Technical Report

Project K-1240

"Post-containment Management and Monitoring of Mercury Pollution in Site of Former PO "Khimprom" and Assessment of Environmental Risk Posed by Contamination of Groundwater and Adjacent Water Bodies of the Northern Industrial Area of Pavlodar"

For the 2nd (January-February-March, 2006)

(Tasks 1-4)

Leading institute:

Non-profit JSC "Almaty Institute of Power Engineering and Telecommunication", BG Chair of Environmental Technology

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Almaty 2006

3. Brief description of the performed work:

The objectives of the work for the reported period are: (i) sending in the orders for expensive equipment and software to ISTC Procurement Department , (ii) producing the local model for the area of groundwater mercury contamination with help of GMS software simulation system, (iii) creating elements of Geographic Information System (GIS) of the Northern industrial area of Pavlodar City relating to the wastewater storage – Lake Balkyldak with help of the software ArcGIS, module Spatial Analyst and (iv) conducting winter field works on wastewater storage Balkyldak.

I. The Sanitation Laboratory of JSC "Pavlodar Chemical Plant" has stopped its activity due to bankruptcy of JSC "Pavlodar Chemical Plant" and dismissal of its staff. Major staff of JSC PCP (including Artur Akhmetov, submanager of PCP team in ISTC project K-1240) transferred to JSC "Kaustic" which is located at the territory of the firmer PO "Khimprom", Pavlodar. However the staff of the Sanitation Laboratory has happened to be distributed among some other enterprises of Pavlodar. Thus AIPET and BMP will have to fulfill most of sampling and chemical analyses planed for PCP until a new partner which will replace PCP becomes officially a participant institute. That is why all materials and equipment scheduled for purchasing for PCP in 2006 was decided to buy for AIPET in order to use it in Pavlodar by all interested participant institutes. Expensive equipment, such as Gas Chromatograph ***Perkin Elmer*** for oil products determination in groundwater, Atomic Fluorescent Spectrophotometer ***Millennium Merlin*** for mercury determination, a system for production of ultra-clean water and two personal computers (PC) were ordered for AIPET through ISTC Procurement Department. Component parts and consumables for scientific equipment have been ordered for BMP, Stepnogorsk. The software ModFlow GMS 5.0 for hydrological modeling has been ordered for IHH. Unfortunately we were not manage to acquire this software with 50% discount as it was scheduled in the Work Plan, that is why IHH had to reduce their budget on a number of other items.

II. Boundaries of the local model for the area of groundwater mercury contamination have been chosen by IHH. Simulated area is of rectangular shape with size of 4.4 x 4.1 km. Western boundary of the model is 1.7 km apart from the first industrial area of the former "Khimprom", northern boundary – 2.4 km, southern boundary – 0.9 km and eastern boundary coincides with the border of the first industrial area.

According to collected data 20 detailed sub-latitude and sub-longitude hydrogeological cross sections have been made.

Preliminary schematization of hydrological conditions has been fulfilled. In the cross section the simulated area is represented by 16 layers. Outer boundaries of the local model are schematized with type 1 boundary conditions (specified Head). Groundwater heads varying with time on outer boundaries of the local model is supposed to read from the regional model of the Northern industrial area of Pavlodar which was produced before. In future the number of layers and their boundaries can be made more exact.

The created cross sections have been digitized and introduced into GIS, produced by means of MapInfo. The results of schematization have also been introduced into GIS. Hydrodynamic scheme has also produced by means of MapInfo.

The results of schematization of hydro-geological conditions have been transformed into formats of scatter point sets which are used in the simulating system GMS.

III-IV. AIPET has supplemented GIS of Northern industrial area of Pavlodar produced before with new data and made it more detailed (boundaries of vegetation and bottom relief have been introduced, nowaday shore line has been made more exact) in area of the wastewater storage – Lake Balkyldak using satellite images, archive materials and our own measurements made by a hand-held GPS. Plan of bottom sediment sampling was prepared on a regular grid for 200 (fig.1), 150, 100 and 50 (fig.2) sampling points which could be corrected at the site depending on complexity and time of field work carrying-out.

