COMMENTS OF SLOVAKIA ON HUNGARY'S ANSWER TO THE QUESTION OF JUDGE RANJEVA, POSED ON 7 MARCH 1997

Slovakia wishes to make a few, brief comments on Hungary's Answer to the following Question of Judge Ranjeva:

„Can Hungary draw up a table calling to mind:

(1) the financial commitments announced by the Union of Soviet Socialist Republics;

(2) the fulfilment of those commitments by the USSR; and

(3) the impact of that fulfilment on performance of the Gabčíkovo-Nagymaros Project?"

First, Hungary refers to „the USSR's loan" (at para. 7 of its Answer). This is misleading. There was no loan, but merely an agreement to supply goods (turbine-generator units) and technical services, the USSR's costs being met „on the basis of the Agreement on settling multilateral accounts by transferable roubles" (HM, Vol. 3, Annex 23).

Second, it is noted that the relevant agreement between Hungary and the USSR was signed after the 1977 Treaty. A similar agreement was also signed between the USSR and Czechoslovakia for the supply of turbines at Gabčíkovo - after the 1977 Treaty (Agreement between the USSR and Czechoslovakia on Cooperation in relation to the Gabčíkovo Part of the G-N Project, 15 June 1978).

Third, as to the approximate value of the goods and services, Hungary suggests a figure of 150 million roubles. But at paragraph 3.33 of the Hungarian Memorial, the figure of 100 million roubles is mentioned in relation to a loan to Hungary and Czechoslovakia (it is unclear as to whether this sum would be shared or be to each party).

Fourth, it is claimed by Hungary that commitments were not fulfilled due to „financial constraints" (para. 6). No supporting reference is given and it is unclear which party (the USSR or Hungary) was suffering from „financial constraints". The impression is given, as in the Hungarian Memorial (para. 3.42), that the USSR was financially unable to meet its commitments. This appears unlikely, particularly as the USSR made no attempt to terminate the similar agreement, mentioned above, that existed between the USSR and Czechoslovakia. While the USSR/Czechoslovakia agreement was not implemented as intended, this was solely because Czechoslovakia wished to utilise its own turbines from the Skoda works.

Fifth, it follows that, as to the alleged „serious resource shortage" (Answer, para. 7), Czechoslovakia could also have supplied turbines to Hungary.

Sixth, it is unclear what impact the non-supply of USSR built turbines could have had. This equipment had no purpose prior to the construction of the Nagymaros barrage - which, of course, never happened.

Finally, it is clear from Hungary's Answer that it managed to finance the construction of Nagymaros in a satisfactory manner.

COMMENTS OF SLOVAKIA ON HUNGARY'S ANSWER TO THE QUESTION OF JUDGE VERESHCHETIN

The question that Judge Vereshchetin put to Hungary is as follows:

„This morning, the counsel for Hungary mentioned that in November 1989, Hungary had handed over to Czechoslovakia a preliminary draft treaty on the completion of the project without Nagymaros. My question is the following: In 1990-1992, the period proceeding the termination of the Treaty by Hungary, did Hungary formally reiterate this proposal or propose new concrete modifications to the 1977 Treaty and to the project itself which, if accepted by the other Party, would have met Hungary's environmental, political and economic concerns and permitted to preserve the integrated character of the project?"

1. There are two separate questions here: first, during 1990-1992, did Hungary ever reiterate the proposal contained in the draft amendment to the 1977 Treaty presented to Czechoslovakia with Hungary's Note Verbale of 30 November 1990 (HM, Vol. 4, Annex 30); second, apart form this proposal of 30 November, did Hungary during 1990-1992 propose any „new concrete modifications to the 1977 Treaty and to the project itself" which, had they been accepted by Czechoslovakia, „would have met Hungary's environmental, political and economic concerns and permitted to preserve the integrated character of the project"?

2. Hungary's answer to the first question is „no", and Slovakia agrees with that answer. But Hungary fails to answer the second question, whose answer is also „no" and it wrongly states that Czechoslovakia never made „an equivalent offer". Hungary's account of events covering the years 1990-1992 is misleading and inaccurate.

3. Hungary's proposal of 30 November 1989 to amend the 1977 Treaty must be viewed in the context of the negotiations that followed Hungary's unilateral suspensions of work at Nagymaros and at Gabčíkovo. At meetings on 24 May and again on 20 July 1989, the two Prime Mnisters had agreed to undertake joint studies into Hungary's environmental concerns so as to be able to discuss what action to take concerning Nagymaros before the end of October 1989. Although no such joint studies were begun[1], the negotiations between the Treaty parties in October 1989 took an encouraging turn, according to Hungary's own account (HM, para. 3.96). For at another meeting of Prime Ministers on 11 October, Hungary's Mr. Németh advanced the following proposal in the form of a „trade": Czechoslovakia would agree to the abandonment of the Nagymaros part of the Project; Hungary, in turn, would resume work at Gabčíkovo and prepare for the damming of the Danube in a year's time (one year behind the agreed schedule as a result of Hungary's suspension of work at Dunakiliti on 20 July) based on mutually agreed environmental and water quality guarantees concerning the operation of Gabčíkovo. (See, SR, paras. 7.26-7.40, concerning the events covered by this para. and by paras. 4-6, below.)

[1] In July 1989, Hungary commissioned the Bechtel study, whose report was issued in February 1990. Hungary did not await the results of this study before abandoning Nagymaros (on 27 October), and Czechoslovakia was unaware of the study at the time. See, e.g., SR, paras. 8.26 and 11.22-11.24.

4. The Czechoslovak Prime Minister gave his Government's response to Hungary's 11 October proposal at a meeting with Mr. Németh on 26 October. He virtually accepted Hungary's proposal as to Gabčíkovo, proposing only to advance somewhat the date for resumption of work. As to Nagymaros, he tabled a counter-proposal, aimed directly at meeting Hungary's environmental concerns:

- To allow time for the agreed joint studies, he proposed that the 15-month speed-up of work under the February 1989 Protocol be cancelled as to Nagymaros, allowing a great deal of time for study before resuming construction there, in addition to the fact that Nagymaros would not go into operation under the revised schedule for another four or five years.

- To further ease Hungary's concerns over the effects of peak mode operation, he pledged that Czechoslovakia would even abandon peak power if the joint studies so indicated.

5. Four days later, by Note Verbale of 30 October, Czechoslovakia confirmed its Prime Ministers proposals. At the same time, in the light of the fact that its proposals would allow plenty of time for further study before any environmental threat could possibly arise, Czechoslovakia made it clear that it saw no justification at the time for the amendment of the 1977 Treaty in order to abandon Nagymaros.

6. On 27 October, the day following the critical meeting of Prime Ministers, Hungary officially abandoned Nagymaros by Government Resolution giving instructions that the related private law contracts be terminated (HM, Vol. 4, Annex 150). In so acting, Hungary carried out, to the letter, the recommendations made the month before by the Hardi committee (see, SC-M, paras. 5.29 and 7.10; see, also, SR, para. 7.29). However, the Resolution reaffirmed Hungary's proposal to proceed with Gabčíkovo subject to a guarantees agreement (see, SR, paras. 8.16-8.18). Thus, the 30 November amendment proposal was advanced by Hungary one month after it had definitively abandoned the Nagymaros section of the Project. There was no longer any chance to „preserve the integrated character of the project". What Hungary sought by its amendment proposal was for Czechoslovakia to accept this fait accompli and to absolve it of any wrong doing. But, of course, Czechoslovakia had already pointed out a month before that there was no justification for such an amendment since there was plenty of time to examine thoroughly the possible adverse effects of the Nagymaros dam and of peak mode operation on the environment and on water quality, which Hungary claimed to fear.

