PCA Case No. 2023-01

IN THE MATTER OF AN ARBITRATION

-before-

THE COURT OF ARBITRATION CONSTITUTED IN ACCORDANCE WITH THE INDUS WATERS TREATY 1960

-between-

THE ISLAMIC REPUBLIC OF PAKISTAN

-and-

THE REPUBLIC OF INDIA

CERTIFIED TRANSCRIPT
(HEARING FOR THE FIRST PHASE ON THE MERITS)

COURT OF ARBITRATION:

Professor Sean D. Murphy (Chairman)
Professor Wouter Buytaert
Mr. Jeffrey P. Minear
Judge Awn Shawkat Al-Khasawneh
Dr. Donald Blackmore

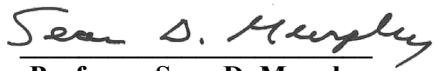
SECRETARIAT:

The Permanent Court of Arbitration

ON BEHALF OF THE COURT OF ARBITRATION:

CERTIFIED PURSUANT TO PARAGRAPH 19 OF ANNEXURE G

9 July 2024



Professor Sean D. Murphy
Chairman

In the matter of an arbitration
pursuant to Article IX and Annexure G
of the Indus Waters Treaty 1960
PCA Case No. 2023-01

Permanent Court of Arbitration
Peace Palace
The Hague
The Netherlands

Day 2 Tuesday, 9 July 2024

Hearing of the First Phase on the Merits

Before:
PROFESSOR SEAN D MURPHY
HE JUDGE AWN AL-KHASAWNEH
DR DON BLACKMORE
MR JEFFREY P MINEAR
PROFESSOR WOUTER BUYTAERT

BETWEEN:

THE ISLAMIC REPUBLIC OF PAKISTAN

-and-

THE REPUBLIC OF INDIA

Transcript produced by Trevor McGowan
Georgina Vaughn and Lisa Gulland

APPEARANCES

FOR THE ISLAMIC REPUBLIC OF PAKISTAN

MR SYED MUHAMMAD MEHAR ALI SHAH, Commissioner for Indus Waters, Ministry of Water Resources
MR ASAD KHAN BURKI, Legal Advisor, Ministry of Foreign Affairs
MR ZOHAIR WAHEED, Office of the Attorney General
H.E. MR SULJUK MUSTANSAR TARAR, Ambassador of Pakistan to the Kingdom of The Netherlands
MS FATIMA HAMDIA TANWEER, First Secretary, Embassy of Pakistan to the Kingdom of The Netherlands
MR JAMAL NASIR, First Secretary, Embassy of Pakistan to the Kingdom of The Netherlands
SIR DANIEL BETHLEHEM KC, Twenty Essex, London
PROFESSOR PHILIPPA WEBB, Twenty Essex, London
DR CAMERON MILES, 3 Verulam Buildings, London
PROFESSOR ATTILA TANZI, 3 Verulam Buildings, London
MR STEPHEN FIETTA KC, Fietta LLP, London
MS LAURA REES-EVANS, Fietta LLP, London
MR ABDULLAH TARIQ, Fietta LLP, London
MS MEGAN RIPPIN, Fietta LLP, London
DR GREGORY L MORRIS, Technical Advisor
MR PETER J RAE, Technical Advisor

THE REPUBLIC OF INDIA WAS NOT REPRESENTED

FOR THE PERMANENT COURT OF ARBITRATION

MR GARTH SCHOFIELD, Deputy Secretary General
MR BRYCE WILLIAMS, Legal Counsel
MR SEBASTIAN KING, Assistant Legal Counsel
MS VILMANTE BLINK, Senior Case Manager

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09:08 Tuesday, 9 July 2024
(9.32 am)
THE CHAIRMAN: Good morning, everyone. This is the second day of the hearing on the first phase in the proceeding.
We finished yesterday with Sir Daniel not quite finished with his opening presentation, so we'll start back up with that, and then proceed.
Sir Daniel.
Opening submissions on behalf of the Islamic Republic of Pakistan (continued)
SIR DANIEL: Thank you very much, Mr Chairman.
Mr Chairman, if you see that I'm standing a little bit further away from you, it's not because I'm a little bit more distant: it's just because a much bigger screen has been put in front. And for those of us who are vertically challenged, we can't exactly see the bottom of the screen from close proximity. I won't be using that, but Mr Fietta and others will be doing so.
Mr Chairman, members of the Court, I, yesterday, was almost through my submissions, and the last part of my submissions was dealing with the genesis of the present dispute, the opposition of the parties on the key issues, and the relevance of the Kishenganga and Baglihar decisions. I had addressed the genesis of the dispute and the opposition of the parties, and I hope

09:33 that that point also had dealt with some of the issues that had arisen in questions over pondage.
I have got just some very brief submissions to conclude from yesterday, about the relevance of the Baglihar determination and the Kishenganga award for these proceedings, and then I will take on my role as MC and just address what you're going to be hearing for the rest of the day.
On the question of the relevance of the Baglihar determination and the Kishenganga award for these proceedings, this is a point that is expressed at paragraphs 1.18 to 1.24 of Pakistan's Memorial, but it informs the analysis in the Memorial more widely. And I note in particular, for the record, paragraphs 8.50 to 8.55 of chapter 8 of the Memorial, which also addresses this issue.
But, as I say, the Baglihar/Kishenganga dimension infuses all of the submissions. And when you come to hear in particular from Dr Miles and Professor Webb, who will be dealing with the paragraph 8 aspects in response to the questions that you posed in advance of the hearing, we will be introducing, even more than we have done in the written Memorial, a reference to India's submissions both in Baglihar and in Kishenganga.
Mr Fietta in particular, in his submissions tomorrow

09:34 addressing the Baglihar and Kishenganga decisions, will also address the Court's question (a), which related to the weight and authority of previous decisions. And I don't propose to trespass unduly onto his issues, but only anticipate one point: the Baglihar Neutral Expert determination of February 2007 was dispositive of the differences in contention between the parties with respect to the Baglihar plant.
This follows from paragraph 11 of Annexure F, which we touched upon yesterday. I don't think I need to take you to it, but it's there. This provides that:
"The decision[s] of the Neutral Expert on all matters within his competence shall be final and binding, in respect of the particular matter[s] on which the decision is made, both upon the Parties and upon any Court of Arbitration ..."
So it's quite clear that this provision is unambiguous. The Court in the Kishenganga arbitration accepted that the Baglihar determination of 2007 was dispositive in respect of the Baglihar plant. And insofar as the Court took issue -- as they did, very heavily -- with the Neutral Expert's determination in Baglihar, they did so for systemic purposes, but not with regards to Baglihar. And it is no part of Pakistan's contention in these proceedings to reopen the

09:36 Baglihar determination or to contest the application of the Baglihar determination to the Baglihar plant.
Determinations of Neutral Experts of the questions of -- and here I'm quoting -- "whether or not the design of a Plant conforms to the criteria set out in Paragraph 8" are plant-specific, and that follows from the language of paragraph 11 of Annexure D.
So we've got multiple paragraph 11s here. Paragraph 11 of Annexure F talks about the "final and binding" quality of Neutral Expert decisions. But paragraph 11 of Annexure D is the provision which is the gateway into dispute settlement in the context of disputes over design.
You will recall that Mr Shah yesterday drew attention to paragraph 9, which was the provision of information. Paragraph 10 of Annexure D is the objection that Pakistan may make. And then paragraph 11 of Annexure D contemplates a process for addressing differences that arise in respect of the design criteria of a plant.
So this reference to "a Plant", the Neutral Expert determination in respect of "a Plant", follows from the coincidence of two provisions: paragraph 11 of Annexure D, which is cast in terms of "the design of a Plant"; and then paragraph 1, subparagraph 11 of

