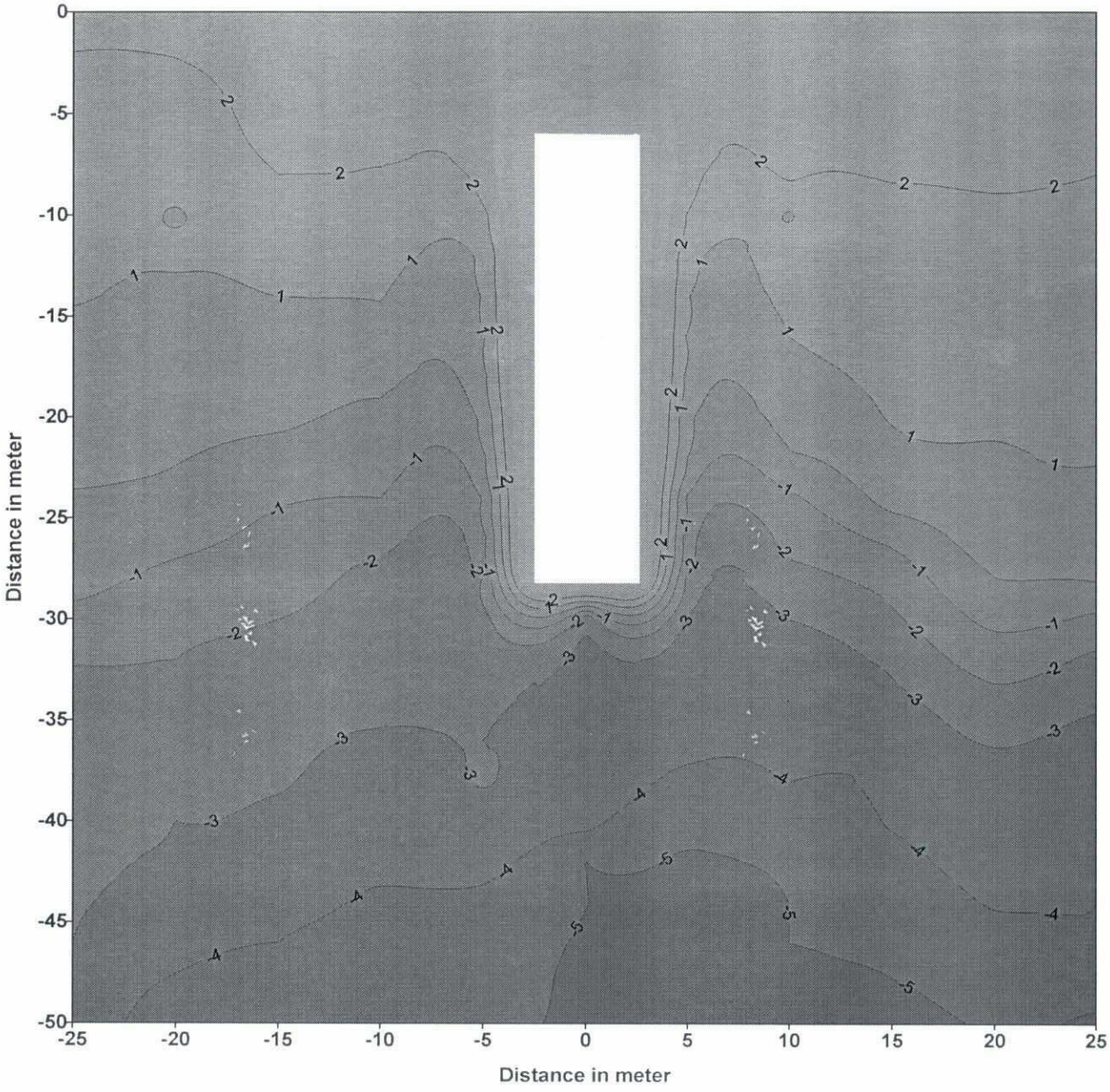


2.30	2.40	2.50	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.25
2.00	2.05	2.30	2.40	2.60	2.50	2.47	2.35	2.50	2.50	2.25
1.50	1.72	2.30	2.40	2.60	2.50	2.47	2.35	2.50	2.45	2.25
1.35	1.50	2.30	2.40	2.60		2.47	2.35	2.40	2.22	2.15
1.40	1.40	2.00	1.90	2.35		2.37	2.20	2.10	2.07	2.00
1.30	0.90	1.40	1.85	1.75		1.92	0.90	1.60	1.92	1.85
1.20	1.20	1.25	1.30	1.20		1.32	1.60	1.50	1.77	1.65
1.05	0.70	1.00	1.05	1.10		1.07	1.25	1.40	1.57	1.55
0.85	0.80	0.80	0.60	0.90		0.87	1.00	1.30	1.47	1.40
0.75	0.60	0.60	0.30	0.75		0.72	0.80	1.15	1.42	1.30
0.55	0.30	0.25	-0.30	0.25		0.22	0.40	1.05	1.22	1.15
0.20	0.05	-0.40	-0.50	-0.20		-0.03	-0.10	0.80	0.82	1.05
-0.05	-0.20	-0.90	-1.00	-0.90		-1.18	-1.20	0.40	0.77	0.75
-0.30	-0.70	-1.30	-1.60	-1.30		-1.58	-1.70	-0.80	0.47	0.50
-0.60	-1.30	-1.50	-2.40	-1.90		-2.28	-2.30	-1.70	-0.03	0.05
-1.30	-1.80	-2.00	-2.40	-2.40	-2.85	-3.18	-3.00	-2.15	-0.73	-1.25
-1.95	-2.00	-2.40	-2.50	-2.60	-3.25	-3.58	-3.60	-2.83	-1.63	-2.25
-2.20	-2.30	-2.50	-2.80	-2.90	-3.45	-3.58	-4.00	-3.23	-2.23	-2.85
-2.50	-2.50	-2.70	-3.10	-3.00	-3.35	-3.78	-3.70	-3.98	-2.93	-3.35
-2.40	-2.40	-2.85	-3.70	-2.90	-3.35	-4.18	-4.00	-3.83	-3.33	-3.85
-2.60	-3.00	-3.30	-3.50	-3.50	-3.70	-4.58	-4.70	-3.93	-3.78	-3.95
-2.65	-3.10	-3.30	-3.70	-3.70	-5.00	-5.18	-4.90	-4.23	-3.73	-3.85
-2.90	-3.70	-3.80	-4.20	-4.20	-4.98	-5.18	-5.00	-4.43	-3.93	-4.00
-3.00	-3.70	-4.00	-4.30	-4.70	-5.08	-5.28	-5.00	-4.83	-4.33	-4.05
-3.25	-4.10	-4.30	-4.45	-4.50	-5.18	-5.10	-5.15	-5.03	-4.63	-4.65
-3.50	-4.60	-4.40	-4.70	-4.90	-5.08	-5.30	-5.20	-5.33	-4.93	-5.15

Bed levels around SPUR-1
Levels are in Meter, PWD
Date of survey : 03 Jul 98

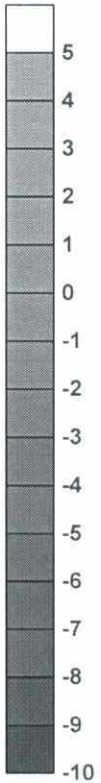
6

Haimchar Erosion Control Pilot Scheme



Bed levels around SPUR-1
Levels are in Meter PWD
Date of survey : 03 Jul 98

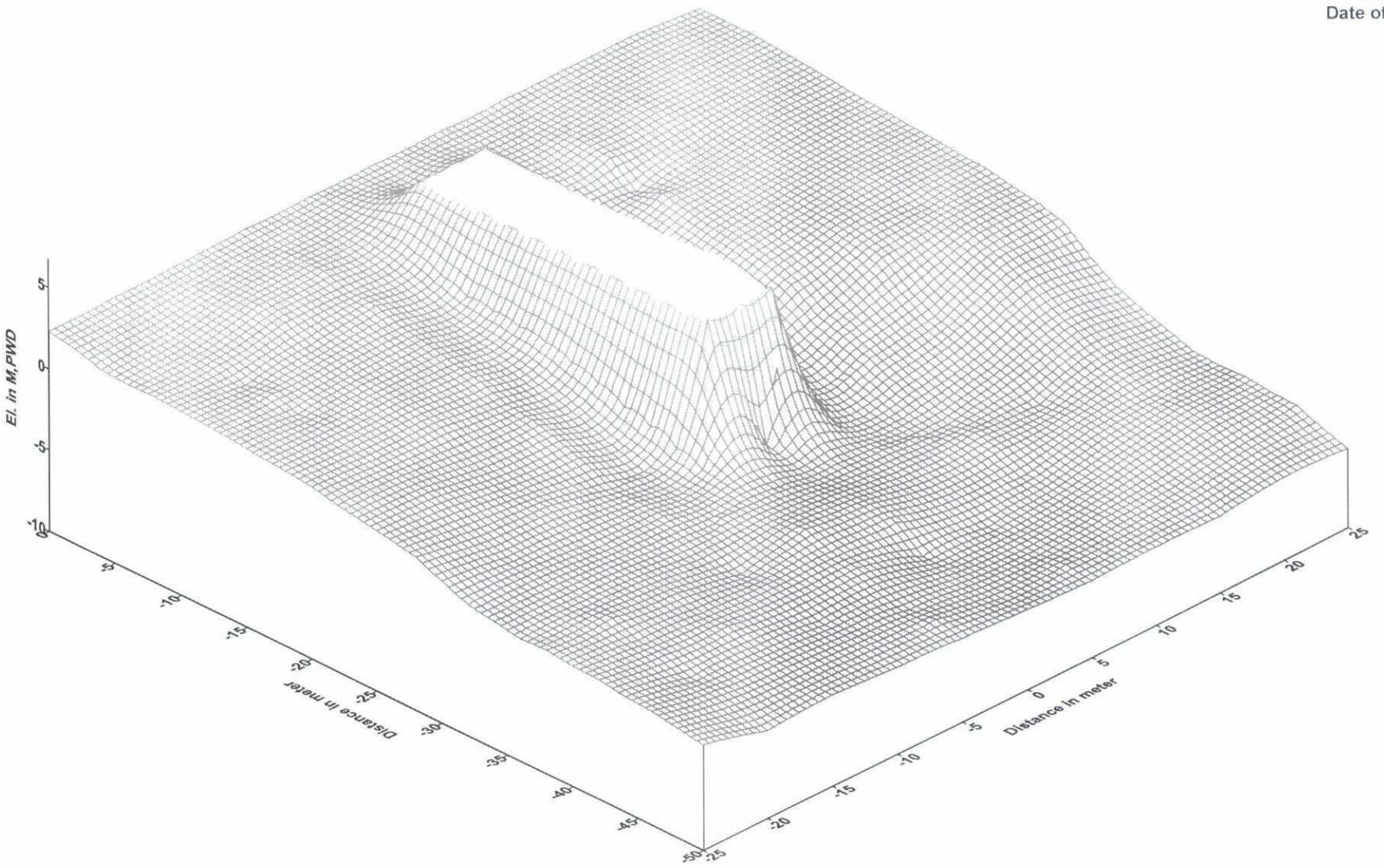
Color scale :



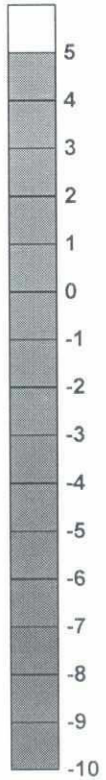
92

Haimchar Erosion Control Pilot Scheme

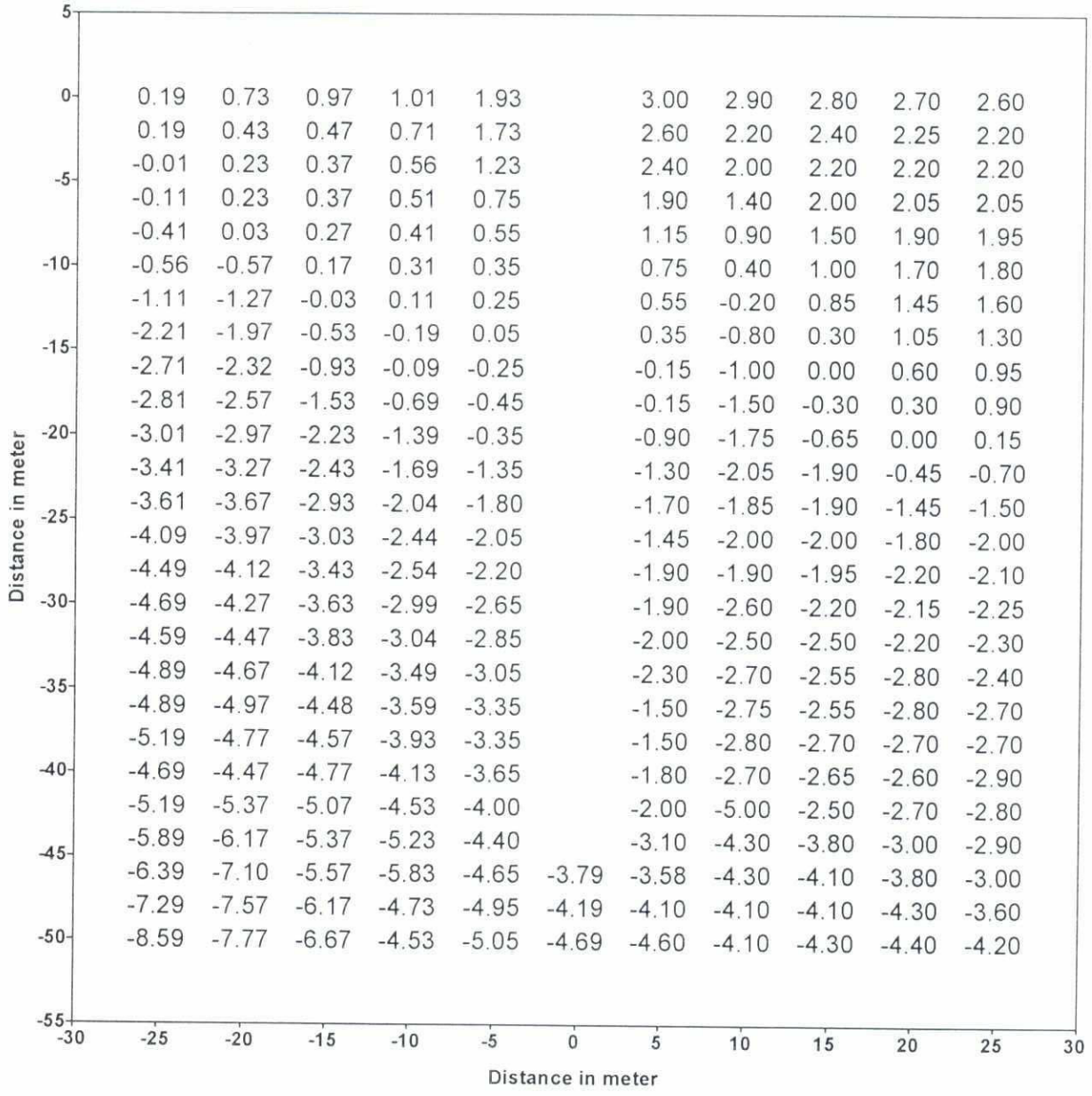
Bed levels around SPUR-1
Levels are in Meter PWD
Date of survey : 03 Jul 98



Color scale :



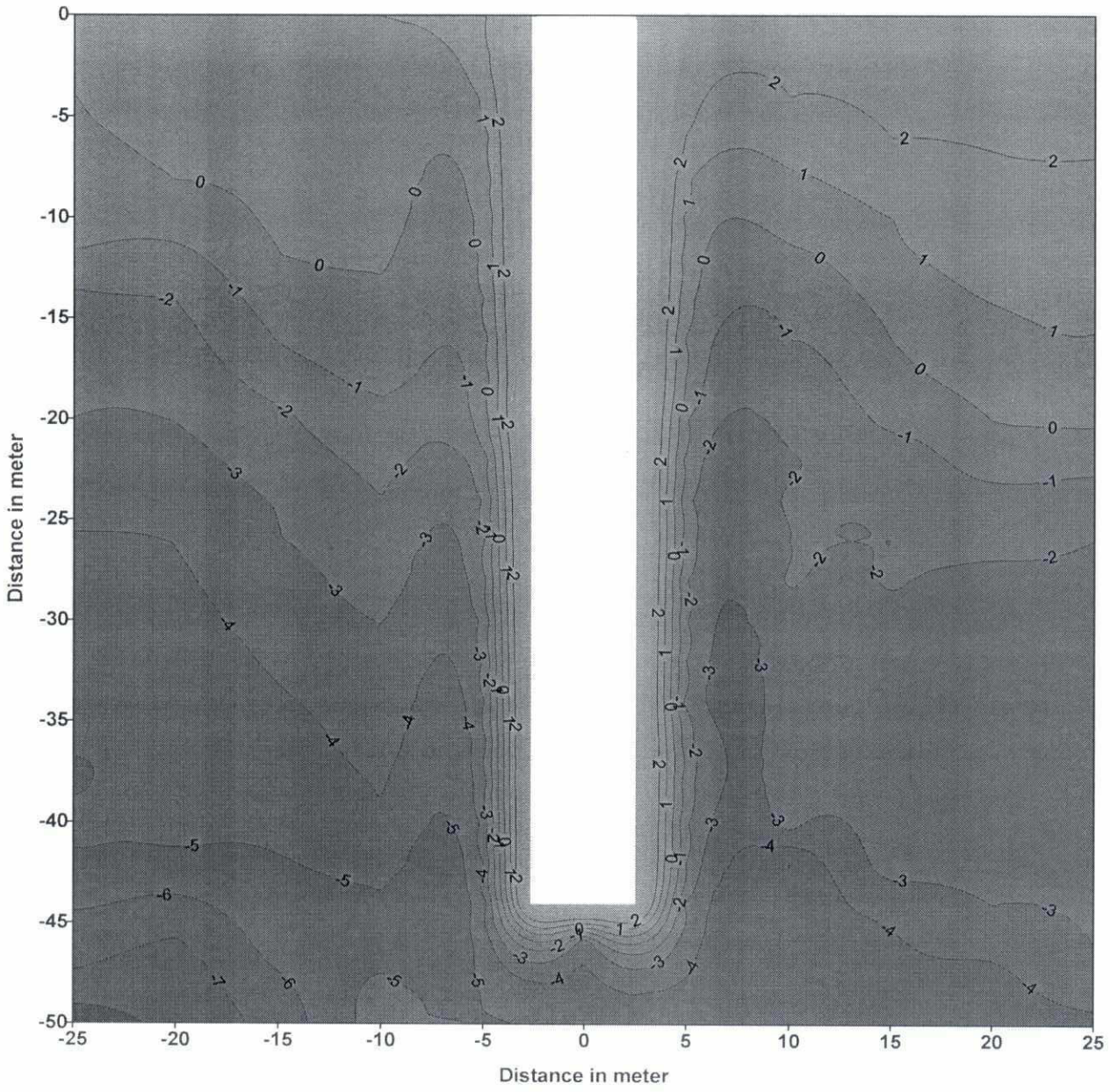
Haimchar Erosion Control Pilot Scheme



0.19	0.73	0.97	1.01	1.93		3.00	2.90	2.80	2.70	2.60
0.19	0.43	0.47	0.71	1.73		2.60	2.20	2.40	2.25	2.20
-0.01	0.23	0.37	0.56	1.23		2.40	2.00	2.20	2.20	2.20
-0.11	0.23	0.37	0.51	0.75		1.90	1.40	2.00	2.05	2.05
-0.41	0.03	0.27	0.41	0.55		1.15	0.90	1.50	1.90	1.95
-0.56	-0.57	0.17	0.31	0.35		0.75	0.40	1.00	1.70	1.80
-1.11	-1.27	-0.03	0.11	0.25		0.55	-0.20	0.85	1.45	1.60
-2.21	-1.97	-0.53	-0.19	0.05		0.35	-0.80	0.30	1.05	1.30
-2.71	-2.32	-0.93	-0.09	-0.25		-0.15	-1.00	0.00	0.60	0.95
-2.81	-2.57	-1.53	-0.69	-0.45		-0.15	-1.50	-0.30	0.30	0.90
-3.01	-2.97	-2.23	-1.39	-0.35		-0.90	-1.75	-0.65	0.00	0.15
-3.41	-3.27	-2.43	-1.69	-1.35		-1.30	-2.05	-1.90	-0.45	-0.70
-3.61	-3.67	-2.93	-2.04	-1.80		-1.70	-1.85	-1.90	-1.45	-1.50
-4.09	-3.97	-3.03	-2.44	-2.05		-1.45	-2.00	-2.00	-1.80	-2.00
-4.49	-4.12	-3.43	-2.54	-2.20		-1.90	-1.90	-1.95	-2.20	-2.10
-4.69	-4.27	-3.63	-2.99	-2.65		-1.90	-2.60	-2.20	-2.15	-2.25
-4.59	-4.47	-3.83	-3.04	-2.85		-2.00	-2.50	-2.50	-2.20	-2.30
-4.89	-4.67	-4.12	-3.49	-3.05		-2.30	-2.70	-2.55	-2.80	-2.40
-4.89	-4.97	-4.48	-3.59	-3.35		-1.50	-2.75	-2.55	-2.80	-2.70
-5.19	-4.77	-4.57	-3.93	-3.35		-1.50	-2.80	-2.70	-2.70	-2.70
-4.69	-4.47	-4.77	-4.13	-3.65		-1.80	-2.70	-2.65	-2.60	-2.90
-5.19	-5.37	-5.07	-4.53	-4.00		-2.00	-5.00	-2.50	-2.70	-2.80
-5.89	-6.17	-5.37	-5.23	-4.40		-3.10	-4.30	-3.80	-3.00	-2.90
-6.39	-7.10	-5.57	-5.83	-4.65	-3.79	-3.58	-4.30	-4.10	-3.80	-3.00
-7.29	-7.57	-6.17	-4.73	-4.95	-4.19	-4.10	-4.10	-4.10	-4.30	-3.60
-8.59	-7.77	-6.67	-4.53	-5.05	-4.69	-4.60	-4.10	-4.30	-4.40	-4.20

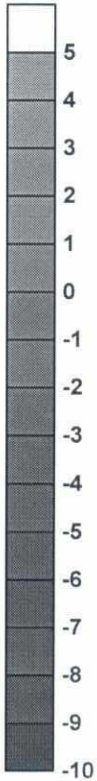
Bed levels around SPUR-2
Levels are in Meter, PWD
Date of survey : 04 Jul 98

Haimchar Erosion Control Pilot Scheme



Bed levels around SPUR-2
Levels are in Meter PWD
Date of survey : 04 Jul 98

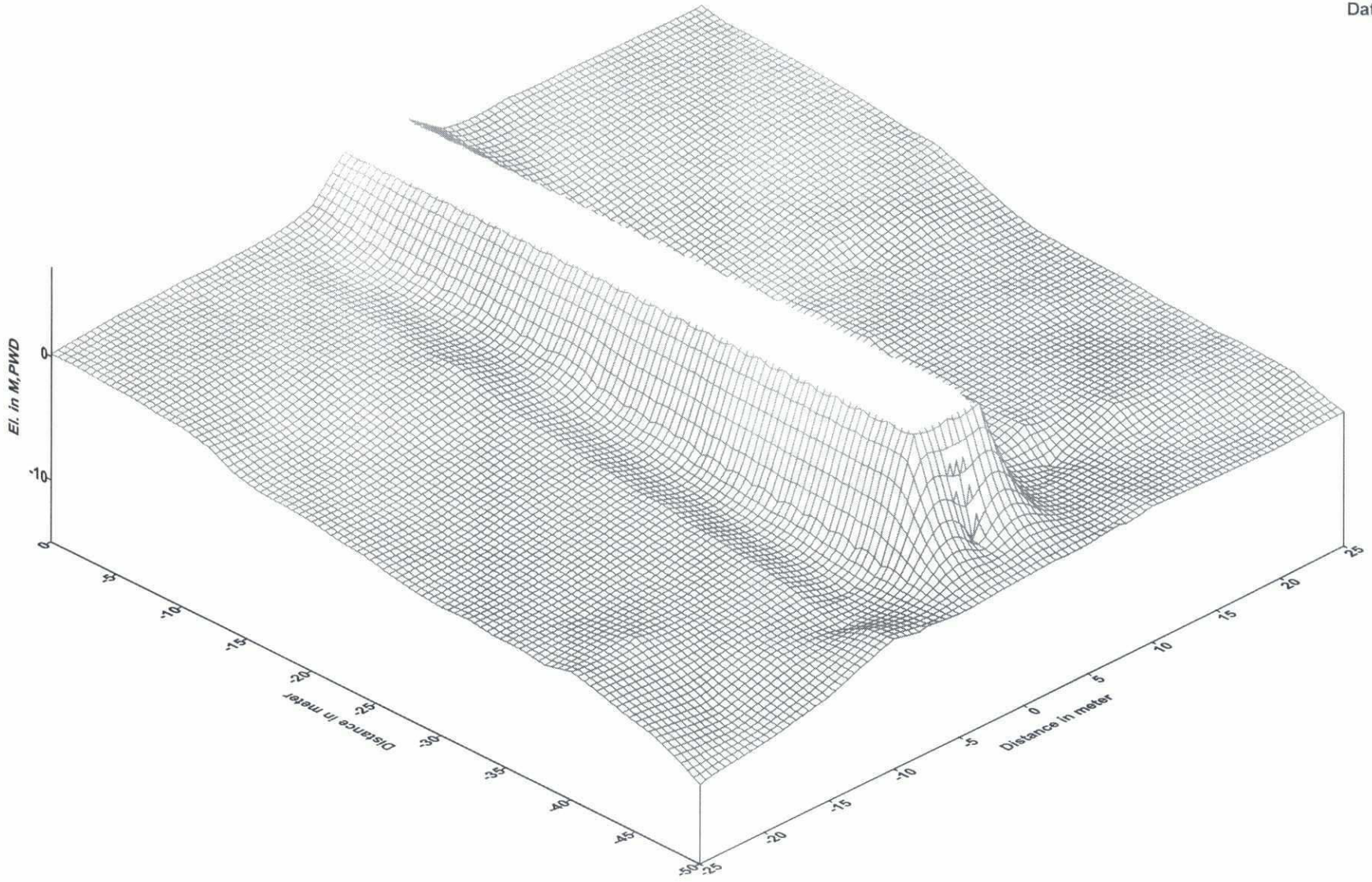
Color scale :



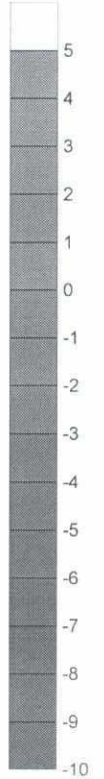
20

Haimchar Erosion Control Pilot Scheme

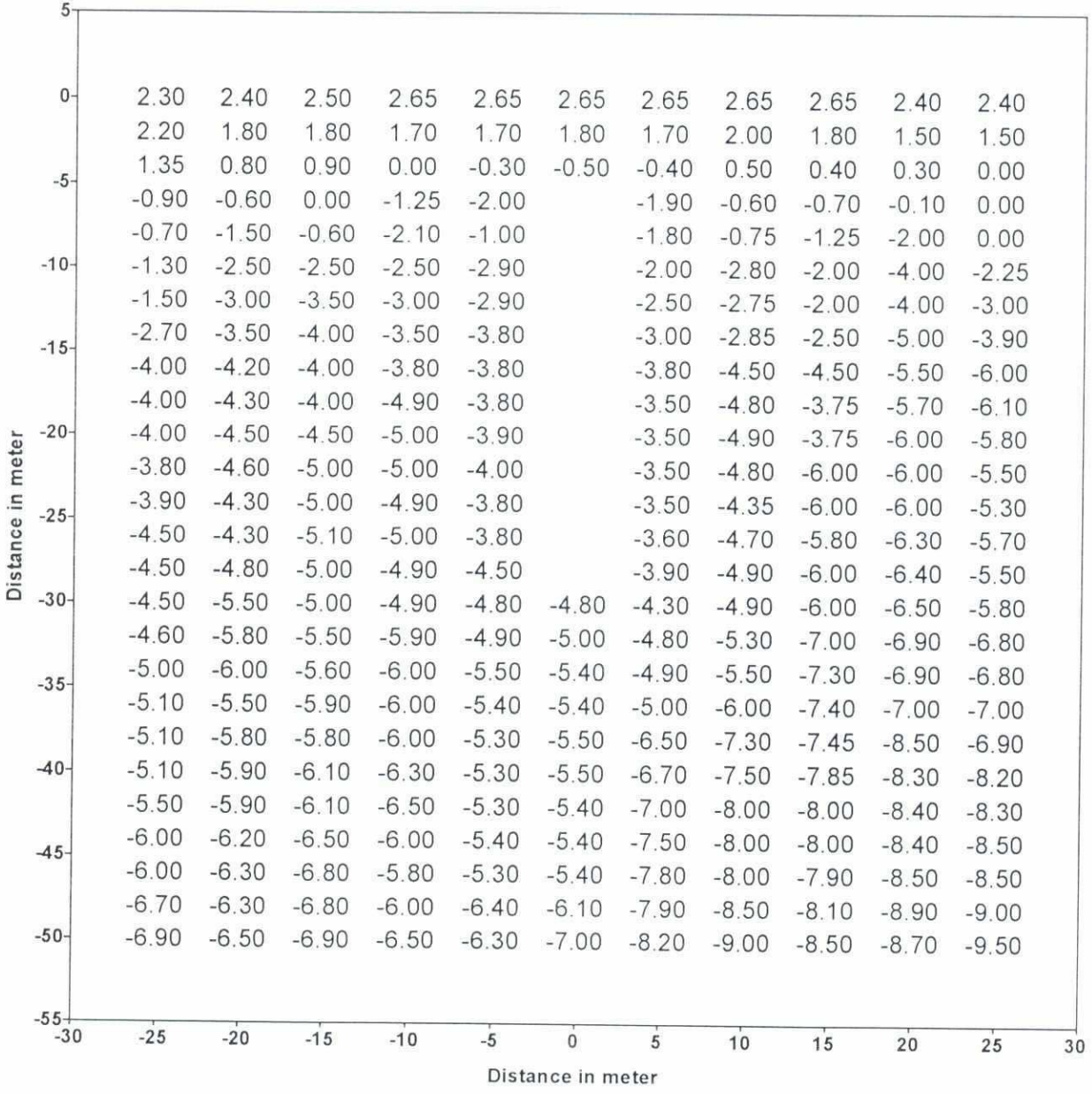
Bed levels around SPUR-2
Levels are in Meter PWD
Date of survey : 04 Jul 98



Color scale :



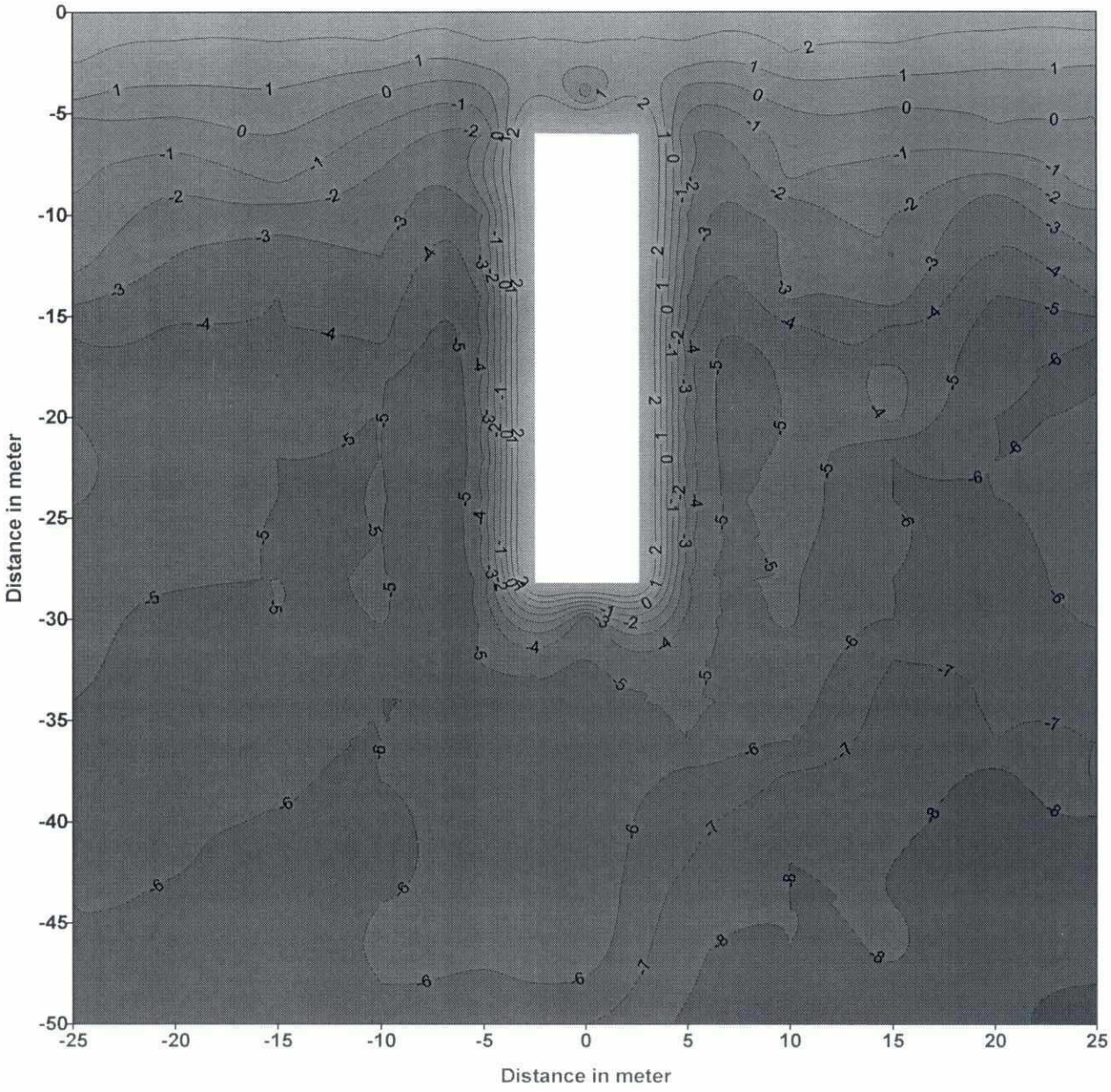
Haimchar Erosion Control Pilot Scheme



2.30	2.40	2.50	2.65	2.65	2.65	2.65	2.65	2.65	2.40	2.40
2.20	1.80	1.80	1.70	1.70	1.80	1.70	2.00	1.80	1.50	1.50
1.35	0.80	0.90	0.00	-0.30	-0.50	-0.40	0.50	0.40	0.30	0.00
-0.90	-0.60	0.00	-1.25	-2.00		-1.90	-0.60	-0.70	-0.10	0.00
-0.70	-1.50	-0.60	-2.10	-1.00		-1.80	-0.75	-1.25	-2.00	0.00
-1.30	-2.50	-2.50	-2.50	-2.90		-2.00	-2.80	-2.00	-4.00	-2.25
-1.50	-3.00	-3.50	-3.00	-2.90		-2.50	-2.75	-2.00	-4.00	-3.00
-2.70	-3.50	-4.00	-3.50	-3.80		-3.00	-2.85	-2.50	-5.00	-3.90
-4.00	-4.20	-4.00	-3.80	-3.80		-3.80	-4.50	-4.50	-5.50	-6.00
-4.00	-4.30	-4.00	-4.90	-3.80		-3.50	-4.80	-3.75	-5.70	-6.10
-4.00	-4.50	-4.50	-5.00	-3.90		-3.50	-4.90	-3.75	-6.00	-5.80
-3.80	-4.60	-5.00	-5.00	-4.00		-3.50	-4.80	-6.00	-6.00	-5.50
-3.90	-4.30	-5.00	-4.90	-3.80		-3.50	-4.35	-6.00	-6.00	-5.30
-4.50	-4.30	-5.10	-5.00	-3.80		-3.60	-4.70	-5.80	-6.30	-5.70
-4.50	-4.80	-5.00	-4.90	-4.50		-3.90	-4.90	-6.00	-6.40	-5.50
-4.50	-5.50	-5.00	-4.90	-4.80	-4.80	-4.30	-4.90	-6.00	-6.50	-5.80
-4.60	-5.80	-5.50	-5.90	-4.90	-5.00	-4.80	-5.30	-7.00	-6.90	-6.80
-5.00	-6.00	-5.60	-6.00	-5.50	-5.40	-4.90	-5.50	-7.30	-6.90	-6.80
-5.10	-5.50	-5.90	-6.00	-5.40	-5.40	-5.00	-6.00	-7.40	-7.00	-7.00
-5.10	-5.80	-5.80	-6.00	-5.30	-5.50	-6.50	-7.30	-7.45	-8.50	-6.90
-5.10	-5.90	-6.10	-6.30	-5.30	-5.50	-6.70	-7.50	-7.85	-8.30	-8.20
-5.50	-5.90	-6.10	-6.50	-5.30	-5.40	-7.00	-8.00	-8.00	-8.40	-8.30
-6.00	-6.20	-6.50	-6.00	-5.40	-5.40	-7.50	-8.00	-8.00	-8.40	-8.50
-6.00	-6.30	-6.80	-5.80	-5.30	-5.40	-7.80	-8.00	-7.90	-8.50	-8.50
-6.70	-6.30	-6.80	-6.00	-6.40	-6.10	-7.90	-8.50	-8.10	-8.90	-9.00
-6.90	-6.50	-6.90	-6.50	-6.30	-7.00	-8.20	-9.00	-8.50	-8.70	-9.50