7. What had changed by then was that Hungary had unilaterally acted to abandon Nagymaros; it was no longer a negotiable topic. In addition, in its 30 November proposal, Hungary expressly linked the October proposal made by Hungary to proceed with Gabčíkovo (subject to a guarantees agreement) to Czechoslovakia's acceptance of a Treaty amendment eliminating the Nagymaros section and peak mode operation - and with it any legal responsibility of Hungary for its unilateral abandonment - even before joint studies had begun (see, SR, paras. 8.19-8.21).

8. As Hungary's Answer points out, the Treaty amendment proposal of 30 November was made at a time when Czechoslovakia was in the throes of the Velvet Revolution: a new Government was installed in Prague on 10 December, and a President was elected on 29 December 1989. In contrast - and contrary to the misleading impression given by paragraph 6 of Hungary's Answer - the change of Government in Hungary occurred later, in May 1990,

when the Németh Government was replaced by a multi-party Government. Thus, it was the same Németh Government that had participated in all of Hungary's actions during 1989 and in the negotiations between May and November 1989 which, by letter dated 10 January 1990 to Czechoslovakia's new Prime Minister, took the next decisive step (HR, Vol. 4, Annex 32). Hungary's summary of this letter is incomplete and misleading.

9. Mr. Németh's 10 January letter notified Czechoslovakia of three things:

- First, that Hungary had definitively abandoned Nagymaros and had taken measures to terminate the related private law contracts. As a result, neither proceeding with the construction of Nagymaros nor peak mode operation (which depended on Nagymaros) were any longer matters for negotiation. This merely confirmed what the Hungarian Government had already decided in its Resolution of 27 October 1989.
- Second, that Hungary had withdrawn its proposal of October 1989, repeated (albeit in modified form) in its 30 November draft Treaty amendment, to proceed with Gabčíkovo subject to a guarantees agreement. Instead, Hungary proposed a reassessment of whether the Project should proceed at all following a joint scientific study.
- Third, that these studies should be scheduled for completion by the second half of 1990 so as to allow the new Governments of the Treaty parties to make the final decisions concerning the Project and any necessary Treaty amendments or even an entirely new treaty. Of course, since Hungary had already abandoned Nagymaros, the only decisions that remained concerned Gabčíkovo. Therefore, the assertion in Hungary's Answer (para. 2) that Mr. Németh proposed in his 10 January letter that joint investigations „should be extended to the Original Project as a whole" is incorrect. The issue of Nagymaros was a closed book by that time.

10. For the same reason, paragraph 3 of Hungary's Answer is misleading. After 30 November, Hungary never deviated from its insistence that the Treaty be amended to eliminate Nagymaros from the Project. That decision was taken without any attempt to proceed with joint studies of supposed environmental risks. Czechoslovakia's 26-30 October proposal as to Nagymaros, which would have allowed ample time for such studies, was totally ignored by Hungary. Its definitive decision to abandon Nagymaros on 27 October was never a matter that Hungary was willing to discuss thereafter. The only issue for discussion by the end of 1989, so far as Hungary was concerned, was whether to abandon the entire Project.

11. Hungary's Answer also misdescribes the final two exchanges between Prime Ministers before Hungary acted to abandon the entire Project by mid-1990. While proposing the resumption of negotiations, the new Czechoslovak Prime Minister's 15 February response to Mr. Németh's 10 January letter did not accept Hungary's proposal for their resumption as set out by Mr. Németh. He specifically referred back to the 30 November Treaty amendment proposal concerning the putting into operation during 1991 of the Gabčíkovo section on a joint basis - that is, to the environmental guarantees agreement proposal that Hungary had first tabled in October 1989. And he proposed that Hungary further elaborate its ideas for Treaty amendments for discussion in June 1990. The new Prime Minister was clearly trying to pick up the negotiations at the point they had left off at the end of 1989, when the Velvet Revolution started to occupy Czechoslovakia's full attention. It was evident that Hungary's own proposal in 1989 to proceed with the Gabčíkovo section subject to a guarantees agreement was entirely different from its 10 January proposal to conduct joint studies to investigate whether Gabčíkovo ought not also to be abandoned along with Nagymaros.

12. The final episode in the negotiations and exchanges that seemed to have begun so fruitfully in the autumn of 1989 was Prime Minister's Németh letter of 6 March 1990. He made it crystal clear that only the fate of the Gabčíkovo section remained at issue and that Hungary had withdrawn its proposal to proceed subject to a guarantees agreement. He expressed Hungary's current assessment of the Project in calling it a „gigantic investment fiasco".

13. Thereafter, there were no further negotiations during 1990 concerning how to proceed with the Gabčíkovo section of the Project. Hungary's 1992 Declaration makes it clear that, by mid-1990, all related private law contracts had been terminated by Hungary (HM, Vol. 4, Annex 82, at p. (162). The same document makes this statement concerning the attitude of the new Hungarian Government to the G-N Project (ibid., at p. 163):

„After the change of the political regime, the new Hungarian government published /its/ general political programme on 22 May 1990. The programme announced /inter alia/ that „The Government, on the ground of experts' opinion, considers the construction of the Danube Barrage System as a mistaken project, and will initiate, as soon as possible, negotiations on the rehabilitation and the sharing of damages with the Czechoslovak government to be elected".

14. The meeting of Environmental Ministers on 5 September 1990, mentioned in paragraph 7 of Hungary's Answer, was for the purpose of informing Hungary of the provisional alternatives then under study by Czechoslovakia. It was a briefing not a negotiation. The meetings of the Plenipotentiaries and the Joint Operational Group during 1990 were purely technical in nature and not directed at advancing proposals to resolve the dispute. As Hungary's 1992 Declaration states, inter-governmental negotiations did not resume until April 1991 (ibid., at p. 163). The impression Hungary's Answer tries to give of continuing negotiations during 1990 and prior to April 1991 is incorrect - there were no such negotiations; but in the meantime Hungary had succeeded in having the scheduled damming of the Danube unilaterally postponed for a second year.

15. Hungary's abandonment of the entire Project by mid-1990 was made official in the Hungarian Government's Resolution of 20 December 1990 (HM, Vol. 4, Annex 153). In this Resolution, the responsible Ministers were instructed to start negotiations with Czechoslovakia „on the termination of the 1977 Treaty by mutual consent and on the conclusion of a treaty addressing the consequences of the termination". Thereafter, the Hungarian Government never again showed the slightest interest in, or advanced any proposals aimed at, the resumption of any part of the Treaty Project on a joint basis.

16. Hungary's Answer (para. 11) contends that by the end of 1990: „Slovakia was, as has now become clear, working hard on the preparation of Variant C. Thus it opposed any compromise that could be reached by the federal Government /i.e., Czechoslovakia/." It goes on to assert that in „December 1990 and January 1991 the Slovak Government completed and approved design details of the construction of Variant C". During the oral hearings, Slovakia described the nature of these studies of alternatives being examined by Czechoslovakia in the light of Hungary's refusal to proceed with Gabčíkovo (see, CR 97/15, pp. 15-16). They were the sorts of internal precautionary measures any responsible government takes in such circumstances. Hungary was, in fact, periodically briefed as to these studies of alternatives and variants; they were not being undertaken in secret as Hungary here intimates. But the only point of relevance to Judge Vereshchetin's Question is that, after its abandonment of the

Project in 1990, Hungary made no concrete proposals of any kind other than for the total termination of the 1977 Treaty. In contrast, as the subsequent negotiations in 1991 revealed, Czechoslovakia was making every effort to get Hungary to make concrete proposals for jointly resuming Gabčíkovo, and Czechoslovakia itself advanced a number of alternatives.

17. The next round of inter-governmental negotiations consisted of meetings in April, July and December 1991. Prior to the April meeting, the Hungarian Parliament had limited the mandate of its Government's negotiations to the termination of the Treaty. This, of course, was in line with the Hungarian Government's Resolution of 20 December 1990 (see. CR 97/10, pp. 53-54). Paragraph 15 of Hungary's Answer is, therefore, correct: Hungary proposed at the April meeting to terminate the Treaty, and Czechoslovakia did not accept that proposal. But there were no Hungarian proposals to make „alterations to the Project". The Project had ended a year before, so far as Hungary was concerned, when it terminated the related private law contracts.