09:38 Annexure F, which is the Neutral Expert's competence.
I'm just looking at members of the Court: would you like me to take you through those provisions, or are you content that those are on the record and you have the interaction of all of these provisions? I would be very happy to take you to them if it would help.
THE CHAIRMAN: I think we reasonably understand the progression, so no need to take us through them. Thank you.
SIR DANIEL: Thank you. I should say that with a little bit of bright sunlight behind you, you are in a comfortable haze, so I'm not quite sure whether I'm reading facial expressions entirely correctly.
So paragraph 1, subparagraph 11 of Annexure F affords the Neutral Expert competence in respect of differences over conformity with the paragraph 8 design criteria and essentially provides that they do not have wider effects beyond the plant-specific. So Neutral Expert determinations are not generic statements of interpretation. They do not apply beyond the plant that they address.
It follows from that, of course, that Neutral Expert determinations do not have any presumptive systemic interpretative effect. Whether a Neutral Expert determination will have any wider influence will

09:39 therefore depend on the persuasiveness of the analysis that underpins that determination.
Of course we are not at all saying, you will appreciate, that you should not look at Raymond Lafitte's Neutral Expert determination in Baglihar. Of course you must do so. Were you to be persuaded that his analysis is correct, then of course it is within your scope of competence to echo that analysis and adopt it. If you were persuaded that his analysis is faulty, then it is within your competence and remit to declare that it is faulty and that it will not apply on a systemic basis. And indeed, that is exactly what the Court in the Kishenganga arbitration did with respect to drawdown flushing: it doubted and rejected the Neutral Expert's determination and moved on.
So this position with regard to the reach and authority of Neutral Expert determinations contrasts materially with the weight and effect of findings of the Court of Arbitration. The findings of a Court of Arbitration -- the Kishenganga Court; in due course, the findings of this Court with respect to systemic views of interpretation -- will have systemic implications and are more widely authoritative and dispositive insofar as they reach findings of general interpretative effect.
My apologies in particular to the non-legal members

09:41 of the Court if this is too broad a brush stroke, that would benefit from further unpacking and explanation, but this is something that Mr Fietta will be dealing with tomorrow when he responds to the Court's question (a).
The point that I would like to leave you with -- and this is almost the conclusion of my opening observations -- the point that I would like to leave you with is straightforward.
Pakistan considers that the Baglihar Neutral Expert determination was fundamentally flawed in both its methodology and its outcomes. You've heard this from us before, you've seen it in our Memorial: it's not a surprise. While the Baglihar determination has binding effect in respect of the Baglihar plant, it has no presumptive effect beyond that plant, and will only be relevant insofar as you may be persuaded by the detail of its analysis.
On this, we hope to persuade you that the Neutral Expert determination in 2007 is critically unsafe and unreliable, and failed to approach the interpretation of the Treaty in a manner that was consistent with the terms of the Treaty, with its object and purpose, and with the bargains that were struck by the parties in 1960. And certainly this was the view of the

09:42 Kishenganga Court, which expressly rejected key elements of the Baglihar methodology and conclusions.
India's position is to essentially ignore the Kishenganga Court's analysis and conclusions in favour of adopting the Baglihar determination. And India persists in insisting that drawdown flushing -- the depletion of dead storage -- is permitted under the Treaty for sediment management, and that it can construe the paragraph 8 design criteria in a manner that will allow it to design HEPs that will thereafter be able to flush. And it has adopted the Baglihar approach to the calculation of maximum allowable pondage.
Mr Chairman, members of the Court, the parties are, once again, in fundamental dispute about these issues. This is why we are here. This is the reason that Pakistan, through the then PCIW, concluded in February 2016 that the only way to resolve the dispute between the parties, this long-running dispute, was not to refer the matter to a Neutral Expert but to refer the matter to a Court. Because the issues in dispute between the parties were not just technical design issues associated with the Kishenganga plant or the Ratle plant, but they were much wider questions of systemic interpretation that went to the interpretation and application of Article III and paragraph 8 of

Annexure D.

So that, as it were, puts its arms -- or at least I hope it does so -- around the whole of the case.

So Mr Chairman, members of the Court, I come to my, as it were, concluding observations of the opening observations. This is not intended to be Churchillian: this is not the end, it's not even the beginning of the end, it's just the end of the beginning. Almost everything that I have to say will be revisited, unpacked and elaborated upon by my colleagues, and we will spend a good deal of time addressing you on the detailed issues of interpretation of Article III and paragraph 8 of Annexure D of the Treaty.

We have approached our submissions like a pyramid, with a broad foundation leading to a pinnacle. The pinnacle, of course, will be the detailed submissions on the interpretation of the subparagraphs of paragraph 8, which you will hear on Thursday and Friday. But the pinnacle is only a pinnacle because it rests on a broad foundation, and the pyramid can only be climbed from below, which is why we are building up systematically.

Let me, with that, turn to my MC role and just sketch out what you are going to be hearing for the rest of today. But before I do so, Mr Chairman, perhaps I should just pause there, as that draws a line under my

substantive submissions, and enquire whether there are any questions from the Court or issues that I can help you with at this point.

THE CHAIRMAN: No, I think there are no questions Sir Daniel. So please proceed with your master of ceremonies role.

SIR DANIEL: I can tell that the Court is eager to get into the detail of the issues.

(9.46 am)

Day 2 Overview

SIR DANIEL: So let me then just turn briefly to give you the menu for what will follow today, and to situate the submissions within the overall framework of Pakistan's case.

You will have four submissions today, all laying the foundations for the interpretative exercise that will begin in earnest tomorrow.

You will hear first from Ms Laura Rees-Evans, who will address you on the negotiations that led to the conclusion of the Indus Waters Treaty and its travaux préparatoires. She will be followed by Professor Webb, who will address you on principles of treaty interpretation. Professor Webb will then be followed by Mr Stephen Fietta, who will make submissions on water usage and sustainability. His submissions are likely to

straddle the lunch break.

Then the day will be completed by Dr Gregory Morris, who is not in the room just at the moment because he is responding on paper to questions that were posed yesterday and just adjusting his script. And he will address you on Himalayan run-of-river and HEP design and operation issues from an engineering perspective.

It may be that, to the extent that there are a considerable number of questions from the Court, which we will certainly try and accommodate in the course of the proceedings today, rather than simply defer them to the second round, it may be that Dr Morris, who has a formal presentation to make, but it may be that we will hold some of that over until tomorrow morning.

I make just two observations there, before I just give you a little summary of the issues that will be addressed.

The first observation is that each of those who will be making submissions during the course of today will endeavour to pick up at least some of the questions that were posed yesterday that fall within their remit. So what we have found as we've been preparing overnight is that the anticipated timing of the submissions may perhaps be a little bit longer than the outline that I gave you yesterday. I think, for example, we

indicated that Professor Webb would be speaking for about 45 minutes: probably that will go up a little. But we are comfortable that we are in the framework of the scheme.

The second point is just to anticipate something that will come to you perhaps around about the coffee break. In response to a question from Dr Blackmore yesterday, Dr Morris proposes to address a number of issues around sedimentation and the dams in the Himalayas, and is proposing to reference some publicly available information from a number of dams to illustrate the point. This is all publicly available. I think that there are two instances of additional exhibits that we would like to put on the record, and we will apply to do so, in response to Dr Blackmore's question. But that will come to you in writing during the course of the morning, in advance of Dr Morris's presentation.

So I'm not proposing to anticipate the takeaway points that each of the advocates will be making during the course of today, but let me just briefly situate their submissions within the overall scheme of Pakistan's case, so that you have a sense of how it all fits together.

As I addressed from a 10,000-foot level yesterday,

09:50 the Treaty has to be interpreted holistically. The paragraph 8 mandatory design criteria must be construed in the light of the let-flow and non-interference provisions of Article III. Article III must, in turn, be interpreted in the light of the Treaty bargain, in which Pakistan was given unrestricted use of the waters of the Western Rivers, while India was given the unrestricted use of the waters of the Eastern Rivers. That's the Treaty bargain. And then the Treaty bargain in turn has to be construed in the light of the broader settlement that was pursued and achieved by the Treaty, the delimitation of the waters that flowed across the partition land, and that's the peace bargain.

These three interlocking bargains which I addressed yesterday -- the hydro bargain, Article III and Annexure D; the Treaty bargain, in shorthand, Article II and Article III; and then the peace bargain, the settlement of the dispute, which is also reflected in Annexure A -- all interlock.