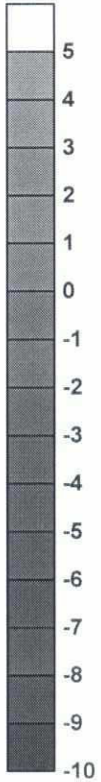
Bed levels around SPUR-1
Levels are in Meter, PWD
Date of survey : 13 Aug 98

Haimchar Erosion Control Pilot Scheme



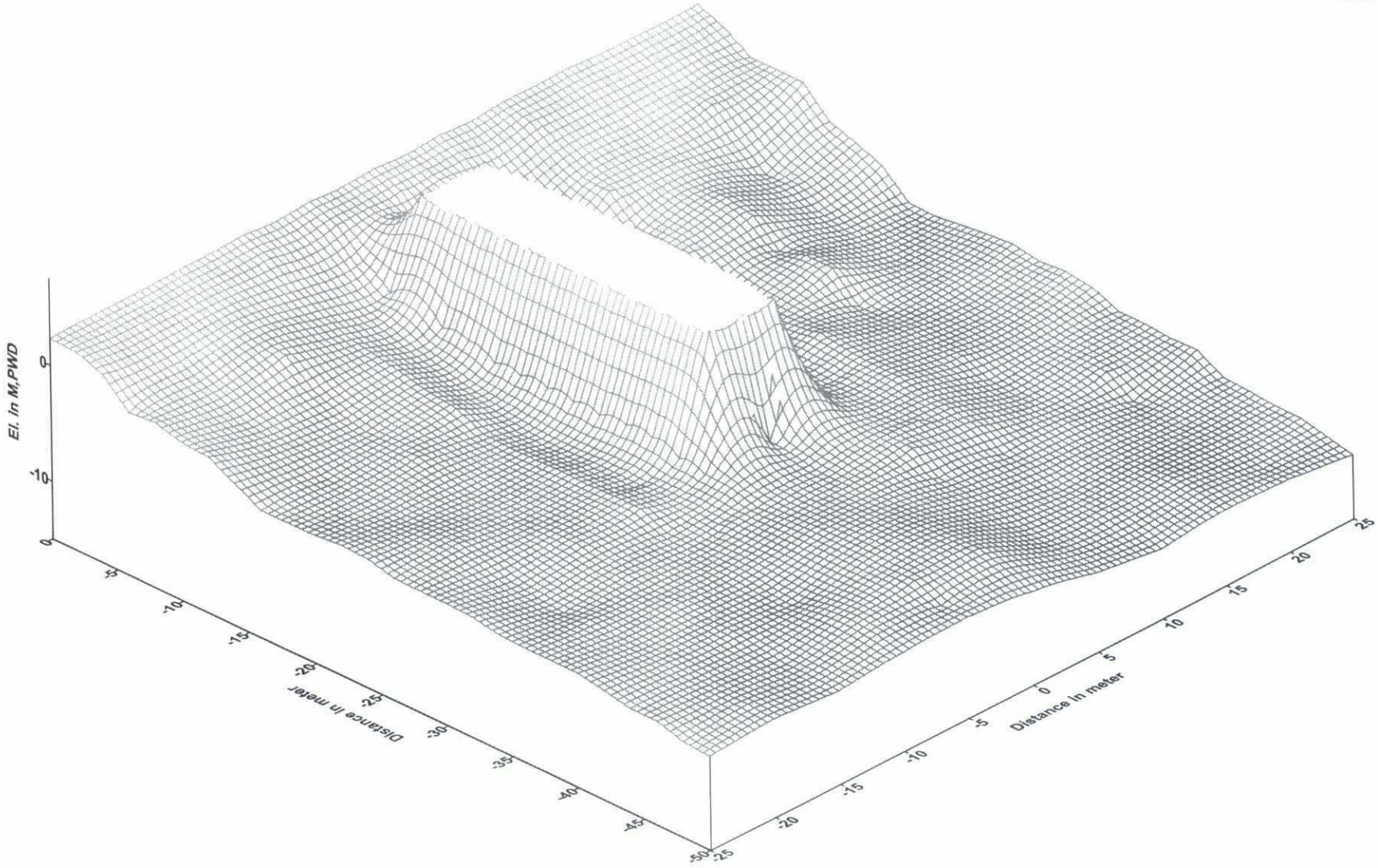
Bed levels around SPUR-1
Levels are in Meter PWD
Date of survey : 13 Aug 98

Color scale :

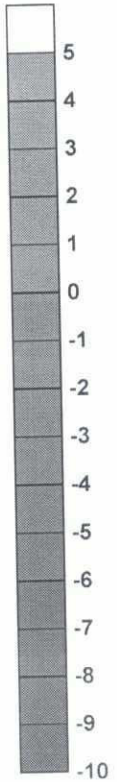


Haimchar Erosion Control Pilot Scheme

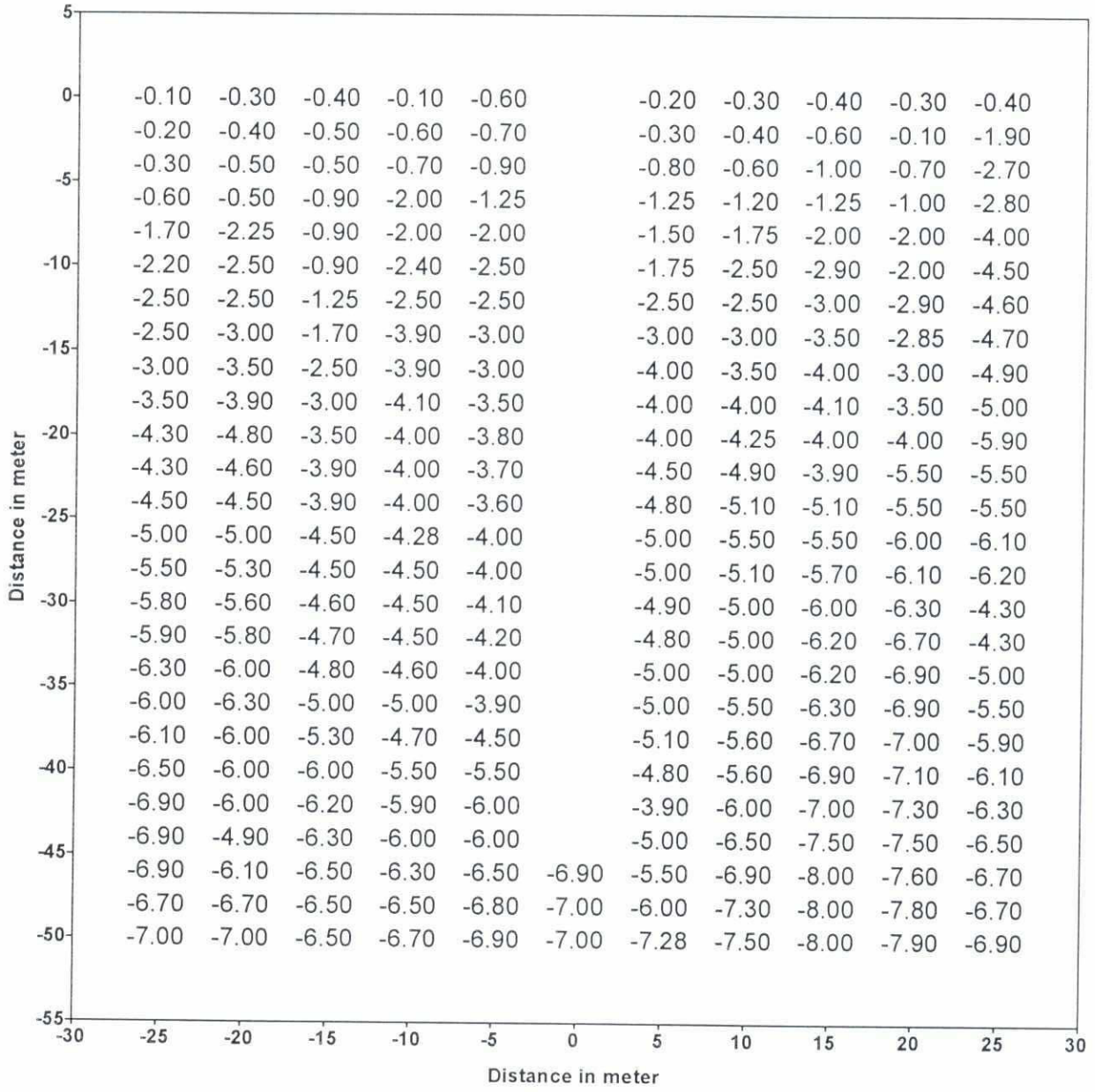
Bed levels around SPUR-1
Levels are in Meter PWD
Date of survey : 13 Aug 98



Color scale :



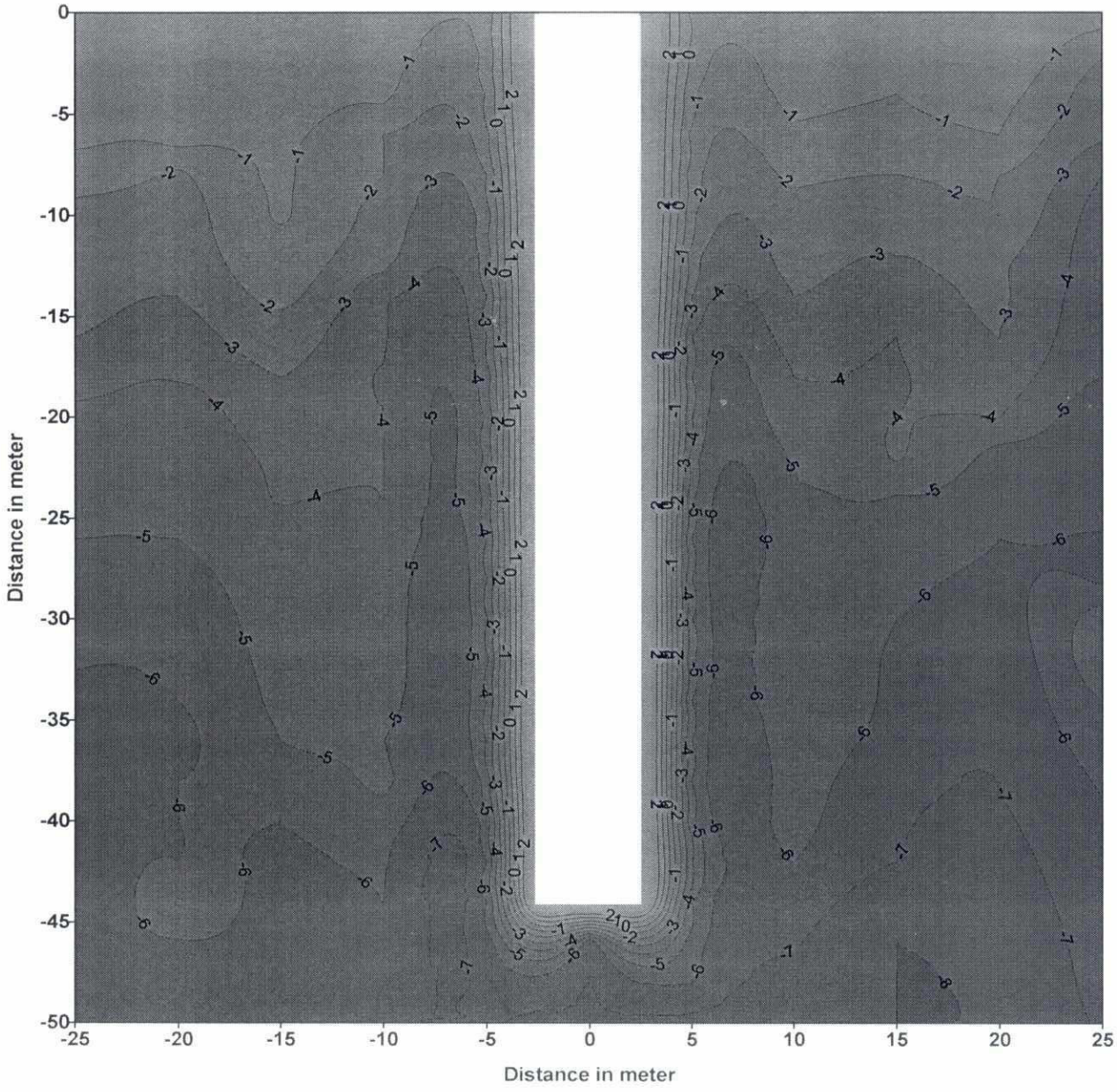
Haimchar Erosion Control Pilot Scheme



-0.10	-0.30	-0.40	-0.10	-0.60		-0.20	-0.30	-0.40	-0.30	-0.40
-0.20	-0.40	-0.50	-0.60	-0.70		-0.30	-0.40	-0.60	-0.10	-1.90
-0.30	-0.50	-0.50	-0.70	-0.90		-0.80	-0.60	-1.00	-0.70	-2.70
-0.60	-0.50	-0.90	-2.00	-1.25		-1.25	-1.20	-1.25	-1.00	-2.80
-1.70	-2.25	-0.90	-2.00	-2.00		-1.50	-1.75	-2.00	-2.00	-4.00
-2.20	-2.50	-0.90	-2.40	-2.50		-1.75	-2.50	-2.90	-2.00	-4.50
-2.50	-2.50	-1.25	-2.50	-2.50		-2.50	-2.50	-3.00	-2.90	-4.60
-2.50	-3.00	-1.70	-3.90	-3.00		-3.00	-3.00	-3.50	-2.85	-4.70
-3.00	-3.50	-2.50	-3.90	-3.00		-4.00	-3.50	-4.00	-3.00	-4.90
-3.50	-3.90	-3.00	-4.10	-3.50		-4.00	-4.00	-4.10	-3.50	-5.00
-4.30	-4.80	-3.50	-4.00	-3.80		-4.00	-4.25	-4.00	-4.00	-5.90
-4.30	-4.60	-3.90	-4.00	-3.70		-4.50	-4.90	-3.90	-5.50	-5.50
-4.50	-4.50	-3.90	-4.00	-3.60		-4.80	-5.10	-5.10	-5.50	-5.50
-5.00	-5.00	-4.50	-4.28	-4.00		-5.00	-5.50	-5.50	-6.00	-6.10
-5.50	-5.30	-4.50	-4.50	-4.00		-5.00	-5.10	-5.70	-6.10	-6.20
-5.80	-5.60	-4.60	-4.50	-4.10		-4.90	-5.00	-6.00	-6.30	-4.30
-5.90	-5.80	-4.70	-4.50	-4.20		-4.80	-5.00	-6.20	-6.70	-4.30
-6.30	-6.00	-4.80	-4.60	-4.00		-5.00	-5.00	-6.20	-6.90	-5.00
-6.00	-6.30	-5.00	-5.00	-3.90		-5.00	-5.50	-6.30	-6.90	-5.50
-6.10	-6.00	-5.30	-4.70	-4.50		-5.10	-5.60	-6.70	-7.00	-5.90
-6.50	-6.00	-6.00	-5.50	-5.50		-4.80	-5.60	-6.90	-7.10	-6.10
-6.90	-6.00	-6.20	-5.90	-6.00		-3.90	-6.00	-7.00	-7.30	-6.30
-6.90	-4.90	-6.30	-6.00	-6.00		-5.00	-6.50	-7.50	-7.50	-6.50
-6.90	-6.10	-6.50	-6.30	-6.50	-6.90	-5.50	-6.90	-8.00	-7.60	-6.70
-6.70	-6.70	-6.50	-6.50	-6.80	-7.00	-6.00	-7.30	-8.00	-7.80	-6.70
-7.00	-7.00	-6.50	-6.70	-6.90	-7.00	-7.28	-7.50	-8.00	-7.90	-6.90

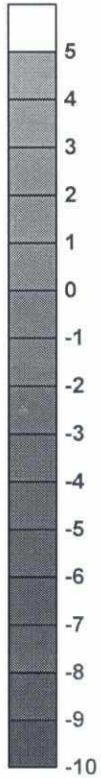
Bed levels around SPUR-2
Levels are in Meter, PWD
Date of survey : 14 Aug 98

Haimchar Erosion Control Pilot Scheme



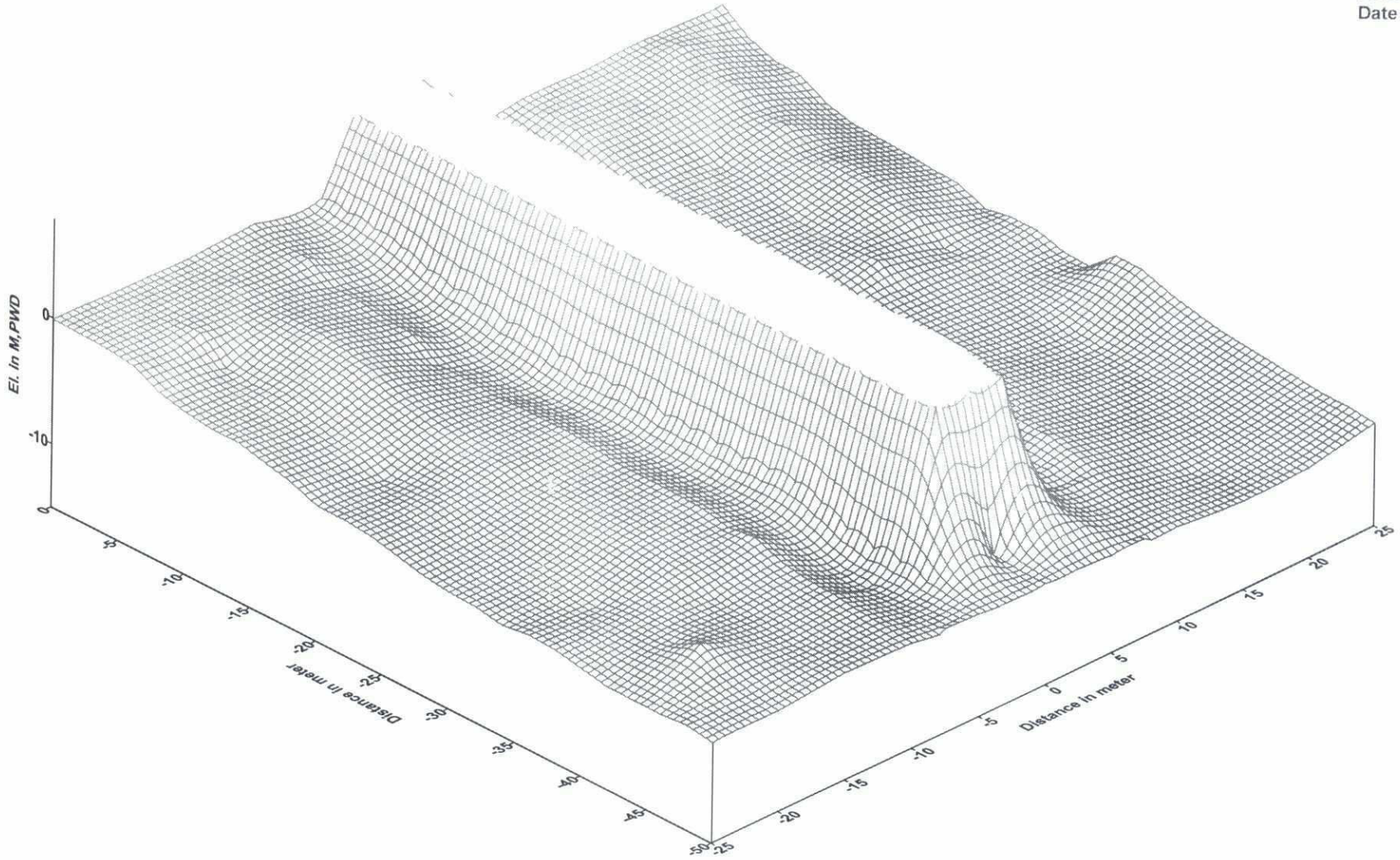
Bed levels around SPUR-2
Levels are in Meter PWD
Date of survey : 14 Aug 98

Color scale :

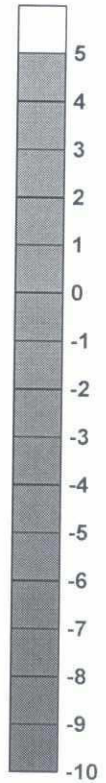


Haimchar Erosion Control Pilot Scheme

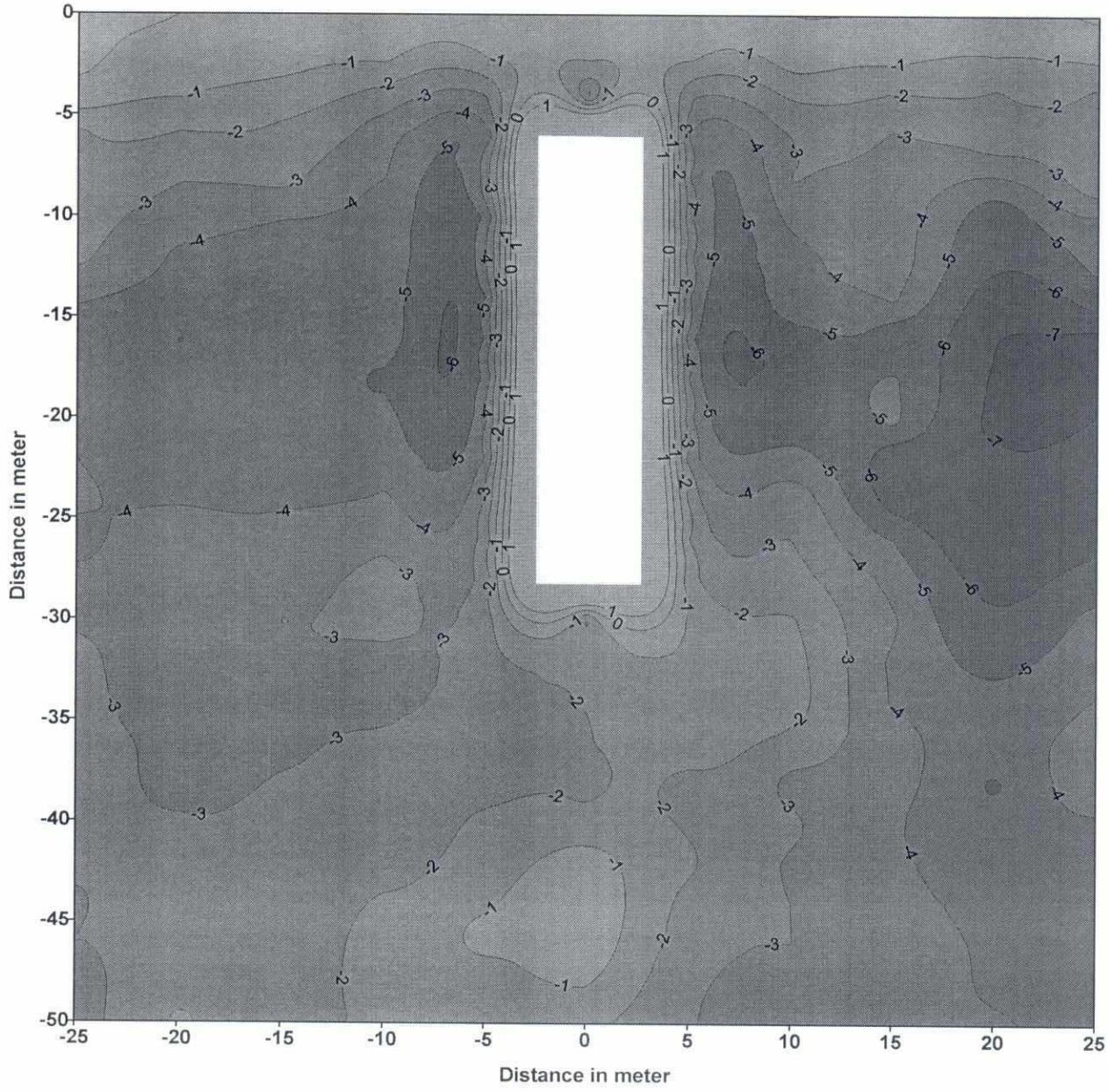
Bed levels around SPUR-2
Levels are in Meter PWD
Date of survey : 14 Aug 98



Color scale :



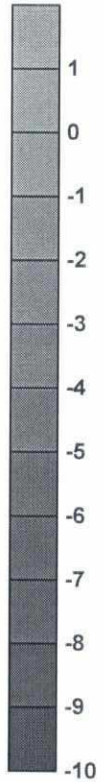
Haimchar Erosion Control Pilot Scheme

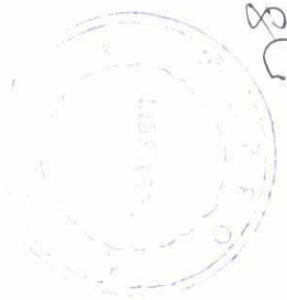


Changes in bed levels
around SPUR-1 in meter

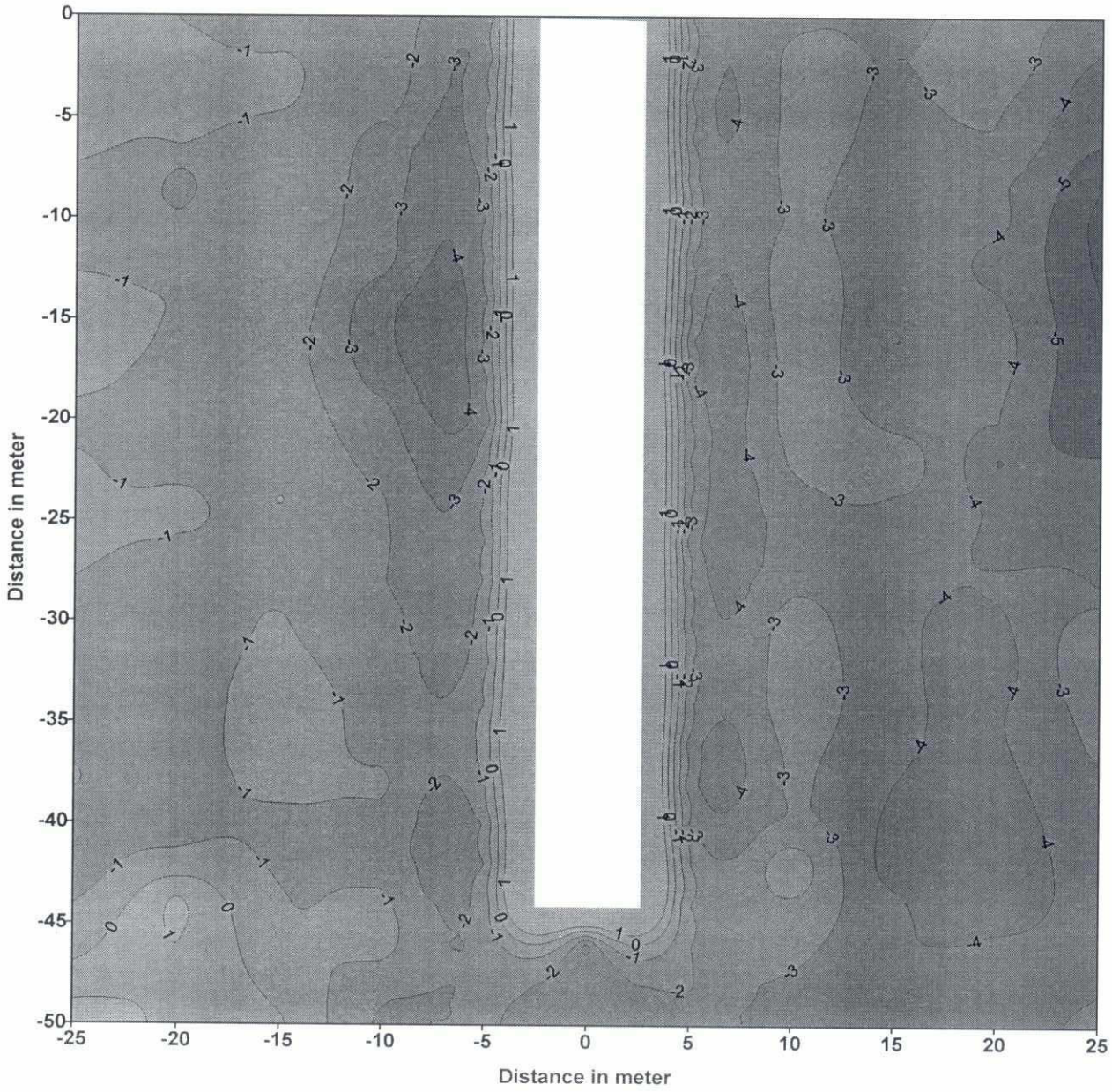
Period : 03 Jul 98 - 13 Aug 98

Color scale :





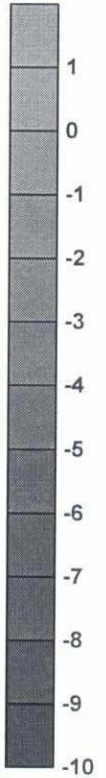
Haimchar Erosion Control Pilot Scheme



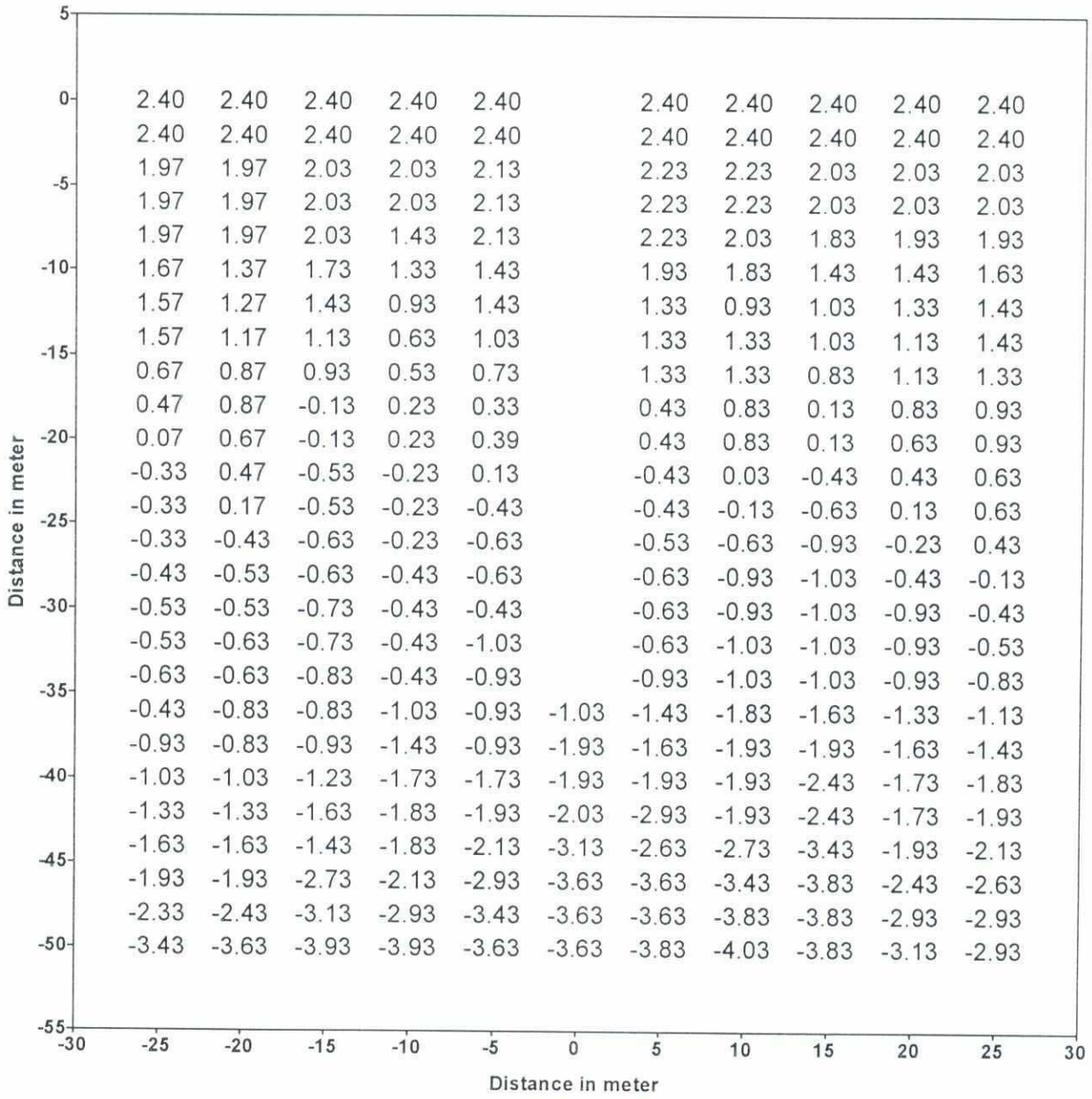
Changes in bed levels
around SPUR-2 in meter