18. The second meeting of 14-15 July 1991 was critical - but it is not mentioned in Hungary's Answer, just as it was studiously avoided in Hungary's written and oral pleadings. It was during this meeting that it became clear to Czechoslovakia that Hungary's sole goal was to secure an agreement to terminate the 1977 Treaty. What transpired during these negotiations has been extensively described in Slovakia's pleadings (see. SR, paras. 9.13-9.22; SC-M, para. 5.75, et seq .). Prior to the meeting, Czechoslovakia called upon Hungary to submit any suggestions it wished to have considered; none were submitted by Hungary. At the meeting, Czechoslovakia proposed that each side formulate variants to the Treaty Project for submission to a trilateral commission, and itself came up with four such alternatives, none of which included Variant „C". Hungary submitted no proposals and adhered to its limited mandate to negotiate only about termination of the 1977 Treaty. It blocked Czechoslovakia's suggestion of a trilateral commission by imposing a condition that all work on the Project be stopped - and at this time no work on Variant „C" had been started (see. CR 97/10, pp. 58-59, and CR 97/15, p. 28).

19. At the July meeting, one of Czechoslovakia's proposed variants for proceeding jointly with Gabčíkovo (called Variant „D") was precisely the sort of proposal that Judge Vereshchetin has inquired about. It involved a „canal solution" on the assumption that Nagymaros would not be built and there would be no peak mode operation. Under this variant, there was to be no reservoir, only a by-pass canal and a run-of-the-river power plant at Gabčíkovo. But during the negotiations Hungary refused to consider this or any other alternative. It was only after this meeting that Czechoslovakia, on 25 July 1991, decided to authorise initial planning and financing for Variant „C" (see. CR 97/10, p. 59).

20. Czechoslovakia called again upon Hungary, by Note Verbale of 27 August, to submit proposals for a solution to the dispute. And as Slovakia's written pleadings and oral presentations have shown, even after Czechoslovakia proceeded with Variant „C" in November 1991, following the issuance of a construction permit on 30 October 1991 which became effective on 18 November, it over and over again urged Hungary to submit proposals for the joint resumption of Gabčíkovo for the consideration of a trilateral commission. Hungary turned a deaf ear and blocked all attempts at appointing a trilateral commission (see. para. 26, below).

21. In paragraph 17 of Hungary's Answer, the unprecedented appearance of Czechoslovakia's Environmental Minister, Mr. Vavroušek, before the Hungarian Parliament's

Committees for the Environment, for the Economy and for Foreign Relations is discussed[2]. His appearance was two months before Czechoslovakia proceeded with Variant „C", as well as prior to the last of the 1991 negotiations, on 2 December. Mr. Vavroušek's statement is of direct pertinence to the Question, for it represented attempt by Czechoslovakia to get Hungary to join in a constructive attempt to resolve the dispute.

22. What Mr. Vavroušek proposed was that all the possible variants and alternatives be examined in an open manner and that the Hungarian negotiators be released from their narrow mandate to consider only the termination of the Treaty. Hungary states in paragraph 17 of its Answer that „Hungary agreed, but by that stage Variant C was well underway and no joint investigation was possible". Of course, this is incorrect: a construction permit had not yet been issued and no steps to proceed with the first construction activities concerning Variant „C" had been taken. And even though initial planning and financing for Variant „C" had been approved on 25 July, in the light of Hungary's refusal during the 14-15 July negotiations to give any consideration to other variants for resuming Gabčíkovo on a joint basis, by its Note Verbale of 27 August Czechoslovakia renewed its request that Hungary come up with proposals for a technical solution of the dispute, a request to which Hungary paid no heed.

23. And even the assertion in paragraph 17 that „Hungary agreed" is incorrect. Mr. Vavroušek's proposals were made to a joint session of three committees of Hungary's Parliament. During the session, it was noted that these committees had no decisional authority over the Parliament, and, of course, they had none in respect to the Hungarian Government, either. Although, no joint communiqué was issued as Mr. Vavroušek had suggested, a joint statement was subsequently made public by the three Parliament Committees on 1 October 1991 (SM, Annex 98) that supported the continuation of the inter-governmental talks but contained no concrete proposals.

24. When these talks resumed on 2 December, the position of the Hungarian Government was, once again, totally obstructive. Clearly, Hungary had not „agreed". It made no proposals; and it laid down a 10-day ultimatum that work on the Project be stopped or Hungary would refuse to consider even the appointment of a trilateral commission. On 23 December, Hungary bluntly put an end to any further discussion of the appointment of such a commission (see, SR, pars. 9.27-9.33).

25. In contrast - right up to the time of Hungary's Notification of termination of the 1977 Treaty on 19 May 1992 - Czechoslovakia made proposal after proposal seeking to find a way to resume Gabčíkovo on a joint basis (see, SR, paras. 9.34-9.48, SC-M, paras. 5.93-5.112; CR 97/10, pp. 54-55).

[2] (SM, Annex 97). This unprecedented meeting took place on 11 September, not 9 November 1991, as Hungary states.

MINISTRY OF FOREIGN AFFAIRS
OF THE SLOVAK REPUBLIC

2 May 1997

Sir,

I have the honour to acknowledge receipt of your letter No. 97158 of 28 April 1997 transmitting the answers of Hungary to questions put by Members of the Court during the second round of oral hearings, together with observations on the PHARE Report.

In conformity with the decision of the Court, announced by the President at the end of oral hearings (CR 97/15, p. 66), I am attaching the comments of Slovakia on Hungary's observations on the Phare Report.

Further, with reference to Article 72 of the Rules of Court, I am sending the comments of Slovakia on Hungary's answer to the question of the President.

Accept, Sir, the assurances of my highest consideration.

Peter TOMKA
Agent of the Slovak Republic

Mr. Eduardo VALENCIA-OSPINA
Registrar
International Court of Justice
Peace Palace
The Hague

Annexes: 19 pages

CASE CONCERNING THE GABCIKOVO-NAGYMAROS PROJECT (HUNGARY/SLOVAKIA)
Slovak Republic

REPLY TO HUNGARY'S COMMENTS ON THE PHARE REPORT

1. Introduction

1.1 Preliminary Comments

The EC PHARE report should be evaluated in the light of the report's context in relation to this dispute. The need for a complex model to help understand the problems affecting surface and ground waters in the Danubian Lowland had been widely recognized, particularly in the light of the impacts of the Gabcikovo section of the G/N Project. Czechoslovakia's proposal, in 1990, that Hungary participate in an EC sponsored project, under the PHARE program, to develop a state of the art computer modelling system was nonetheless rejected by Hungary. Czechoslovakia proceeded alone in the project, substantially financed by the EC and run by an independent consortium of expert consultancy firms. The project lasted four years.

Hungary has submitted no evidence of equivalent weight to the PHARE project's findings in this dispute. It has not carried out an EIA subsequent to the 1985 EIA of the Hungarian Academy of Sciences. It has merely produced the 1994 Scientific Evaluation[1], which is a compilation of chapters by authors (mainly) unfamiliar with the Project area and which, unsurprisingly, focus on uncertainties experienced in the evaluation of the Project impacts[2].

With its Reply, Slovakia responded to Hungary's Scientific Evaluation with studies founded on actual data[3]. It was only after these exchanges that the PHARE report appeared in early 1996. It, too, gave no support to Hungary's claims of an ecological state of necessity. Having sought to exclude the PHARE report on procedural grounds, Hungary now seeks to criticise the report on technical grounds whilst, at the same time, claiming that the report supports Hungary's legal position.