The circumstances of the conclusion of the Treaty and its preparatory works are the start of this narrative, and this is what will be the subject of Ms Rees-Evans's submissions in just a moment. As Professor Webb, who will follow Ms Rees-Evans, will subsequently explain, settled principles of treaty

09:51 interpretation provide that the circumstances of the conclusion of a treaty and its preparatory works, its travaux préparatoires, can be used as a supplementary means of interpretation.

Ms Rees-Evans will therefore take you through these preparatory works and the circumstances of the conclusion of the Treaty. She will be filling out and making solid the elements that I addressed yesterday when I laid out the three bargains embodied in the Treaty. And she will also be responding to a number of points that were raised in the submissions yesterday.

If Ms Rees-Evans will begin the exercise of laying the bricks of the structure of Pakistan's case -- mine is the design, we then move to the construction -- Professor Webb will provide you with the mortar that will be necessary to keep the bricks in place and ensure that the structure is secure. And she will address the bespoke and well-settled rules and principles of treaty interpretation that will guide you in your task.

And importantly, and I hope usefully for your purposes, she will root those general principles of interpretation also in the practice of the Kishenganga Court. Because the Kishenganga Court, at various stages in its various decisions and awards, referenced these settled principles in some detail.

09:53 Her submissions will provide not only the legal framework that applies to the interpretation of treaties but, importantly, she will also address the relationship between, for interpretative purposes, the primary rule and the exceptions to the rule. And that's the relationship between the headline provision in Article III -- let flow, unrestricted use, non-interference and no storage -- and the exception for hydroelectric power and pondage sufficient to provide for firm power, which are found in Annexure D. So there's the primary rule, Article III; then there are the exceptions to the rule, which are essentially found, or detailed, in Annexure D.

Professor Webb will also address you on the interpretative approach to terms that are given a special meaning. I anticipated a little bit of this yesterday when I drew your attention to paragraph 2 of Annexure D, and that a number of the provisions -- for example, pondage, dead storage level and so on -- are given a bespoke meaning in the Treaty. And Professor Webb will address you on the interpretative approach to terms that are given a special meaning.

She will also address the issue of subsequent agreements and subsequent practice that were the subject of enquiry yesterday from you, Mr Chairman. She will

09:54 also pick up on a number of other themes from yesterday, including the relevance of the special character of the Treaty.

Mr Fietta, who will follow Professor Webb, will address you in some detail on the critically important issue of water usage and sustainability. I note that this is a very broadbrush headline, but it's a headline title that he will use to take you into the basis of the Treaty bargain that was struck in 1960 and the peace bargain framework for doing so.

His submissions will, of course, be given through the lens and the voice of a lawyer, but they are not principally submissions on legal issues, as he will explain the basis for the Treaty bargain division of rights between the Eastern Rivers and the Western Rivers. You will recall that I said yesterday that this division was not a Solomonic exercise of simply cutting the baby, but was actually based on foundation, on the watershed, on the flow of the rivers, and he will address that.

He will also address the critical importance to Pakistan of the unrestricted flow of the waters of the Western Rivers, and Pakistan's acute vulnerability to the interference in the flow of those waters. So his submissions will therefore be providing you with the

09:56 policy and the hydrological underpinnings of the Treaty. And I use the word "hydrological" with a sense of caution, because I'm not intending to label an engineering hydrological mantle for Mr Fietta, but he's going to be talking about all of those issues.

Finally, we will come to Dr Morris's presentation, providing an opportunity for an authentic engineering voice in the discussion. You heard in the Neelum-Jhelum site visit a lot of Pakistan's expert engineers obviously not talking about the Treaty, but giving you an insight into the operation of run-of-river dams. And this will be an opportunity for an authentic engineering voice actually addressing the dispute and the Treaty.

The Treaty, although it is a legal instrument and one of constitutional importance, was critically informed in its negotiation by engineers. As we have addressed in our Memorial, the World Bank team that held the ring in the negotiations of the Treaty was led, amongst others, by Raymond Wheeler, the engineering advisor to the World Bank from 1949 to 1964.

As formerly Lieutenant General Raymond Wheeler, Mr Wheeler had been the Chief of Engineers of the United States Army in the period before his appointment to the World Bank, his retirement from the army. So he was an expert engineer of longstanding experience, who was

09:57 at the helm of the negotiations of the Treaty on the technical engineering side, from their inception to their conclusion. His period at the World Bank [was] from 1949 all the way through to 1964.

As you will also appreciate from Pakistan's Memorial, the US Army Corps of Engineers standards and guidance published over the years is a hugely important resource in this field.

As I mentioned just a moment ago, Dr Morris has a structured presentation to give you. But the purpose of his submissions is not only to make the structured presentation but to provide an opportunity for the Court to engage with Dr Morris on issues arising from the Neelum-Jhelum site visit that you may have wanted to raise with him in the course of the site visit but, because of the Site Visit Protocol, were not able to do so.

You will know that Dr Morris is a leading authority on sediment management. Amongst his many other virtues, he also has a deep experience across the whole of the Himalayan region, being intimately familiar not only with Pakistani dams but also with other large dams across the Himalayas. And one of the responses that Dr Morris will give to the enquiry raised by Dr Blackmore will reference a number of other

09:59 non-Pakistani dams -- also Pakistani dams, but a number of other non-Pakistani dams -- to address Dr Blackmore's enquiry.

Dr Morris is also a veteran of the Kishenganga arbitration, so he brings a measure of institutional memory from those proceedings.

Mr Chairman, members of the Court, before I hand over to Ms Rees-Evans, which I will do in 60 seconds, I have one concluding observation to make.

As I addressed yesterday, while the origins of the present dispute are to be found in the Kishenganga dispute, which was crystallised in 2006, with the first correspondence identifying that it was a dispute for purposes of Article IX, the roots of the parties' systemic dispute, of which you are seised, go back much deeper: to Pakistan's objection to India's Baglihar Dam proposals in 1992. And I referenced the letter in which Pakistan cited a number of the paragraph 8 subparagraphs in 1992, in which it objected to India's Baglihar proposal.

That objection particularised Pakistan's concerns over India's interpretation of the paragraph 8 design criteria of run-of-river HEPs. That dispute has never been resolved or gone away, other than with respect to the binding determination concerning the Baglihar plant

10:00 alone, following the Neutral Expert's determination of February 2007. The contours of the systemic interpretative dispute that are now before you are largely the same as they were going back to 1992. There has been some variation, there has been some circumstantial change, but it's largely the same dispute.

The Kishenganga Court gave binding interpretations with systemic effect in respect of a number of matters, including the preclusion of drawdown flushing. India continues to contest this. And as we heard from Pakistan's Commissioner yesterday, India flushes its Western River HEPs, including without notification to Pakistan, and India refuses to come to these proceedings. And as both Pakistan's Deputy Agent and I noted yesterday, India cannot, by its absence from these proceedings, strengthen a fundamentally flawed case by the device of simply not making it.

Mr Chairman, with that, unless there's anything further with which I can help you, may I ask you to invite Ms Rees-Evans to the podium to continue Pakistan's submissions.

THE CHAIRMAN: Thank you, Sir Daniel. I don't think there are any questions we have for you at this time.

So I invite Ms Rees-Evans to take to the podium.