Period : 04 Jul 98 - 14 Aug 98

Color scale :



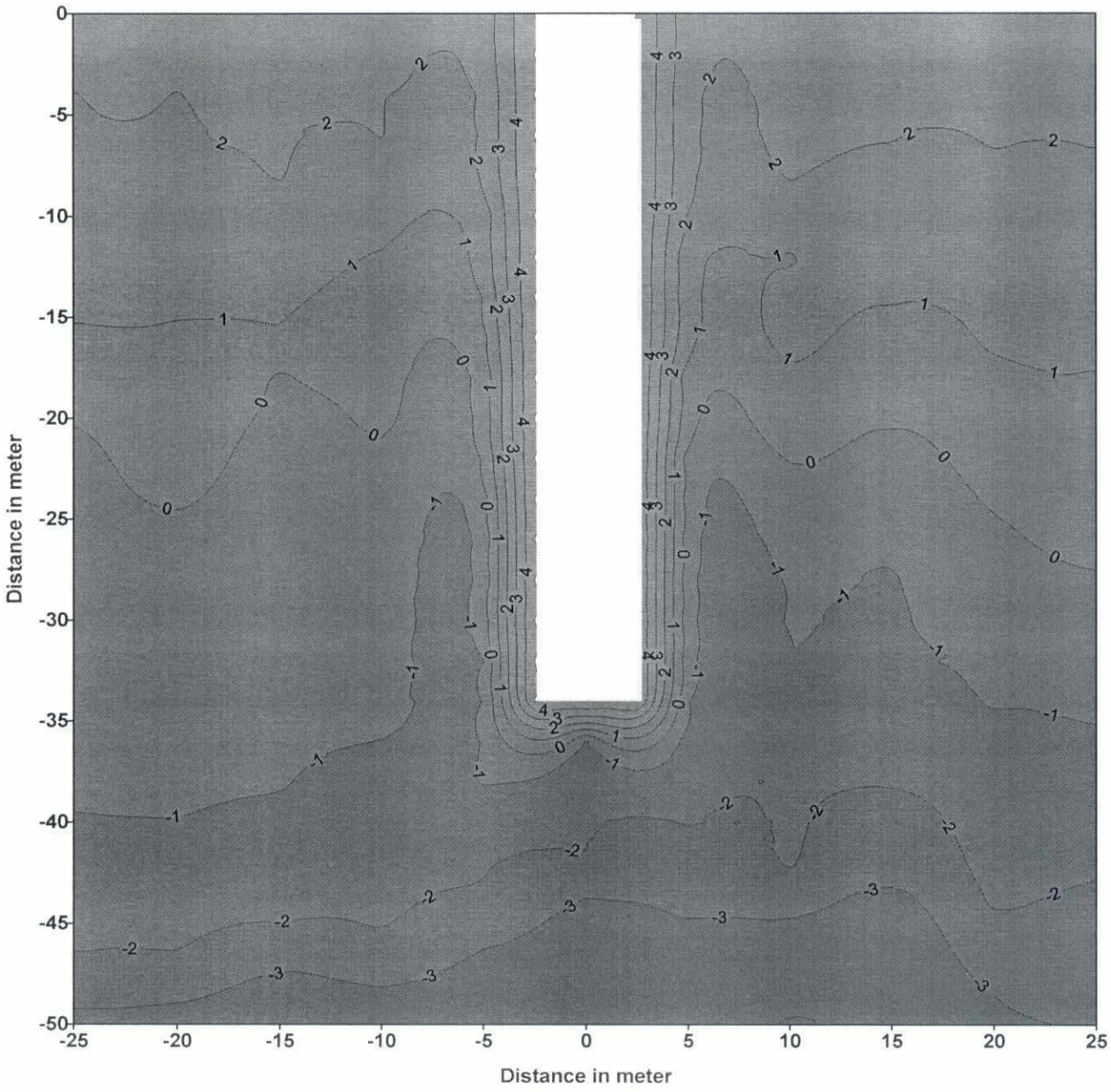
Khorki Bank Protection Pilot Scheme



2.40	2.40	2.40	2.40	2.40		2.40	2.40	2.40	2.40	2.40
2.40	2.40	2.40	2.40	2.40		2.40	2.40	2.40	2.40	2.40
1.97	1.97	2.03	2.03	2.13		2.23	2.23	2.03	2.03	2.03
1.97	1.97	2.03	2.03	2.13		2.23	2.23	2.03	2.03	2.03
1.97	1.97	2.03	1.43	2.13		2.23	2.03	1.83	1.93	1.93
1.67	1.37	1.73	1.33	1.43		1.93	1.83	1.43	1.43	1.63
1.57	1.27	1.43	0.93	1.43		1.33	0.93	1.03	1.33	1.43
1.57	1.17	1.13	0.63	1.03		1.33	1.33	1.03	1.13	1.43
0.67	0.87	0.93	0.53	0.73		1.33	1.33	0.83	1.13	1.33
0.47	0.87	-0.13	0.23	0.33		0.43	0.83	0.13	0.83	0.93
0.07	0.67	-0.13	0.23	0.39		0.43	0.83	0.13	0.63	0.93
-0.33	0.47	-0.53	-0.23	0.13		-0.43	0.03	-0.43	0.43	0.63
-0.33	0.17	-0.53	-0.23	-0.43		-0.43	-0.13	-0.63	0.13	0.63
-0.33	-0.43	-0.63	-0.23	-0.63		-0.53	-0.63	-0.93	-0.23	0.43
-0.43	-0.53	-0.63	-0.43	-0.63		-0.63	-0.93	-1.03	-0.43	-0.13
-0.53	-0.53	-0.73	-0.43	-0.43		-0.63	-0.93	-1.03	-0.93	-0.43
-0.53	-0.63	-0.73	-0.43	-1.03		-0.63	-1.03	-1.03	-0.93	-0.53
-0.63	-0.63	-0.83	-0.43	-0.93		-0.93	-1.03	-1.03	-0.93	-0.83
-0.43	-0.83	-0.83	-1.03	-0.93	-1.03	-1.43	-1.83	-1.63	-1.33	-1.13
-0.93	-0.83	-0.93	-1.43	-0.93	-1.93	-1.63	-1.93	-1.93	-1.63	-1.43
-1.03	-1.03	-1.23	-1.73	-1.73	-1.93	-1.93	-1.93	-2.43	-1.73	-1.83
-1.33	-1.33	-1.63	-1.83	-1.93	-2.03	-2.93	-1.93	-2.43	-1.73	-1.93
-1.63	-1.63	-1.43	-1.83	-2.13	-3.13	-2.63	-2.73	-3.43	-1.93	-2.13
-1.93	-1.93	-2.73	-2.13	-2.93	-3.63	-3.63	-3.43	-3.83	-2.43	-2.63
-2.33	-2.43	-3.13	-2.93	-3.43	-3.63	-3.63	-3.83	-3.83	-2.93	-2.93
-3.43	-3.63	-3.93	-3.93	-3.63	-3.63	-3.83	-4.03	-3.83	-3.13	-2.93

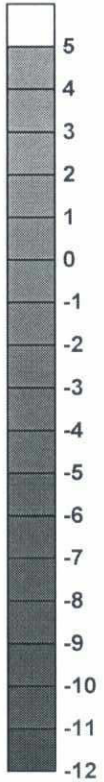
Bed levels around SPUR-1
Levels are in Meter, PWD
Date of survey : 11 Jun 98

Khorki Bank Protection Pilot Scheme



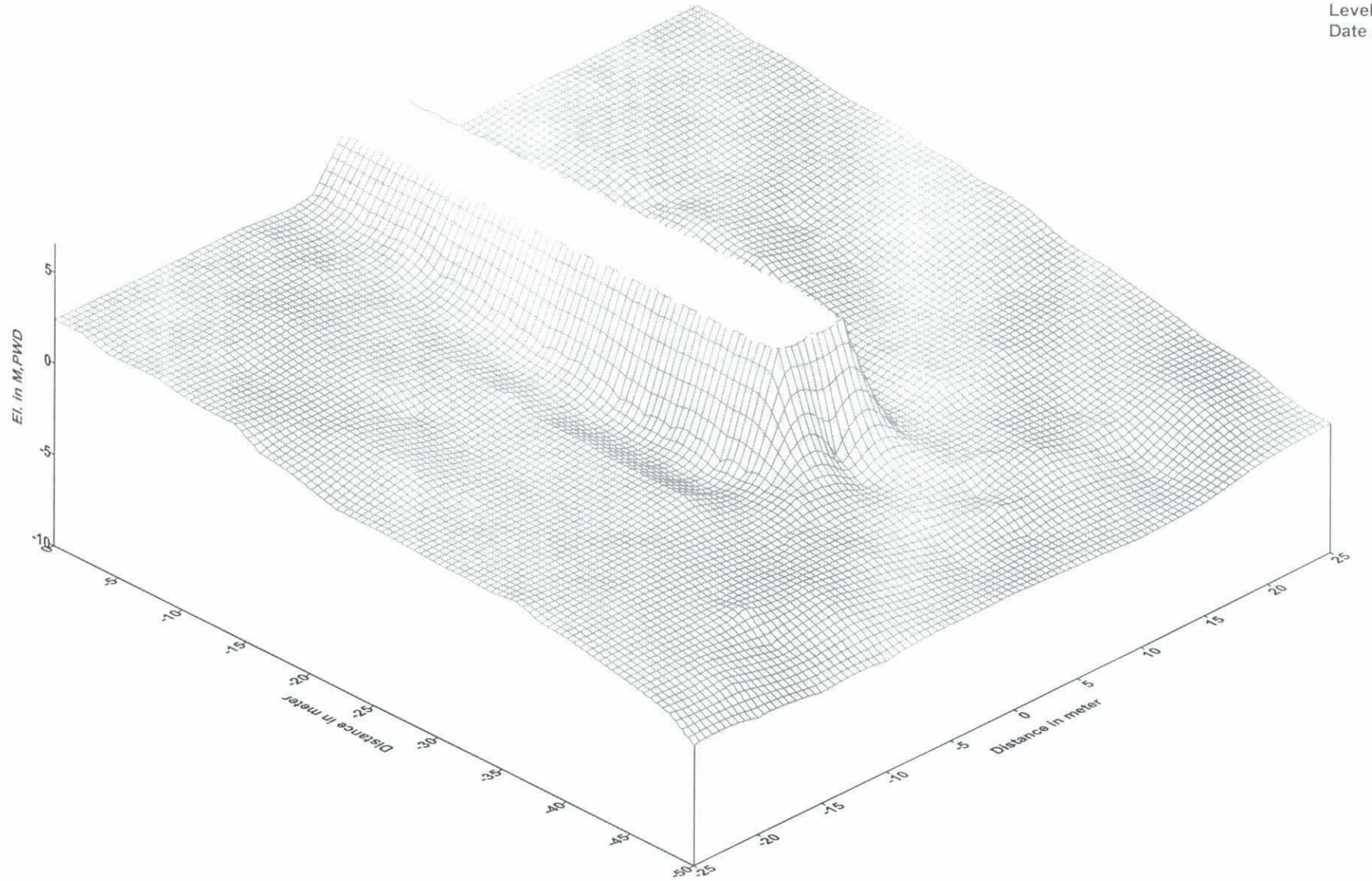
Bed levels around SPUR-1
Levels are in Meter PWD
Date of survey : 11 Jun 98

Color scale :

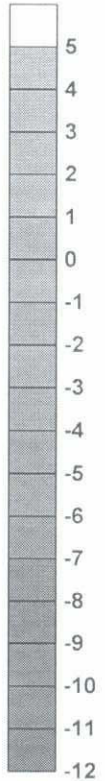


Khorki Bank Protection Pilot Scheme

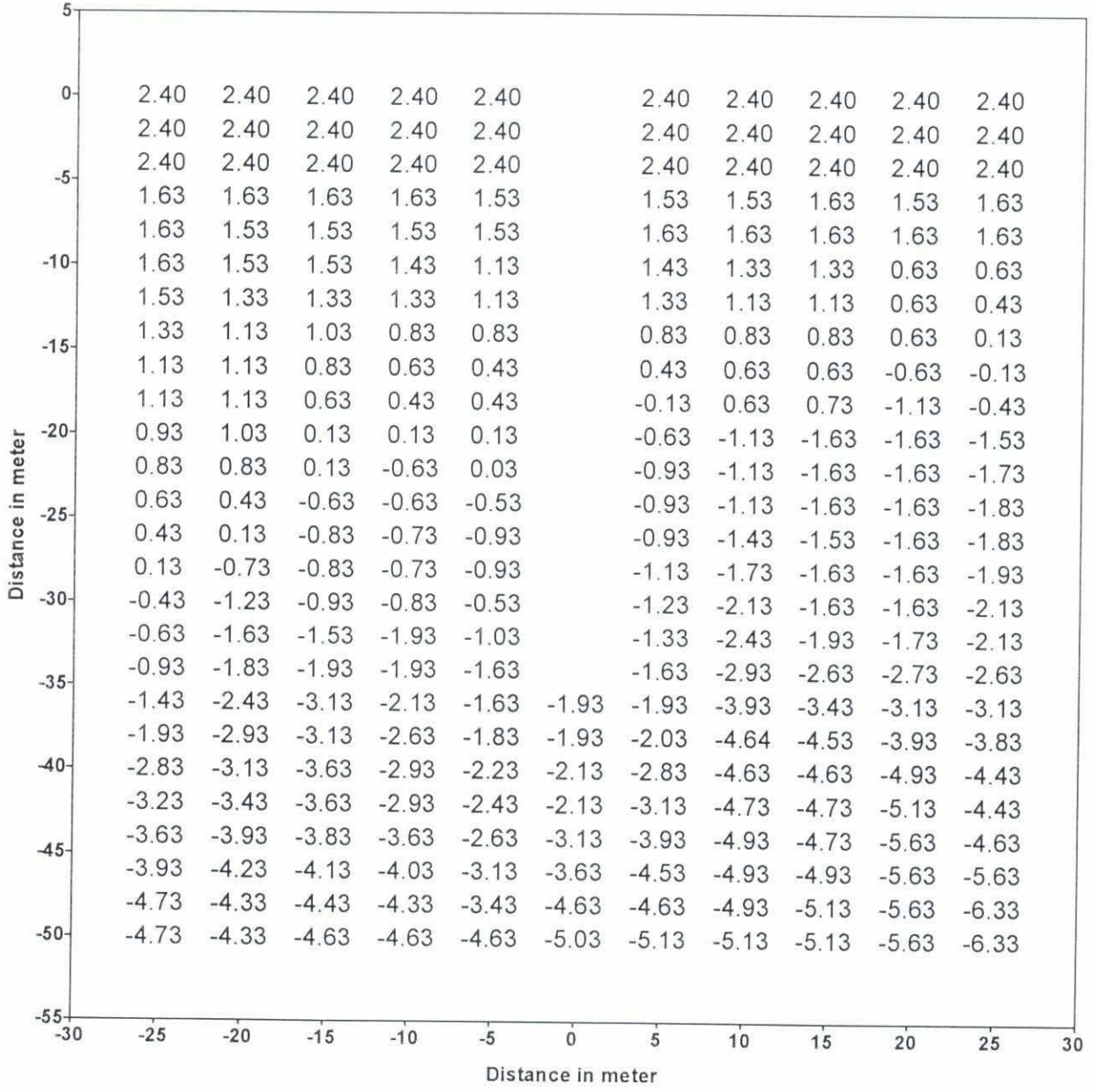
Bed levels around SPUR-1
Levels are in Meter PWD
Date of survey : 11 Jun 98



Color scale :



Khorki Bank Protection Pilot Scheme

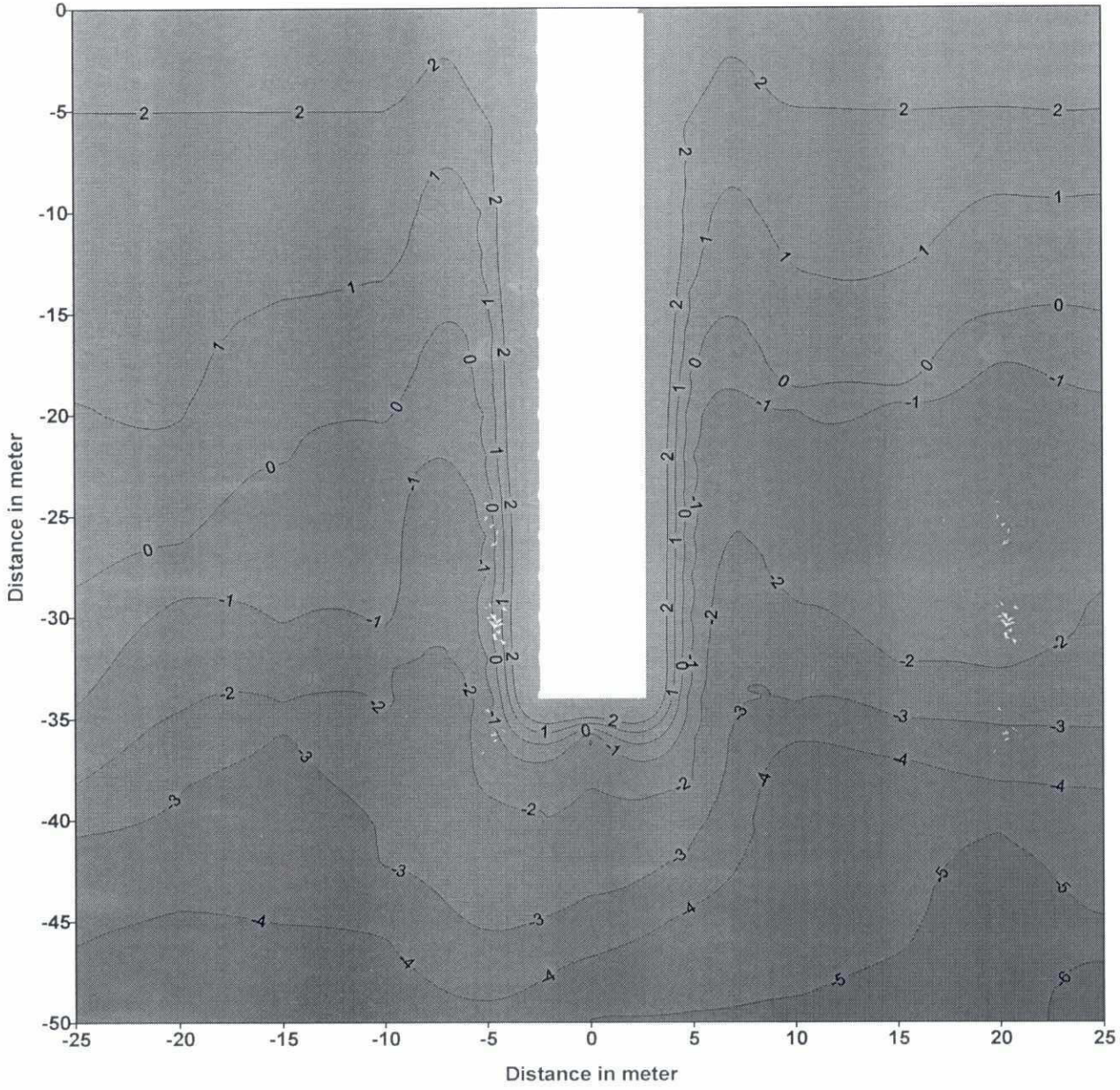


2.40	2.40	2.40	2.40	2.40		2.40	2.40	2.40	2.40	2.40
2.40	2.40	2.40	2.40	2.40		2.40	2.40	2.40	2.40	2.40
2.40	2.40	2.40	2.40	2.40		2.40	2.40	2.40	2.40	2.40
1.63	1.63	1.63	1.63	1.53		1.53	1.53	1.63	1.53	1.63
1.63	1.53	1.53	1.53	1.53		1.63	1.63	1.63	1.63	1.63
1.63	1.53	1.53	1.43	1.13		1.43	1.33	1.33	0.63	0.63
1.53	1.33	1.33	1.33	1.13		1.33	1.13	1.13	0.63	0.43
1.33	1.13	1.03	0.83	0.83		0.83	0.83	0.83	0.63	0.13
1.13	1.13	0.83	0.63	0.43		0.43	0.63	0.63	-0.63	-0.13
1.13	1.13	0.63	0.43	0.43		-0.13	0.63	0.73	-1.13	-0.43
0.93	1.03	0.13	0.13	0.13		-0.63	-1.13	-1.63	-1.63	-1.53
0.83	0.83	0.13	-0.63	0.03		-0.93	-1.13	-1.63	-1.63	-1.73
0.63	0.43	-0.63	-0.63	-0.53		-0.93	-1.13	-1.63	-1.63	-1.83
0.43	0.13	-0.83	-0.73	-0.93		-0.93	-1.43	-1.53	-1.63	-1.83
0.13	-0.73	-0.83	-0.73	-0.93		-1.13	-1.73	-1.63	-1.63	-1.93
-0.43	-1.23	-0.93	-0.83	-0.53		-1.23	-2.13	-1.63	-1.63	-2.13
-0.63	-1.63	-1.53	-1.93	-1.03		-1.33	-2.43	-1.93	-1.73	-2.13
-0.93	-1.83	-1.93	-1.93	-1.63		-1.63	-2.93	-2.63	-2.73	-2.63
-1.43	-2.43	-3.13	-2.13	-1.63	-1.93	-1.93	-3.93	-3.43	-3.13	-3.13
-1.93	-2.93	-3.13	-2.63	-1.83	-1.93	-2.03	-4.64	-4.53	-3.93	-3.83
-2.83	-3.13	-3.63	-2.93	-2.23	-2.13	-2.83	-4.63	-4.63	-4.93	-4.43
-3.23	-3.43	-3.63	-2.93	-2.43	-2.13	-3.13	-4.73	-4.73	-5.13	-4.43
-3.63	-3.93	-3.83	-3.63	-2.63	-3.13	-3.93	-4.93	-4.73	-5.63	-4.63
-3.93	-4.23	-4.13	-4.03	-3.13	-3.63	-4.53	-4.93	-4.93	-5.63	-5.63
-4.73	-4.33	-4.43	-4.33	-3.43	-4.63	-4.63	-4.93	-5.13	-5.63	-6.33
-4.73	-4.33	-4.63	-4.63	-4.63	-5.03	-5.13	-5.13	-5.13	-5.63	-6.33

Bed levels around SPUR-2
Levels are in Meter, PWD
Date of survey : 12 Jun 98

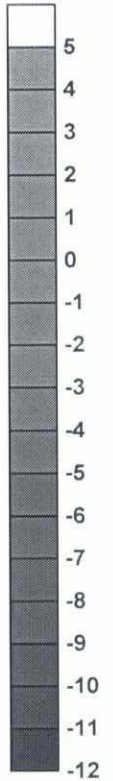
98

Khorki Bank Protection Pilot Scheme



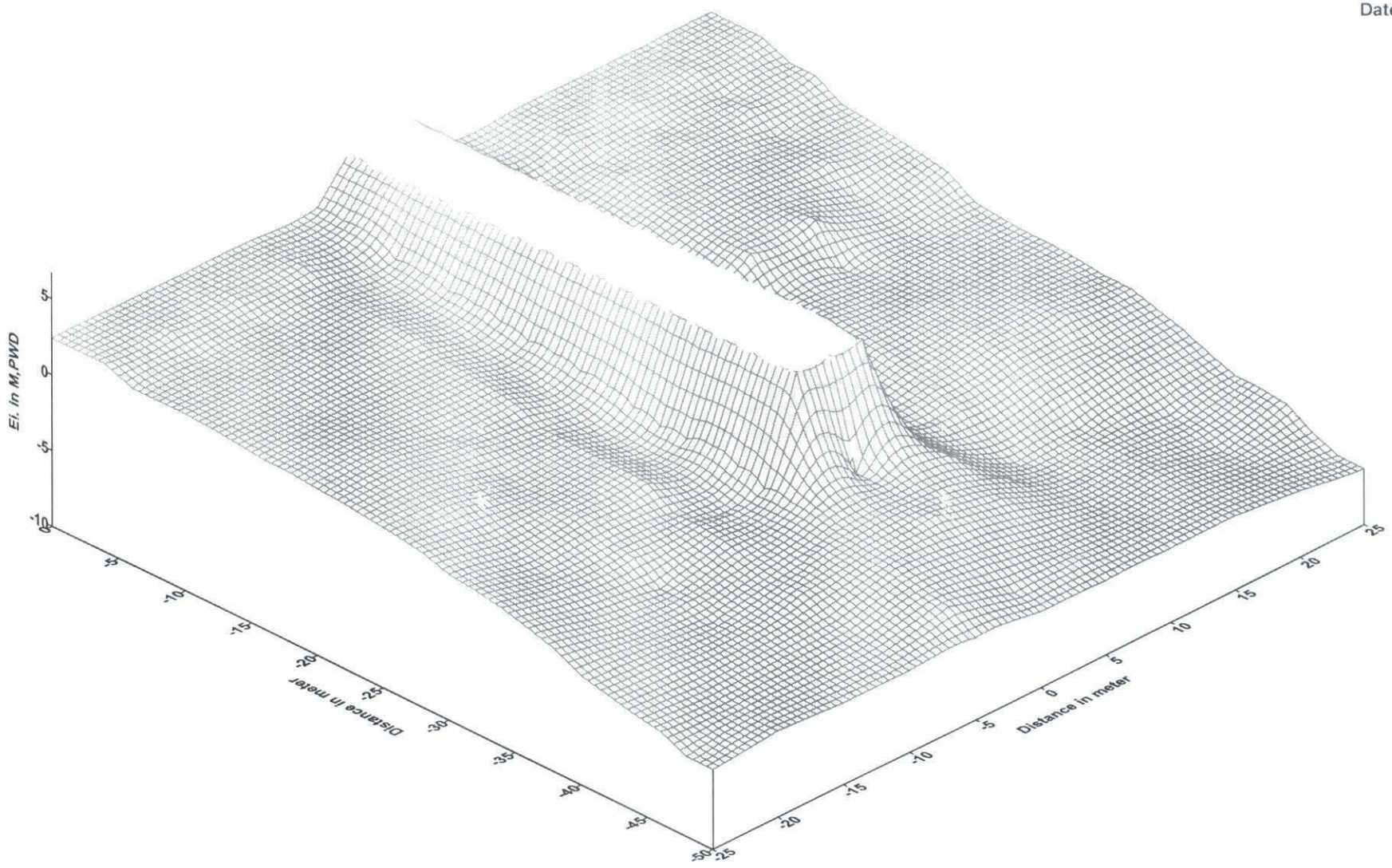
Bed levels around SPUR-2
Levels are in Meter PWD
Date of survey : 12 Jun 98

Color scale :



Khorki Bank Protection Pilot Scheme

Bed levels around SPUR-2
Levels are in Meter PWD
Date of survey : 12 Jun 98



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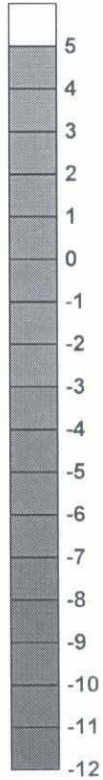
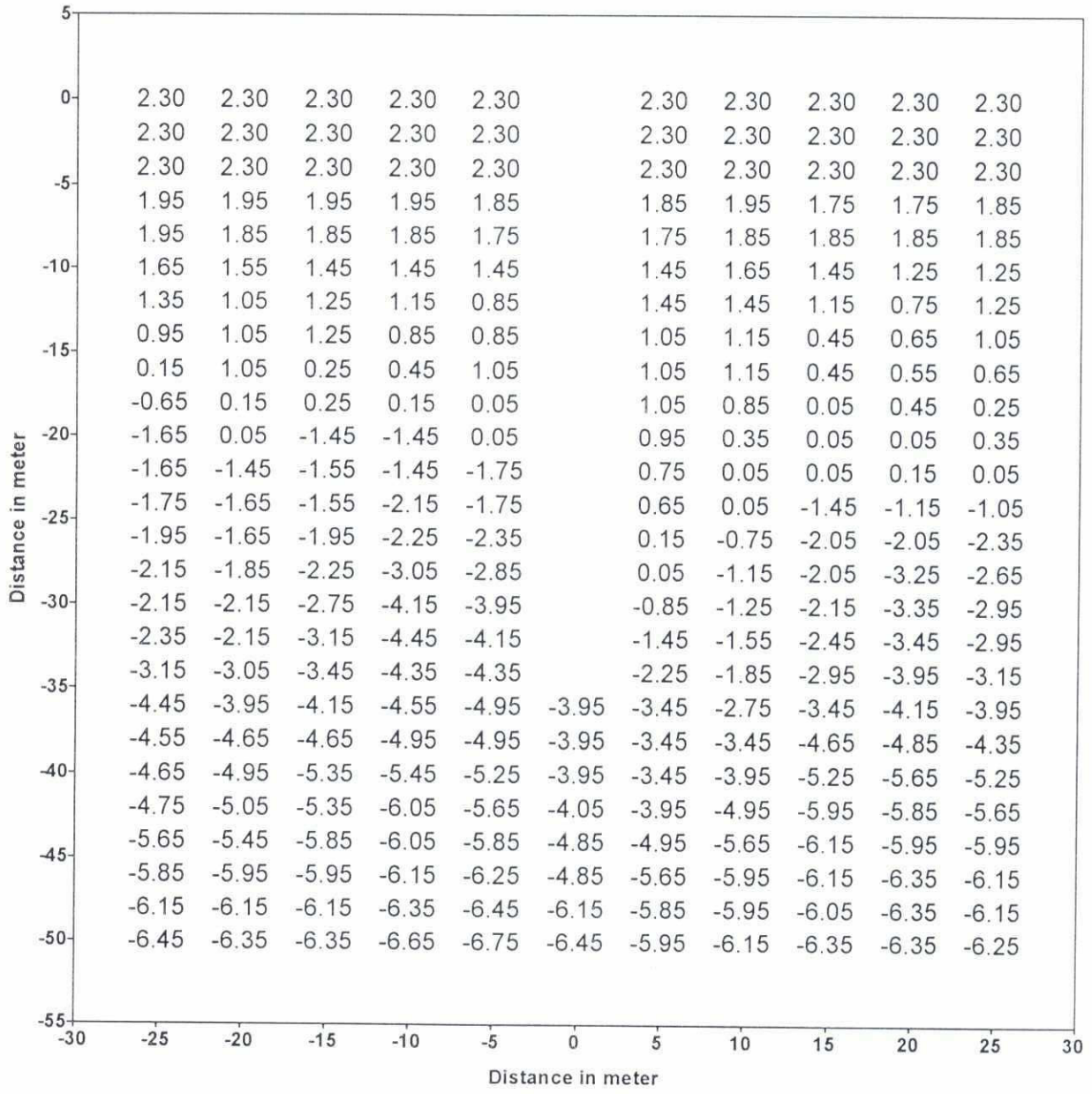


12

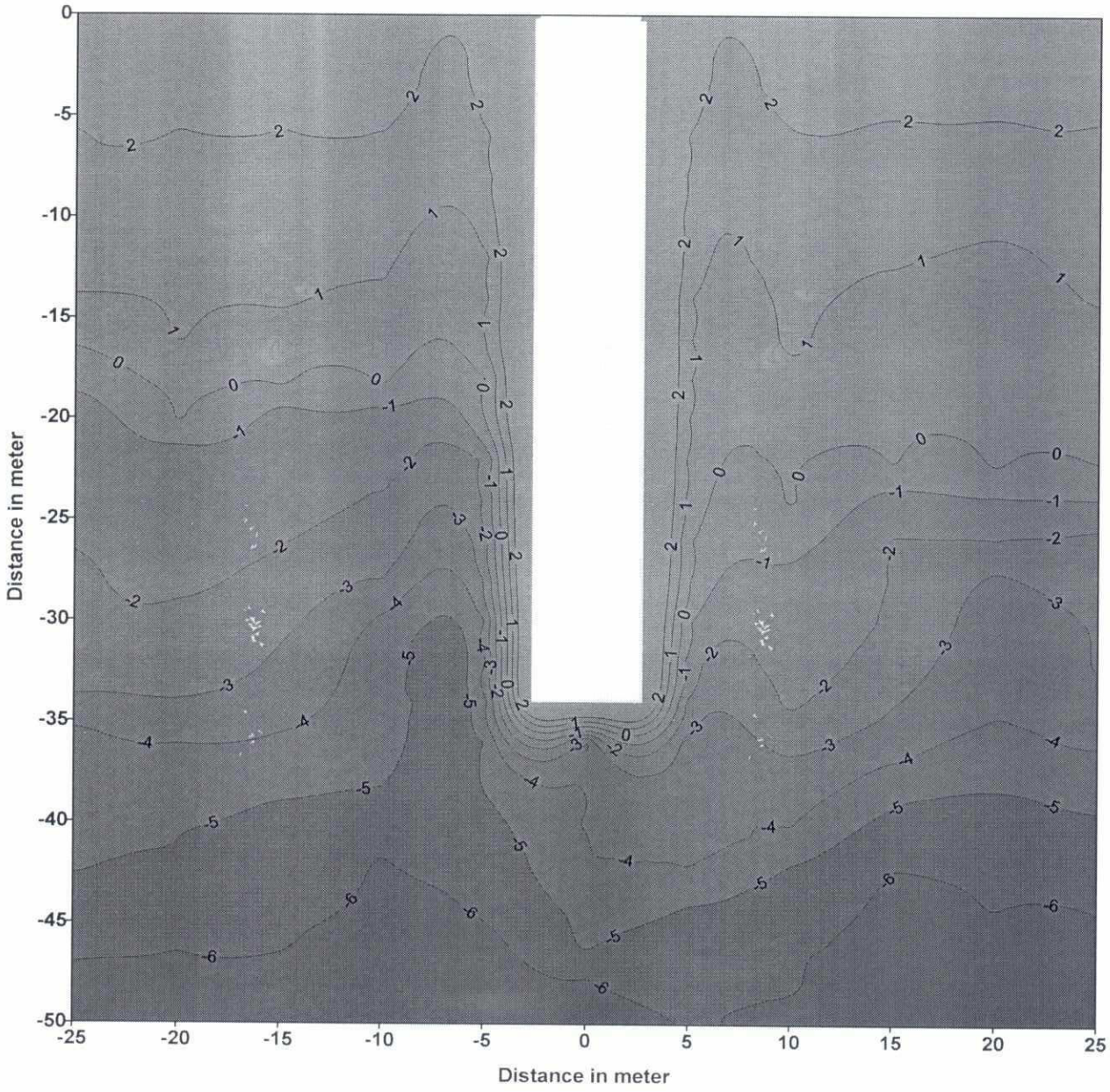
Khorki Bank Protection Pilot Scheme



2.30	2.30	2.30	2.30	2.30		2.30	2.30	2.30	2.30	2.30
2.30	2.30	2.30	2.30	2.30		2.30	2.30	2.30	2.30	2.30
2.30	2.30	2.30	2.30	2.30		2.30	2.30	2.30	2.30	2.30
1.95	1.95	1.95	1.95	1.85		1.85	1.95	1.75	1.75	1.85
1.95	1.85	1.85	1.85	1.75		1.75	1.85	1.85	1.85	1.85
1.65	1.55	1.45	1.45	1.45		1.45	1.65	1.45	1.25	1.25
1.35	1.05	1.25	1.15	0.85		1.45	1.45	1.15	0.75	1.25
0.95	1.05	1.25	0.85	0.85		1.05	1.15	0.45	0.65	1.05
0.15	1.05	0.25	0.45	1.05		1.05	1.15	0.45	0.55	0.65
-0.65	0.15	0.25	0.15	0.05		1.05	0.85	0.05	0.45	0.25
-1.65	0.05	-1.45	-1.45	0.05		0.95	0.35	0.05	0.05	0.35
-1.65	-1.45	-1.55	-1.45	-1.75		0.75	0.05	0.05	0.15	0.05
-1.75	-1.65	-1.55	-2.15	-1.75		0.65	0.05	-1.45	-1.15	-1.05
-1.95	-1.65	-1.95	-2.25	-2.35		0.15	-0.75	-2.05	-2.05	-2.35
-2.15	-1.85	-2.25	-3.05	-2.85		0.05	-1.15	-2.05	-3.25	-2.65
-2.15	-2.15	-2.75	-4.15	-3.95		-0.85	-1.25	-2.15	-3.35	-2.95
-2.35	-2.15	-3.15	-4.45	-4.15		-1.45	-1.55	-2.45	-3.45	-2.95
-3.15	-3.05	-3.45	-4.35	-4.35		-2.25	-1.85	-2.95	-3.95	-3.15
-4.45	-3.95	-4.15	-4.55	-4.95	-3.95	-3.45	-2.75	-3.45	-4.15	-3.95
-4.55	-4.65	-4.65	-4.95	-4.95	-3.95	-3.45	-3.45	-4.65	-4.85	-4.35
-4.65	-4.95	-5.35	-5.45	-5.25	-3.95	-3.45	-3.95	-5.25	-5.65	-5.25
-4.75	-5.05	-5.35	-6.05	-5.65	-4.05	-3.95	-4.95	-5.95	-5.85	-5.65
-5.65	-5.45	-5.85	-6.05	-5.85	-4.85	-4.95	-5.65	-6.15	-5.95	-5.95
-5.85	-5.95	-5.95	-6.15	-6.25	-4.85	-5.65	-5.95	-6.15	-6.35	-6.15
-6.15	-6.15	-6.15	-6.35	-6.45	-6.15	-5.85	-5.95	-6.05	-6.35	-6.15
-6.45	-6.35	-6.35	-6.65	-6.75	-6.45	-5.95	-6.15	-6.35	-6.35	-6.25