In the comments that follow, it will be shown that these approaches are ill-founded. Hungary's critisisms of the PHARE report are based on a superficial and erroroneous

[1] Volume 2 to the Hungarian Counter-Memorial
[2] SR, paras 1.13-1.17, 11.04-11.06
[3] SR, Vol. 3

analysis of its contents. And, aside from its findings, there is a further important aspect to the four year PHARE project. A state of the art computer modelling system has now been developed that provides the means for predicting - and, therefore, managing - environmental impacts. This is a management tool that goes far beyond the limited analyses of an EIA.

It should also be emphasized that the PHARE project, in addition to being carried out by an international team of 25 specialists from six internationally well known and respected organisations, had its own system of independent review. Hence, in connection with two workshops held in 1992 and 1995, the following international experts undertook reviews of the project methodology and results:

- Professor Wolfgang Kinzelbach, Kassel University (1992 + 1995)
- Dr. C.A.J. Appelo, Free University Amsterdam (1992)
- Dr. Hans-Peter Nachtnebel, Universität für Bodenkultur, Wien (1992 + 1995)
- Professor Ludwig Luckner, Institut für Bodenkultur und Wasserwirtschaft, Dresden (1992)
- Dr. Stefan Bruk, UNESCO, Paris (1992)
- Professor Johann Schreiner, Norddeutche Naturschutz Akademi, Schneverdingen (1995).

1.2 Contents of this reply

In its comments on the PHARE report, dated 24 April 1997, Hungary brings forward numerous claims and statements, which, if they should all be clarified and commented upon, would require an even longer reply than the Hungarian comments and their related annexes. This would be neither useful nor feasible in the short time available. The present reply, therefore, does not pretend to address all the issues raised in the Hungarian comments, but concentrates on the more important ones.

Some general comments on the Hungarian approach of selecting quotations from the PHARE report are given immediately below (Subsection 1.3) together with general comments on the lack of scientific balance in the Hungarian comments. The following sections reply to the key points in Hungary's comments on documentation (Section 2), review of model calibration and validation (Section 3) and review of model applications (Section 4). These sections correspond to the chapters with the same numbers in Hungary's comments. Finally, Section 5 contains some brief conclusions.

1.3 Hungary's selective quotations from the PHARE report and its use of unbalanced scientific arguments

In Hungary's comments on the PHARE report, Hungary acknowledges that the PHARE project was "an ambitious and extensive computer programme of computer simulation modelling to provide tools to assist in environmental assessment of water

management in the Danubian Lowland"[4]. Hungary further refers to numerous quotations[5] from the PHARE report, which it states support Hungary's concerns. However, Hungary also concludes that the model simulations "are unreliable and form no basis for dismissing long-term concerns"[6].

The approach taken and the points made in the Hungarian comments are repetitive of its oral pleadings. Thus, as Slovakia has stated previously[7], Hungary's approach is misleading and unscientific in certain aspects.

Hungary's Appendix 3 contains 18 pages of selected extracts from the PHARE report. Many of these are misleading for one of the following two reasons:

- either the quotations are taken completely out of context by selecting only half sentences or omitting the explanatory comments in the following sentences, thus leaving a distorted impression,
- or the quotations are taken from the problem identification sections, which describe processes that can occur in theory, while the corresponding text from the concluding sections are most often omitted. It is in these (omitted) sections of the PHARE report that, on the basis of the comprehensive project work, the conclusions may be found as to the extent that such processes are important in practise. To present only the sentences from the problem identification section gives the impression that these sentences represent conclusions of the report.

Examples of this are shown in Appendix 1 to the present Reply.

As result of this approach, the general overview, as well as the balance between positive and negative impacts, is lost. Of course the PHARE report does not speak of only positive impacts. But the Hungarian approach has been to select the particular sentences which favour its case and say that only these sentences are credible and then claim that the rest is not reliable. This is clearly unacceptable from a scientific standpoint.

2. Documentation

Hungary states that the model documentation is inadequate[8] and that "There are no equations presented"[9]. Hungary's statement merely seems to reflect the fact that the model documentation is not formally part of the Final Report. As noted during the oral pleadings[10], comprehensive documentation has of course been provided to the project. Thus scientific documentation (including extensive equations and descriptions of numerical techniques) and users guides have been provided for all the models

---

[4] Hungarian comments on the PHARE report, p 1.
[5] Hungarian comments on the PHARE report, Appendix 3 (identical to Annex 13 to Hungary's oral presentation)
[6] Hungarian comments on the PHARE report, p 17.
[7] CR 97/15, pp 30-39 (Refsgaard)
[8] Hungarian comments on the PHARE report, p 3.
[9] Hungarian comments on the PHARE report, Appendix 1, p 1.
[10] CR 97/15, p 31 (Refsgaard)

briefly described in Appendices A1-A10 of Volume 2 of the PHARE Final Report. The documentation amounts to more than 1500 pages and is thus not suitable for inclusion in a final project report.

This is entirely usual practice and cannot come as a surprise to Hungary:

- First, it is well known in the professional scientific community that good model codes are always supplied together with comprehensive documentation.
- Second, two of the model codes applied in the PHARE Project are also being used in Hungary[11]. One of them has actually been purchased by the Government of Hungary, namely the MIKE SHE model code, which is installed at the Ministry for Environment and Regional Policy, Budapest.

The Hungarian claim that the model documentation is inadequate is simply not correct. For practical reasons, the comprehensive documentation available did not form part of the PHARE Final Report.

3. Model Calibration and Validation

3.1 Introduction

Slovakia agrees with Hungary's comments on the need for model calibration and rigorous validation tests in order to demonstrate the models' predictive capabilities. Such validation tests have generally been carried out following a rigorous procedure. The comprehensive data existing both for the pre-dam situation and the post-dam situation provided much more difficult, and more useful, tests than is usually possible. Although much data were available, more data would always be desirable, and as stated in the PHARE Report there are examples of situations where a thorough model validation of the individual models was not possible. However, it must be emphasized that these few examples are exceptions to a very comprehensive validation test scheme and have been blown out of all proportion by Hungary.

Furthermore, it should be kept in mind that the modelling system is integrated, with one model being dependent on (linked to) the other models. This, for Hungary means a "potential for mistakes". It states: "Small errors in assumed values for one part of the calculation may have disproportionate consequences on dependent processes. It is also easy to overlook important effects in attempting to obtain a workable model"[12]. This is a rather theoretical view, which has not taken all the strengths of integrated modelling into account. The integrated modelling carried out in the PHARE project, where the interdependency between processes are described as interdependency between models, does not pose larger risks than the more traditional use of individual 'stand alone' models. On the contrary, the fact that possible errors for one part have effects on other dependent processes, implies that, even if the first process cannot be

[11] PHARE Project, Final Report, December 1995, Vol 2, Appendix E, MIKE SHE installations, p 2 and MIKE 11 installations, p 2.
[12] Hungarian comments on the PHARE report, p 2

fully validated due to lack of data on that process, then it can implicitly be validated by testing against field data on the other process. Or, in other words, an integrated modelling approach provides much better possibilities for checking the consistency of the overall model against all different sorts of data and consequently makes much more efficient use of the existing data. An example of this is the model validation against discharge data in the seepage canals[13], as discussed below.

Hungary has not presented any integrated modelling at all, but has in its pleadings confined its presentations to limited modelling of individual processes. The Hungarian comments to the PHARE project often reflect this non-integrated approach.

An important part of the modelling study is the assessment of uncertainties on model simulations described in Volume 3 of the Final Report of the PHARE Project. The value of this approach is in general acknowledged by Hungary. However, it most often re-labels model results acknowledged as being 'uncertain' as 'unreliable'.

3.2 River and Reservoir Hydrodynamic Modelling

The river and reservoir hydrodynamics (i.e. flow velocities) can be considered as quite accurate, and under all circumstances much less uncertain than the dependent processes such as sediment transport and water quality.