10:02 Thank you very much.
(10.02 am)
Submissions on Negotiating the Treaty
MS REES-EVANS: Thank you, Mr Chairman, members of the Court. It's an honour to appear before you again this morning to represent the Islamic Republic of Pakistan. Today I will address you on aspects of the negotiating history of the Indus Waters Treaty that are relevant to this phase of the proceedings.
Before I do, I'd like to pick up on a point that Mr Minear raised in a question to Mr Shah yesterday in his examination. This was in the transcript at Day 1, page 167, lines 16 to 19. Mr Minear asked:
"... under Article VII(2), does Pakistan, as a downstream riparian, ever have occasion or obligation to notify India of its engineering works that might materially affect India?"
Mr Shah answered:
"I don't think so."
We just wanted to pick up on this response by reference to the terms of Article VII(2) of the Treaty.
Under Article VII(2), the information-sharing obligations apply to both parties. It provides that:
"If either party plans to construct any engineering work which would cause interference with the waters of

10:04 any of the Rivers and which in its opinion, would affect the other Party materially, it shall notify the other Party of its plans and shall supply such data relating to the work as may be available and as would enable the other Party to inform itself of the nature, magnitude and effect of the work."
So it's mutual: both parties are under the obligation. Pakistan has the same obligation as India. But Pakistan hasn't had occasion -- in your words, Mr Minear -- to notify under Article VII(2). And the obligation is of more limited relevance, therefore, to Pakistan, because there are limited circumstances in which Pakistan would be capable of constructing engineering work which would cause interference with the waters and would affect India materially.
So it's this practical reality that was reflected in Mr Shah's answer to you, but we wanted to ensure that the legal position was clear on the record.
MR MINEAR: Thank you, Ms Rees-Evans. (Pause) Sorry for the delay in my question, Ms Rees-Evans.
The basis for my question, just so I'm clear on this, is the situation such as Pakistan's planned construction of the Neelum-Jhelum Dam and hydropower plant. That construction could have affected India's plans with respect to Kishenganga. And it's in that

10:05 circumstance where I wondered if Pakistan would provide advance notice, since the early construction of Neelum-Jhelum could have preempted or prevented the construction of Kishenganga.
That was the thought that motivated my question. I'm not looking for a particular answer on that at this point, but I just wanted to clarify why I asked that question.
MS REES-EVANS: Okay. That's helpful to know, thank you. We will check whether there is any clarification we need to make on that, and revert if there is.
MR MINEAR: Thank you.
MS REES-EVANS: (Slide 2) So with that, I will turn now to my presentation. The purpose of the presentation -- situated, as it is, at the beginning of Pakistan's submissions -- is to highlight for you the key features of the historical context that lies behind the Treaty. And it will take three parts.
First of all, I will look at the historical origins and circumstances of conclusion of the Treaty. Then I will go through the negotiation of the Treaty in the critical period between 1954 and 1960. Then finally, I will draw some conclusions in my third section on the travaux and the interpretation of Article III Annexure D. And it's in this section that I will return

10:07 to, Mr Minear, one of your questions on the travaux to Mr Shah yesterday afternoon.
(Slide 3) So turning to the first of these three topics.
Mr Chairman, members of the Court, as you will by now know well, the events that led to the negotiation and conclusion of the Treaty are not just a point of historical interest. Appreciation of those events is essential to understanding the text of the Treaty and its operation in practice to this day.
Sir Daniel referred you yesterday to the partition of British colonial India into what are now independent states of Pakistan and India by an act of the British Parliament in 1947. As he said yesterday and this morning, the act divided the land, but failed to address the allocation of waters. It left parts or all of the upper reaches of the six main rivers of the Indus system in what is now Indian-controlled Kashmir, with their downstream stretches flowing through Pakistan.
As the Deputy Agent said in his opening remarks yesterday:
"... since the independence of the Islamic Republic of Pakistan in 1947, Pakistan, being the lower riparian, has lived in insecurity."
That was yesterday, the Day 1 transcript, page 13,

10:08 lines 4 to 6.

You were referred yesterday to the events of April 1948, the so-called "water dispute". This incident left deep and long-lasting scars in the memories of the people of Pakistan, and Pakistan has lived ever since in the shadow of the insecurity of the 1948 rupture.

That shadow is well encapsulated in an article written by Mr David Lilienthal and published in Collier's magazine just three years after the water dispute, in 1951 (P-233). If you're familiar with Appendix A of Pakistan's Memorial, where we set out the travaux in quite some extensive detail, you'll be familiar with Mr Lilienthal, whose name appears throughout it. He was the founding chairman of the Tennessee Valley Authority, a public corporation, whose purpose was, among other things, to supervise a vast system of navigation, flood control and electricity generation in Tennessee and parts of several surrounding US states.

In 1951, the Governments of India and Pakistan invited him to visit India and Pakistan. His article summarised the findings of his trip and made proposals for the resolution of the water dispute. He observed with his own eyes a temporary reduction in the flow of

10:09 water from India, in a source of water that supplied Lahore and the surrounding farming country near the border. Pakistanis were, in his words, "furious". He put their visceral reaction down to the 1948 dispute. That dispute, as you can see in the quote on slide 4 now, at the very end, "makes Pakistan fearful of the future".

As early as 1951, Mr Lilienthal saw firsthand India's expansive canal-building and irrigation programme. He commented that:

"Most of this new withdrawal of water will come from rivers or canals within India which would otherwise flow on to Pakistan."

That's Exhibit P-233 at page 8.

At the same time, India was proudly promoting its extensive hydroelectric plants for its "vast resources of large rivers and high mountains". That's Exhibit P-409, page ii.

This existential and ever-present threat of Indian interference with waters on which Pakistan was reliant was, in his view, one of the most important elements of the dispute between the two countries.

THE CHAIRMAN: Ms Rees-Evans, sorry to cut in relatively early in your presentation, but since you have this particular slide on the screen -- or at least if we

10:10 could go back to the one that we just had (slide 4).

I'm still not clear how best to interpret what's being said here. As indicated yesterday, I think India, in one of its memorials in the Kishenganga proceeding, argued that the cut-off was not of all the water flowing from India into Pakistan, all six rivers, if you will; instead, it was of two canals. And so when I read this kind of quote, where it says, "during ... negotiations [regarding] allocation of water for irrigation, India cut off most of the supply of water", is that to be interpreted as two particular canals were cut off, or the entire water supply was cut off?

MS REES-EVANS: Well, we looked into this after your question yesterday and I have deliberately not gone into too much detail about this today because the reality is that what matters is [that] the impression that was left in Pakistan was this impression of extreme fear, and the rupture stayed in the minds of the negotiators thereafter, and in Pakistanis to this day. So the feeling among Pakistanis caused by this incident was of India being an extreme threat in terms of its control over the waters.

In terms of the specifics of what happened in the incident, India has taken the position that you described yesterday in its counter-memorial. Pakistan

10:12 describes a different situation in -- I think it's a publication of 1952. And I can find the reference for you: I think it might be P-150, but we can confirm that [P-350].

Pakistan sets out in that publication its version of events of the 1948 dispute in quite some detail, but it doesn't pick up on these two canals that India referred to in its submissions. It refers to a more general impact on a wide area within Pakistan.

So if you would like us to return to that question and set out in any more detail the specifics of exactly what happened in 1948, we can certainly do that. But I think as Sir Daniel said yesterday, the main takeaway from it is the impact that it had in the minds of Pakistanis and how it influenced their approach to the negotiations during this period from 1948 to 1960.

THE CHAIRMAN: Thank you.

MS REES-EVANS: So Mr Lilienthal observed -- this is at slide 5, and this is the description that Mr Lilienthal, a third-party neutral observer, had of what was happening there at this time -- that:

"No army, with bombs and shellfire, could devastate a land as thoroughly as Pakistan could be devastated by the simple expedient of India's permanently shutting off the sources of water that keep the fields and the people

of Pakistan alive."

This is Exhibit P-233, pages 7 to 8.

In other words, he is describing the power of India to weaponise the water. It was then, as it still is now, a very real one. And the risk of weaponisation of water lay, both then and now, at the heart of the dispute between the parties.

He described then that "The starting point" of the settlement of the dispute -- this is at slide 6 -- "should be ... to set to rest Pakistan's fears of deprivation and a return to desert". That should be the starting point of the solution to the Indus Waters problem.

Mr Lilienthal's article was the catalyst that prompted the World Bank's intervention. In 1951, having seen the article, the then President of the World Bank, Mr Eugene Black, wrote to India and Pakistan. He offered them the Bank's good offices to develop an approach to the management of the Indus Waters resources. His letters are at P-354 and P-355.

The proposal put forward was based on that set out in Mr Lilienthal's article. It envisaged cooperative development of the water resources of the basin. The proposal itself is set out in Exhibits P-356 and P-357, and again they are letters from Mr Black to the

Prime Ministers of Pakistan and India respectively.

Two years of negotiations based on his proposal failed to yield any agreement. The poor prospects of a smooth-running joint administration were part of the problem. Another part of the problem was the fundamentally different approaches of Pakistan and India to how each side's existing uses of water should be serviced.

It was this latter problem, the existing uses, that the Bank attempted to solve with its February 1954 proposal, and that's in Exhibit P-130. This proposal gained traction with the negotiating states, and ultimately it came to underpin the grand bargain reflected in the Treaty.