Bed levels around SPUR-3
Levels are in Meter, PWD
Date of survey : 13 Jun 98

Khorki Bank Protection Pilot Scheme



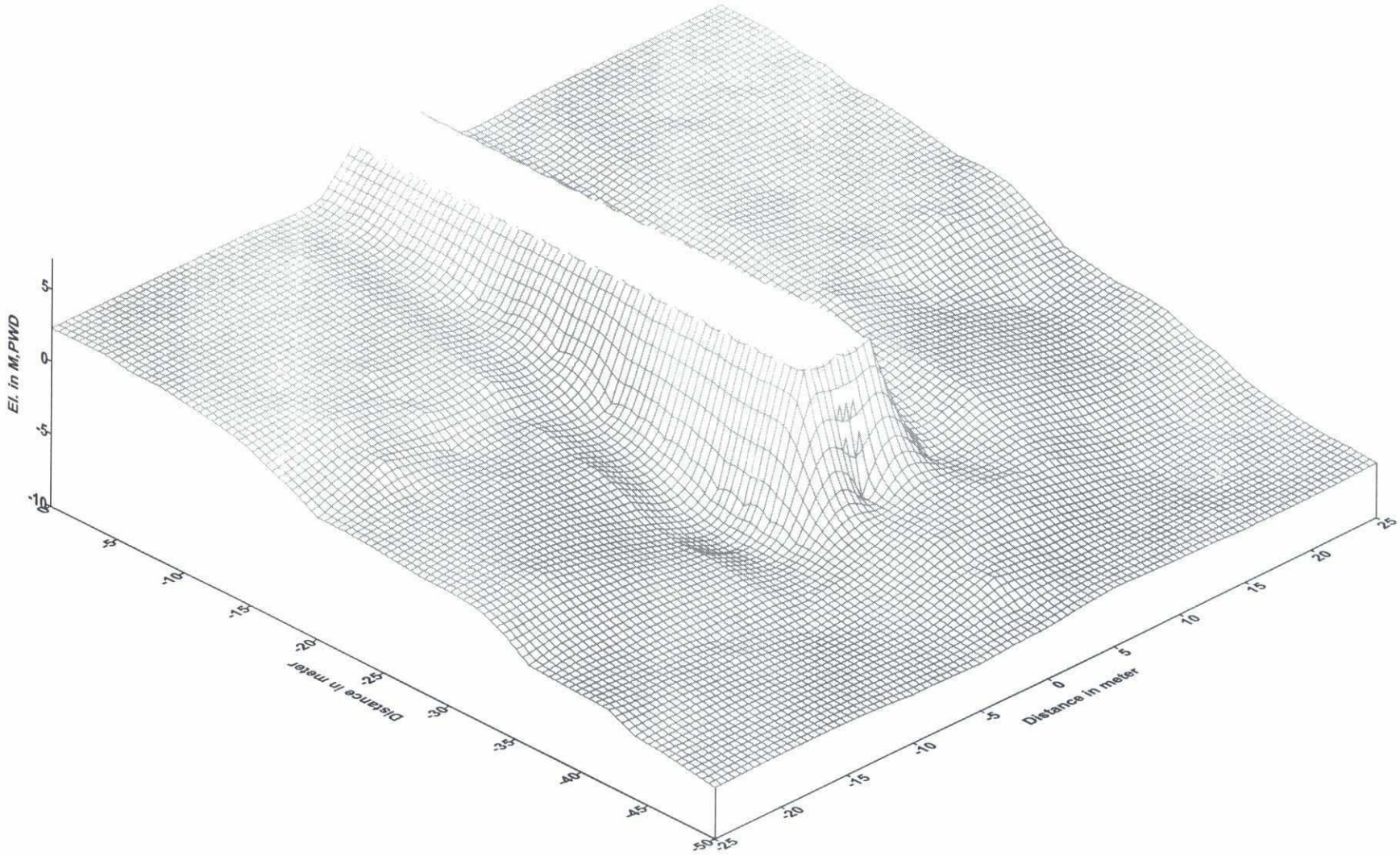
Bed levels around SPUR-3
Levels are in Meter PWD
Date of survey : 13 Jun 98

Color scale :

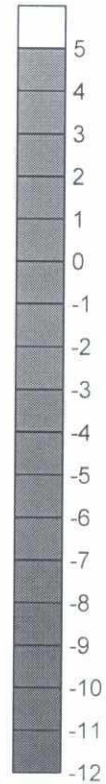
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12

Khorki Bank Protection Pilot Scheme

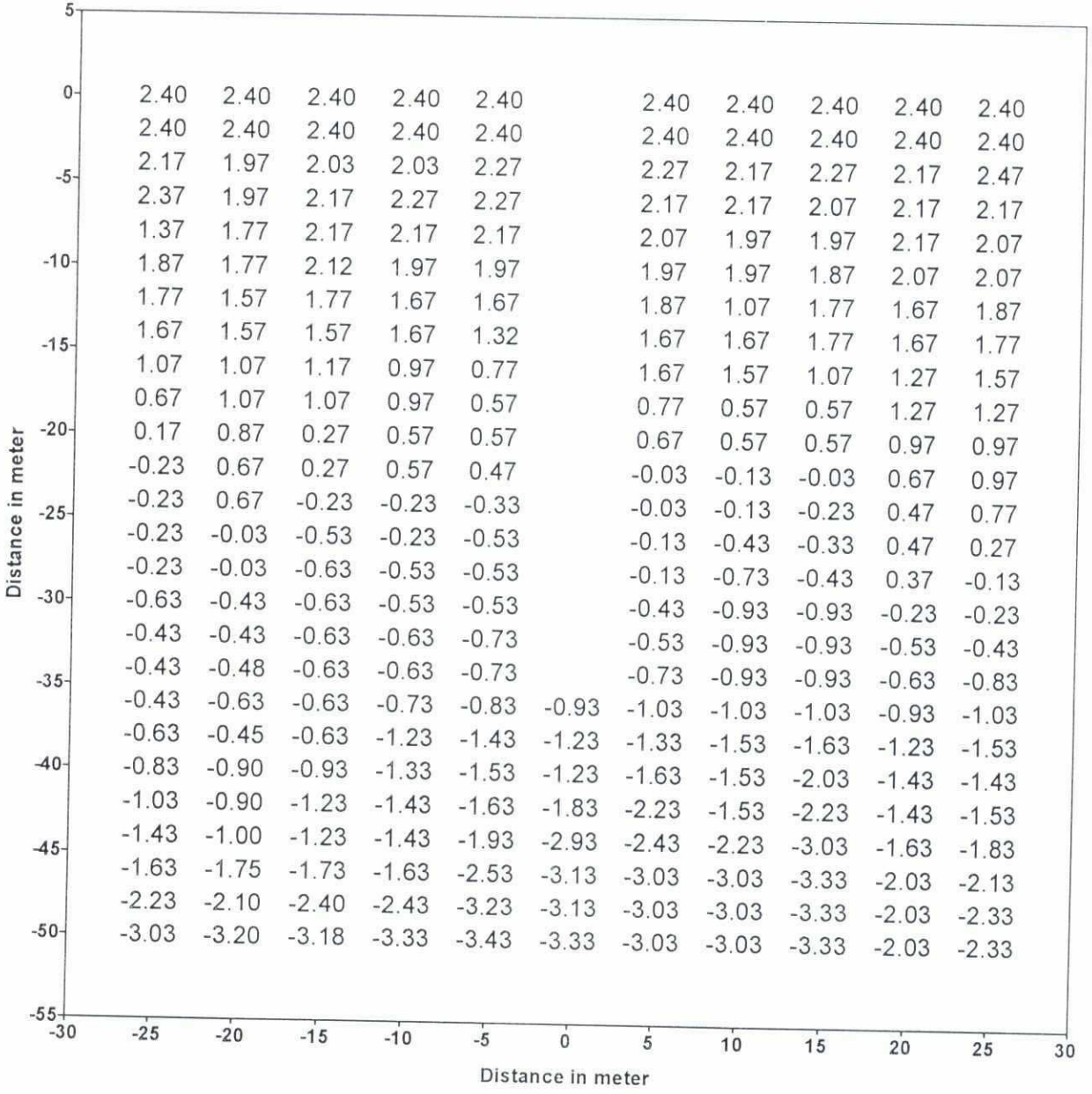
Bed levels around SPUR-3
Levels are in Meter PWD
Date of survey : 13 Jun 98



Color scale :



Khorki Bank Protection Pilot Scheme



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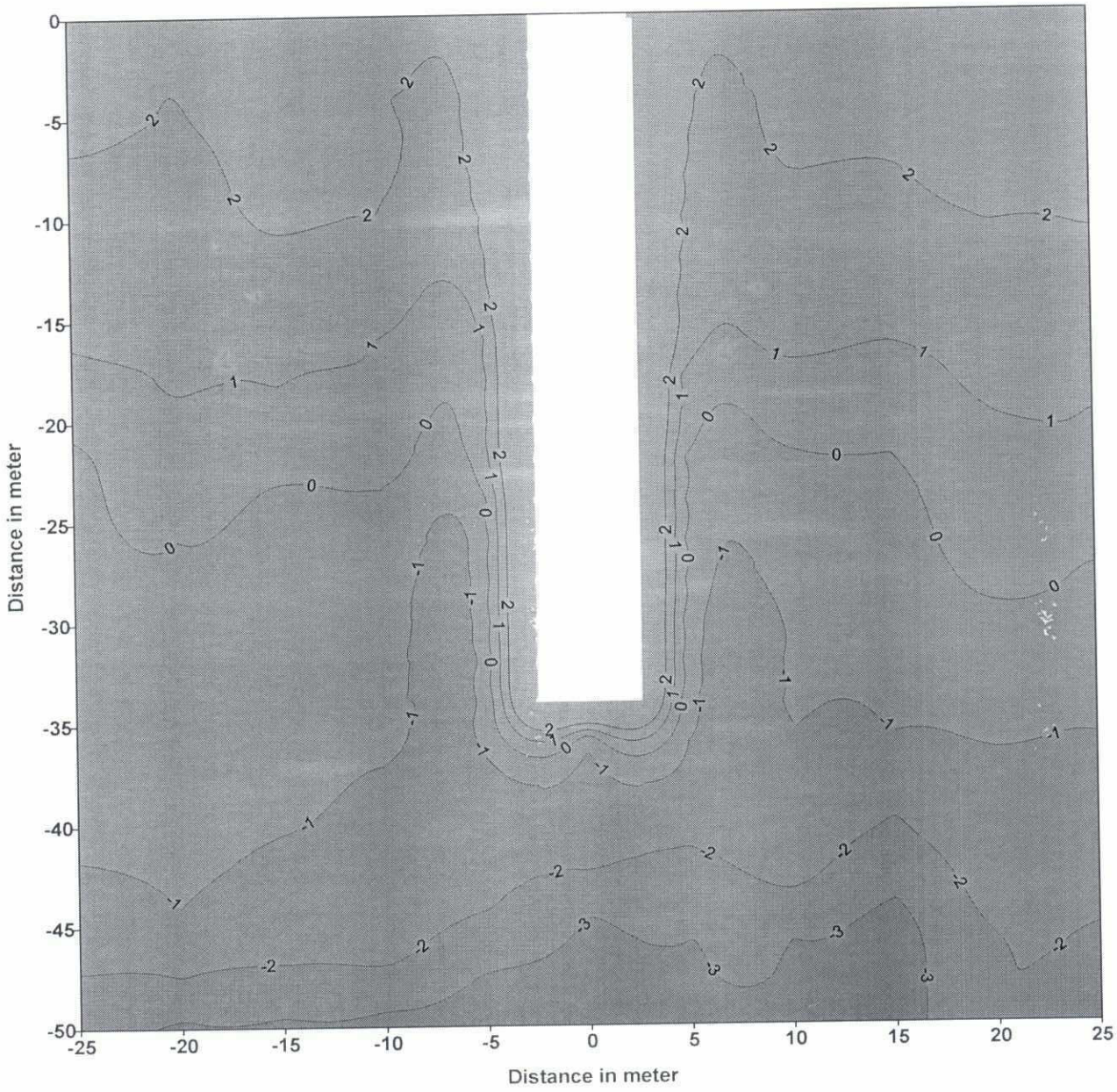
2.40	2.40	2.40	2.40	2.40		2.40	2.40	2.40	2.40	2.40
2.17	1.97	2.03	2.03	2.27		2.27	2.17	2.27	2.17	2.47
2.37	1.97	2.17	2.27	2.27		2.17	2.17	2.07	2.17	2.17
1.37	1.77	2.17	2.17	2.17		2.07	1.97	1.97	2.17	2.07
1.87	1.77	2.12	1.97	1.97		1.97	1.97	1.87	2.07	2.07
1.77	1.57	1.77	1.67	1.67		1.87	1.07	1.77	1.67	1.87
1.67	1.57	1.57	1.67	1.32		1.67	1.67	1.77	1.67	1.77
1.07	1.07	1.17	0.97	0.77		1.67	1.57	1.07	1.27	1.57
0.67	1.07	1.07	0.97	0.57		0.77	0.57	0.57	1.27	1.27
0.17	0.87	0.27	0.57	0.57		0.67	0.57	0.57	0.97	0.97
-0.23	0.67	0.27	0.57	0.47		-0.03	-0.13	-0.03	0.67	0.97
-0.23	0.67	-0.23	-0.23	-0.33		-0.03	-0.13	-0.23	0.47	0.77
-0.23	-0.03	-0.53	-0.23	-0.53		-0.13	-0.43	-0.33	0.47	0.27
-0.23	-0.03	-0.63	-0.53	-0.53		-0.13	-0.73	-0.43	0.37	-0.13
-0.63	-0.43	-0.63	-0.53	-0.53		-0.43	-0.93	-0.93	-0.23	-0.23
-0.43	-0.43	-0.63	-0.63	-0.73		-0.53	-0.93	-0.93	-0.53	-0.43
-0.43	-0.48	-0.63	-0.63	-0.73		-0.73	-0.93	-0.93	-0.63	-0.83
-0.43	-0.63	-0.63	-0.73	-0.83	-0.93	-1.03	-1.03	-1.03	-0.93	-1.03
-0.63	-0.45	-0.63	-1.23	-1.43	-1.23	-1.33	-1.53	-1.63	-1.23	-1.53
-0.83	-0.90	-0.93	-1.33	-1.53	-1.23	-1.63	-1.53	-2.03	-1.43	-1.43
-1.03	-0.90	-1.23	-1.43	-1.63	-1.83	-2.23	-1.53	-2.23	-1.43	-1.53
-1.43	-1.00	-1.23	-1.43	-1.93	-2.93	-2.43	-2.23	-3.03	-1.63	-1.83
-1.63	-1.75	-1.73	-1.63	-2.53	-3.13	-3.03	-3.03	-3.33	-2.03	-2.13
-2.23	-2.10	-2.40	-2.43	-3.23	-3.13	-3.03	-3.03	-3.33	-2.03	-2.33
-3.03	-3.20	-3.18	-3.33	-3.43	-3.33	-3.03	-3.03	-3.33	-2.03	-2.33

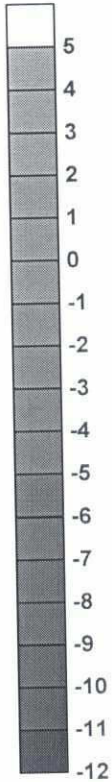
Bed levels around SPUR-1
Levels are in Meter, PWD
Date of survey : 23 Jul 98

Khorki Bank Protection Pilot Scheme



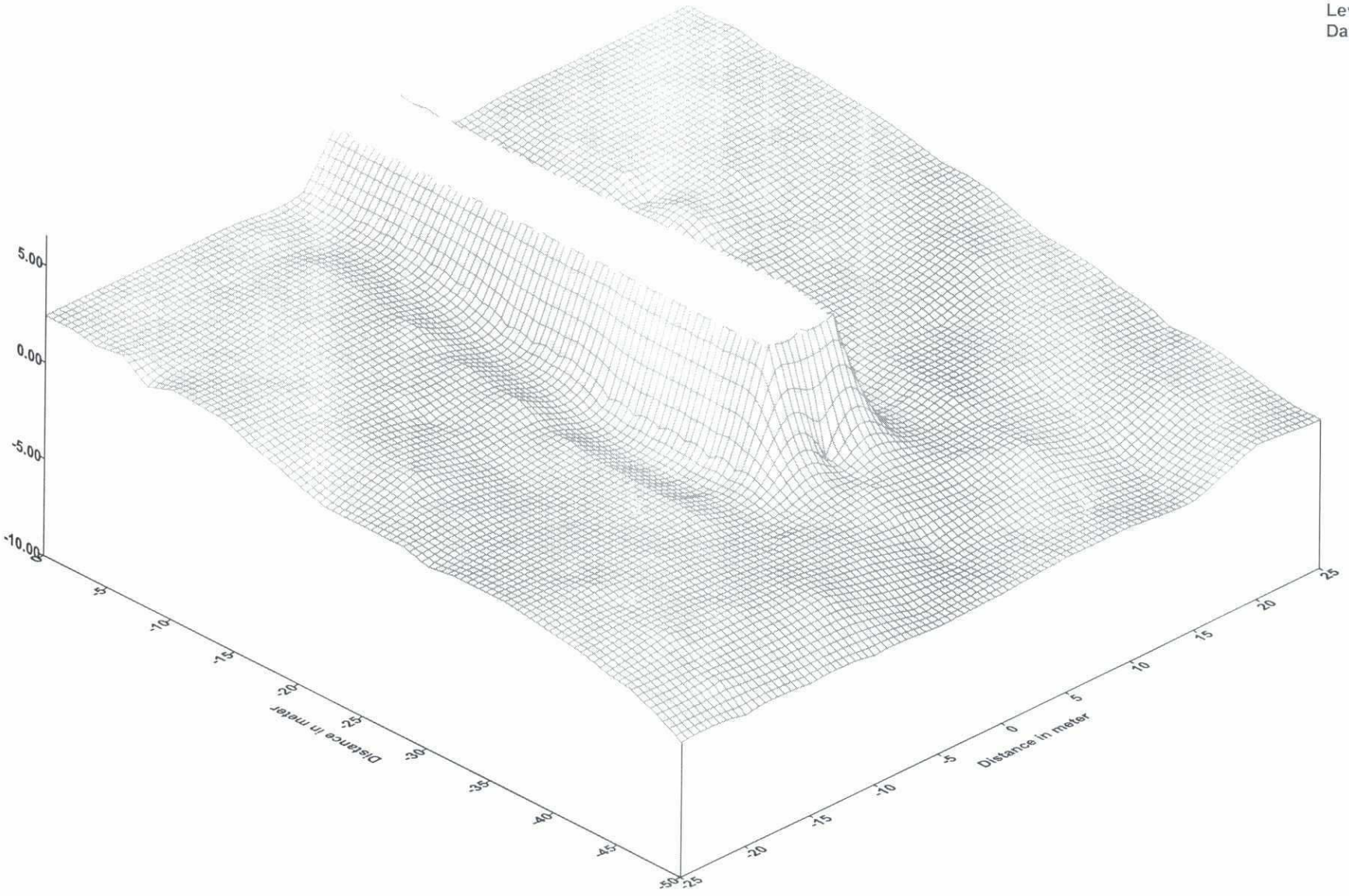
Bed levels around SPUR-1
Levels are in Meter PWD
Date of survey : 23 Jul 98

Color scale :

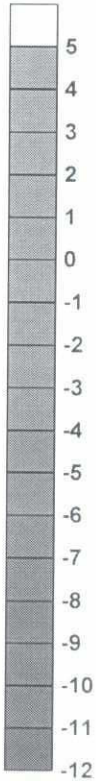


Khorki Bank Protection Pilot Scheme

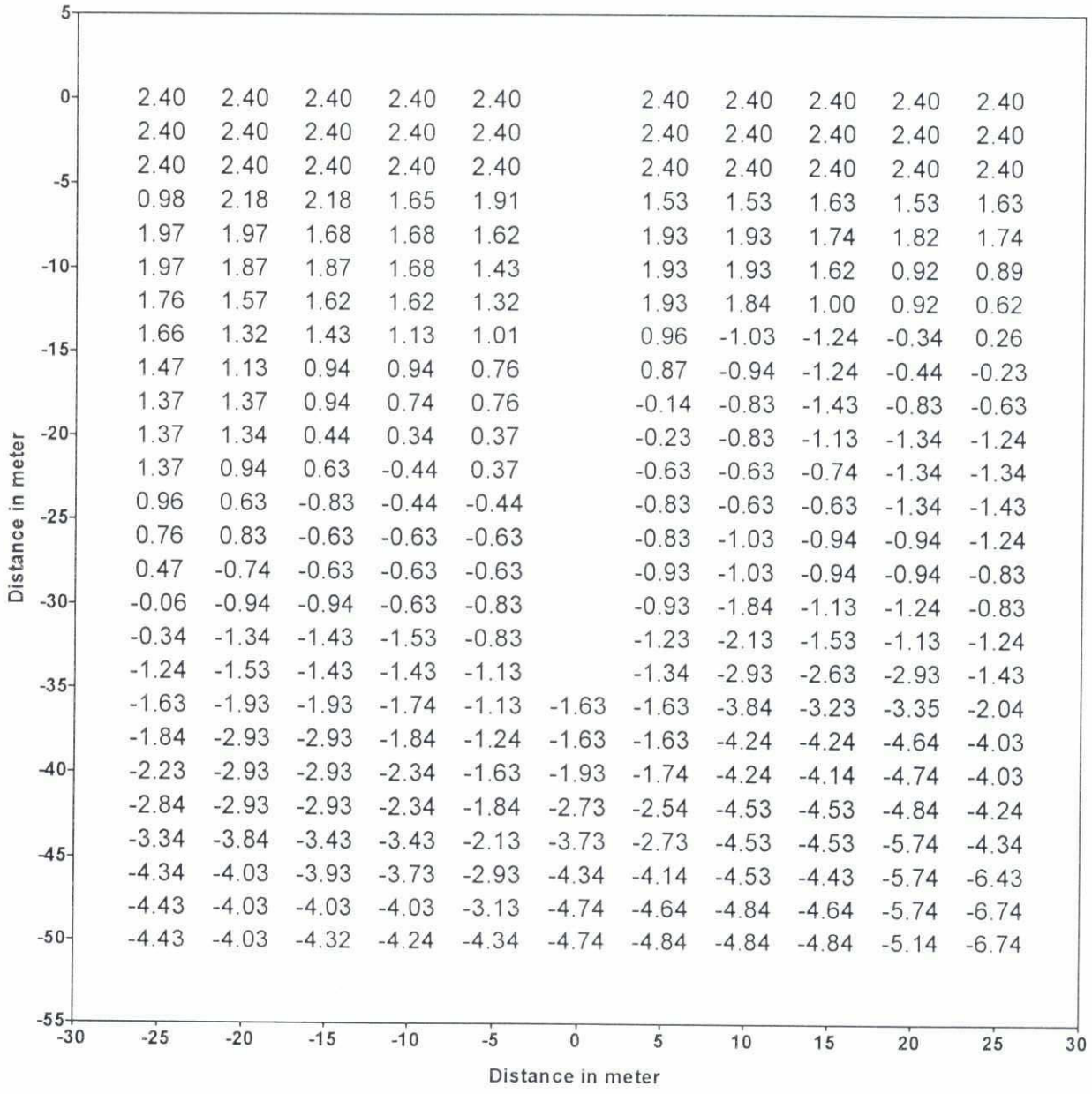
Bed levels around SPUR-1
Levels are in Meter PWD
Date of survey : 23 Jul 98



Color scale :



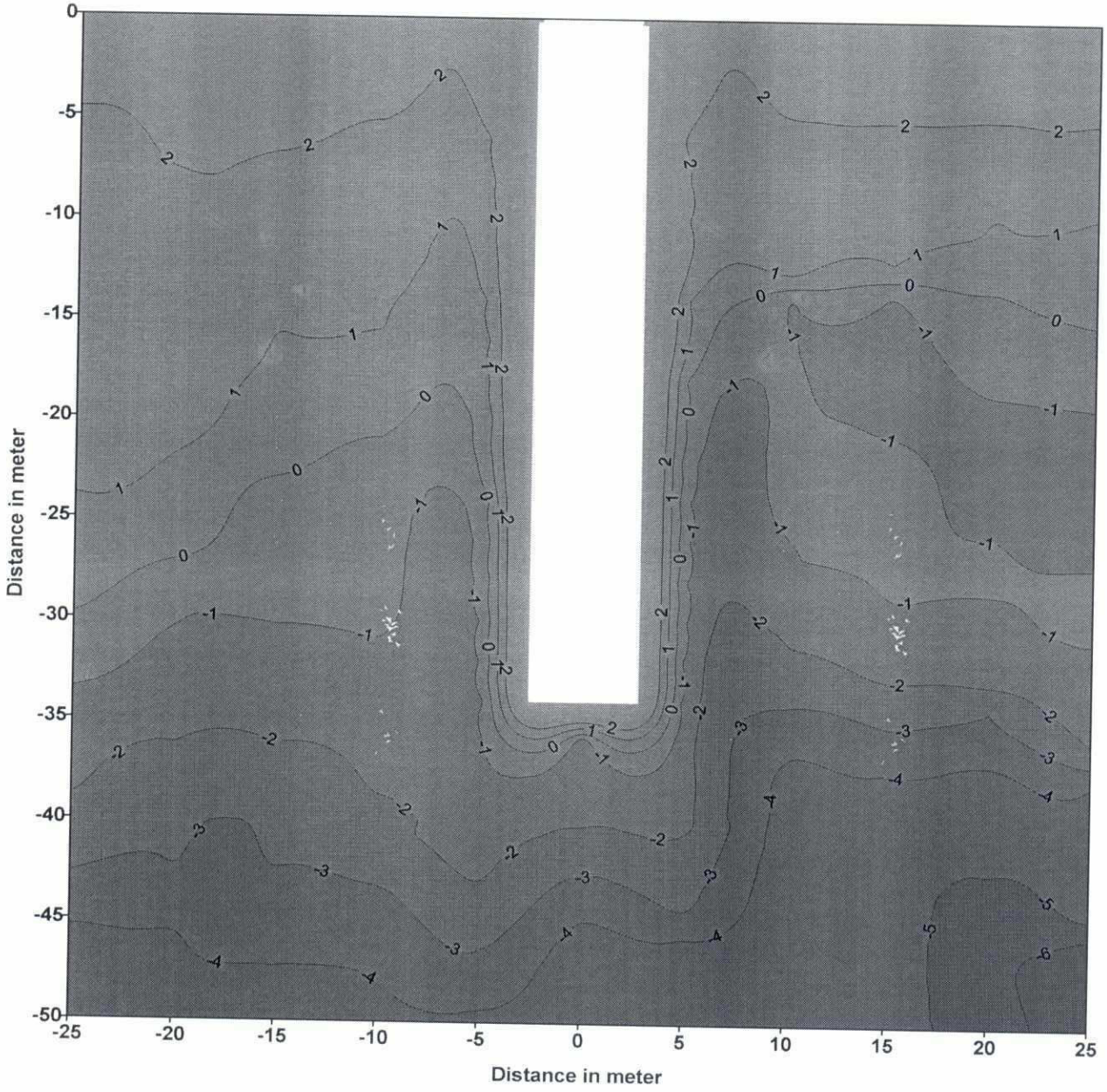
Khorki Bank Protection Pilot Scheme



2.40	2.40	2.40	2.40	2.40		2.40	2.40	2.40	2.40	2.40
2.40	2.40	2.40	2.40	2.40		2.40	2.40	2.40	2.40	2.40
2.40	2.40	2.40	2.40	2.40		2.40	2.40	2.40	2.40	2.40
0.98	2.18	2.18	1.65	1.91		1.53	1.53	1.63	1.53	1.63
1.97	1.97	1.68	1.68	1.62		1.93	1.93	1.74	1.82	1.74
1.97	1.87	1.87	1.68	1.43		1.93	1.93	1.62	0.92	0.89
1.76	1.57	1.62	1.62	1.32		1.93	1.84	1.00	0.92	0.62
1.66	1.32	1.43	1.13	1.01		0.96	-1.03	-1.24	-0.34	0.26
1.47	1.13	0.94	0.94	0.76		0.87	-0.94	-1.24	-0.44	-0.23
1.37	1.37	0.94	0.74	0.76		-0.14	-0.83	-1.43	-0.83	-0.63
1.37	1.34	0.44	0.34	0.37		-0.23	-0.83	-1.13	-1.34	-1.24
1.37	0.94	0.63	-0.44	0.37		-0.63	-0.63	-0.74	-1.34	-1.34
0.96	0.63	-0.83	-0.44	-0.44		-0.83	-0.63	-0.63	-1.34	-1.43
0.76	0.83	-0.63	-0.63	-0.63		-0.83	-1.03	-0.94	-0.94	-1.24
0.47	-0.74	-0.63	-0.63	-0.63		-0.93	-1.03	-0.94	-0.94	-0.83
-0.06	-0.94	-0.94	-0.63	-0.83		-0.93	-1.84	-1.13	-1.24	-0.83
-0.34	-1.34	-1.43	-1.53	-0.83		-1.23	-2.13	-1.53	-1.13	-1.24
-1.24	-1.53	-1.43	-1.43	-1.13		-1.34	-2.93	-2.63	-2.93	-1.43
-1.63	-1.93	-1.93	-1.74	-1.13	-1.63	-1.63	-3.84	-3.23	-3.35	-2.04
-1.84	-2.93	-2.93	-1.84	-1.24	-1.63	-1.63	-4.24	-4.24	-4.64	-4.03
-2.23	-2.93	-2.93	-2.34	-1.63	-1.93	-1.74	-4.24	-4.14	-4.74	-4.03
-2.84	-2.93	-2.93	-2.34	-1.84	-2.73	-2.54	-4.53	-4.53	-4.84	-4.24
-3.34	-3.84	-3.43	-3.43	-2.13	-3.73	-2.73	-4.53	-4.53	-5.74	-4.34
-4.34	-4.03	-3.93	-3.73	-2.93	-4.34	-4.14	-4.53	-4.43	-5.74	-6.43
-4.43	-4.03	-4.03	-4.03	-3.13	-4.74	-4.64	-4.84	-4.64	-5.74	-6.74
-4.43	-4.03	-4.32	-4.24	-4.34	-4.74	-4.84	-4.84	-4.84	-5.14	-6.74

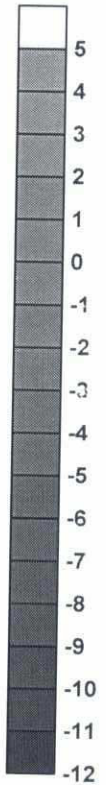
Bed levels around SPUR-2
Levels are in Meter, PWD
Date of survey : 24 Jul 98