In March 2006 AIPET and PSU conducted field works when winter air temperatures had gone up to – 10^{o}C. These works was interrupted at the end of March after the ice surface had started cracking intensively when the temperature had elevated 0^{o}C (fig. 3). In winter of 2005/2006 the ice thickness on the storage pond Balkyldak reached 0.6 – 0.9 m. It allowed using cars with cross-country capacity to move across the surface (the area of about 23 km^{2}) of the lake. However snowdrifts made the field works very difficult in places of reeds (fig.4). During a month of field works they managed to realize with little excess the regular sampling plan for 50 sampling points (excluding sampling points where it was impossible to take bottom sediments because of ice reaching the bottom; the samples will be taken in summer time). In total 107 bottom sediment samples have been taken from 52 sampling points through holes drilled in ice (fig. 5-6) with help of samplers of two kinds: soft sediments were taken layerwise at 50 cm intervals (fig. 7), clay samples were taken from surface bottom layer to the depth of 25 cm (fig. 8). Using the samplers it was possible to take ground at pond's depths down to 12 m (bathymetric and soft sediment capacity measurements were being done simultaneously with sampling). Coordinates of sampling points were determined

with help of hand-held GPS with maximum error of 7 m. The samples were taken into throwaway linen bags which in turn were packed together with an identification tags into new double plastic bags. After each sampling the equipment was cleaned thoroughly from remaining snow or water from the storage pond (Quality control of the clean-up was not conducted). The samples were delivered to Almaty at the beginning of April and dried to air-dry state at room temperature in aerated, warm and clean room (plastic bags were opened, but linen bags remained closed). Then dry bottom sediments have been kept in the same packing where they were put in at sampling and were being dried.

The register of the taken samples with indicating sediment thickness, depths and coordinates in the sampling points have been compiled. Bathymetric data on the storage pond in the sampling points were used to make the archival map of depths in the storage pond - Lake Balkyldak more exact. The computer map of depths and thicknesses of bottom sediment of the storage pond has been produced within GIS of Lake Balkyldak using software ArcGIS, module Spatial Analyst (fig. 9). At the figure 9 one can see that the biggest thicknesses of the bottom sediments in the storage pond Balkyldak (up to 1.6 m in the points 1 and 2) correspond to maximum depths (down to 9.5m) and falls on areas of water of former natural salty lakes Balkyldak and Sheptykol primarily existed before creating the wastewater storage pond Balkyldak. Maximal accumulation of the sediments in the point 1 also results from the fact that most industrial wastewater from drain system go exactly into this part of the storage pond. Poor accumulation of the sediments in the point 3 is confined within the bottom depression among reeds which mitigate wave activity. Produced computer maps will be made more exact after bottom sediments sampling from planed 150 sampling points in summer 2006 and early spring of 2007.

4. Executed stages:

Task 1, stage 1 - partly,
task 2, stage 3 - partly,
task 3, stage 1 - partly,
task 4, stage 1 – completely, stage 2 - partly.

5. Important business trip:

Three business trips from Almaty to Pavlodar funded from AIPET budget in ISTC project K-1240; field works on wastewater storage pond – Lake Balkyldak partly from the budget of AIPET in ISTC project K-1240 and partly from the general budget of PSU since financing of PSU on ISTC project K-1240 has not been opened yet.

6. Main acquired equipment:
No equipment has been acquired in this period.

8. Current state of affairs:
The work on the project does with delay due to big changes in personnel, late signing the contract and interruption in opening financing on ISTC project K1240.

During winter field work PSU team took minimum part in the bottom sediment sampling and did not managed to arrange winter fishing. Practically the total volume of winter field work has been implemented by AIPET team.

9. Delays, problems, suggestions:
Due to JSC "PCP" bankruptcy and dismissal of its staff it is suggested replacing this partner by JSC "Kaustic" (Kaustic). JSC "Kaustic" requests to consider it as a successor in title of JSC "PCP" because its production basis is located on the territory of former PO "Khimprom", Pavlodar, most staff of JSC "PCP" has transferred to JSC "Kaustic" and JSC "Kaustic" is purchasing general technological facilities and premises of JSC "PCP". However replacing one participant by another one is a long process and it can result in cessation of the project K-1240. In order to avoid such interruption and keep up in general the schedule of seasonal field works we suggest: (a) to buy for AIPET scientific equipment which first was intended for PCP so that in future AIPET could use these equipment in Pavlodar, in a laboratory of Kaustic; (b) to conduct (with adequate increase of funding for these participants on the given stage) most field and chemico-analytical works of summer field season, 2006 by teams of AIPET (mercury monitoring) and BMP (oil products monitoring); (c) at introducing JSC "Kaustic" to the list of Participant Institutes and concluding the sub contract with it to enlist the support of its administration in carrying out the work program on ISTC project K-1240 before signing all necessary documents and beginning of their activity funding.