Slide 7 has now got the 1954 proposal on it, and it embodied two fundamental principles. The first was that:

"... historic withdrawals [of waters] must be continued, [but] not necessarily ... from existing sources."

The second was the principle of "mutual independence". It was to be achieved by dividing control of the waters: Western Rivers to Pakistan, Eastern Rivers to India. The division of control of the Western and Eastern Rivers would give each

an independent and separate supply, and this would help to "minimiz[e] friction between the two countries".

Justifying this fundamental principle of independence, the Bank stated that it was "desirable", in its view:

"... so far as practicable, to avoid control by India over waters on which Pakistan will be dependent, and to enable each country to control the works supplying the water allocated to it and [to] determine in its own interests the apportionment of waters within its ... territories."

That's at paragraph 22 of the 1954 proposal.

Just as Mr Lilienthal had envisaged, this would help to allay Pakistan's fears of deprivation and, in his words, "return to desert".

The 1954 proposal further explained that mutual independence would be achieved by:

"... locati[ng] ... works serving each country on territories under its control, and [by the provision of] assurances against interference by either country with the supplies on which the other depends ..."

These mechanisms, the Bank proposed, would "reduce the chances of disputes", and would "promote the development of the entire basin". That's at P-130, paragraphs 41 and 42.

The basic scheme of the 1954 proposal survived essentially unaltered in the subsequent years of negotiations.

With that background context, I now turn to the second part of my presentation, which is a more detailed run-through of the critical negotiating period between 1954 and 1960. And there are two main themes that arise from this period: first, the pivotal importance to Pakistan of India's non-interference with or control of the waters of the Western Rivers; second, that exceptions to the principle of India's non-interference with or control of the waters of the Western Rivers, in particular the generation of hydroelectric power, were fiercely contested. Because of that, ultimately they were tightly constrained.

So I return just for a moment back to the basis of the negotiations over this period, which is the 1954 proposal of the Bank. The key details of that proposal were set out in four simple paragraphs, shown on this and the next slide, slides 9 and 10.

The first paragraph is the early progenitor of India's let-flow obligation. This is an obligation that would ultimately be crystallised in Article III(1) of the Treaty. It provided that:

"The entire flow of the Western rivers (Indus,

Jhelum and Chenab) would be available for the exclusive use and benefit of Pakistan, and for development by Pakistan, except for the insignificant volume of Jhelum flow presently used in Kashmir."

India's share of the bargain, as it was envisaged in 1954, was reflected in the second paragraph. It provided that:

"The entire flow of the Eastern rivers (Ravi, Beas and Sutlej) would be available for the exclusive use and benefit of India, and for development by India ..."

Except during a specified transition period.

(Slide 10) The third paragraph provided that the transition period was to be calculated based on the time needed to effect the replacement of supplies for Pakistan's historic withdrawals from the Eastern Rivers.

The fourth paragraph addressed the construction and cost of the works required to effect the replacement of supplies from India.

The Bank argued that its 1954 proposal provided a "fair division" of the waters, and secured each state mutual independence. India swiftly accepted the Bank's proposal.

Pakistan was more cautious. It saw the Bank's proposal as involving, in its words, "great sacrifices". And that's in the letter from Foreign Minister Zafrullah

Khan to Mr Black of 28 July 1954, Exhibit P-383 at paragraph 3.

Pakistan had two principal concerns. They were set out in a letter from Prime Minister Ali to Mr Black of May 1954; that's Exhibit P-382. Pakistan's first concern was that the Bank proposal did not in fact guarantee supplies for Pakistan's existing uses. Second, Pakistan was concerned about the proposal to cut off the supplies which Pakistan has traditionally received from the Eastern Rivers, even if as a way to operationalise the goal of avoiding Indian control over supplies on which Pakistan would be dependent.

After some months of discussion, Pakistan accepted the 1954 proposal. Its acceptance was subject, among other things, to the condition that it receive assurances that Pakistan's existing uses supplied by the Eastern Rivers, and the planned requirements of Gudu and Sukkur, could be met from the flow of the Western Rivers. That's Exhibit P-383, paragraphs 2 to 3.

Pakistan was right to hesitate. The Bank's consultants, a firm called TAMS, subsequently concluded that the 1954 proposal would lead to:

"... consistent shortages [of water] in Rabi ..."

That is, winter crop season:

"... occasionally beginning in late September or

extending into early April ... of a degree, duration and frequency which the Bank Group could not regard as 'tolerable'."

That's in the 1956 aide-mémoire, Exhibit P-131, paragraph 6(c)(iii). TAMS's findings led to an adjustment to the proposal, which was set out in the aide-mémoire from the Bank of May 1956.

The aide-mémoire also recorded India's claim "that some part of the flow of the Jhelum and Chenab should be reserved for future development", involving "relatively insignificant consumptive uses", in the State of Jammu and Kashmir. That's at paragraph 7(b) in Exhibit P-131. That was an issue deferred for discussion until much further down the track, presumably on basis that given the "insignificance" -- to use the terms of the aide-mémoire -- of such uses, it would not ultimately affect the fundamental balance set out in the 1954 Bank proposal.

The next major landmark in the negotiations came in May 1957. The Bank conveyed to India and Pakistan "some suggestions" for a heads of agreement based on the 1954 proposal, as adjusted by the 1956 aide-mémoire.

(Slide 11) The May 1957 head of agreement -- this is at P-0362 -- built upon the division of the waters and exclusivity advanced in the 1954 proposal. It recalled

again the central tenet of the 1954 proposal: the division of the control of the "entire flow" of the Western and Eastern Rivers to Pakistan and India respectively. This is now in paragraph 1, now shown on the slide.

(Slide 12) The May 1957 heads of agreement also introduced for the first time the concept of a Commission. The functions of the Commission would include overseeing proposals concerning:

"... construction of the works on the Indus or on the Jhelum or on the Chenab, outside the boundaries of Pakistan, which are likely to interfere with the timing of the natural flow into Pakistan of the waters of any of these Rivers."

This is at point (h), now shown underlined on the slide.

This provision caused Pakistan concern. The fundamental basis of the 1954 proposal was "to avoid control by India over waters on which Pakistan will be dependent": that's in the 1954 proposal at P-130, paragraph 22. And Pakistan would fiercely contest any attempt to encroach on this.

(Slide 13) Pakistan raised its concerns on paragraph 10(h) with the Bank. Pakistan said it assumed that the provision was:

"... not meant to ... increase Indian control over the Western Rivers including their upstream tributaries."

Pakistan noted that:

"... any development on these rivers upstream of Pakistan would have to have the consent of the Government of Pakistan. It is not sufficient to have the Commission ascertain that the proposed works are not likely to interfere with the timing or amount of the natural flow into Pakistan."

That's Exhibit P-410, pages 2 to 3.

So it seems that paragraph 10(h) in the draft May 1957 heads of terms was likely what provoked the first discussions between the parties over India's plans to construct run-of-river HEPs on the Western Rivers. And this is what followed, in slide 14.

At a meeting at the Bank at the end of May 1957, Mr Gulhati, the head of the Indian delegation, confirmed that "India would wish to be free to construct run-of-the-river plants". But he reassured the Bank that:

"... India would certainly be prepared to undertake not to construct live storage on any of those rivers or to interfere with the timing of the natural flow ..."

That's Exhibit P-411, page 1.

Pakistan remained firm. In discussions with the Bank in mid-June 1957, Pakistan reaffirmed that it was "not prepared to acquiesce in any interference by India on the River Chenab". This is Exhibit P-412, paragraph 4(1). Its fears of Indian interference with or control over the waters also led Pakistan to take a firm line on Indian HEP-building on the Western Rivers. Pakistan informed the Bank that it "could not agree to the control by India of the Western Rivers even through works for the generation of Hydro-electricity". That's Exhibit P-363, paragraph 6.

Following these discussions, the Bank produced a revised set of heads of terms, the June 1957 heads of terms. The following month Pakistan's chief negotiator, Mr Mueenudin, wrote to Mr Iliff. In his letter, he identified eleven "principles" of the Bank's 1954 proposal and the 1956 aide-mémoire.