Khorki Bank Protection Pilot Scheme



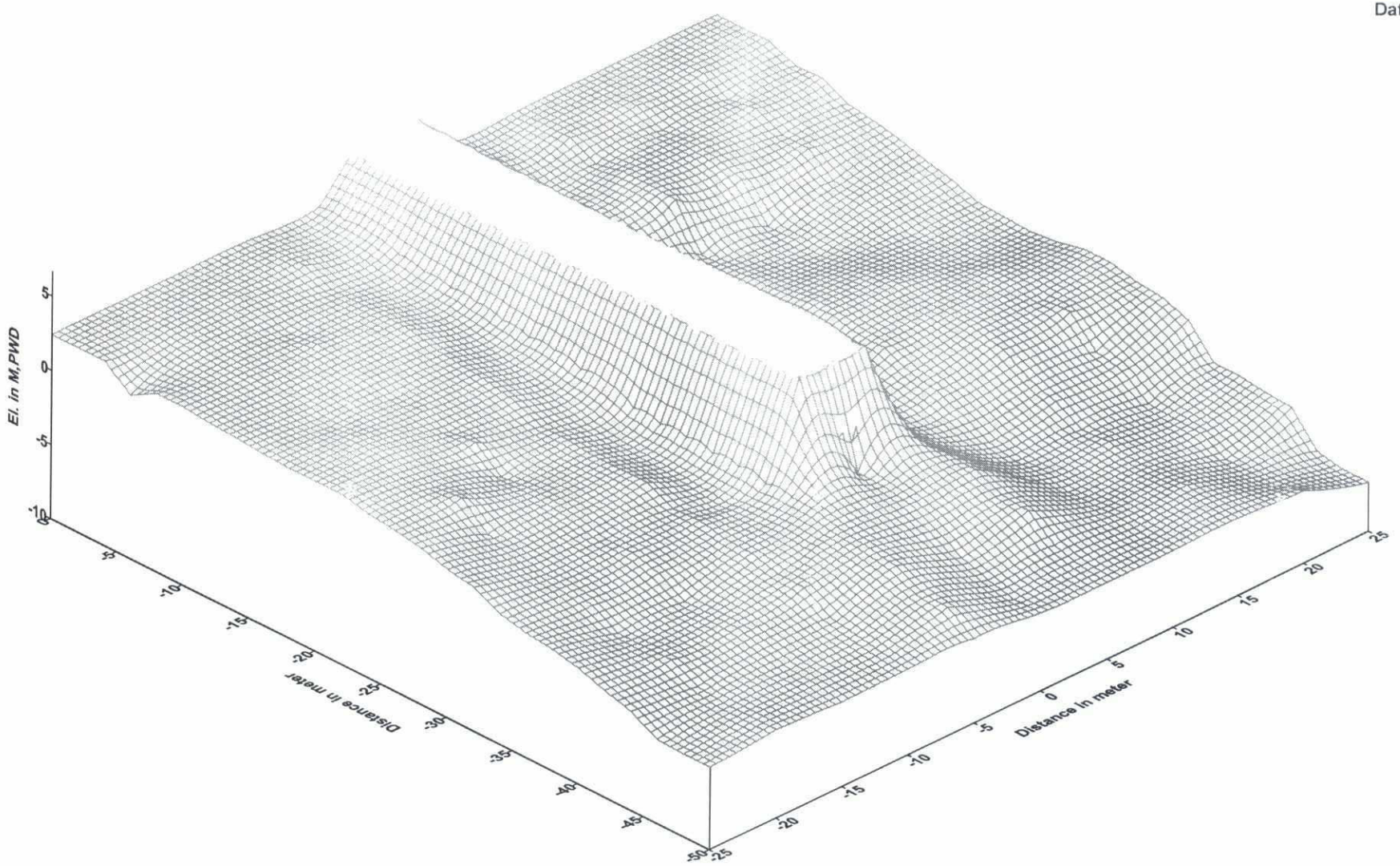
Bed levels around SPUR-2
Levels are in Meter PWD
Date of survey : 24 Jul 98

Color scale :

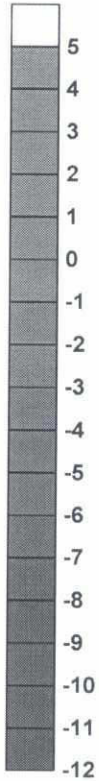


Khorki Bank Protection Pilot Scheme

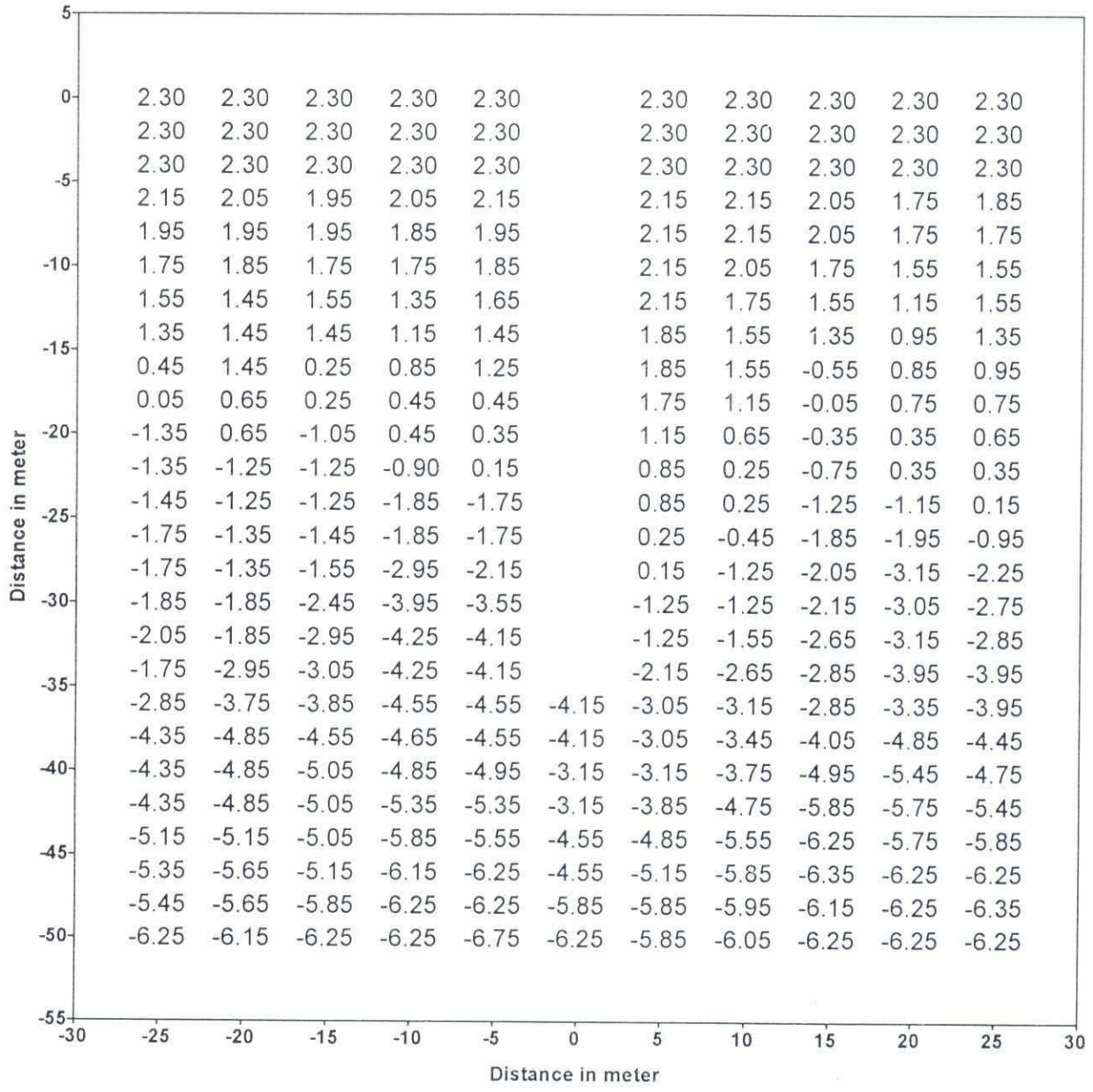
Bed levels around SPUR-2
Levels are in Meter PWD
Date of survey : 24 Jul 98



Color scale :



Khorki Bank Protection Pilot Scheme

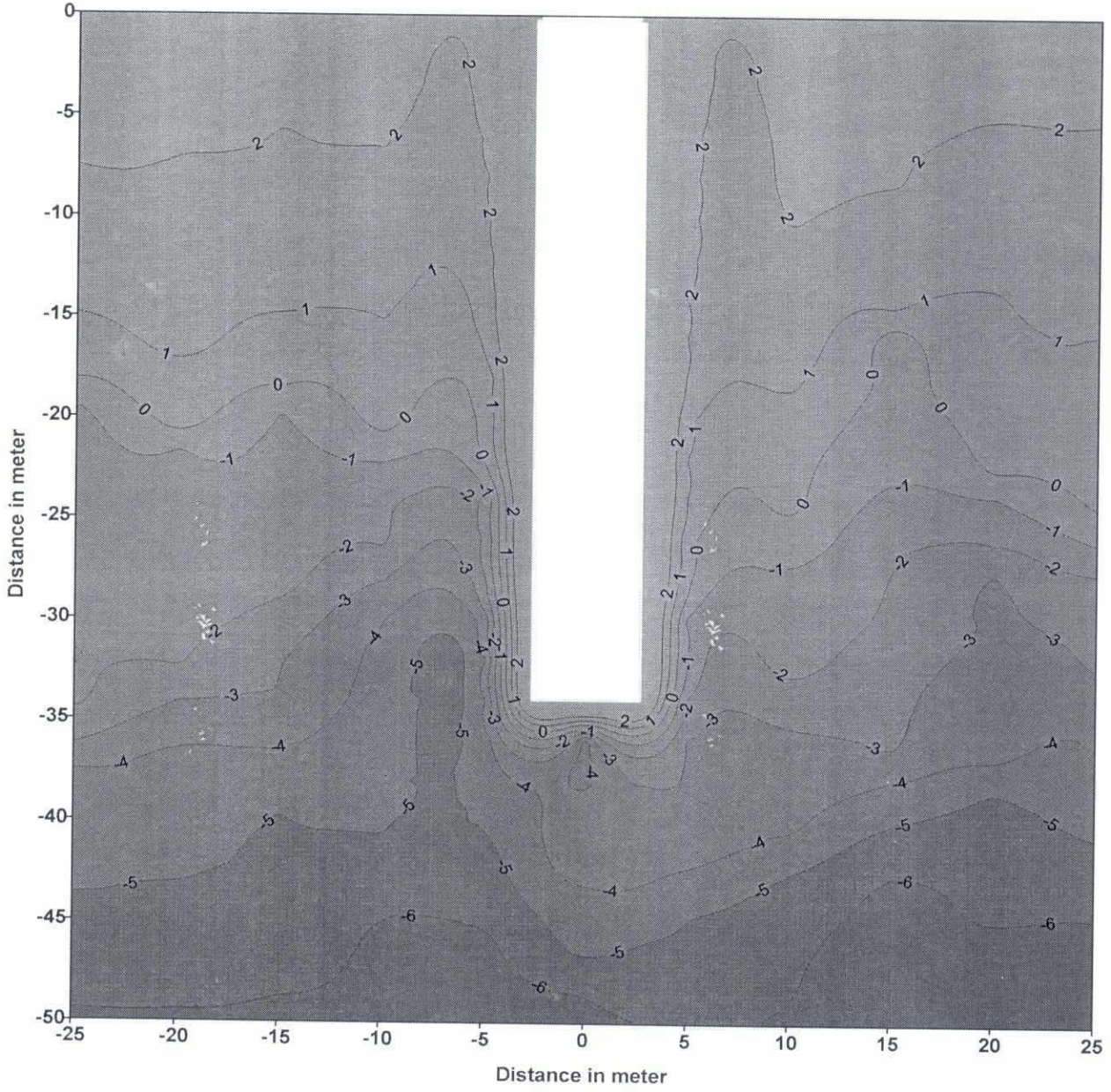


2.30	2.30	2.30	2.30	2.30		2.30	2.30	2.30	2.30	2.30
2.30	2.30	2.30	2.30	2.30		2.30	2.30	2.30	2.30	2.30
2.30	2.30	2.30	2.30	2.30		2.30	2.30	2.30	2.30	2.30
2.15	2.05	1.95	2.05	2.15		2.15	2.15	2.05	1.75	1.85
1.95	1.95	1.95	1.85	1.95		2.15	2.15	2.05	1.75	1.75
1.75	1.85	1.75	1.75	1.85		2.15	2.05	1.75	1.55	1.55
1.55	1.45	1.55	1.35	1.65		2.15	1.75	1.55	1.15	1.55
1.35	1.45	1.45	1.15	1.45		1.85	1.55	1.35	0.95	1.35
0.45	1.45	0.25	0.85	1.25		1.85	1.55	-0.55	0.85	0.95
0.05	0.65	0.25	0.45	0.45		1.75	1.15	-0.05	0.75	0.75
-1.35	0.65	-1.05	0.45	0.35		1.15	0.65	-0.35	0.35	0.65
-1.35	-1.25	-1.25	-0.90	0.15		0.85	0.25	-0.75	0.35	0.35
-1.45	-1.25	-1.25	-1.85	-1.75		0.85	0.25	-1.25	-1.15	0.15
-1.75	-1.35	-1.45	-1.85	-1.75		0.25	-0.45	-1.85	-1.95	-0.95
-1.75	-1.35	-1.55	-2.95	-2.15		0.15	-1.25	-2.05	-3.15	-2.25
-1.85	-1.85	-2.45	-3.95	-3.55		-1.25	-1.25	-2.15	-3.05	-2.75
-2.05	-1.85	-2.95	-4.25	-4.15		-1.25	-1.55	-2.65	-3.15	-2.85
-1.75	-2.95	-3.05	-4.25	-4.15		-2.15	-2.65	-2.85	-3.95	-3.95
-2.85	-3.75	-3.85	-4.55	-4.55	-4.15	-3.05	-3.15	-2.85	-3.35	-3.95
-4.35	-4.85	-4.55	-4.65	-4.55	-4.15	-3.05	-3.45	-4.05	-4.85	-4.45
-4.35	-4.85	-5.05	-4.85	-4.95	-3.15	-3.15	-3.75	-4.95	-5.45	-4.75
-4.35	-4.85	-5.05	-5.35	-5.35	-3.15	-3.85	-4.75	-5.85	-5.75	-5.45
-5.15	-5.15	-5.05	-5.85	-5.55	-4.55	-4.85	-5.55	-6.25	-5.75	-5.85
-5.35	-5.65	-5.15	-6.15	-6.25	-4.55	-5.15	-5.85	-6.35	-6.25	-6.25
-5.45	-5.65	-5.85	-6.25	-6.25	-5.85	-5.85	-5.95	-6.15	-6.25	-6.35
-6.25	-6.15	-6.25	-6.25	-6.75	-6.25	-5.85	-6.05	-6.25	-6.25	-6.25

Bed levels around SPUR-3
Levels are in Meter, PWD
Date of survey : 28 Jul 98

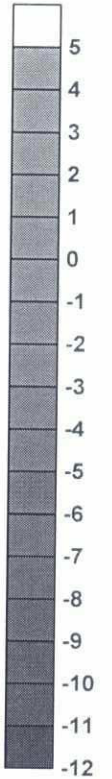
42

Khorki Bank Protection Pilot Scheme



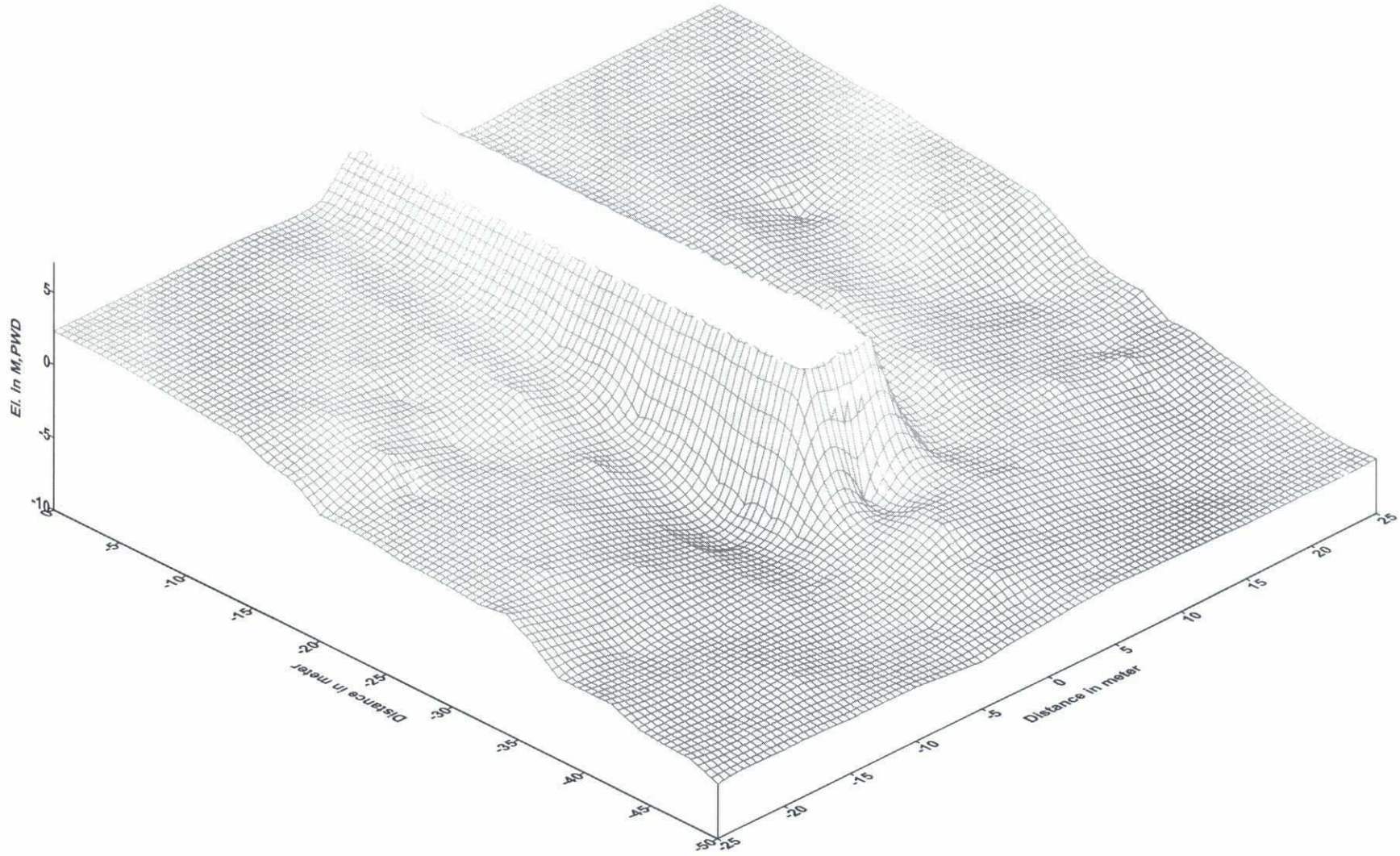
Bed levels around SPUR-3
Levels are in Meter PWD
Date of survey : 28 Jul 98

Color scale :



Khorki Bank Protection Pilot Scheme

Bed levels around SPUR-3
Levels are in Meter PWD
Date of survey : 28 Jul 98



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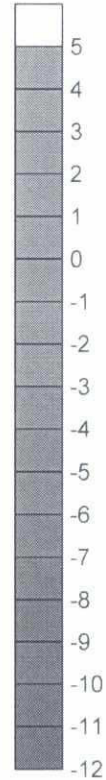
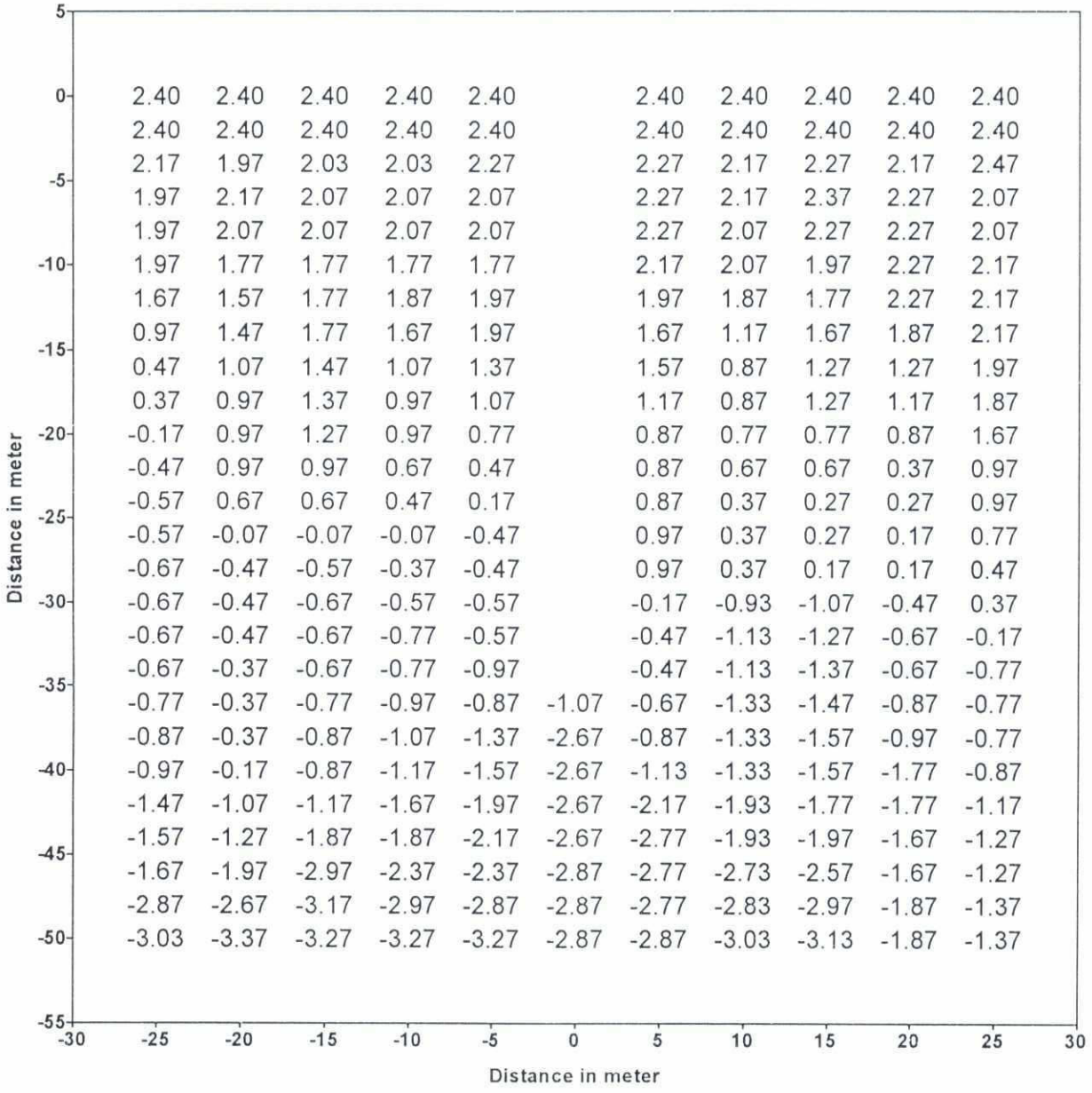


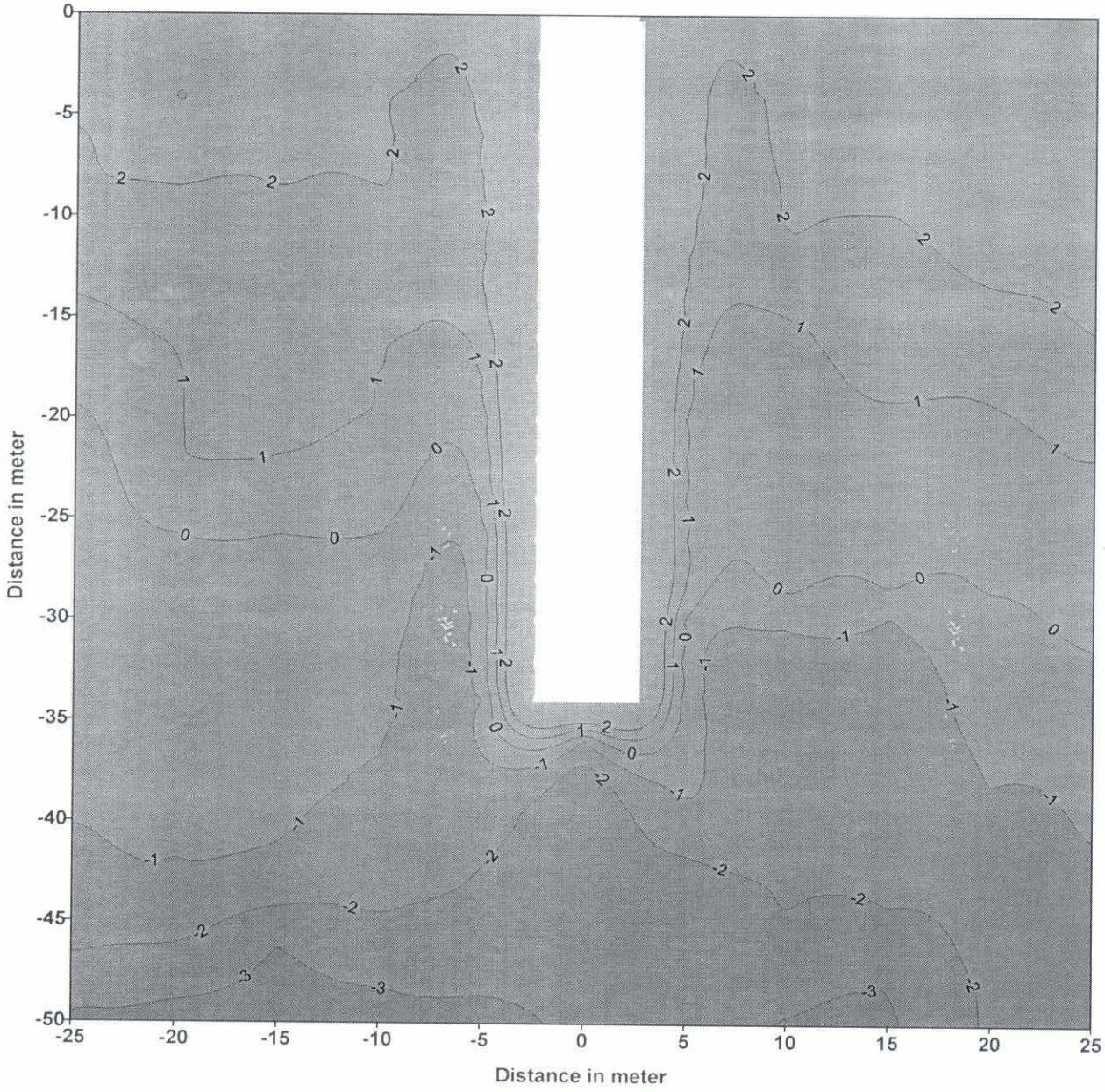
Khorki Bank Protection Pilot Scheme



2.40	2.40	2.40	2.40	2.40		2.40	2.40	2.40	2.40	2.40
2.40	2.40	2.40	2.40	2.40		2.40	2.40	2.40	2.40	2.40
2.17	1.97	2.03	2.03	2.27		2.27	2.17	2.27	2.17	2.47
1.97	2.17	2.07	2.07	2.07		2.27	2.17	2.37	2.27	2.07
1.97	2.07	2.07	2.07	2.07		2.27	2.07	2.27	2.27	2.07
1.97	1.77	1.77	1.77	1.77		2.17	2.07	1.97	2.27	2.17
1.67	1.57	1.77	1.87	1.97		1.97	1.87	1.77	2.27	2.17
0.97	1.47	1.77	1.67	1.97		1.67	1.17	1.67	1.87	2.17
0.47	1.07	1.47	1.07	1.37		1.57	0.87	1.27	1.27	1.97
0.37	0.97	1.37	0.97	1.07		1.17	0.87	1.27	1.17	1.87
-0.17	0.97	1.27	0.97	0.77		0.87	0.77	0.77	0.87	1.67
-0.47	0.97	0.97	0.67	0.47		0.87	0.67	0.67	0.37	0.97
-0.57	0.67	0.67	0.47	0.17		0.87	0.37	0.27	0.27	0.97
-0.57	-0.07	-0.07	-0.07	-0.47		0.97	0.37	0.27	0.17	0.77
-0.67	-0.47	-0.57	-0.37	-0.47		0.97	0.37	0.17	0.17	0.47
-0.67	-0.47	-0.67	-0.57	-0.57		-0.17	-0.93	-1.07	-0.47	0.37
-0.67	-0.47	-0.67	-0.77	-0.57		-0.47	-1.13	-1.27	-0.67	-0.17
-0.67	-0.37	-0.67	-0.77	-0.97		-0.47	-1.13	-1.37	-0.67	-0.77
-0.77	-0.37	-0.77	-0.97	-0.87	-1.07	-0.67	-1.33	-1.47	-0.87	-0.77
-0.87	-0.37	-0.87	-1.07	-1.37	-2.67	-0.87	-1.33	-1.57	-0.97	-0.77
-0.97	-0.17	-0.87	-1.17	-1.57	-2.67	-1.13	-1.33	-1.57	-1.77	-0.87
-1.47	-1.07	-1.17	-1.67	-1.97	-2.67	-2.17	-1.93	-1.77	-1.77	-1.17
-1.57	-1.27	-1.87	-1.87	-2.17	-2.67	-2.77	-1.93	-1.97	-1.67	-1.27
-1.67	-1.97	-2.97	-2.37	-2.37	-2.87	-2.77	-2.73	-2.57	-1.67	-1.27
-2.87	-2.67	-3.17	-2.97	-2.87	-2.87	-2.77	-2.83	-2.97	-1.87	-1.37
-3.03	-3.37	-3.27	-3.27	-3.27	-2.87	-2.87	-3.03	-3.13	-1.87	-1.37

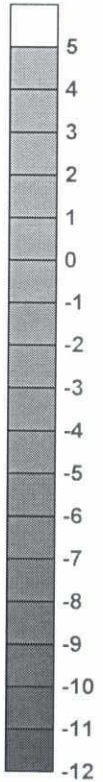
Bed levels around SPUR-1
Levels are in Meter, PWD
Date of survey : 11 Aug 98

Khorki Bank Protection Pilot Scheme



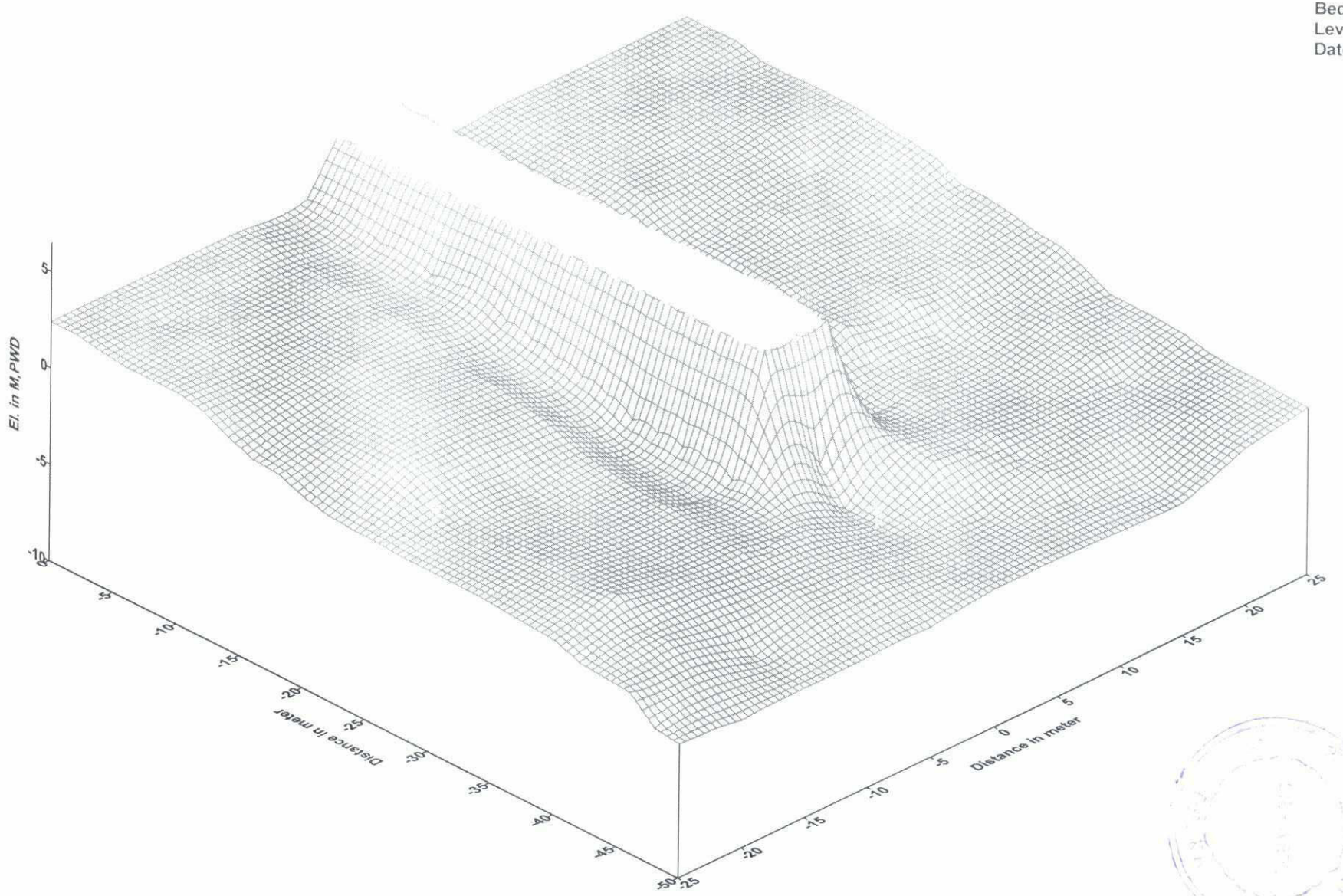
Bed levels around SPUR-1
Levels are in Meter PWD
Date of survey : 11 Aug 98

Color scale :