Manager of K-1240 project M. Ilyushchenko

ANNEX

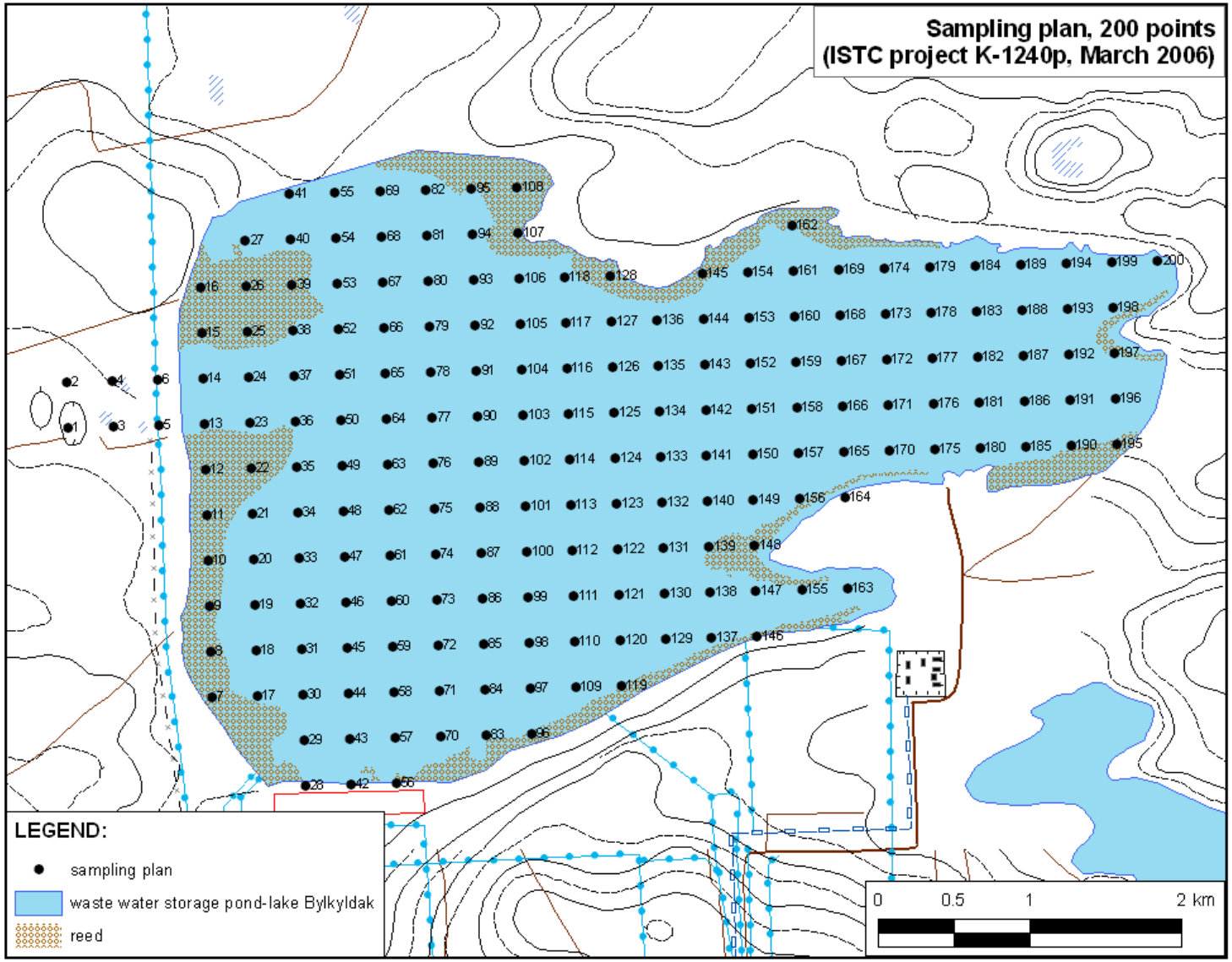
Sampling plan, 200 points
(ISTC project K-1240p, March 2006)
LEGEND:
sampling plan
waste water storage pond-lake Bylkyldak
reed
0
0.5
1
2 km