Hungary's comments on the consequences of the relatively small amount of flow velocity data in the reservoir[14] is out of proportion to the real problem. It is correct that limited data on flow velocities were available. However, as flow modelling in such a reservoir with very well defined geometry is quite simple and does not represent any fundamental scientific problem, the question of limited reservoir flow data being available is in the overall context not considered major.

Moreover, such data are easy and cheap to obtain. If it had been considered scientifically important by the international PHARE team to get better data here, this would easily have been possible within the framework of the PHARE project. In fact, the PHARE project funded much more expensive field work on other topics, which were considered more important.

3.3 River and Reservoir Sediment Transport Modelling

Cohesive sediment transport modelling is, as mentioned by Professor van Rijn[15], a very complex task, and the parameters are in general associated with a high degree of uncertainty as mentioned in the PHARE Final Report. In Volume 2, it is explictly stated: "Some of the models, however, could still need further calibration in order to improve the accuracy. Further data from continous monitoring of the reservoir

---

[13] PHARE Project, Final Report, December 1995, Vol 2, Fig. 5.19
[14] Hungarian comments on the PHARE report, p 4
[15] Hungarian comments on the PHARE Report, Appendix 2

sedimentation are required in this respect"[16]. Despite this uncertainty due to missing data, a high degree of consistency in the modelling results of the sedimentation in the reservoir was revealed even with very conservative estimates of critical values for erosion and deposition as discussed below.

Unfortunately, Professor van Rijn only commented on Volume 2 of the PHARE report (and apparently only one part thereof). In Volume 3, the uncertainties in model predictions and model parameters of the mentioned sediment transport models are adressed in Section 6.4 (1-D model of the Danube), 7.4 (1-D model of the river branch system), and 8.4 (2-D model of the reservoir). There is no issue with the comment of Professor van Rijn, that the critical velocity for erosion is probably too low for consolidated sediment. However, the objective of the modelling was not to simulate erosion of consolidated sediment; but to simulate deposition of new sediment. For flushing scenarios (not included), it would have been relevant. Hence, as mentioned in the PHARE Report[17], the erosion is not a dominant process in the reservoir for the investigated scenarios where the objectives were to simulate the sedimentation pattern. Uncertainties in erosion parameters are not critical for the investigated scenarios.

The calibration of fall velocity is based on the comparison between the measured grain size distribution of suspended sediment and newly deposited sediment. Thus, both grain size distribution and fall velocity are associated with considerably less uncertainty compared to the uncertainty on erosion and deposition rates. The deposition rate (critical fall velocity for deposition) can only be determined accurately when adequate data on reservoir sedimentation after some years are available.

No standard cohesive sediment model parameters exist and a high degree of variability from one application to another exists as mentioned by Professor van Rijn. The parameters are not only site specific[18], but also model specific[19]. As an example, the critical velocity in a 1-D model refers to a cross-sectional averaged velocity whereas in a 2-D model it refers to a depth averaged velocity. The critical velocity in a 1-D model is therefore necessarily smaller than the corresponding model parameter in a 2-D model. Only field measurements and in-situ tests provide sufficient data for accurate calibration of the cohesive sediment transport model. Due to lack of field measurements, prelimary values were obtained from the literature and not least from the experience of the consultants. In the reference mentioned in the report[20] an extensive and very useful summary of relevant literature is provided. The author (L.C. van Rijn) referred to other authors regarding examples of applied sediment parameters. Examples of the information obtained from the Handbook are:

- critical shear stress for deposition 0.06 N/m^2 (Section 12.5 in the Handbook), which correspond to 0.10 m/s for a Chezy value of 40 $m^{1/2}/s$

---

[16] PHARE Project, Final Report, December 1995, Vol 2, p 10-48
[17] PHARE Project, Final Report, Vol. 3, Section 8.4.2
[18] PHARE Project, Final Report, Vol. 3, p 7-32
[19] PHARE Project, Final Report, Vol. 2, 10-28
[20] Rijn, L.C. van, 1989, "Handbook on sediment transport by currents and waves, Delft Hydraulics, Report H461"

- critical velocity for erosion 0.30 m/s for loose lean clayey soil (Section 12.7.2 in the Handbook)
- erosion rates or erodibility coefficient M 0.01 -0.4 g/m^2/s (Section 12.7.4 in the Handbook). Based on consultants experience, this value is, however, much too high in the 2-D model where only a value of 0.005 g/m^2/s (corresponding to 50% of the lower limit) was used.

The cohesive sediment transport parameters regarding erosion of the sediment and regarding the critical velocity for deposition are associated with considerable uncertainties as mentioned by Professor van Rijn. However, the basic hydrodynamic conditions show that even with very conservative estimates of the critical velocity for deposition, the old highly permeable main channel through the reservoir will not be subject to severe sedimentation. Figure 9.26 in Volume 2 of the PHARE report shows the simulated and measured flow velocities from two cross-sections in the reservoir during a period with very low discharge (825 m^3/s at Bratislava). Two things are noticed: first, a satisfactory agreement between model results and measurements is present and second, even for this extreme low discharge the velocity is higher than the critical velocity for deposition of 0.10 m/s (assumed in the model) in the main channel. In addition, with such a low discharge, the concentration of suspended sediment from upstream is very low.

The PHARE project consultant team has extensive experience in modelling of cohesive sediment gained from other similar projects. Examples are Venice Lagoon Italy, Hamburg Harbour Germany, Plouvenice Czech Republic, River Elbe, Copenhagen Harbour, The Great Belt Denmark, the Øresund Denmark, The Loire France, the River Usk England. Adequate documentation of the general model validity therefore exists from numerous projects.

The Hungarian comments on the sediment modelling are all based on the note from Professor van Rijn. It should be noted that Professor van Rijn's comments are not as critical as the Hungarian comments imply. Professor van Rijn refers to the PHARE models as "state of the art" and suggests that the results produced may be reasonable in the light of how much they have been calibrated. He is complimentary about the attempt of the project to undertake the difficult task of modelling the transport processes of graded sediments. Finally, it should be noticed that Professor van Rijn's note is little more than one page long with reference to only one of several relevant chapters in the PHARE Report. In the light of these facts and of the above detailed comments to the points made by Professor van Rijn, it can be concluded that the Hungarian claims as to the unreliability of the PHARE models results are incorrect and result from a superficial analysis.

3.4 Surface Water Quality Modelling

In Hungary's comments, it is stated that there is not enough data for an adequate model calibration and validation[21]. As also stated at several places in the PHARE

[21] Hungary's comments on the PHARE report, p 7

report, the data on surface water quality are limited and more data would reduce the uncertainty of the subsequent model predictions. However, it must be emphasized that enough useful data were available to allow calibration and in some cases rough model validations.

The uncertainty on some model parameters due to limited data must also be seen in the context of how the models were used in the subsequent scenario simulations. Generally, the parameters and input functions chosen for the simulations have been assessed on the 'safe' side, implying that simulations show worse situations than the best estimate. Furthermore, the uncertainties are analysed and their importance for model outputs are quantified by thorough sensitivity analyses[22]. The conclusions drawn in the PHARE report have taken these uncertainties into account:

- The margin between the simulated eutrophication level in the reservoir and the, water quality wise, critical level is so large that the acknowledged model uncertainties do not affect the conclusion that there are no eutrophication or other water quality problems in the reservoir.
- The uncertainties affect the conclusion on water quality (oxygen conditions) in the Old Danube in the way that, if these uncertainties had not been considered, the conclusion that no water quality problems will occur in the Old Danube for discharges at 400 m^3/s or more might have been extended to smaller discharges.

These aspects have apparently not been taken into account by Hungary's Professor Somlyody or in the Hungarian comments. Thus, the Hungarian view appears to be of a rather pre-determined character, implicitly leading towards a conclusion that in spite of available knowledge and local data, nothing useful can be said. The conclusion of the PHARE Project, on the other hand, is that, put in the right perspective and considering the uncertainties involved, the water quality models can produce extremely useful results.