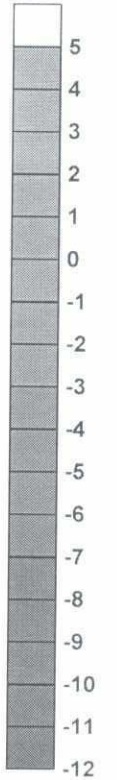


Khorki Bank Protection Pilot Scheme

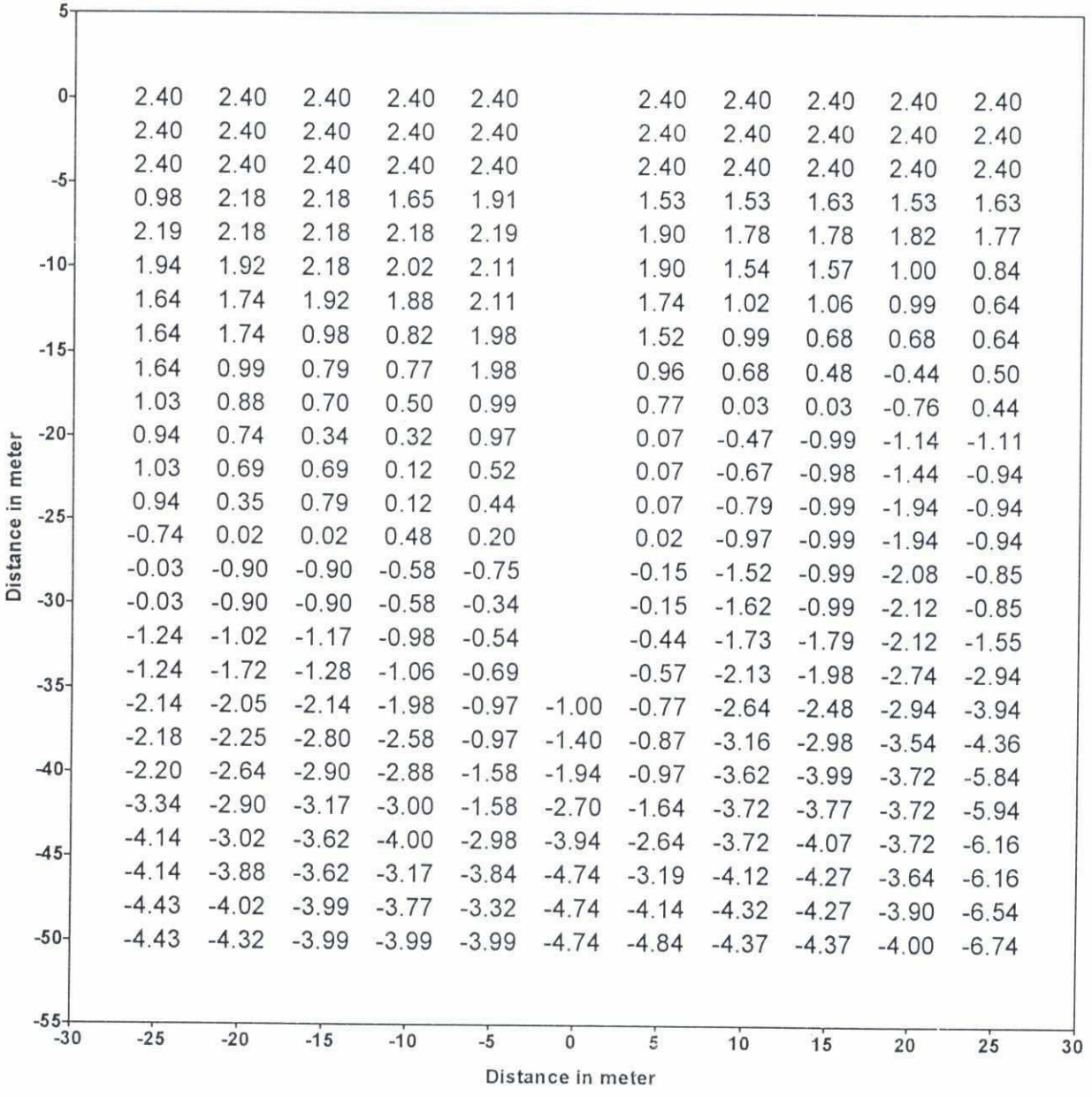
Bed levels around SPUR-1
Levels are in Meter PWD
Date of survey : 11 Aug 98



Color scale :



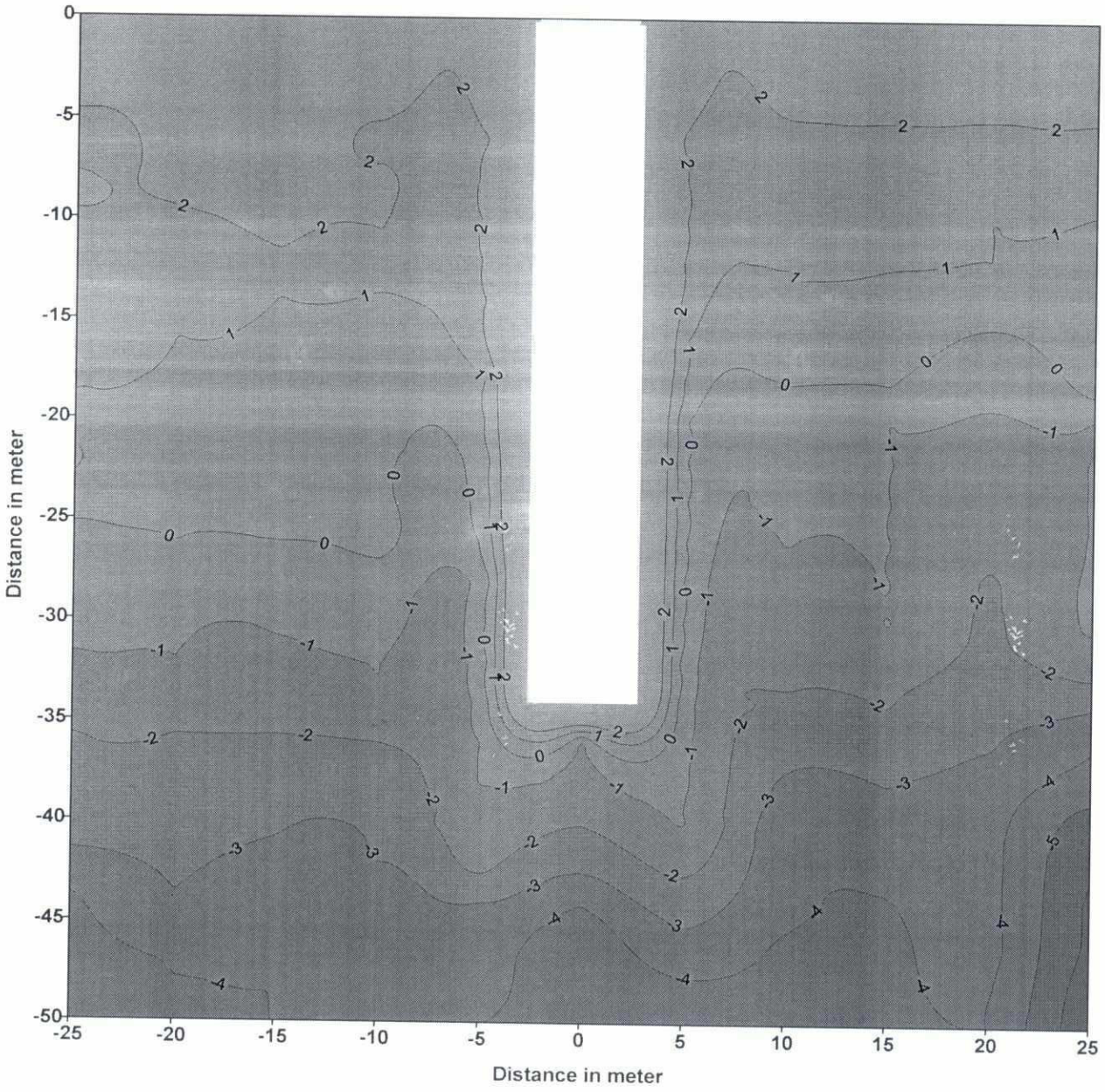
Khorki Bank Protection Pilot Scheme



2.40	2.40	2.40	2.40	2.40		2.40	2.40	2.40	2.40	2.40
2.40	2.40	2.40	2.40	2.40		2.40	2.40	2.40	2.40	2.40
2.40	2.40	2.40	2.40	2.40		2.40	2.40	2.40	2.40	2.40
0.98	2.18	2.18	1.65	1.91		1.53	1.53	1.63	1.53	1.63
2.19	2.18	2.18	2.18	2.19		1.90	1.78	1.78	1.82	1.77
1.94	1.92	2.18	2.02	2.11		1.90	1.54	1.57	1.00	0.84
1.64	1.74	1.92	1.88	2.11		1.74	1.02	1.06	0.99	0.64
1.64	1.74	0.98	0.82	1.98		1.52	0.99	0.68	0.68	0.64
1.64	0.99	0.79	0.77	1.98		0.96	0.68	0.48	-0.44	0.50
1.03	0.88	0.70	0.50	0.99		0.77	0.03	0.03	-0.76	0.44
0.94	0.74	0.34	0.32	0.97		0.07	-0.47	-0.99	-1.14	-1.11
1.03	0.69	0.69	0.12	0.52		0.07	-0.67	-0.98	-1.44	-0.94
0.94	0.35	0.79	0.12	0.44		0.07	-0.79	-0.99	-1.94	-0.94
-0.74	0.02	0.02	0.48	0.20		0.02	-0.97	-0.99	-1.94	-0.94
-0.03	-0.90	-0.90	-0.58	-0.75		-0.15	-1.52	-0.99	-2.08	-0.85
-0.03	-0.90	-0.90	-0.58	-0.34		-0.15	-1.62	-0.99	-2.12	-0.85
-1.24	-1.02	-1.17	-0.98	-0.54		-0.44	-1.73	-1.79	-2.12	-1.55
-1.24	-1.72	-1.28	-1.06	-0.69		-0.57	-2.13	-1.98	-2.74	-2.94
-2.14	-2.05	-2.14	-1.98	-0.97	-1.00	-0.77	-2.64	-2.48	-2.94	-3.94
-2.18	-2.25	-2.80	-2.58	-0.97	-1.40	-0.87	-3.16	-2.98	-3.54	-4.36
-2.20	-2.64	-2.90	-2.88	-1.58	-1.94	-0.97	-3.62	-3.99	-3.72	-5.84
-3.34	-2.90	-3.17	-3.00	-1.58	-2.70	-1.64	-3.72	-3.77	-3.72	-5.94
-4.14	-3.02	-3.62	-4.00	-2.98	-3.94	-2.64	-3.72	-4.07	-3.72	-6.16
-4.14	-3.88	-3.62	-3.17	-3.84	-4.74	-3.19	-4.12	-4.27	-3.64	-6.16
-4.43	-4.02	-3.99	-3.77	-3.32	-4.74	-4.14	-4.32	-4.27	-3.90	-6.54
-4.43	-4.32	-3.99	-3.99	-3.99	-4.74	-4.84	-4.37	-4.37	-4.00	-6.74

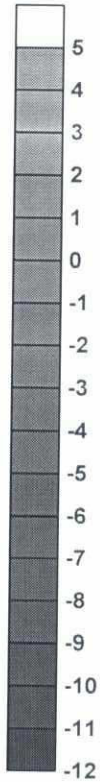
Bed levels around SPUR-2
Levels are in Meter, PWD
Date of survey : 11 Aug 98

Khorki Bank Protection Pilot Scheme



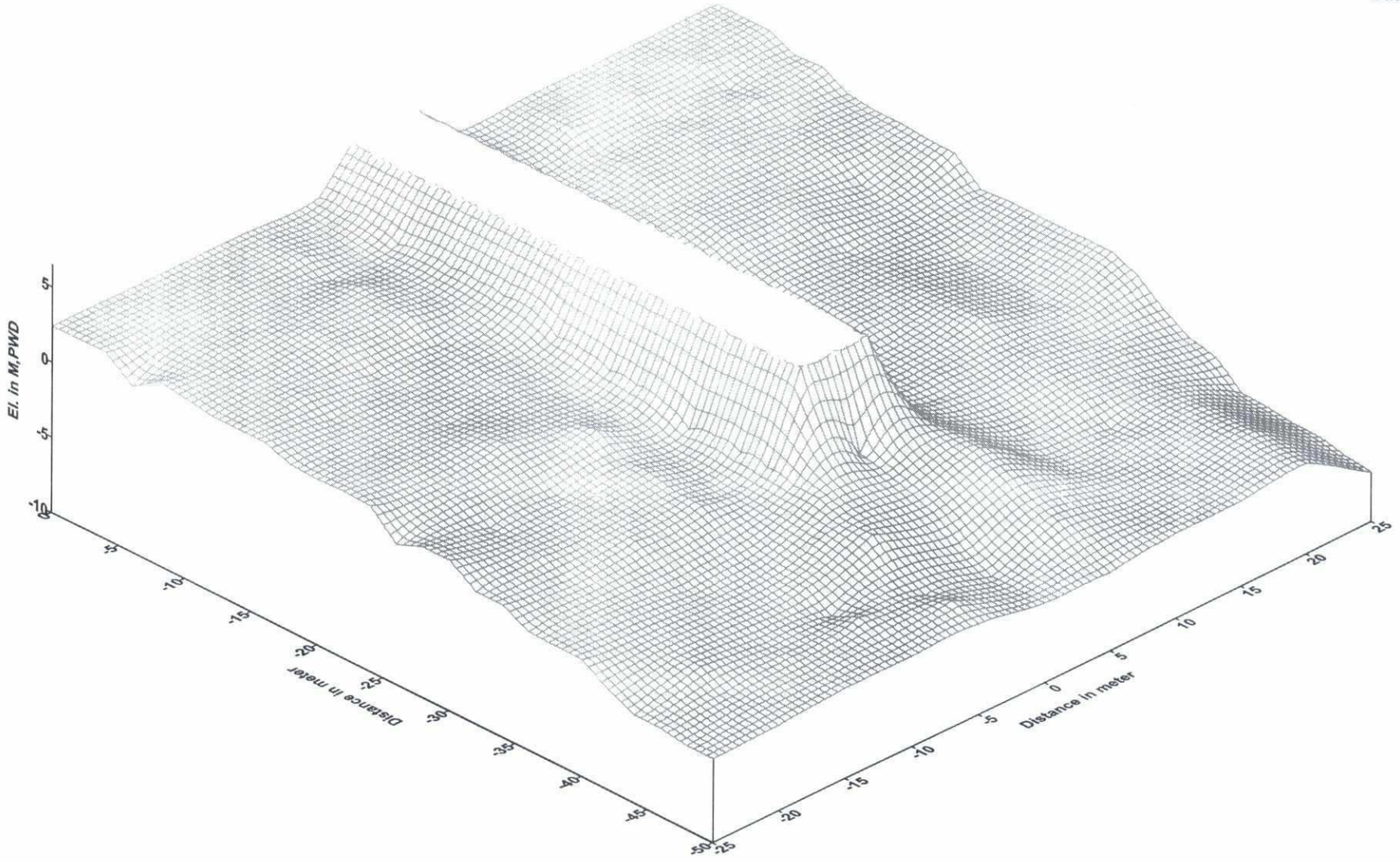
Bed levels around SPUR-2
Levels are in Meter PWD
Date of survey : 11 Aug 98

Color scale :

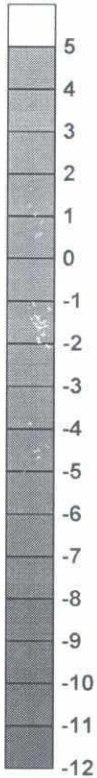


Khorki Bank Protection Pilot Scheme

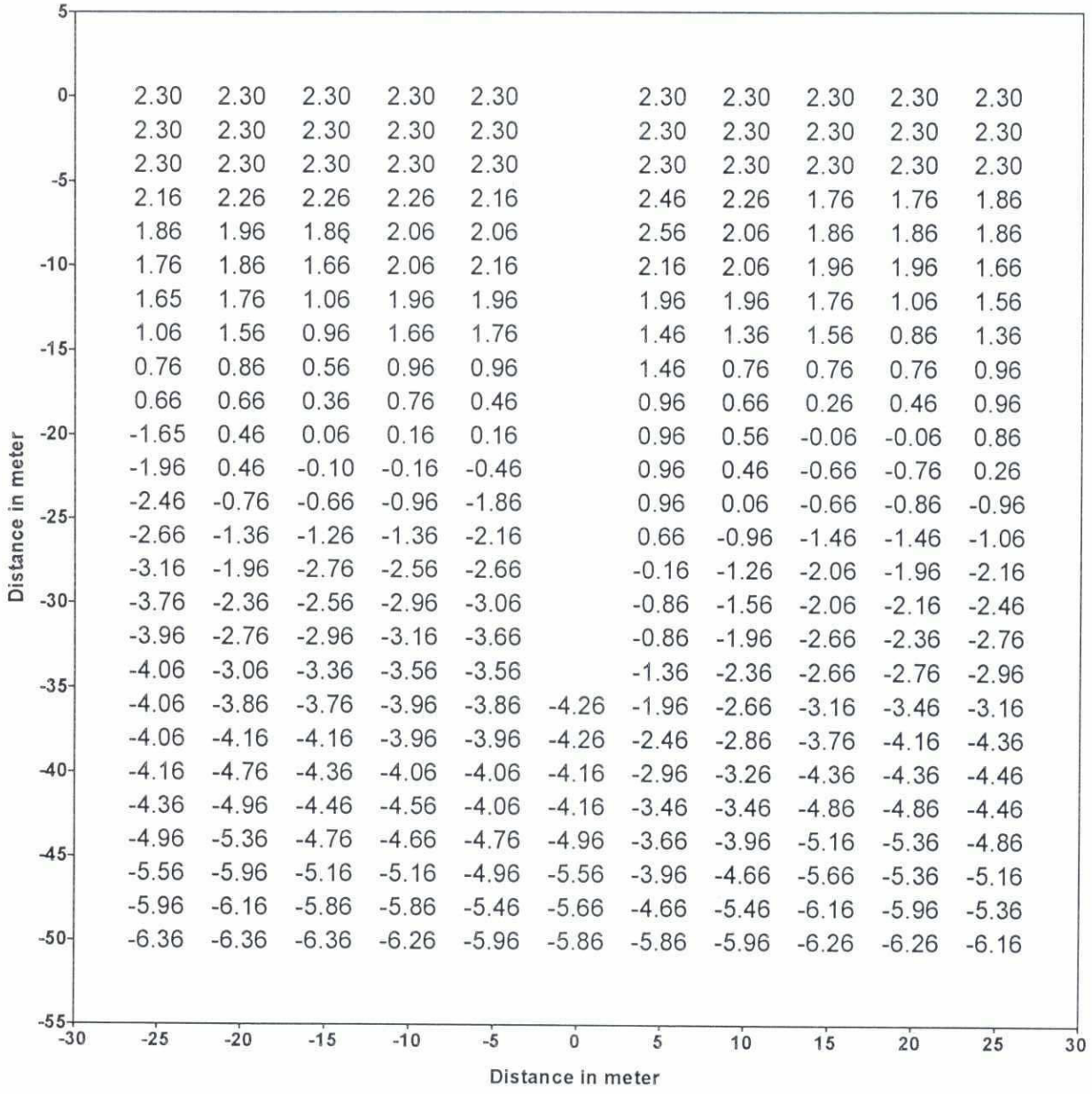
Bed levels around SPUR-2
Levels are in Meter PWD
Date of survey : 11 Aug 98



Color scale :



Khorki Bank Protection Pilot Scheme

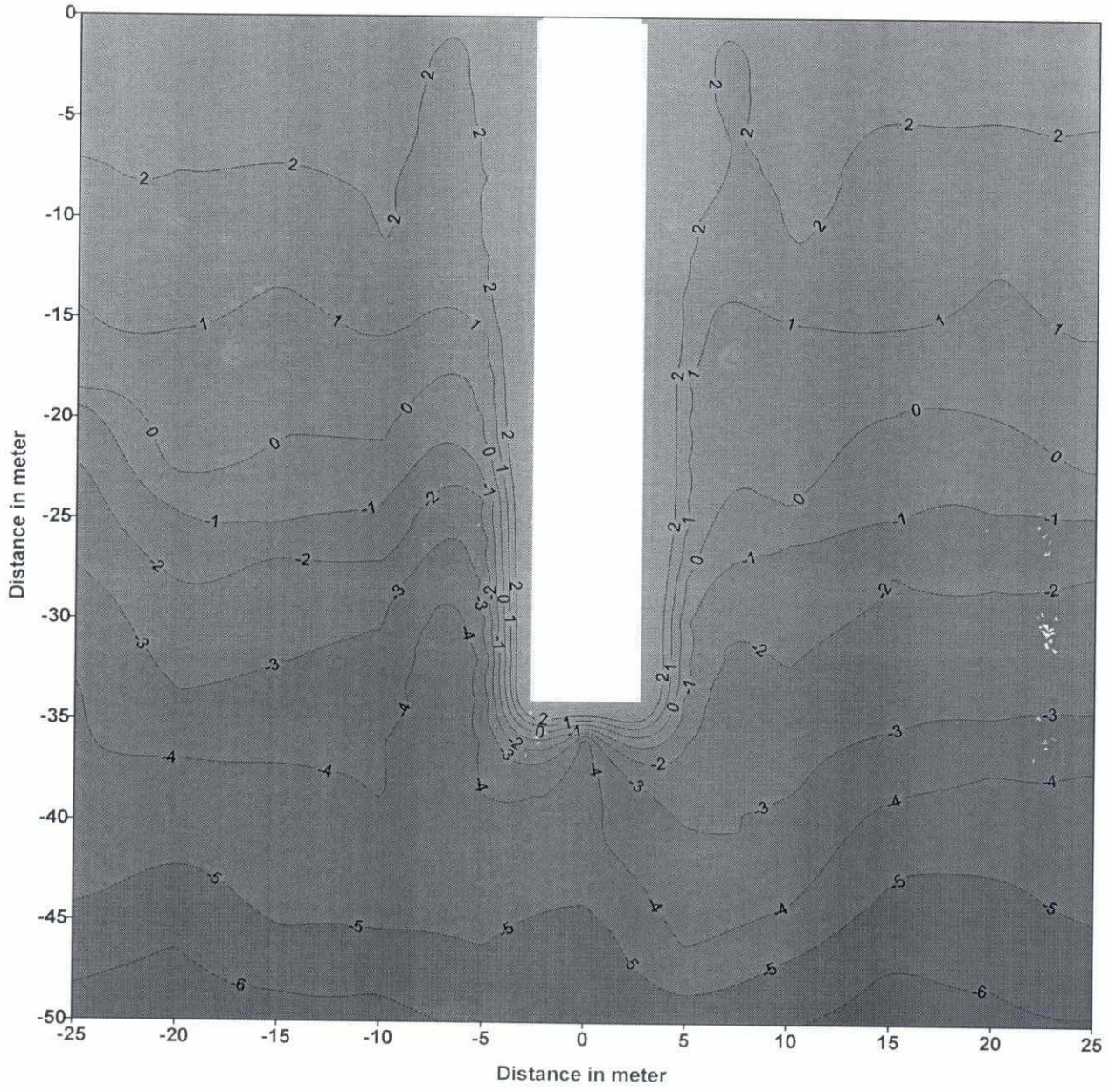


2.30	2.30	2.30	2.30	2.30		2.30	2.30	2.30	2.30	2.30
2.30	2.30	2.30	2.30	2.30		2.30	2.30	2.30	2.30	2.30
2.30	2.30	2.30	2.30	2.30		2.30	2.30	2.30	2.30	2.30
2.16	2.26	2.26	2.26	2.16		2.46	2.26	1.76	1.76	1.86
1.86	1.96	1.86	2.06	2.06		2.56	2.06	1.86	1.86	1.86
1.76	1.86	1.66	2.06	2.16		2.16	2.06	1.96	1.96	1.66
1.65	1.76	1.06	1.96	1.96		1.96	1.96	1.76	1.06	1.56
1.06	1.56	0.96	1.66	1.76		1.46	1.36	1.56	0.86	1.36
0.76	0.86	0.56	0.96	0.96		1.46	0.76	0.76	0.76	0.96
0.66	0.66	0.36	0.76	0.46		0.96	0.66	0.26	0.46	0.96
-1.65	0.46	0.06	0.16	0.16		0.96	0.56	-0.06	-0.06	0.86
-1.96	0.46	-0.10	-0.16	-0.46		0.96	0.46	-0.66	-0.76	0.26
-2.46	-0.76	-0.66	-0.96	-1.86		0.96	0.06	-0.66	-0.86	-0.96
-2.66	-1.36	-1.26	-1.36	-2.16		0.66	-0.96	-1.46	-1.46	-1.06
-3.16	-1.96	-2.76	-2.56	-2.66		-0.16	-1.26	-2.06	-1.96	-2.16
-3.76	-2.36	-2.56	-2.96	-3.06		-0.86	-1.56	-2.06	-2.16	-2.46
-3.96	-2.76	-2.96	-3.16	-3.66		-0.86	-1.96	-2.66	-2.36	-2.76
-4.06	-3.06	-3.36	-3.56	-3.56		-1.36	-2.36	-2.66	-2.76	-2.96
-4.06	-3.86	-3.76	-3.96	-3.86	-4.26	-1.96	-2.66	-3.16	-3.46	-3.16
-4.06	-4.16	-4.16	-3.96	-3.96	-4.26	-2.46	-2.86	-3.76	-4.16	-4.36
-4.16	-4.76	-4.36	-4.06	-4.06	-4.16	-2.96	-3.26	-4.36	-4.36	-4.46
-4.36	-4.96	-4.46	-4.56	-4.06	-4.16	-3.46	-3.46	-4.86	-4.86	-4.46
-4.96	-5.36	-4.76	-4.66	-4.76	-4.96	-3.66	-3.96	-5.16	-5.36	-4.86
-5.56	-5.96	-5.16	-5.16	-4.96	-5.56	-3.96	-4.66	-5.66	-5.36	-5.16
-5.96	-6.16	-5.86	-5.86	-5.46	-5.66	-4.66	-5.46	-6.16	-5.96	-5.36
-6.36	-6.36	-6.36	-6.26	-5.96	-5.86	-5.86	-5.96	-6.26	-6.26	-6.16

Bed levels around SPUR-3
Levels are in Meter, PWD
Date of survey : 12 Aug 98

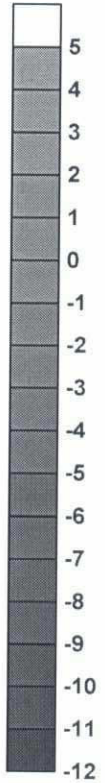
42

Khorki Bank Protection Pilot Scheme



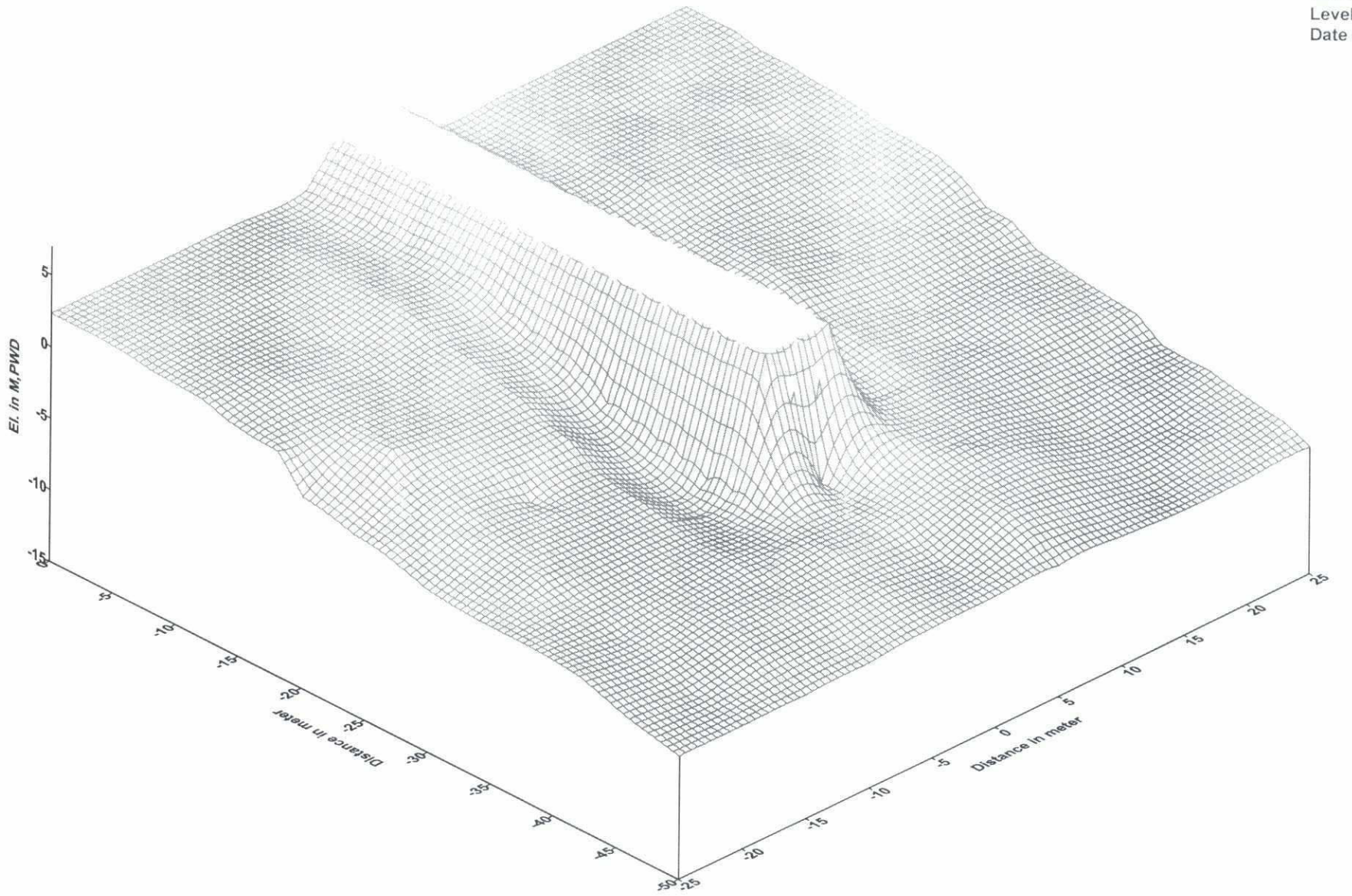
Bed levels around SPUR-3
Levels are in Meter PWD
Date of survey : 12 Aug 98

Color scale :

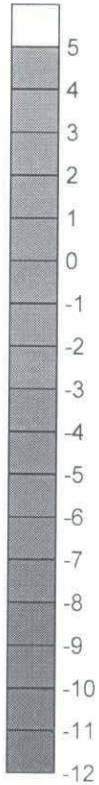


Khorki Bank Protection Pilot Scheme

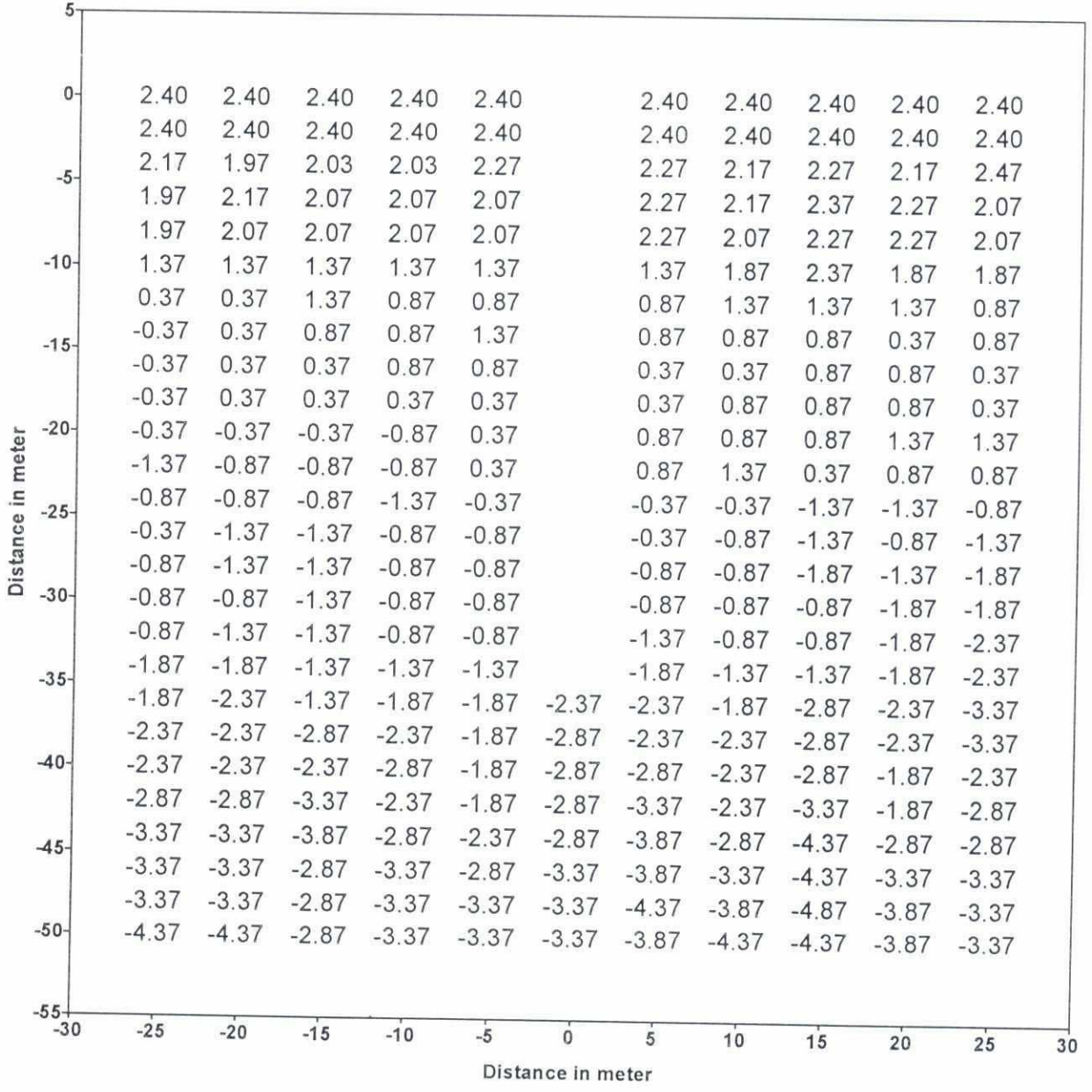
Bed levels around SPUR-3
Levels are in Meter PWD
Date of survey : 12 Aug 98



Color scale :