The importance Pakistan placed on India's non-interference with or control of the waters of the Western Rivers is plain. Mr Mueenudin's letter emphasised that "the entire natural flow" of the Indus system of rivers historically reaching Pakistan -- that is, aside from the Eastern Rivers -- was to be "available for the exclusive use and benefit of Pakistan". It also affirmed that:

"Works may not be constructed outside the boundary of Pakistan which might interfere or make it possible to interfere with the natural flow into Pakistan of the Western Rivers."

This is at P-416, paragraphs 4.A and B, shown on the slide.

Pakistan reiterated in subsequent correspondence its firm opposition to the construction of any works outside the boundary of Pakistan that might interfere, or make it possible to interfere, with the natural flow of the Western Rivers.

In a letter to Mr Iliff of September 1957, shown now on slide 15, Pakistan's chief negotiator set out in clear terms the motivations behind its position. In short, it saw this as encroachment on the promises of non-interference and mutual independent embodied in the 1954 proposal and 1956 aide-mémoire.

Pakistan observed that, as the "lower riparian, [it] alone is vulnerable to interference by India". It saw the introduction for the first time of an "unrestricted right to develop hydro-electric power" as India having its cake and eating it: securing exclusivity of control over the Eastern Rivers, while at the same time denying Pakistan its independence by attempting to secure rights to interfere, or make it possible to interfere, with the

natural flow of the waters of the Western Rivers. That's Exhibit P-420, paragraph 3, and appendix, general head 1, paragraph 3.

The subsequent negotiations up to March 1959 focused almost exclusively on the nature and financing of the works required to effect the division of waters. Even during this time, Pakistan's firmly held position on non-interference was a common theme. As Dr Alam observes in his PhD thesis on the Indus Waters Treaty:

"... Pakistan ... refuse[d] India's plans ..."

That is, for replacement works:

"... because they often involved a continued dependence upon it for Pakistan's water. This is something Pakistan was no longer willing, after April 1948, to countenance."

That's Exhibit P-245 at page 143.

Ten years later, the ghosts of that crisis still haunted Pakistan and the scars still ran deep in the psyche of its negotiators. The only solution to effect the division of waters could therefore be one in which all the works necessary to divert from the Western Rivers supplies to replace those that Pakistan had historically enjoyed from the Eastern rivers were under Pakistan's control. This was, therefore, necessarily one of the linchpins of the proposals that the Bank set

10:30 out in its March 1959 settlement plan at Exhibit P-439.

Another linchpin of the settlement plan was a ten-year transition period to carry out the replacement works. Those works would be largely funded by contributions from friendly governments. In talks held in New Delhi and Karachi in the spring of 1959, Pakistan and India agreed to those foundational principles.

Despite the broad success of these talks in spring 1959, the issue of India's use of the Western Rivers for hydroelectric purposes emerged as a significant issue of divergence. Pakistan maintained the position that India should not be permitted to construct works for the generation of hydroelectric power on the Western Rivers in India. India insisted that its uses while in Indian territory "must include" such "non-consumptive uses". That's Exhibit P-450.

The Bank aligned with India. It informed Pakistan that it could "not support" Pakistan's absolute opposition "to build even 'run of the river' hydro-electric works on any of the Western Rivers". It recognised in internal correspondence, however, that the negotiations were going to have what they called "a tough passage" on that point. That's in Exhibit P-451.

10:31 Pakistan was forced by the Bank to soften its position on Indian HEP-building on the Western Rivers, but it remained clear that no such uses could be accepted if they were to interfere with the supplies of these rivers. Its concerns were summarised in a letter from Mr Iliff to Mr Gulhati of June 1959, shown on slide 16.

While Pakistan "accept[ed] the general principle that India should be entitled to reserve on the Western Rivers ... Hydel Uses not involving consumptive use of water", it "expressed concern that the works that India constructed might interfere with the timely flow of water in the low-water season, and emphasised that they would look for some protection on that point". That's Exhibit P-452 at paragraphs 8 and 10.

(Slide 17) A message from Mr Mueenudin to Mr Iliff the following month conveyed the same sentiment in even stronger terms: "India should not", he said, "have a stranglehold on the Pak economy". That's Exhibit P-453.

(Slide 18) So I'm going to turn now to the last important phase of negotiations, which commenced in August 1959 and took place in London, when the negotiating parties held the first detailed negotiations on the heads of agreement for an international water

10:33 treaty. India's use of the Western Rivers for the generation of hydroelectric power was a core part of these discussions, which are recorded in very cursory detail, or high level, we can say, in the World Bank archives minutes from this period.

On 10 August 1959, Pakistan and India each put forward their own draft heads of agreement. Both drafts envisaged that India's hydroelectric uses of the Western Rivers would be a type of non-consumptive use. Pakistan offered India its standing consent to India's use of the Western Rivers for such purpose. However, it was subject to a proviso, that:

"Such use does not involve construction of any work which can be operated to interfere with the rate, quantity or quality of the natural flow of the river or its tributaries."

Pakistan gave as an example of such a work "any structure which holds up the river flow temporarily or stores it for a certain period of time for use in subsequent periods". Pakistan's draft also provided for "full details" of the scheme to be provided in advance of construction of such works. That's in Exhibit P-133, paragraphs 3(b)(i) and (ii). Pakistan recognised from an early stage that information-sharing would be critical.

10:34 Over the subsequent days and weeks of the London negotiations, the parties continued to discuss and exchange proposals surrounding India's use of the Western Rivers for the generation of hydroelectric power. The detailed history is set out in paragraphs 121 to 134 of Appendix A to Pakistan's Memorial, so I can spare you that today.

At the heart of Pakistan's position in this period were its concerns over Indian interference with the natural flow of the waters on which Pakistan would be reliant. As Pakistan's chief negotiator explained at the time:

"... we do not want any works to be built which [give] India the power to hurt us ..."

That's Exhibit P-365.

These sentiments were repeated in contemporaneous internal Pakistan correspondence sent around the close of the negotiations in September 1959, and these are shown on slide 18 now.

In a letter from Pakistan's chief negotiator to Mr Sheikh, Secretary of the Ministry of Works, Irrigation and Power, Mr Mueenudin confirmed he had made it clear that:

"... our Government cannot possibly agree to storages which, if malevolently operated, would make

10:35 an appreciable difference to our economy."
And that:
"... Pakistan would not agree to giving India a stranglehold over her economy."
That's Exhibit P-475, paragraph 5.
In a subsequent letter, Mr Mueenudin confirmed again that he had made it clear that Pakistan:
"... would not, under any circumstances, agree to the construction of works which would give India the power to do us effective harm."
That's Exhibit P-134, paragraph 6.
The London talks ultimately led to the Bank's preparation of a new draft heads of agreement dated 15 September 1959. That's Exhibit P-136. The heads of agreement 1959 set out the basic scheme of the division of waters and the let-flow obligation on India as regards the Western Rivers. I've set out the relevant provisions on this slide 19. The heads of agreement also attempted to address Pakistan's concerns regarding the Indian storage on the Western Rivers.
Annex B of the heads of agreement encapsulated the detailed provisions that had been discussed between the parties in the London negotiations as to the use of the Western Rivers for the generation of hydroelectric power. It provided a definition of "run-of-river"

10:37 plants. It also set out detailed design and operational constraints in respect of run-of-river HEPs constructed by India on the Western Rivers. Annex B is the forerunner of what became Annexure D to the Treaty and there are close parallels between them.
MR MINEAR: Excuse me, Ms Rees-Evans. The language "let flow", was the origin of that language the Bank's, or do we know if it came from some other source?
MS REES-EVANS: Thank you, Mr Minear, for the question.
I don't think we know where that came from, because I think it was introduced for the first time in the December 1959 heads of agreement, but it wasn't discussed in those terms in a way that comes out of the minutes of the August 1959 minutes.
So the answer, as with much of the questions that we have about the travaux, is unclear. It doesn't come out of the documents.
MR MINEAR: As I recall from your Memorial, it's quite distinctive language. Is that correct? It doesn't appear in other similar treaties involving water rights?
MS REES-EVANS: I think that's right. I don't think we found comparable language in other international treaties. It's one of the things that obviously, when we looked through the travaux, we were very keen to see whether there was an explanation for why that particular