3.5 Groundwater Modelling

Hungary's comments on groundwater modelling are undermined by various factual errors:

- The claim that the "historical groundwater level decreases around Bratislava are clearly due mainly to local abstraction (80% of the 100 million cubic meters of groundwater abstracted from the Zitny Ostrov per year)"[23] is not correct. The general decrease of groundwater levels between 1960 and 1990 is more than 1 m over an area of more than 100 km^2. The impact of groundwater abstraction of 16 mill m^3/s at Kalinkovo is shown in the PHARE Report[24] to be more than 10 cm only over an area of 1-2 km^2.
- In the Hungarian comments, it is estimated that a hydraulic conductivity of 100 m/day at the O-18 front has been used in the model, and Hungary states that this indicates a contradiction to values in the regional model, which generally are larger[25]. This estimate is based on a simple calculation apparently using data from

[22] PHARE Project, Final Report, December 1995, Vol. 3 pp 6-41, Vol 3 pp 7-32, Vol 3. pp 8-36.
[23] Hungarian comments on the PHARE Report, p 7
[24] PHARE Project, Final Report, December, Vol. 3, Fig. 3.13
[25] Hungarian comments on the PHARE Report, p 7

Fig. 7.25 and Table 7.3 in Vol. 2 of the PHARE Final Report. Unfortunately, the calculation is wrong by a factor of 3. If instead of a "given typical hydraulic gradients" the specific gradient is read from the concerned figure (Fig. 7.25 in Vol 2) the gradient can be seen to be 0.001, and hence the hydraulic conductivity can be calculated to 300 m/day, which (in contrast to the 100 m/day estimated by Hungary) is consistent with values in the regional model. Thus there is no contradiction in the PHARE Report - but instead a simple error in the Hungarian comments.

In the Hungarian comments it is stated that the performance of the ground water modelling is "relatively poor"[26]. However, this is based on references to the wrong figures and sections in the PHARE Report:

- All the references in relation to model performance are made to the so-called regional groundwater model, which covers the entire 3000 km^2 modelling area. However, as stated explicitly in the PHARE Report[27] the regional model was supplemented by local models in the two key areas, namely around the reservoir (approximately 300 km^2) and in the river branch system (approximately 100 km^2). The role of the regional model in this regard was to provide boundary conditions to the two local models.
- The regional ground water model is not as accurate as the local models for two main reasons, first due to the coarser resolution in the model grid, and second due to the fact that the local models have been established exactly in the areas where it was considered of highest priority to get as good a model performance as possible. Therefore, the quotations from the PHARE Report selected by Hungary - that the regional model did not perform so well in the downstream model area and close to the model boundaries - simply reflect the fact that these areas are not so important for the PHARE project as the reservoir and river branch areas. The important thing is that the model performance in these areas are still so good that the deficiencies there do not influence the model performances in the two high priority areas.
- The local models have a much finer resolution in their respective areas than the regional model. Thus the models in the reservoir and river branch area uses horizontal discretizations of 250 m and 100 m, respectively, as compared to the 500 m grid in the regional model.
- Thus, the discussion on model performance in these high priority areas should be made on the basis of results from the local models, and not the regional models as done by Hungary. For example the relevant figures showing the performance of the ground water model in the reservoir area are Figs 5.22 and 5.25 in Vol. 2 of the Final Report, and not Fig. 5.18 as referred to by Hungary. The model performance on these figures are seen to be very good both for the pre-dam situation (Fig. 5.22) and for the post-dam situation (Fig. 5.25). The performance of the post-dam situation should be seen in the light that it is a model validation with increased groundwater levels and decreased ground water fluctuations, which generally are quite well predicted.

[26] Hungarian comments on the PHARE Report, p 9
[27] PHARE Project, Final Report, December, Vol. 1, p 4-8 and Fig. 4.3

In the Hungarian comments, it is stated that "the leakage deduced from the sediment model had to be divided by a factor of ten. In other words, the sediment modelling is given ten-fold errors, and the error is suggesting tenfold underestimation of the effects of sedimentation and clogging"[28]. This is not a correct presentation of the scientific methodology applied in the PHARE Project:

- The leakage is not deduced from the sediment model alone, and the sediment model is not giving ten-fold errors. In fact by comparison against local field data the sedimentation appears to be in the right order of magnitude[29].
- The calculation of the flow of water from the reservoir into the aquifer is determined from two factors, one of which represents the differences in level between the reservoir water table and the aquifer ground water table, and the second of which is the so-called leakage coefficient. This coefficient is calculated on the basis of the well known Carman-Kozeny theoretical formula, including a calibration factor, which has to be assessed through comparison of model output and field data (in this case ground water level observations from a few wells around the reservoir). The calibration factor is justified theoretically by the fact that the sediments are stratified or layered due to variations in flow velocities during the sedimentation process.
- For illustration, the Carman-Kozeny formula has also been used to convert data on grain size distribution in the aquifer to model parameters. Also for the aquifer a calibration factor of about 10 was used. Obviously, clogging does not exist in the gravel aquifer many meters below the surface. This calibration factor has nothing whatsoever to do with clogging.

In the Hungarian comments, it is stated that the model calculation of water flows from the aquifer to the aquifer is not reliable. However, the evidence in the PHARE Report supporting these calculations is reliable and has either been distorted or neglected by Hungary:

- The model simulates the ground water levels near the reservoir quite well, both with respect to level and dynamics[30]. This fact is distorted because Hungary made reference to the wrong figure as described above.
- The model gives a good simulation of the transport of the oxygen isotope O-18 from the reservoir into the aquifer near Kalinkovo[31]. This fact is distorted because Hungary made a simple calculation error as described above.
- The model gives a very good prediction of the discharges in the seepage canals[32]. The water in the seepage canals originates from the flow of water through the bottom of the reservoir. The comparison of model predictions against measured discharge data shows a remarkably good match at different locations along the canals. Thus, at the two stations most downstream on both seepage canals (station 2809 and 3214 in Fig. 5.19, Vol. 2) the agreements between model predictions and field data are within 5%. It should be emphasized that this is a very reliable test, because the discharge data have not been used at all in the calibration process, and because it integrates the effects of reservoir sedimentation, calculation of leakage

[28] Hungarian comments on the PHARE Report, p 8
[29] PHARE Project, Final Report, December 1995, Vol. 2, Table 10.5
[30] PHARE Project, Final Report, December 1995, Vol. 2, Fig. 5.25
[31] PHARE Project, Final Report, December 1995, Vol. 2, Fig. 7.24
[32] PHARE Project, Final Report, December 1995, Vol. 2, Fig. 5.19

factors and geological parameters in the aquifer. This evidence is completely neglected in the Hungarian comments.

Thus, tests against different types of data, made possible only due to the integrated nature of the modelling, show consistency, implying that the total test is stronger than each of the tests individually.

The conclusions in the Hungarian comments are scientifically incorrect due to a combination of errors, misinterpretations of results from the PHARE Report and neglect of important evidence presented in the PHARE Report.

3.6 Groundwater Quality

The concern for groundwater quality defined in the introductory sections of the PHARE Report constituted an important motivation for establishing the PHARE Project itself, and it was the single most important issue studied in the entire project.

In Hungary's comments, two key aspects are focused on, namely the link to the reservoir, including reservoir sedimentation and the geochemical processes within the aquifer.

The doubts expressed by Hungary on the sedimentation calculation and leakage calculations in the reservoir have already been addressed above.

With regard to the geochemical processes, these were studied in great detail. A comprehensive field program was conducted in the cross-section near Kalinkovo and a very comprehensive bio-geochemical model was constructed and used in order to improve the understanding of the complex processes. This work, which was basically research work, was presented to many international experts in the field, including the persons participating in the international PHARE workshops[33], and was also presented at an international conference, where a paper was accepted after the usual scientific, peer review procedures[34].