Fig.1

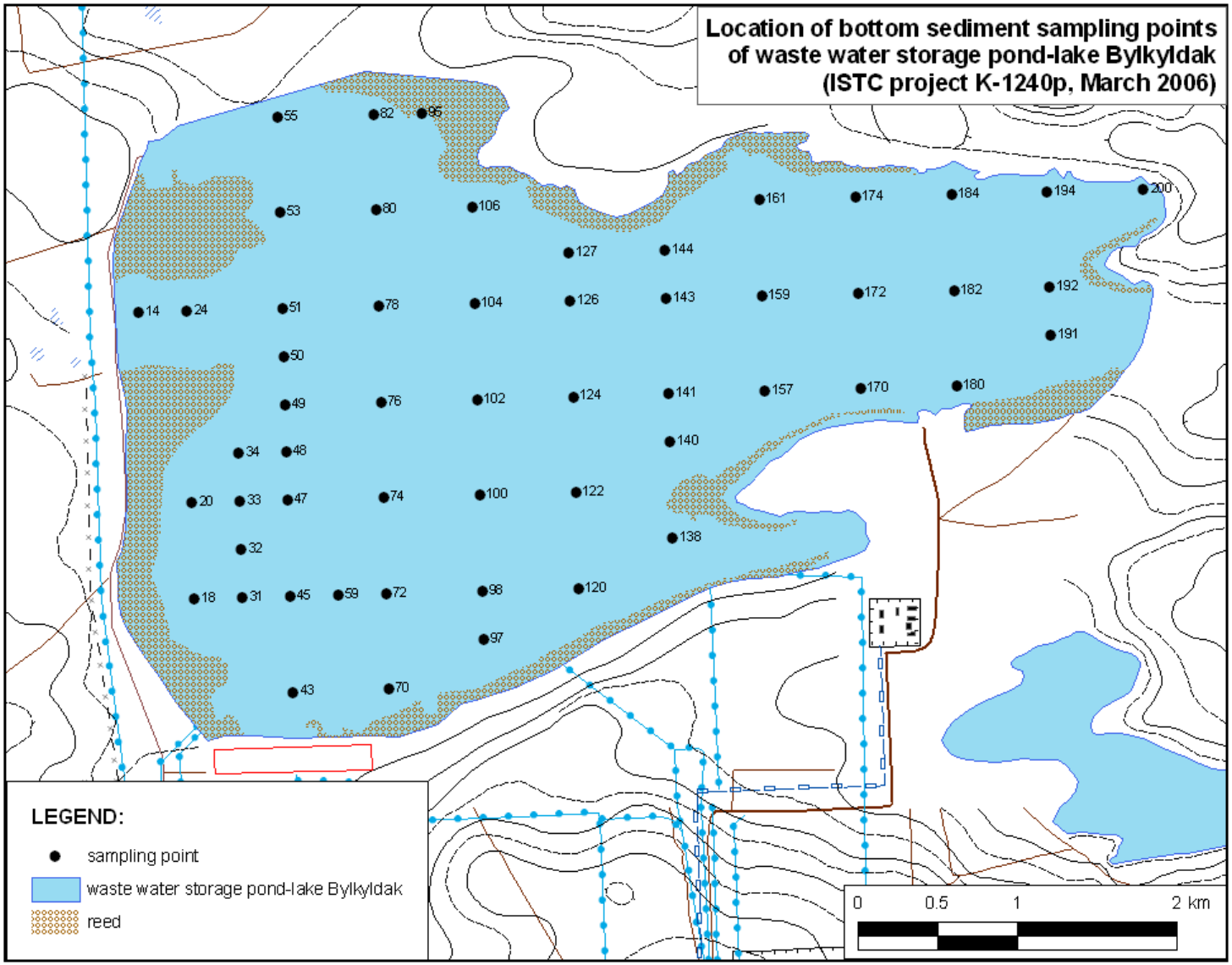
Location of bottom sediment sampling points
of waste water storage pond-lake Bylkyldak
(ISTC project K-1240p, March 2006)
55
82
85
53
80
106
161
174
184
194
200
127
144
14
24
51
78
104
126
143
159
172
182
192
191
50
49
76
102
124
141
157
170
180
34
48
140
20
33
47
74
100
122
32
138
18
31
45
59
72
98
120
97
43
70
LEGEND:
sampling point
waste water storage pond-lake Bylkyldak
reed
0
0.5
1
2 km

Fig.2

Fig.3. Cracks formation on ice surface of wastewater storage pond Balkyldak in March, 2006

Fig.4. Snowdrifts in the place of reeds. Wastewater storage pond Balkyldak, March, 2006.

Fig.5. Hole drilling in ice surface in a point of bottom sediment sampling. Wastewater storage pond Balkyldak, March, 2006.

Fig.6. Bottom sediment sampling from the depth of 9 m. Wastewater storage pond Balkyldak, March, 2006.