10:38 language was used, and disappointed to find that there was not much in the way of answer there.
MR MINEAR: Thank you.
MS REES-EVANS: So as I said, the archives contain a reasonable collection of the various drafts that came after the 1959 heads of agreement, but the context around them, and certainly why they changed over time, is completely lacking in the archives. So I'll take you through the drafts and explain some of this lack of context as I go through.
(Slide 20) The first draft of the Treaty presented to the governments was that of 9 December 1959, in Exhibit P-139. Draft Article III set out in detail India's obligation to "let flow" the Western Rivers. The provision was significant for a number of reasons.
First, it articulated the "let flow" obligation in clear terms and matched it with a prohibition on "interference" by India with the waters of the Western Rivers.
Second, it marked a shift in the language regarding India's use of the Western Rivers for the generation of hydroelectric power. The language of India's "entitlement" to such use, as it was under Annex B of the heads of agreement 1959, became a statement of obligation subject to a defined exception in the 1959

10:40 draft.
Third, the only exception it envisaged to the prohibition on storage for India on the Western Rivers was that specifically envisaged in Annexure E of the Treaty. HEPs could not, therefore, incorporate storage, save as permitted by Annexure E.
The December 1959 draft therefore clearly emphasised the primacy of the let-flow obligation, and the limited character of any exceptions to that obligation. And Pakistan's chief negotiator reported to his government that "by and large", the December 1959 draft "safeguards Pakistan's interests". That's Exhibit P-140.
Notwithstanding this apparent progress, by March 1960 the parties were still unable to reach agreement on Western Rivers uses, including storage, among other issues. Progress in the negotiations was stymied by India's ever-increasing demands for use of the Western Rivers. The parties' exchanges over this period are set out in paragraphs 159 to 168 of Appendix A to Pakistan's Memorial.
The common -- and by now, recurring -- thread of this period was, on the one hand, India's ever-increasing demands over the Western Rivers and, on the other, Pakistan's imperative to "avoid control by India over waters on which Pakistan will be dependent".

10:41 As Pakistan's Ambassador to the US recalled in his memorandum to the President of the Bank in April 1960, Pakistan had:

"... agreed to ... permit[] India as much power development as it desires from run-of-the-river plants ... [and also to] 0.5 MAF of storage for irrigation ... [which could also] be used for hydro-electric power as well."

He emphasised that any proposals the Bank should put forward to Pakistan for further Indian storage should:

"... keep in view ... that it is politically essential for Pakistan's irrigation system to be as independent as possible and works that could cause interference should be minimal ..."

This is P-483, enclosure pages 5 to 6, on slide 21.

In a further conversation, the Ambassador warned Mr Iliff that Pakistan would be very reluctant to ignore the basic assumptions of the Bank's 1954 proposal regarding mutual independence and Western uses. This is at Exhibit P-484, paragraph 6.

These exchanges were directed primarily at negotiations surrounding what became Annexures C and E., so they're not directly relevant to D. But they do provide important context to Pakistan's position on exceptions to India's let-flow obligation, including on

10:42 hydroelectric power generation.

The Bank produced a revised draft of the Treaty in April 1960 -- that's at P-476 -- together with a set of draft annexures, including D, that's Exhibit P-476, and E, at Exhibit P-489. The archives provide no context over any of the changes made in the April 1960 draft as against the December 1959 draft. Nor do the archives provide any transparency regarding the process leading up to the June 1960 draft and its annexures. The final text of the Indus Waters Treaty was ultimately agreed on 6 September 1960.

It is clear from this negotiating history of the Treaty that the final balance struck was hard-fought. The constant that remained from the Bank's 1954 proposal was the division of control over the Western and Eastern Rivers, and the mutual independence that that assured. It was not a perfect solution for Pakistan.

As Pakistan's Foreign Minister said in 1954, the original proposal on which it was based involved "great sacrifices" for Pakistan. That's P-383, paragraph 3. But it was acceptable on the basis -- and indeed, on the condition, as Pakistan repeatedly emphasised during the negotiations -- that it would protect Pakistan against control over waters on which it would be reliant. It is for that reason that the detailed parameters

10:44 constraining India's use of the Western Rivers for hydroelectric power, in Mr Iliff's words after the conclusion of the Treaty, he said, "tie India up very tightly". That's at Exhibit P-515.

I'm now going to turn to the third part of my presentation; unless, Mr Minear, you wanted to jump in with a question?

MR MINEAR: I apologise, I do have a question here with respect to Exhibit P-483.

There is the statement here that:

"... [Pakistan] has agreed to meet these needs by permitting India as much power development as it desires from run-of-the-river plants."

Is that statement, do you think, reflective of Pakistan's policy with regard to power generation, that there were no limits on the amount of power that India might produce, as long as it came from a run-of-river plant?

MS REES-EVANS: I think what Pakistan had in mind here was that there was no limit, as you say. In some ways, it was quite a broad consent to India to develop the Western Rivers for power development. But at the same time, it had in mind very much run-of-river plants with no storage other than this 0.5 MAF of storage that could use be used for hydropower.

10:45 But I think it's clear from the correspondence at this time that Pakistan envisaged very much plants that involved no consumptive use of water, didn't affect the timing or quantity of the natural flow of the water. And what subsequently came through, obviously, in the detailed provisions of Annexure D, was how to ensure that Pakistan's concerns over the timing -- no interference with the timing and quantity of the natural flow of the water -- could be regulated and ensured.

So provided that those two things could be ensured, that the timing of the water and the quantity of it couldn't be interfered with, Pakistan came to accept that India could develop the Western Rivers for hydroelectric power at that time.

MR MINEAR: Thank you.

MS REES-EVANS: (Slide 22) Turning to the final part of my presentation. In this part of my submission I'm going to highlight four specific conclusions from the travaux préparatoires regarding the evolution of the key provisions at issue in this proceeding, namely of Article III and various paragraphs of Annexure D.

As Professor Webb will go on to explain, the travaux can, in certain circumstances, be an important factor in the interpretation of the Treaty pursuant to the customary rules of treaty interpretation reflected in

Article 32 of the Vienna Convention on the Law of Treaties.

(Slide 23) The first conclusion is that the let-flow principle was deliberately fortified over time to its final incarnation as an obligation on India to let flow all the waters of the Western Rivers. This reflected Pakistan's firmly held and oft-expressed concerns regarding any threat of Indian control over the waters on which it was due to be reliant.

Articles II and III of the Treaty are the operationalisation of the 1954 proposal's foundational principle of the division of the waters. The language it uses, of the entire flow of each of the Western and Eastern Rivers being "available for" the exclusive use of Pakistan and India, respectively, was mirrored in the 1957 heads of agreement. This is P-362 and P-413.

From the summer of 1959, the language moved towards that of obligation. The heads of agreement of 1959 provided that "India shall let flow the water[s] of the Western Rivers free from any interference", save for certain exceptions. That's in Article IV at Exhibit P-136, shown now on slide 23.

The December 1959 draft went further still. This is on slide 24 now. It spelt out explicitly India's "obligation to let flow all the waters of the Western

Rivers". This is at Article III(2).

(Slide 25) Then between the December 1959 draft and the final Treaty, the main substantive change to Article III of the Treaty was to strengthen Pakistan's rights to receive all those waters of the Western Rivers which India is under an obligation to let flow. That change was effected through the removal of the words "be entitled to" in the June 1959 draft. In the June 1959 draft [as] in the final version, the Treaty simply provides that Pakistan "shall receive" those waters. This is visible in the red-line shown now on slide 25.

(Slide 26) The second conclusion is that India's ability to utilise the Western Rivers for the generation of hydroelectric power was deliberately couched as an exception to India's positive and binding obligation to let flow. This in itself represented a concession by Pakistan.

Pakistan's opening position, reflected in its comments to the May 1957 heads of agreement, was that:

"... any development on [the Western] rivers upstream of Pakistan would have to have the consent of the Government of Pakistan."

That's Exhibit P-410.

Under pressure from India and the Bank, Pakistan eventually, in 1959, conceded, subject to conditions,

that it would not object to India's use of the Western Rivers for the non-consumptive generation of hydroelectric power. That's at P-133.