The facts emphasized by Hungary on the detected concentrations of manganese and nitrite in the Kalinkovo field monitoring, are not surprising and are not a matter of concern. As stated during the oral pleadings Hungary's emphasis on such concentrations at this location is out of proportion both with regard to manganese[35] and nitrite[36].

---

[33] CR 97/15, p 31 (Refsgaard)

[34] Griffioen, J., P. Engesgaard, A. Brun, D. Rodak, I. Mucha, and J.C. Refsgaard: Nitrate and Mn chemistry in the alluvial Danubian Lowland aquifer, Slovakia. Proceedings of the International Conference on Groundwater Quality: Remidiation and Protection (GQ95), Prague, IAHS Publication No. 225, pp 87-95, 1995

[35] CR 97/15, p 36 (Refsgaard)

[36] CR 97/15, p 12 (Mucha)

The groundwater chemistry in the aquifers is, and always has been, of a very complex nature. Thus, there are some uncertainties regarding how the system will develop in the future. What has been concluded on the basis of the PHARE Project and the comprehensive monitoring which has run in parallel, is simply that neither the model studies nor the field data has so far shown any indications on problems with ground water quality caused by the reservoir. Furthermore, it can be stated that if such signs should occur at some time in the future, there are possible management options to remediate them.

3.7 Floodplain Ecology

Apparently Hungary largely agrees with the approach taken by the PHARE Project on floodplain ecology[37].

The only point where there is some disagreement, is whether the pegelweg (sum of variations over a year) is an appropriate parameter for the description of water level dynamics. In the PHARE Project, recommendations from the international experts[38] given at the first workshop in 1992 have been followed. These recommendations are, amongst others, based on comprehensive experience from studies of the Danube in Austria[39].

4. Model Applications

4.1 Hydrodynamics, Sediment Transport and Water Quality

In Hungary's comments, the PHARE modelling of coarse sediment transport in the Old Danube is critizised with a particular focus on the armouring process just downstream of the weirs at Cunovo[40]. But the sediment transport model established in the PHARE Project was not aimed at providing detailed predictions of changes in river cross sections on a very local scale, but rather to assess long term effects on a regional scale.

The effects on the very local scale will anyway be affected by the meandering of the river within the old river embankments, which has been initiated during the past four years.

The armouring process is not described extensively in the PHARE Report. However, the key point, namely the assumption that armouring will occur, is very reasonable and in accordance with the experience of the international consultant team on similar projects. However, even if the armouring assumption turned out not to be valid, the

---

[37] Hungarian comments on the PHARE Report, p 11
[38] CR 97/15, p 31 (Refsgaard)
[39] "Ökosystemstudie Donaustau Altenwörth". Universitätsverlag Wagner - Innsbruck 1989. Editor: Hans-Peter Nachtnebel.
[40] Hungarian comments on the PHARE Report, p 12

erosion would under all circumstances only be a small fraction of the bed load transported in the pre-dam situation, because the discharges are much smaller.

With regard to sediment deposition in the river branch system, the conclusion from the PHARE Project is that sedimentation will generally occur in the side branches where the velocities are very small, and not in the main branch. In the main branch, sedimentation will not occur in the upstream parts due to relatively high flow velocities, while in the downstream parts where velocities are much smaller there is no sediment left in the water, because it has deposited in the upstream side branches.

The Hungarian comments refer to the above conclusions and state that "the authors of the PHARE report conclude that no deposition of fine sediments will occur in the main side-branches - a conclusion which contradicts their own findings"[41]. This is wrong: there is no contradiction.

Concerning water quality, the fact that model simulations have not been carried out for long time series is described by Hungary as "an important restriction of model performance"[42]. However, as stated in the PHARE Report, the key reason for this limitation is the simple fact that such model simulations are not feasible with the present generation of computers. Hence, this cannot be considered a realistic critisism. The approach taken in the PHARE Project is the standard one of identifying worst case scenarios, where combinations of adverse flow and climate circumstances are studied. In the present case, the uncertainties in this regard have been assesssed further through sensitivity analyses.

In the Hungarian comments, the conditions in the Old Danube are, on the basis of selective extracts from the PHARE Report, presented as being generally rather poor, giving "rise to water quality problems. Under WMR IV, for summer conditions, dissolved oxygen levels fall to 2 mg/l, and for WMR II, levels fall to around 5 mg/l. As noted in the report, these levels are at or below limits for cyprinid water and well below limits for salmonid fish"[43]. However, Hungary has not included in its comments the following important facts:

- The WMR IV scenario corresponds to 200 m^3/s discharge in the Old Danube, while WMR II corresponds to the actual 400 m^3/s.
- The 2 mg/l and 5 mg/l oxygen concentrations are minimum concentrations occurring between 3 and 6 am in the early morning. Due to diurnal variations the maximum concentrations 12 hours later is 3-5 mg/l higher[44].
- The oxygen conditions predicted for WMR II are almost the same as in the pre-dam situation[45]. Thus the situation at 400 m^3/s can be assumed to be as good as the pre-dam situation, i.e. not critical at all.
- With regard to the low oxygen concentrations for WMR IV, the PHARE Report concludes: "Whereas 2.5 mg O_2/l in general is a very low concentration critical to fish species, but generally not to benthic fauna, it must be emphasised that this

[41] Hungarian comments on the PHARE Report, p 13
[42] Hungarian comments on the PHARE Report, p 13
[43] Hungarian comments on the PHARE Report, p 13
[44] PHARE Project, Final Report, December 1995, Vol. 3, Fig. 6.17
[45] PHARE Project, Final Report, December 1995, Vol. 3, Figs. 6.17 - 6.19

worst case situation will occur very rarely and over only a few km river length. Furthermore, this critical situation will have a duration of a few hours, so that the fish may move away and return afterwards. Hence, such rarely occurring worst case situations are not expected to have significant long lasting ecological effects"[46].

With respect to the reservoir water quality, Hungary states that "It is noted that some stratification in the reservoir might be expected, but has not been included in the model"[47]. This is again a theoretical statement, which, when placed in perspective with the relevant data turns out to be of no practical importance. In fact, this was an issue in the Inception Phase of the PHARE Project in 1992. However, after some initial studies, it was concluded that statification was not likely to develop due to the large flow velocities and short retention times. This conclusion was confirmed by field data in 1994[48].

4.2 Groundwater Flow and Groundwater Quality

Hungary states that there is some confusion in the PHARE report regarding remedial measures[49]. This is apparently because Hungary, as already described in Subsection 3.5, has mixed the results from the regional model and the local models. As stated in Subsection 3.5, the regional ground water model is not suitable for making predictions near the reservoir and in the river branch system, where results from local models should be used instead. This is consistent in the text of the PHARE Report, but may not be evident at a first glance from all figures. For example, Fig. 5.1 of Vol. 1, which Hungary refers to, shows a graphical map from the regional model. Ideally, the data from the two areas covered by the local models should have been replaced by model output from these models. However, this has not been done, which apparently confuses some readers.

Concerning modelling of flows in the river branch system, Hungary states that "it thus becomes apparent that the regional ground water model is incapable of representing the remedial measures"[50]. This is not of any importance, because the local river branch model is used for this purpose. The river branch model has been calibrated against field data from the surface water system, and further uses exactly the same geological parameters as the regional model, just with a much finer spatial resolution.

With regard to groundwater quality modelling, Hungary focuses only on the scenario calculations made by the denitrification model, and describes an apparent lack of calculations on the more complex Manganese dissolution processes[51]. However, such comprehensive calculations have been carried out for the Kalinkovo cross-section.