Fig.7. Sampler for level-to-level sampling of soft sediment cores. Wastewater storage pond Balkyldak, March, 2006.

Fig.8. Sampler for consolidated clay sediment sampling. Wastewater storage pond Balkyldak, March, 2006.

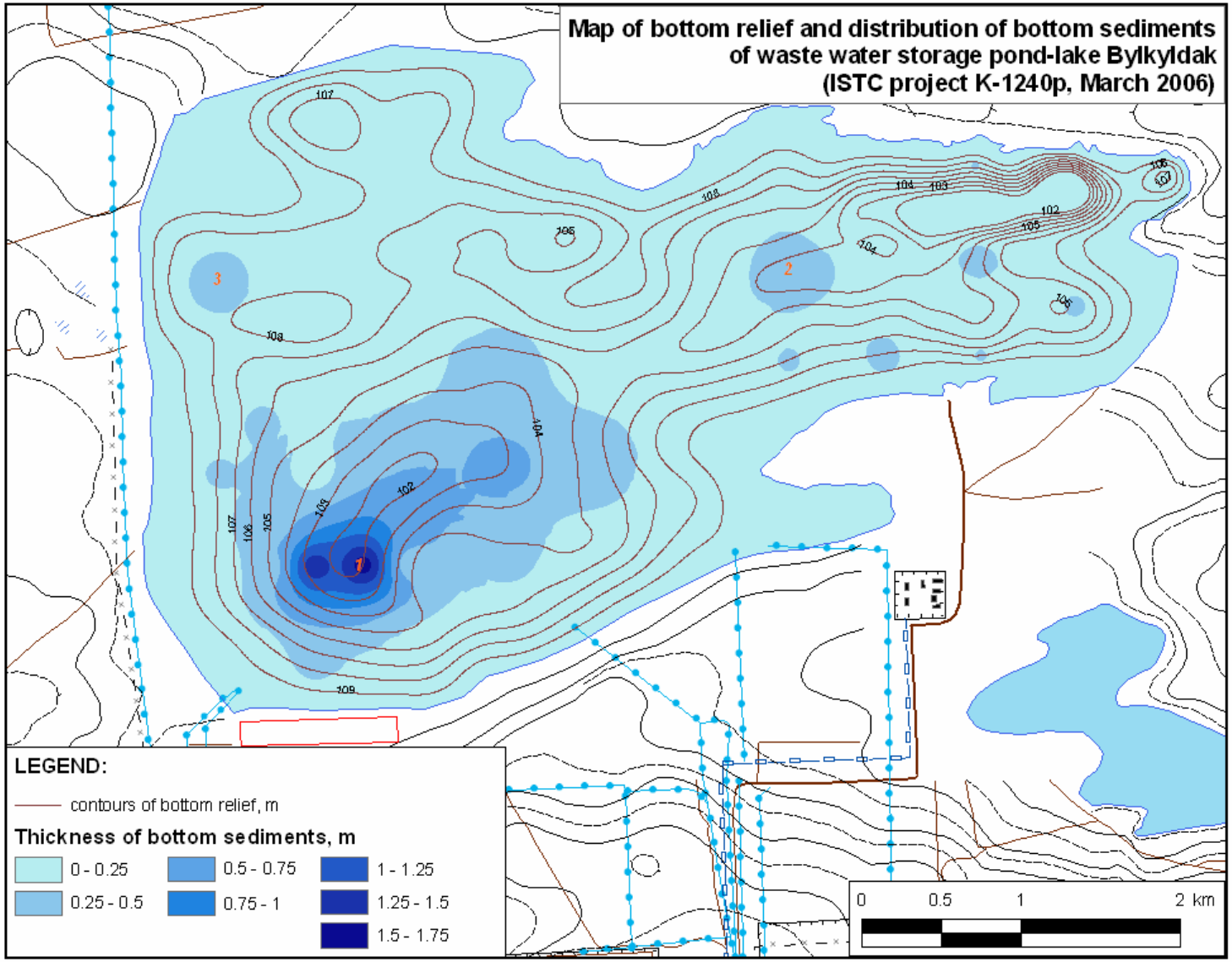
Map of bottom relief and distribution of bottom sediments
of waste water storage pond-lake Bylkyldak
(ISTC project K-1240p, March 2006)
LEGEND:
contours of bottom relief, m
Thickness of bottom sediments, m
0 - 0.25
0.25 - 0.5
0.5 - 0.75
0.75 - 1
1 - 1.25
1.25 - 1.5
1.5 - 1.75
0
0.5
1
2 km

Fig.9