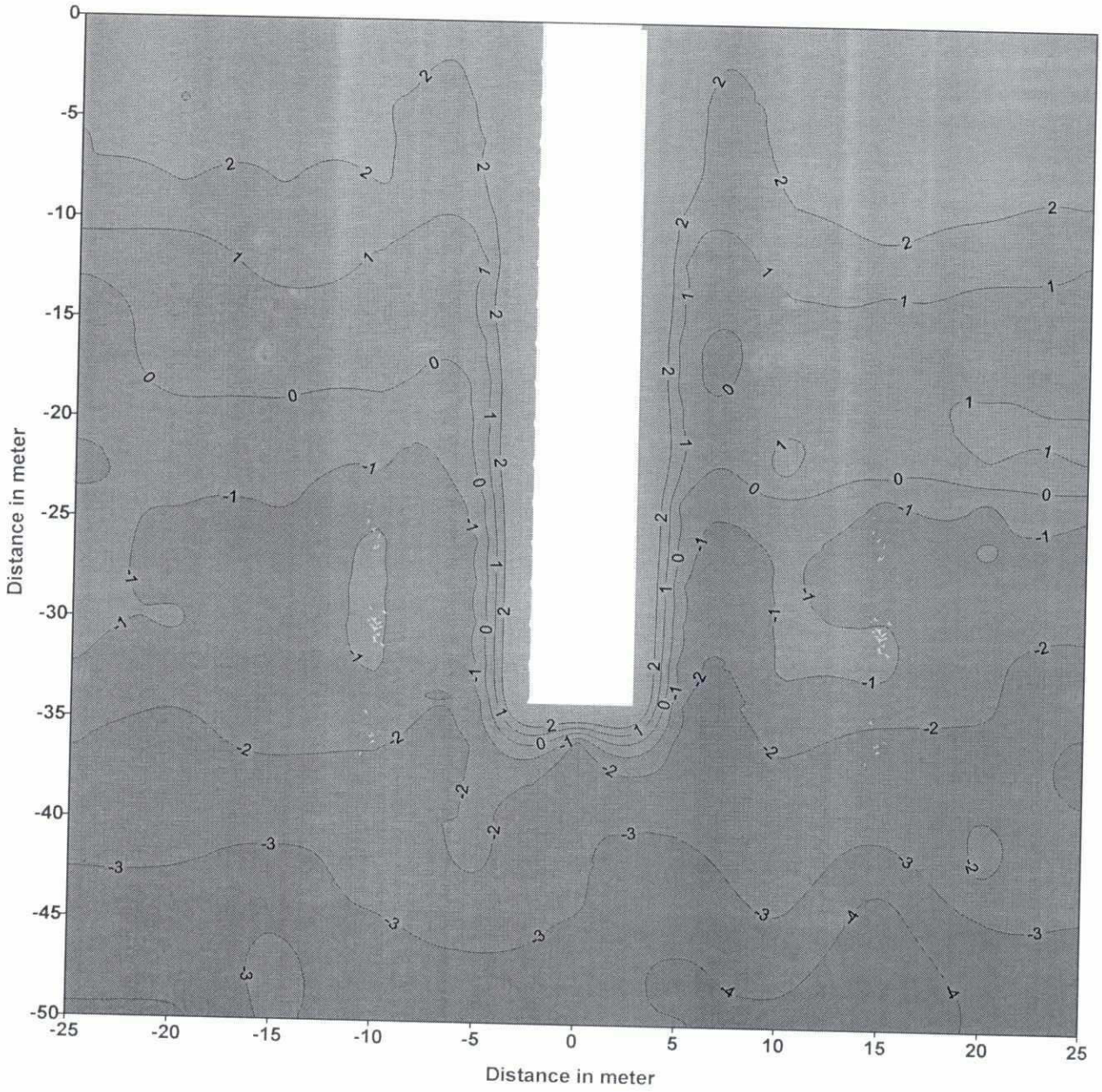
Khorki Bank Protection Pilot Scheme



2.40	2.40	2.40	2.40	2.40		2.40	2.40	2.40	2.40	2.40
2.40	2.40	2.40	2.40	2.40		2.40	2.40	2.40	2.40	2.40
2.17	1.97	2.03	2.03	2.27		2.27	2.17	2.27	2.17	2.47
1.97	2.17	2.07	2.07	2.07		2.27	2.17	2.37	2.27	2.07
1.97	2.07	2.07	2.07	2.07		2.27	2.07	2.27	2.27	2.07
1.37	1.37	1.37	1.37	1.37		1.37	1.87	2.37	1.87	1.87
0.37	0.37	1.37	0.87	0.87		0.87	1.37	1.37	1.37	0.87
-0.37	0.37	0.87	0.87	1.37		0.87	0.87	0.87	0.37	0.87
-0.37	0.37	0.37	0.87	0.87		0.37	0.37	0.87	0.87	0.37
-0.37	0.37	0.37	0.37	0.37		0.37	0.87	0.87	0.87	0.37
-0.37	-0.37	-0.37	-0.87	0.37		0.87	0.87	0.87	1.37	1.37
-1.37	-0.87	-0.87	-0.87	0.37		0.87	1.37	0.37	0.87	0.87
-0.87	-0.87	-0.87	-1.37	-0.37		-0.37	-0.37	-1.37	-1.37	-0.87
-0.37	-1.37	-1.37	-0.87	-0.87		-0.37	-0.87	-1.37	-0.87	-1.37
-0.87	-1.37	-1.37	-0.87	-0.87		-0.87	-0.87	-1.87	-1.37	-1.87
-0.87	-0.87	-1.37	-0.87	-0.87		-0.87	-0.87	-0.87	-1.87	-1.87
-0.87	-1.37	-1.37	-0.87	-0.87		-1.37	-0.87	-0.87	-1.87	-2.37
-1.87	-1.87	-1.37	-1.37	-1.37		-1.87	-1.37	-1.37	-1.87	-2.37
-1.87	-2.37	-1.37	-1.87	-1.87	-2.37	-2.37	-1.87	-2.87	-2.37	-3.37
-2.37	-2.37	-2.87	-2.37	-1.87	-2.87	-2.37	-2.37	-2.87	-2.37	-3.37
-2.37	-2.37	-2.37	-2.87	-1.87	-2.87	-2.87	-2.37	-2.87	-1.87	-2.37
-2.87	-2.87	-3.37	-2.37	-1.87	-2.87	-3.37	-2.37	-3.37	-1.87	-2.87
-3.37	-3.37	-3.87	-2.87	-2.37	-2.87	-3.87	-2.87	-4.37	-2.87	-2.87
-3.37	-3.37	-2.87	-3.37	-2.87	-3.37	-3.87	-3.37	-4.37	-3.37	-3.37
-3.37	-3.37	-2.87	-3.37	-3.37	-3.37	-4.37	-3.87	-4.87	-3.87	-3.37
-4.37	-4.37	-2.87	-3.37	-3.37	-3.37	-3.87	-4.37	-4.37	-3.87	-3.37

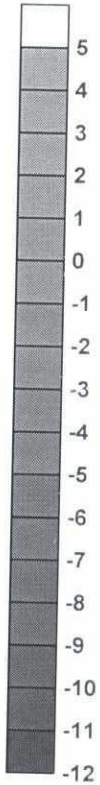
Bed levels around SPUR-1
Levels are in Meter, PWD
Date of survey : 28 Sep 98

Khorki Bank Protection Pilot Scheme



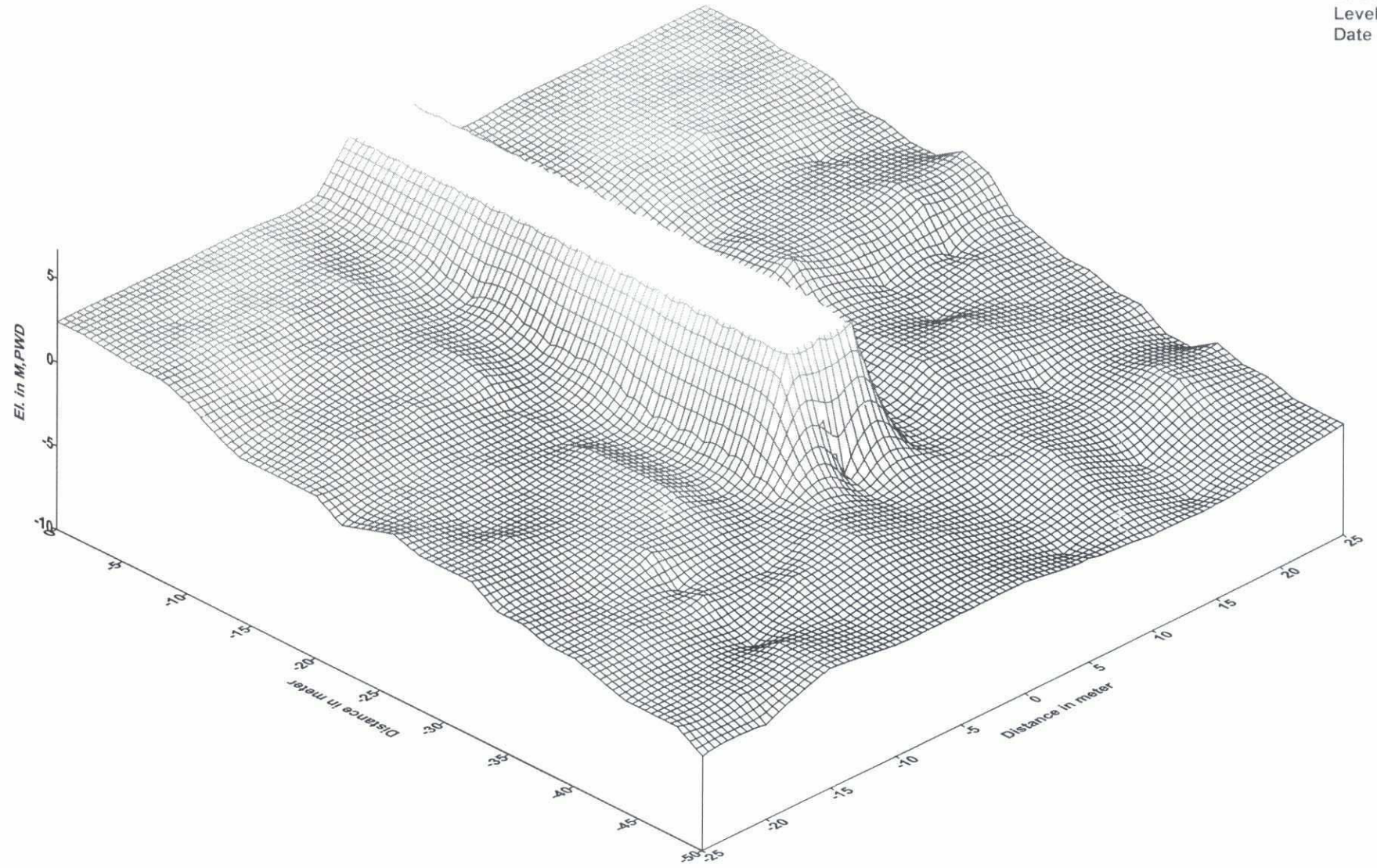
Bed levels around SPUR-1
Levels are in Meter PWD
Date of survey : 28 Sep 98

Color scale :

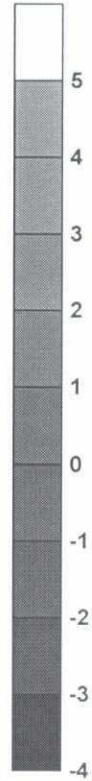


Khorki Bank Protection Pilot Scheme

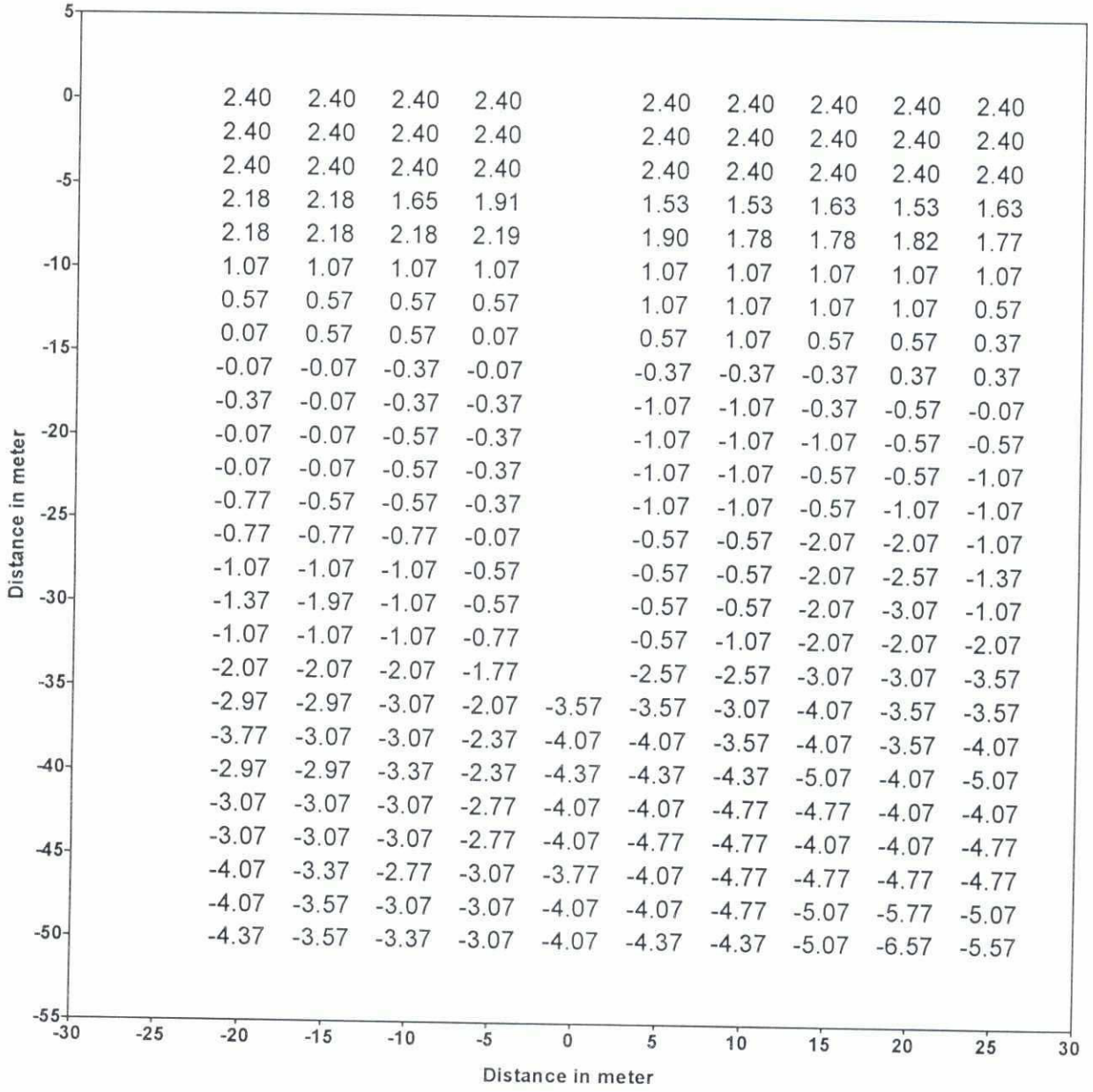
Bed levels around SPUR-1
Levels are in Meter PWD
Date of survey : 28 Sep 98



Color scale :



Khorki Bank Protection Pilot Scheme



2.40	2.40	2.40	2.40		2.40	2.40	2.40	2.40	2.40
2.40	2.40	2.40	2.40		2.40	2.40	2.40	2.40	2.40
2.40	2.40	2.40	2.40		2.40	2.40	2.40	2.40	2.40
2.18	2.18	1.65	1.91		1.53	1.53	1.63	1.53	1.63
2.18	2.18	2.18	2.19		1.90	1.78	1.78	1.82	1.77
1.07	1.07	1.07	1.07		1.07	1.07	1.07	1.07	1.07
0.57	0.57	0.57	0.57		1.07	1.07	1.07	1.07	0.57
0.07	0.57	0.57	0.07		0.57	1.07	0.57	0.57	0.37
-0.07	-0.07	-0.37	-0.07		-0.37	-0.37	-0.37	0.37	0.37
-0.37	-0.07	-0.37	-0.37		-1.07	-1.07	-0.37	-0.57	-0.07
-0.07	-0.07	-0.57	-0.37		-1.07	-1.07	-1.07	-0.57	-0.57
-0.07	-0.07	-0.57	-0.37		-1.07	-1.07	-0.57	-0.57	-1.07
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-0.77	-0.77	-0.77	-0.07		-0.57	-0.57	-2.07	-2.07	-1.07
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-1.37	-1.97	-1.07	-0.57		-0.57	-0.57	-2.07	-3.07	-1.07
-1.07	-1.07	-1.07	-0.77		-0.57	-1.07	-2.07	-2.07	-2.07
-2.07	-2.07	-2.07	-1.77		-2.57	-2.57	-3.07	-3.07	-3.57
-2.97	-2.97	-3.07	-2.07	-3.57	-3.57	-3.07	-4.07	-3.57	-3.57
-3.77	-3.07	-3.07	-2.37	-4.07	-4.07	-3.57	-4.07	-3.57	-4.07
-2.97	-2.97	-3.37	-2.37	-4.37	-4.37	-4.37	-5.07	-4.07	-5.07
-3.07	-3.07	-3.07	-2.77	-4.07	-4.07	-4.77	-4.77	-4.07	-4.07
-3.07	-3.07	-3.07	-2.77	-4.07	-4.77	-4.77	-4.07	-4.07	-4.77
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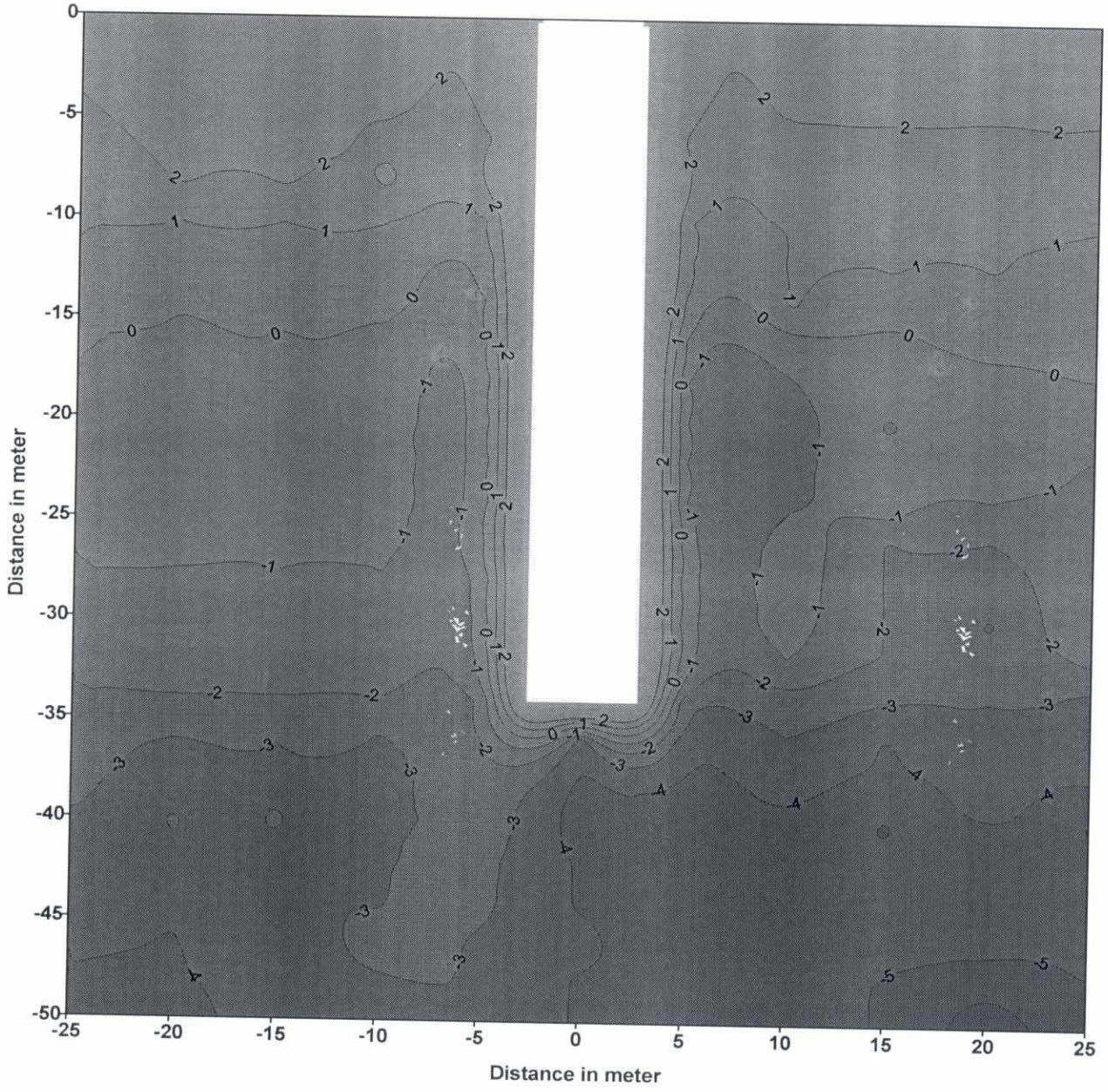
-4.07	-3.57	-3.07	-3.07	-4.07	-4.07	-4.77	-5.07	-5.77	-5.07
-4.37	-3.57	-3.37	-3.07	-4.07	-4.37	-4.37	-5.07	-6.57	-5.57

Bed levels around SPUR-2
Levels are in Meter, PWD
Date of survey : 27 Sep 98

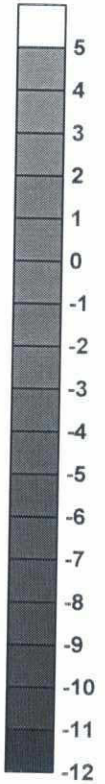
D 4

Khorki Bank Protection Pilot Scheme



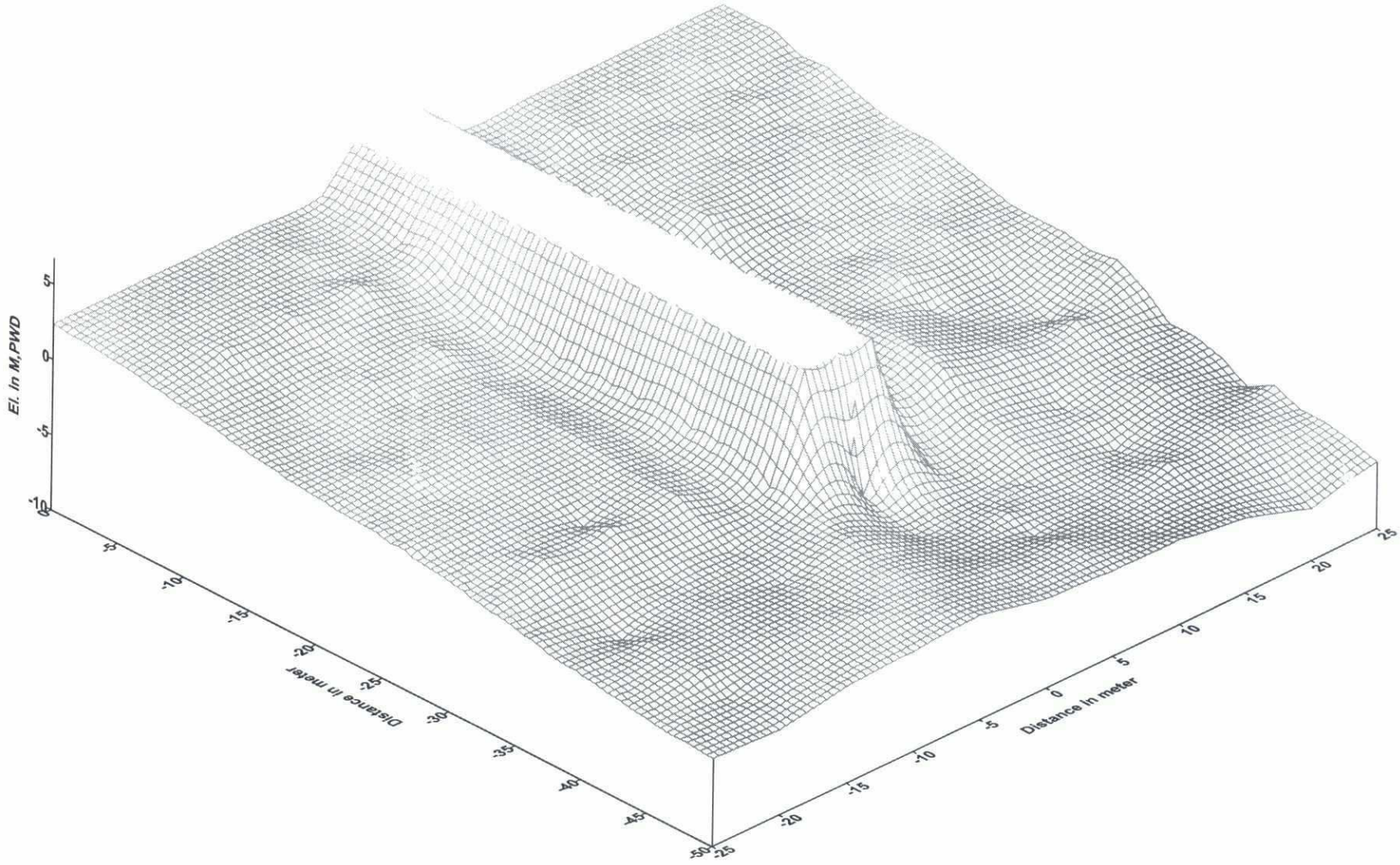
Bed levels around SPUR-2
Levels are in Meter PWD
Date of survey : 27 Sep 98

Color scale :



Khorki Bank Protection Pilot Scheme

Bed levels around SPUR-2
Levels are in Meter PWD
Date of survey : 27 Sep 98



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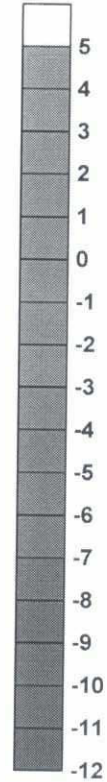
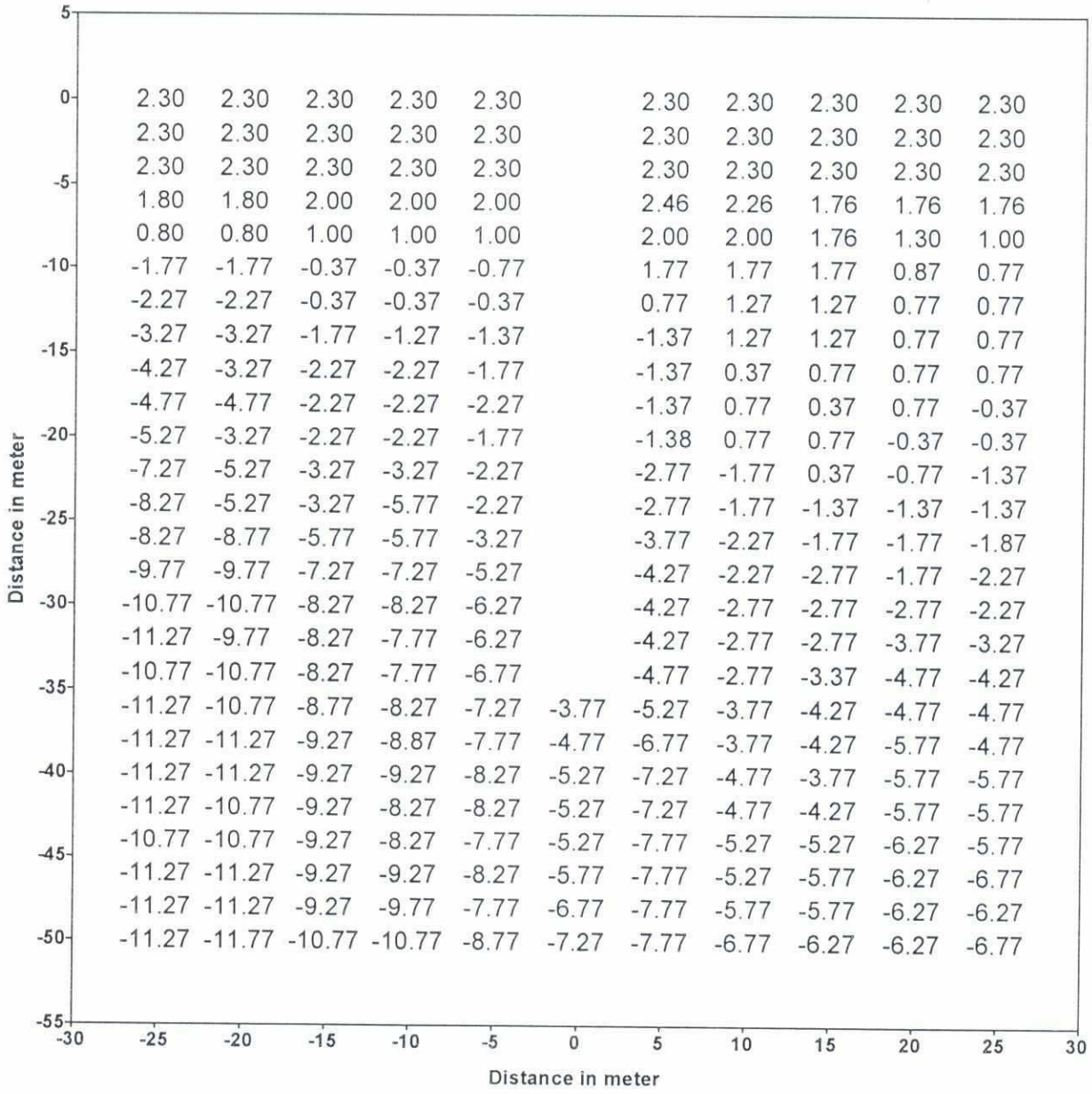


Khorki Bank Protection Pilot Scheme



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2.30	2.30	2.30	2.30	2.30		2.30	2.30	2.30	2.30	2.30
2.30	2.30	2.30	2.30	2.30		2.30	2.30	2.30	2.30	2.30
1.80	1.80	2.00	2.00	2.00		2.46	2.26	1.76	1.76	1.76
0.80	0.80	1.00	1.00	1.00		2.00	2.00	1.76	1.30	1.00
-1.77	-1.77	-0.37	-0.37	-0.77		1.77	1.77	1.77	0.87	0.77
-2.27	-2.27	-0.37	-0.37	-0.37		0.77	1.27	1.27	0.77	0.77
-3.27	-3.27	-1.77	-1.27	-1.37		-1.37	1.27	1.27	0.77	0.77
-4.27	-3.27	-2.27	-2.27	-1.77		-1.37	0.37	0.77	0.77	0.77
-4.77	-4.77	-2.27	-2.27	-2.27		-1.37	0.77	0.37	0.77	-0.37
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-11.27	-10.77	-8.77	-8.27	-7.27	-3.77	-5.27	-3.77	-4.27	-4.77	-4.77
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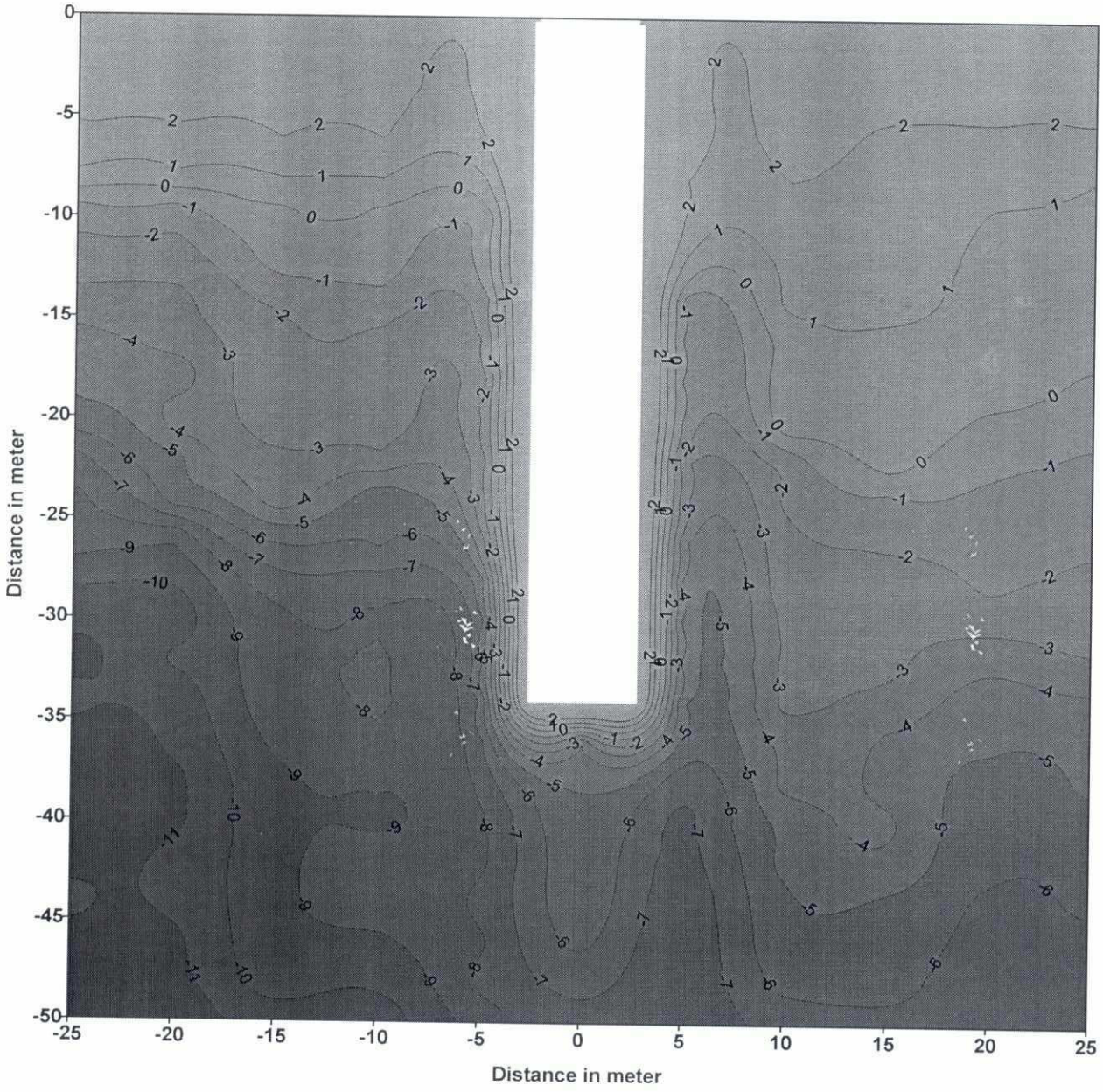
-11.27	-10.77	-9.27	-8.27	-8.27	-5.27	-7.27	-4.77	-4.27	-5.77	-5.77
-10.77	-10.77	-9.27	-8.27	-7.77	-5.27	-7.77	-5.27	-5.27	-6.27	-5.77
-11.27	-11.27	-9.27	-9.27	-8.27	-5.77	-7.77	-5.27	-5.77	-6.27	-6.77
-11.27	-11.27	-9.27	-9.77	-7.77	-6.77	-7.77	-5.77	-5.77	-6.27	-6.27
-11.27	-11.77	-10.77	-10.77	-8.77	-7.27	-7.77	-6.77	-6.27	-6.27	-6.77

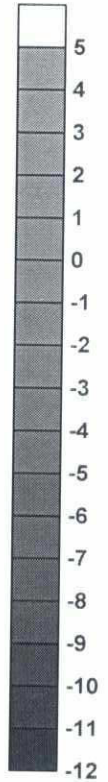
Bed levels around SPUR-3
Levels are in Meter, PWD
Date of survey : 29 Sep 98