---

[46] PHARE Project, Final Report, December 1995, Vol. 1, p 5-13
[47] Hungarian comments on the PHARE Report, p 14
[48] PHARE Project, Final Report, December 1995, Vol. 3, p 11-10
[49] Hungarian comments on the PHARE Report, p 14
[50] Hungarian comments on the PHARE Report, p 14
[51] Hungarian comments on the PHARE Report, p 15

They are thoroughly described in Subsection 5.2.1 of Vol. 2, where the effects of the reactive sediment layer, which Hungary could not find[52], are also described.

4.3 Agriculture

Hungary apparently agrees with the approach and results produced by the PHARE Project[53] here.

The figures on reductions in crop yield in case of reduced ground water levels may be put into proportion by quoting the main conclusion regarding the situation on the Slovak side: "The changes in agricultural production on Zitny Ostrov due to the damming of the Danube are marginal. The difference in crop yield indexes between pre-dam (WMR I) and post-dam (WMR II) scenarios was simulated to be less than 1% for irrigated as well as for non-irrigated areas"[54].

4.4 Ecology

Hungary apparently agrees with the approach and the results from the PHARE Project here, and the main bulk of the Hungarian comments is constituted by more than 20 quotations from the PHARE Report.

Hungary further states that: "An important point made by the report is that no clear ecological objectives have been decided for the area, which is a necessary pre-requisite to a decision on management strategies"[55] (which was also a point made in the Slovak oral pleadings). This implies that value judgements as to which impacts are negative and which are positive are difficult to make, because they must implicitly reflect (non-formulated) ecological objectives. If this fact is combined with two other conclusions, which have not been contested by Hungary:

- Both the EC Working Group Data Report from November 1993 and the PHARE project have confirmed that no irreversible general ecological impacts have occurred since October 1992[56]
- The Variant C barrage system does not in itself pose important constraints, on the contrary, it provides a wide range of management possibilities[57]

it becomes evident that it is still possible to decide on the objectives for this area and consequently create the types of ecological systems desired.

---

[52] Hungarian comments on the PHARE Report, p 15
[53] Hungarian comments on the PHARE Report, p 15
[54] PHARE Project, Final Report, December 1995, Vol. 1, p 5-6
[55] Hungarian comments on the PHARE Report, p 15
[56] CR 97/15, pp 37-38 (Refsgaard)
[57] CR 97/15, p 38 (Refsgaard)

5. Brief Conclusions

The PHARE project represented a major effort by a joint international team of experts supported by Slovak experts to develop a comprehensive integrated computer modelling system for environmental assessment of water resources in the Danubian Lowland.

The Hungarian claims as to the lack of reliability of model results have been shown to be based on superficial analyses and comprise numerous factual errrors, misinterpretations, as well as an unbalanced selection of quotations.

Consequently, the conclusions presented by Slovakia in the oral pleadings[58] can be maintained. These conclusions, while maintaining a scientific balance between positive and negative impacts, are basically supportive of the Slovak view that Variant C has had no irreversible environmental adverse effects, and that most of the impacts can, seen from an environmental point of view, be considered as positive.

[58] CR 97/10, pp 48-49; CR 97/15, pp 30-39 (Refsgaard)

APPENDIX 1

Examples of Hungarian quotations from the PHARE report - shown in their full context.

Below, four examples of misleading Hungarian quotations are given. These examples are from the first pages of the 18 page long Appendix 3 to the Hungarian comments. Many more examples can be found on subsequent pages.

In the examples given below *the Hungarian selection in Appendix 3 to the Hungarian comments is shown with italics*, while the text not included in the Hungarian selection is shown with ordinary text script.

Example 1:

"Some samples .... showed relatively high contents of some PAH's"
(Hungarian Appendix 3, p Annex 13-2)

"From the existing data no general pollution has been detected. However, *some samples* from the flood plain along the Danube river *showed relatively high contents of some PAH's*, which can be attributed to local pollution."
(PHARE Project, Final Report, December 1995, Vol. 1, p 4-10)

Example 2:

"Only very scarce and not very reliable data on flow and water levels in the river branch system was available"
(Hungarian Appendix 3, p Annex 13-2)

"Only very scarce and not very reliable data on flow and water levels in the river branch system was available. Therefore, a programme comprising measurements of discharges and water levels at a number of locations was carried out under this project during the summer 1994."
(PHARE Project, Final Report, December 1995, Vol. 1, p 4-18)

Example 3:

"The sum of the annual ground water fluctuations (Pegelweg) .. *was reduced to about 1/3 .. in most of the upstream part of Zitny Ostrov."*
(Hungarian Appendix 3, p Annex 13-3)

"The sum of the annual ground water fluctuations (Pegelweg) in WMRII and WMRIII *was reduced to about 1/3* of WMRI *in most of the upstream part of Zitny Ostrov*. However, a management scenario with temporal variations of water levels in the seepage canals indicate that for areas less than about 1.5 km away from the canals it will be possible to establish groundwater dynamics with the same Pegelweg as in WMRI (pre-dam)."
(PHARE Project, Final Report, December 1995, Vol. 1, p 5-3)

Example 4:

"For all post-dam scenarios the lowest oxygen concentrations are simulated in the backwater zone ... minimum concentration is 5-6 mg O_2/l with the exception of WMR IV with underwater weirs, where it is around 2.5 mg O_2/l ... 2.5 mg O_2/l in general is a very low concentration critical to fish species .."
(Hungarian Appendix 3, p Annex 13-3)

"In general, water quality simulations do not indicate major problems in the Old Danube. *For all post-dam scenarios the lowest oxygen concentrations are simulated in the backwater zone* close to the confluence between the canal and the Danube. Model results for a worst case situation are presented in Fig. 5.4. This situation corresponds to discharges of approximately 1000 m^3/s at Bratislava of which all (WMR I), 400 m^3/s (WMR II), 800 m^3/s (WMR III) and 200 m^3/s (WMR IV), respectively, flows in the Danube channel between Cunovo and the downstream confluence with the power canal. Furthermore, respiration rates corresponding to the highest ones observed during the field campaign, i.e. summer periods with high biological activities, have been assumed. The oxygen concentrations have diurnal variations which generally increase with decrease in discharge. The concentrations shown in Fig. 5.4 are the minimum ones occurring early morning between 3 and 6 am. The maximum concentrations occurring late afternoon are typically 2-3 mg O_2/l higher. It is seen from the figure that this worst case *minimum concentration is 5-6 mg O_2/l with the exception of WMR IV with underwater weirs, where it is around 2.5 mg O_2/l.* Whereas *2.5 mg O_2/l in general is a very low concentration critical to fish species*, but generally not to benthic fauna, it must be emphasised that this worst case situation will occur very rarely and over only a few km river length. Furthermore, this critical situation will have a duration of a few hours, so that the fish may move away and return afterwards. Hence, such rarely occurring worst case situations are not expected to have significant long lasting ecological effects."
(PHARE Project, Final Report, December 1995, Vol. 1, p 5-13)

COMMENTS OF SLOVAKIA ON HUNGARY'S ANSWER TO THE QUESTION OF THE PRESIDENT

In Hungary's lengthy response to the President's Question, it is claimed that the discharge distribution set by the Joint Contractual Plan was never amended (at para. 6).

The Parties are in agreement that the Joint Contractual Plan originally provided for a discharge of 50 m^3/ s into the old riverbed - but only in the months March - November. By 1989, this had evolved. The minimum discharge was 50 m^3/s and the amount of water had been increased to 200 m^3/s during the vegetation period. Thus, the Hungarian Memorial states:

"The Joint Contractual Plan was subsequently amended to allow for a 200 m^3/s discharge" (HM, para. 5.52).

In Hungary's analyses of the impacts of the "Original Project", the minimum discharges are 50/200 m^3/s (e.g. HC-M, para. 1.83, HR, para. 1.117) or 200 m^3/s (e.g. HR, Vol. 2, Plates 7.2 and 7.3). This is consistent with sub-paragraphs (i) and (ii) at page 2 to Slovakia´s response to the President's Question.