Khorki Bank Protection Pilot Scheme



Bed levels around SPUR-3
Levels are in Meter PWD
Date of survey : 29 Sep 98

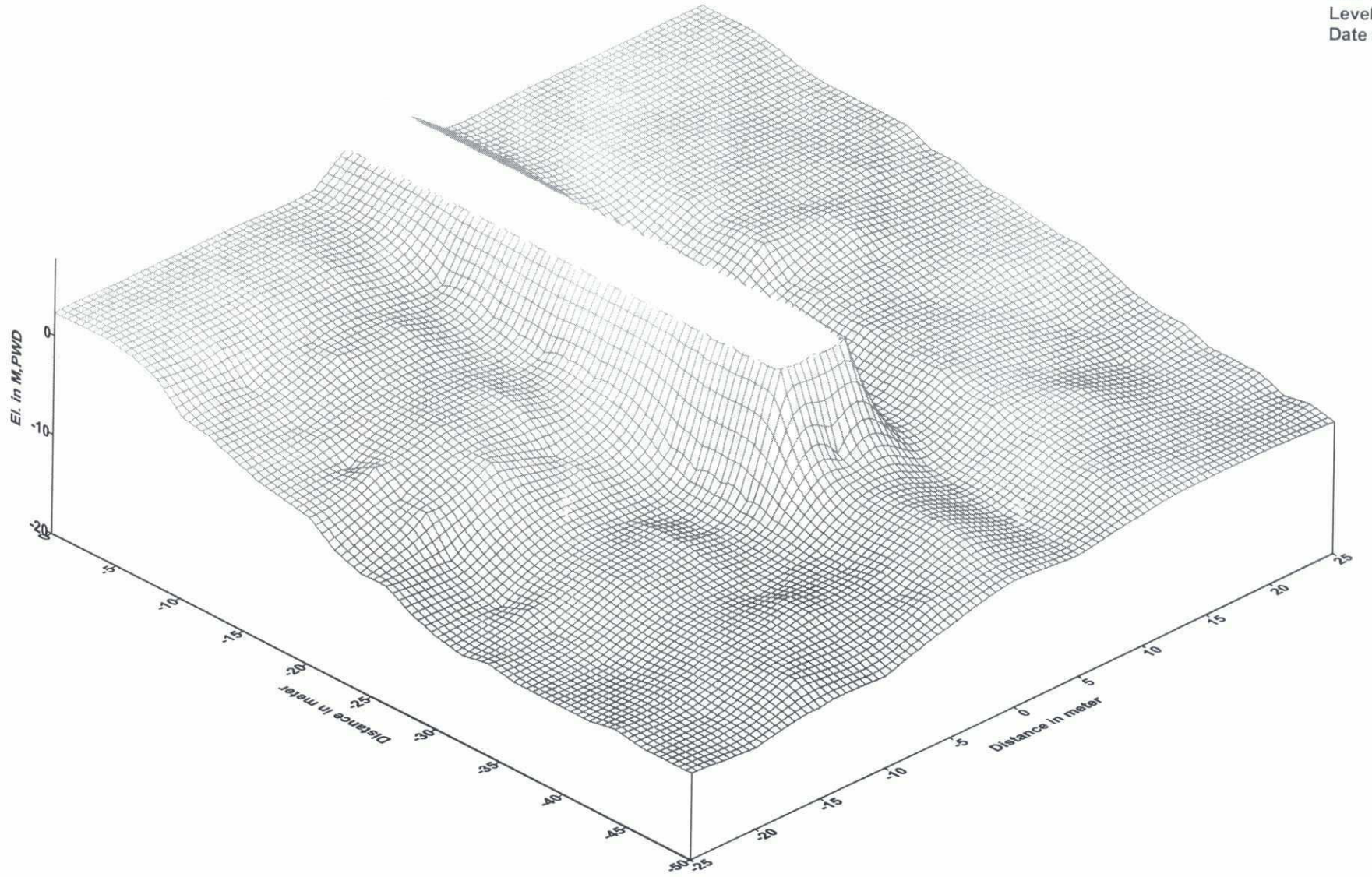
Color scale :



42

Khorki Bank Protection Pilot Scheme

Bed levels around SPUR-3
Levels are in Meter PWD
Date of survey : 29 Sep 98



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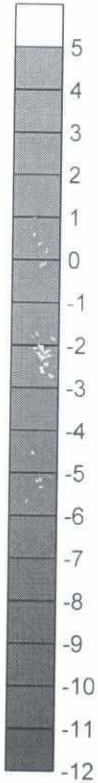
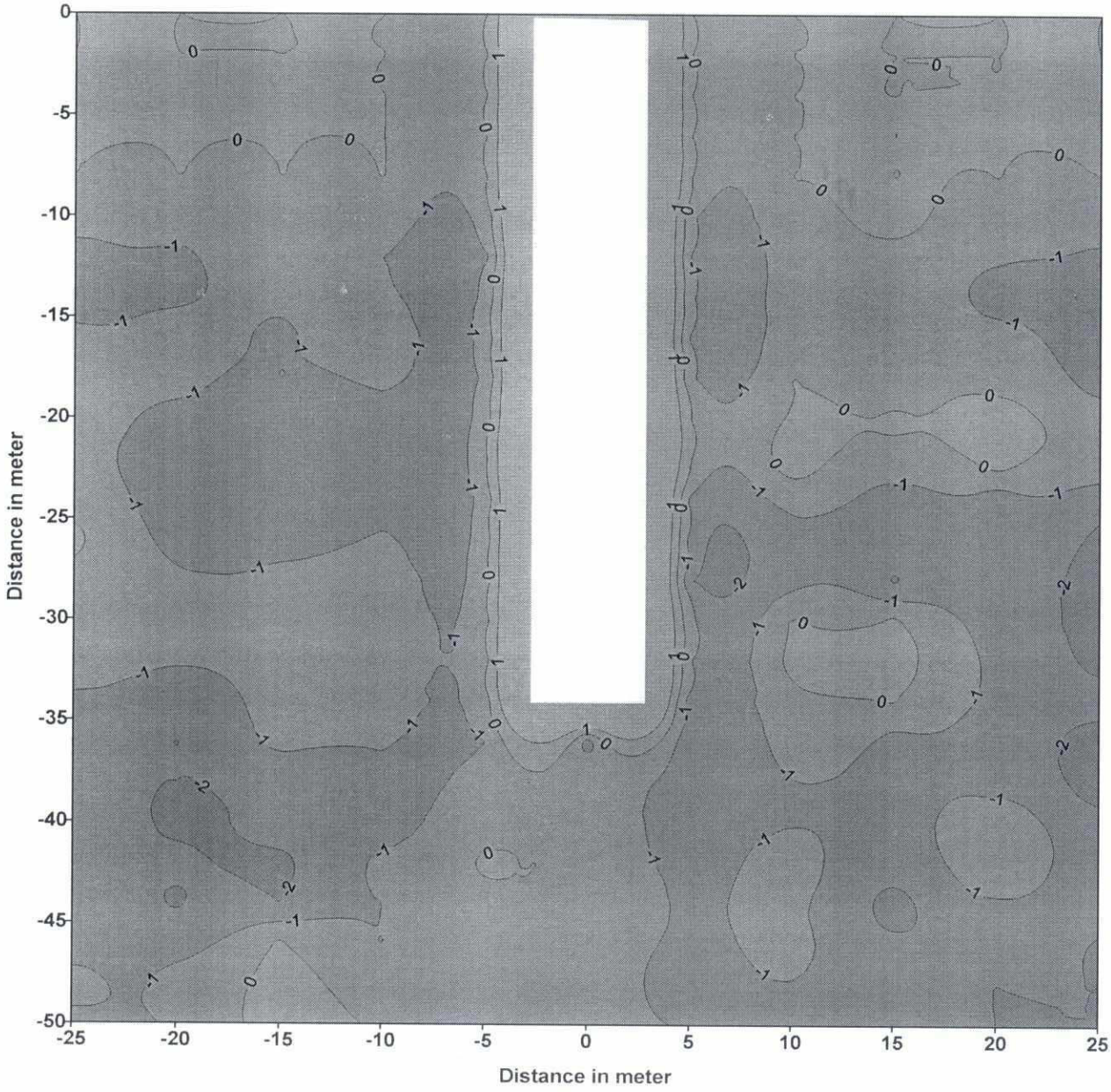


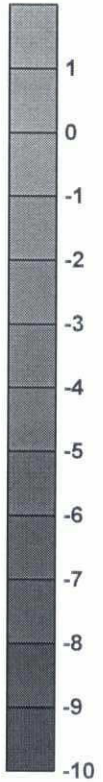
Khorki Bank Protection Pilot Scheme



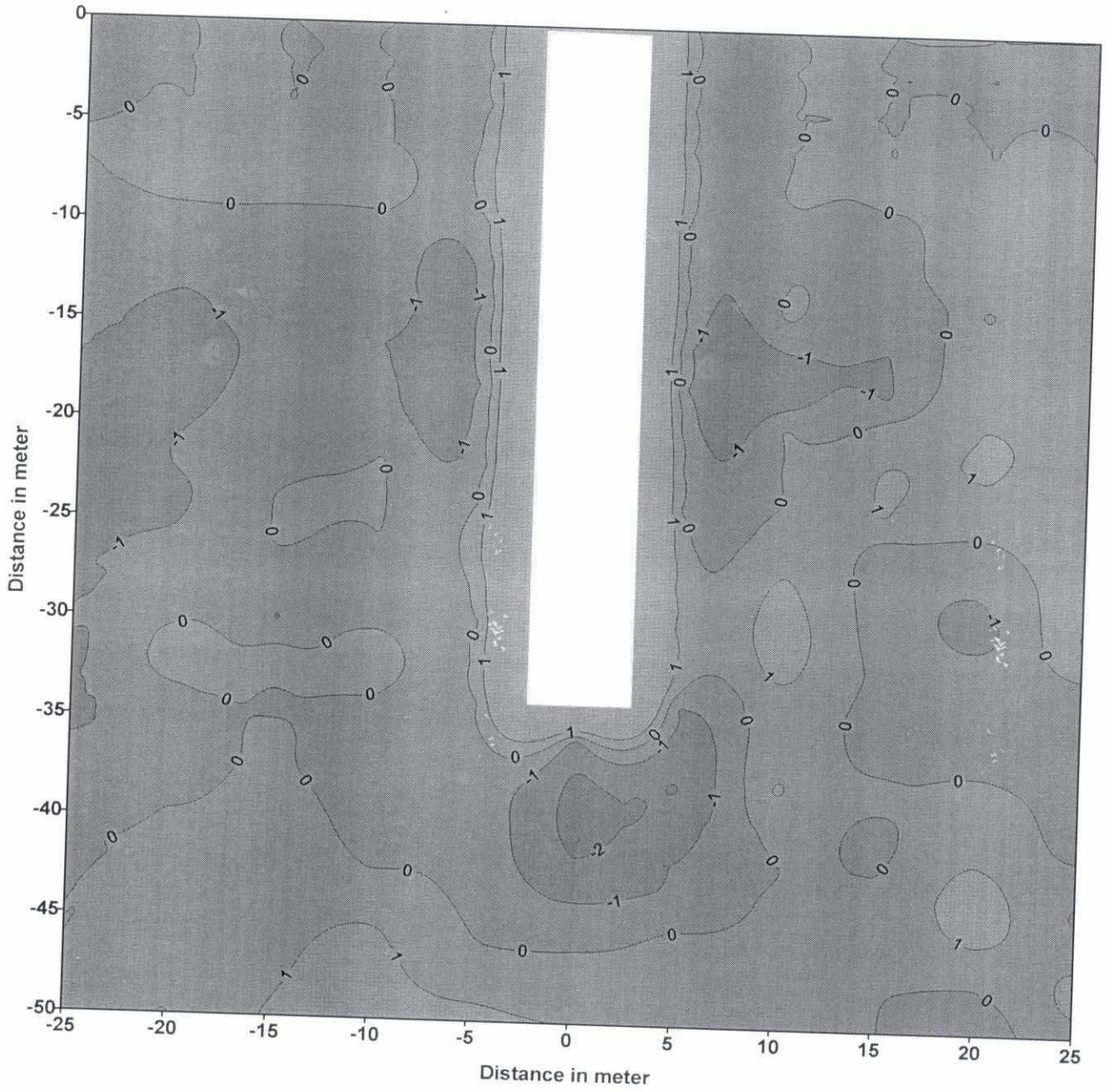
Changes in bed levels
around SPUR-1 in meter

Period : 11 Jun 98 - 28 Sep 98

Color scale :



Khorki Bank Protection Pilot Scheme

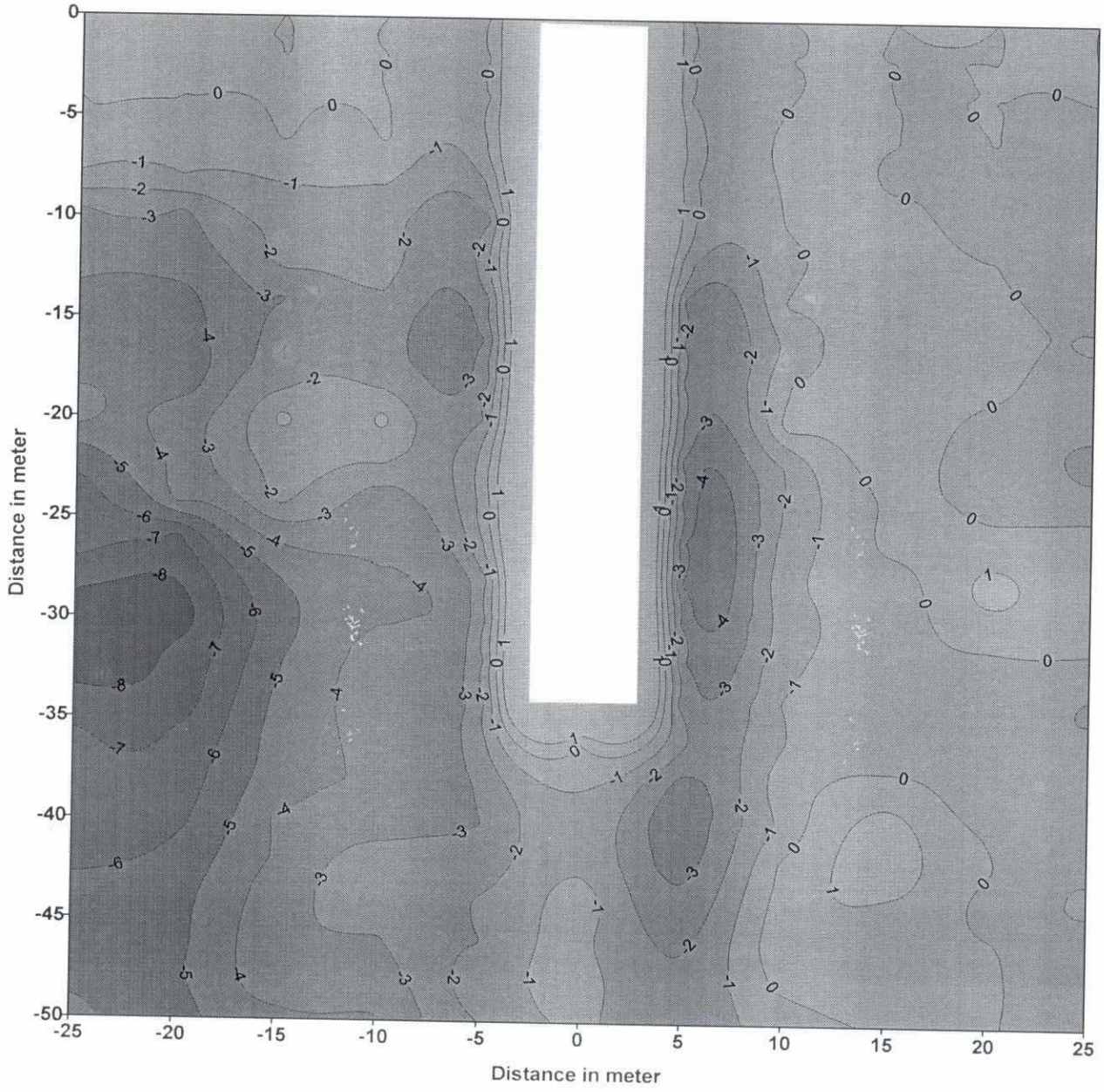


Changes in bed levels
around SPUR-2 in meter

Period : 12 Jun 98 - 27 Sep 98

Color scale :

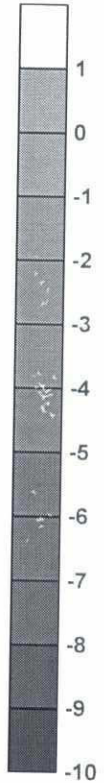
Khorki Bank Protection Pilot Scheme



Changes in bed levels
around SPUR-3 in meter

Period : 13 Jun 98 - 29 Sep 98

Color scale :

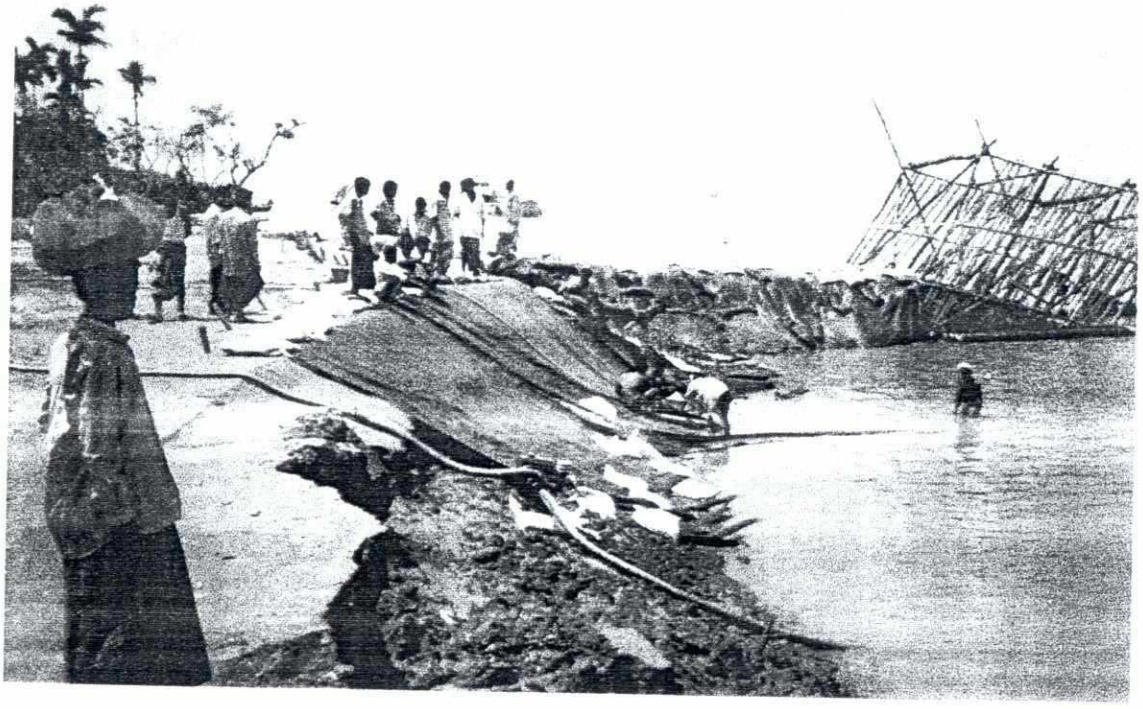


PICTURES

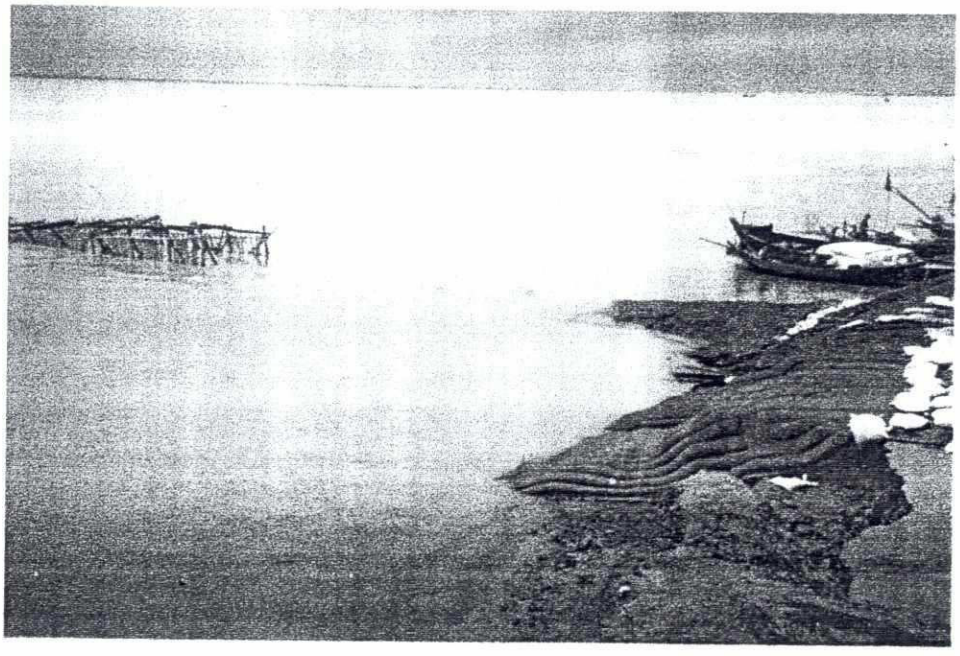
LIST OF PICTURES

Picture 1 Erosion pattern before execution of the work at Haimchar

Picture 2 Downstream spur and connecting dyke with Profix system



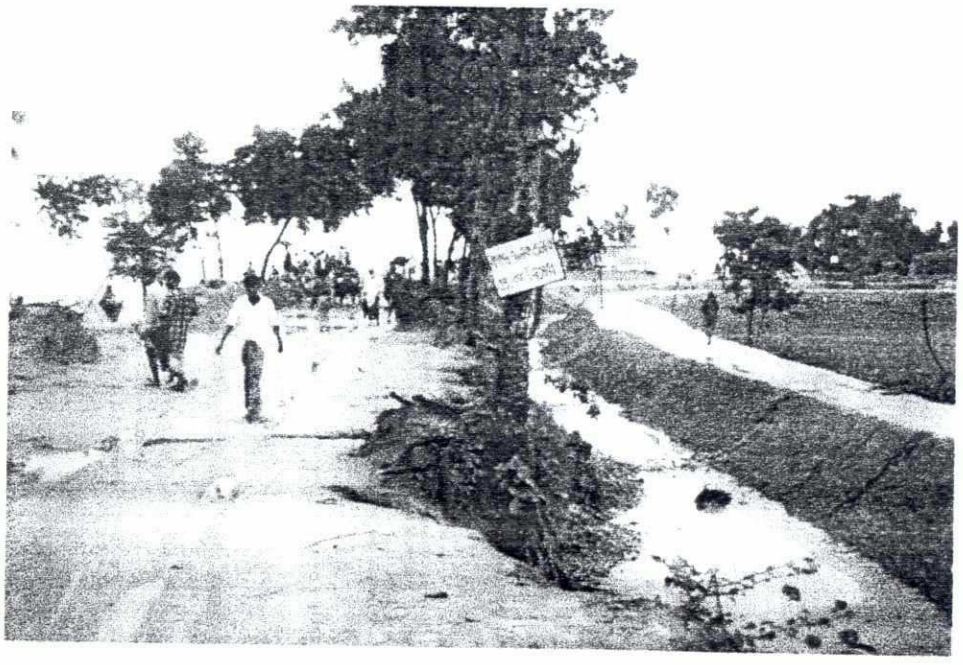
Picture 3 Upstream spur and connecting dyke with Profix system during flood



Picture 4 Block pitching performed by the Chadpur BWDB near the downstream spur

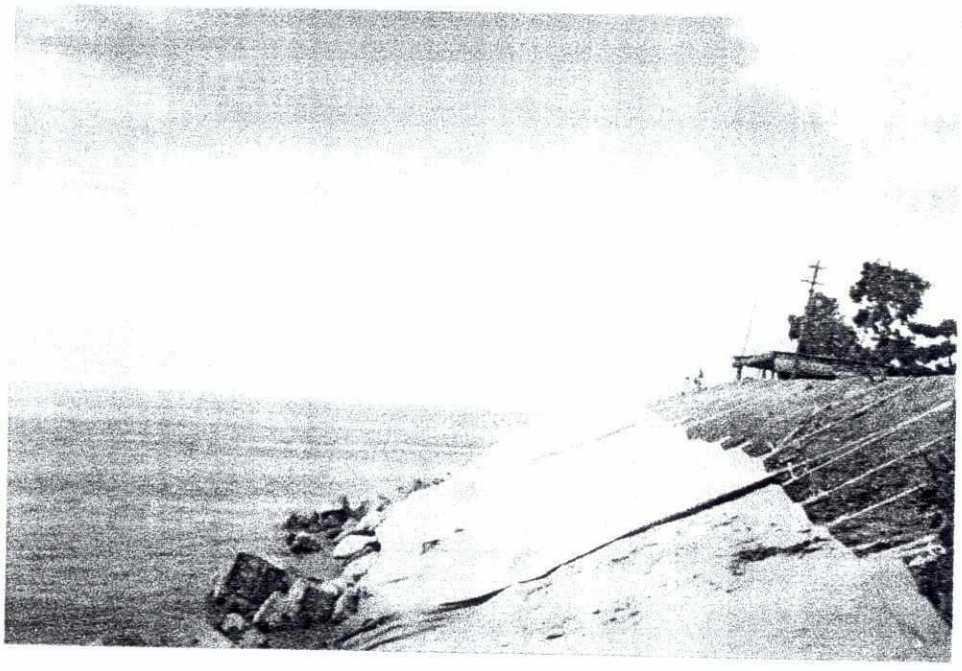
Picture 5 Block pitching performed by the Chadpur BWDB near the upstream spur

Picture 6 An alternative embankment was constructed next to the existing one.



Picture 7 Blocks are sliding down near the upstream spur which has dissapeared

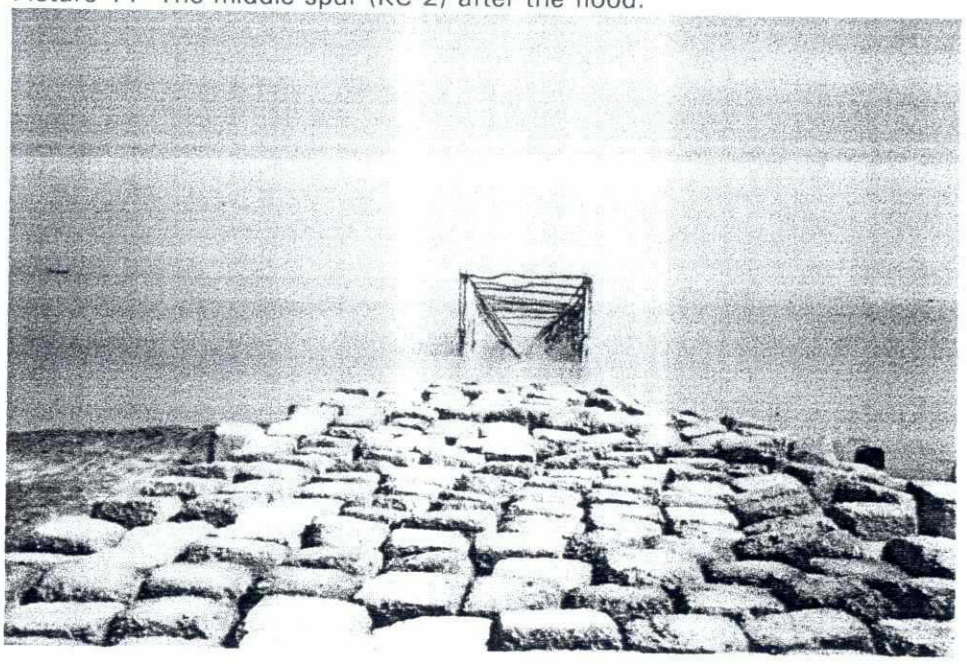
Picture 8 During the flood block pitching slided off threatening the embankment which was covered by non-woven material, dumped blocks and synthetic bags filled with brick bats



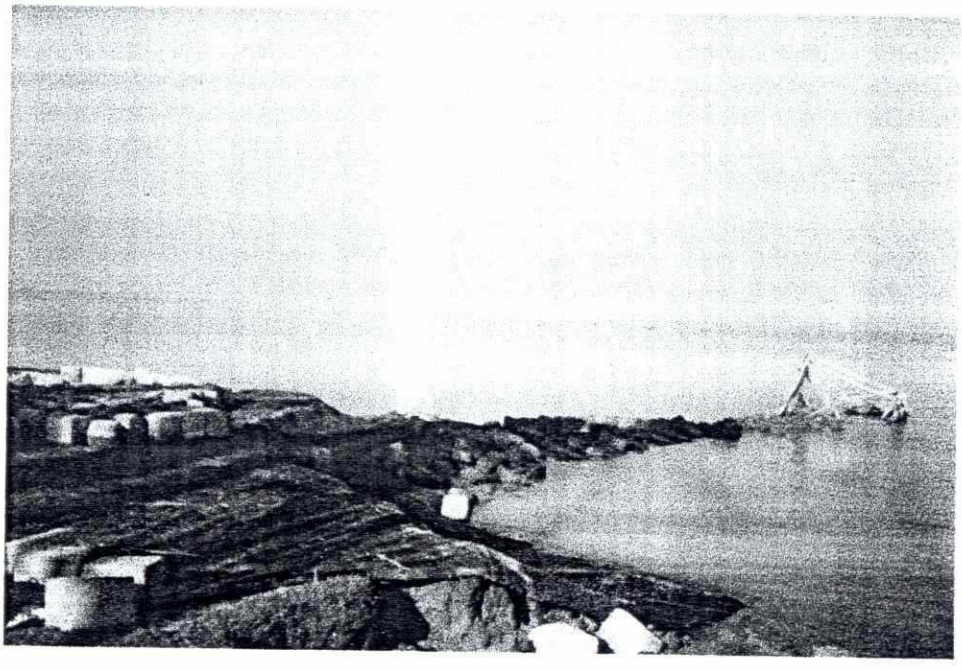
Picture 9 During the flood the downstream spur has disappeared at Haimchar.

Picture 10 The downstream spur (KC-3) after construction.

Picture 11 The middle spur (KC-2) after the flood.



Picture 12 After being hit by a river vessel the downstream spur has tilted.

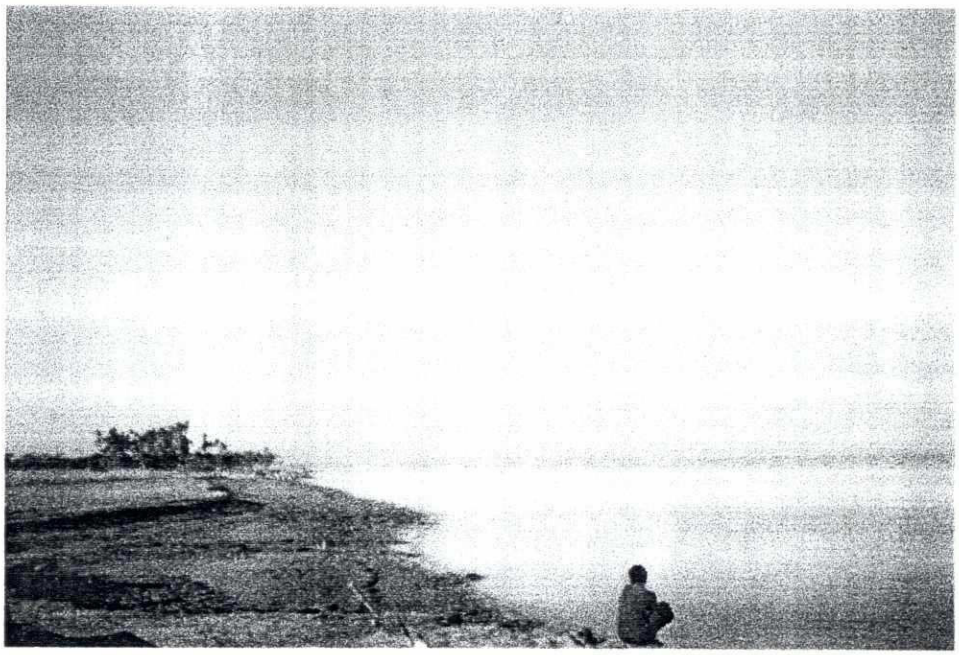


Picture 13 During the flood erosion attacked the downstream side of KC-3.

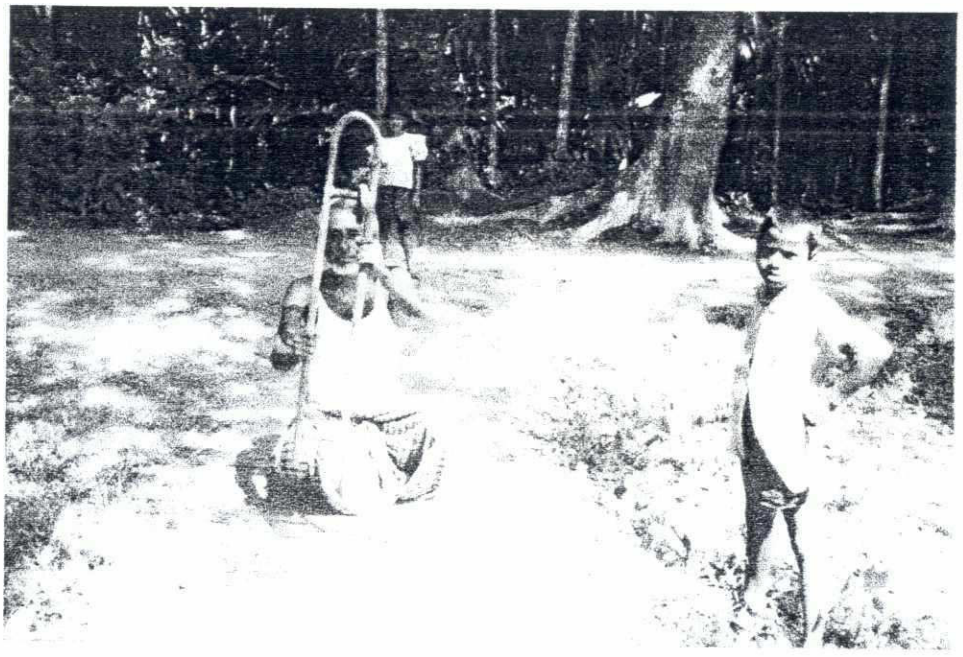
Picture 14 The unharmed shoreline upstream of the upstream spur (KC-1).

Picture 15 Siltation pattern at the upstream side of the middle spur (KC-2)

Picture 16 Shoreline regression decreased and siltation is visible at the upstream side of the downstream spur (KC-3).



Picture 17 A lifting hook has broken off the foundation of a bottom vane screen.



Picture 18 The PVC float pipes of this bottom vane screen, which is disconnected from the anchor slab, are squeezed due to a hit of a river vessel. The edges of the geotextile shifted away from the edges of the floats.