(Slide 27) The 1959 agreement was couched instead in permissive language, providing at Article IV(2) that:

"India shall be entitled to generate hydro-electric power on the Western Rivers in accordance with the provisions of Annex 'B'."

That's the precursor to Annexure D.

(Slide 28) The permissiveness of the 1959 heads of agreement was then corrected in the first full draft provided to the Governments of India and Pakistan as the December 1959 draft. It provided that India "shall not permit any interference with the waters" of the Western Rivers except for the defined list of uses, which included the generation of hydroelectric power. This shift in language is significant. It points to the primacy of the pivotal let-flow obligation and, by implication, the limiting character of the exception.

Further reinforcing this conclusion is the introduction as from the December 1959 draft of the Treaty of the clear prohibition, subject to the exceptions set out in Annexures D and E, on India's storage of any water or construction of any storage works on the Western Rivers. This is at Article III(4)

of the final Treaty. This provision remained largely constant from December 1959 to the final version of the Treaty.

It is evident from the intense exchanges between the negotiating parties in the final months of negotiations that India's attempts to expand on the storage allocated to it was fiercely fought. For that reason, the negotiating history supports a narrow construction of these exceptions to India's let-flow obligation.

(Slide 29) The third conclusion is that the requirement that India provide Pakistan with information about its run-of-river HEP plants was a constant feature of the drafts. I think Mr Shah yesterday referred to "the wisdom of the framers of the Treaty" in this respect (Day 1, page 163, line 9).

As early as the May 1957 heads of terms in P-362, now shown on slide 29, the parties recognised that information-sharing was absolutely vital to the permission that the Treaty was to give to India.

(Slide 30) The fourth conclusion from the travaux is that unfortunately, as I've said before, they provide little assistance in providing context to certain aspects of the Treaty. And most notably, I think that's around some of the key provisions at Annexure D.

Negotiations of those provisions appear largely to

have taken place in the London meetings in August 1959, but they don't give much detail in the minutes of those meetings. And there are then likely to have been further detailed negotiations in the run-up to the April 1960 draft of Annexure D. But again, there's no detail of the negotiations at all in the archives in that period.

Pakistan has summarised the evolution of aspects of the relevant provisions of Annexure D in paragraphs 50 to 52 of Appendix A of its Memorial. I intend to focus my remarks on that which can be gleaned about the term "pondage" and related terms, in response to the question that you asked, Mr Minear, of Mr Shah yesterday.

Mr Minear observed -- and this is the Day 1 transcript, page 215, lines 10 to 14 -- that:

"... Pakistan initially suggested a pondage determination based on a minimum load factor, and I would be interested in knowing what relevance that might have to the position that was ultimately formulated in the Treaty."

It is helpful, in answering this question, to go through, with your indulgence -- and this will be the end of my presentation -- the chronology of the drafts on this particular point.

It appears that the term "pondage" was first

introduced by Pakistan in a draft of 15 August 1959. That's Exhibit P-365, enclosure 2, at paragraph 2(b). I've set out the provision on the slide and it's highlighted in 2(b).

In Pakistan's August 1959 draft, it used the term "pondage" in one of a number of considerations that "shall govern the design, construction and operation" of hydroelectric power plant works. And it stipulated that the pondage shall be that which is:

"... adequate only to cater for the weekly load factor of the power plant (daily load factor in the case of a power house involving the construction of a dam on the main stem of the Chenab River)."

At this stage, a pondage determination based on a load factor was put forward as a design criterion.

So then the next time it appears is in the heads of agreement of 1959 (P-136). There, it is described in paragraph 2 -- on slide 31 now -- as:

"... the [live] storage in the operating pool ... required to meet fluctuations in the discharge of the turbines arising from variations in the daily or weekly load of the power plant."

Then paragraph 3(b) of the heads of agreement 1959 is the precursor to paragraph 8(c) of Annexure D. And again, this provision was included on Pakistan's

proposal. Paragraph 3(b) set out a design criterion which required that the "volume between the maximum and minimum levels of the operating pool shall not exceed that required to meet the daily or weekly load fluctuations as the case may be".

So we think that Pakistan clearly intended, with its proposed addition, to establish a limit on India's allowable pondage. So at that stage they were working out how to establish that limit.

This isn't the end of the story, because then we have the, essentially, gaping hole in the negotiating records. We know next to nothing about why the draft of the Treaty evolved as it did between the heads of agreement 1959 and the April 1960 draft of Annexure D. All that we know is from the subsequent drafts themselves.

(Slide 32) So if we look at the April 1960 draft, we see that it introduces a formal definition of "pondage", which is largely consistent with the description in the heads of agreement of 1959. It provides that:

"'Pondage' means storage of only sufficient magnitude to meet fluctuations in the discharge of the turbines arising from variations in the daily and weekly load of the plant."

This is P-476, draft paragraph 5(c).

But the equivalent of paragraph 3(b) of Annex B of the heads of agreement -- so this is the design criterion -- no longer refers to the concept of "load". Instead it is linked to "firm power". This is at paragraph 7(c). It provided that:

"The maximum Pondage in the Operating Pool shall not exceed twice the Pondage required for Firm Power."

So at this point the concept of "load" is confined solely to the definition and the concept of "firm power" is introduced. The concept of "load" is removed completely from the design criterion for new run-of-river plants.

We can only speculate about why this was, because again, as I said, we don't have the records of the negotiations. But if we were to speculate, we might say that it's a reflection that the parties didn't want the design criterion to be linked to something as subjective as load or demand, so how much power the operator wants to generate from the plant. But the travaux don't confirm either way.

What we do know, however, is that from this point on, the parties clearly recognised the significance of the term "firm power". So while the definition of the term "pondage" stayed almost entirely constant in the April 1960 [and] June 1960 drafts and the final Treaty,

10:58 the definition of "firm power" evolved. So that's what they were looking at. This is described in paragraph 49 of Appendix A, and is captured clearly in the red-line showing the changes made to the April 1960 draft of Annexure D in the final version, submitted at P-522.

So to conclude the answer to Mr Minear's question, it's difficult to know really what was going on because the record in this period is so sparse. But if you have to draw a conclusion, it's the marginalisation of load as a relevant factor in the calculation of pondage, and the steadily increasing importance of firm power. And in transitioning from the relevance of load factor to firm power, it made the pondage more restricted.

That brings me to the end of my presentation, unless there are any further questions from the Court.

Questions from THE COURT

DR BLACKMORE: I noticed the agreement was designed for its time, so I accept all of that. I was just wondering, given you studied it very closely, what would happen to emerging technologies that might impact on the agreement, that haven't been canvassed by the agreement but could still have an impact? I'll leave global warming out, as a sort of generic issue. But would something like cloud seeding, for example, be deemed an engineering work? That's a question.

11:00 MS REES-EVANS: I think I might leave that to be taken up by one of the subsequent presentations, if I may. It certainly isn't addressed in what I've seen of the travaux. I haven't seen anything in the travaux that pays very close attention to how developments in technology will be addressed by the text that is currently under negotiation as at 1959/1960.

DR BLACKMORE: Thank you. I just wanted to see whether there was somewhere a cubbyhole that had an ability to start a conversation about those things. But apparently not. So thank you.

MS REES-EVANS: It's certainly something that will be addressed in subsequent submissions. But as I say, the travaux just don't provide very much guidance on how the Treaty will be responsive to future developments in technologies.

MR MINEAR: I just would like to flag an enquiry that might arise later. I don't think it falls within your presentation, but it seems an appropriate point to make it.

In Annexure E, paragraph 21(a), there's a reference to "firm power" there as well, and I would be curious if that definition of "firm power" is the same as used in Annexure D.

I don't believe, as I say, that this falls within

11:01 your presentation, but I just wanted to flag this question for one of your future presenters.

MS REES-EVANS: Sorry, could you give me the paragraph reference?

MR MINEAR: Yes: it's paragraph 21 of Annexure E.

MS REES-EVANS: Paragraph 21, okay.

MR MINEAR: I can read it to you if you'd like.

MS REES-EVANS: No, I have that, thank you.

I think we'll come back to that then, yes. Thank you.

MR MINEAR: Yes.

THE CHAIRMAN: So I have a question that I think does fall within the scope of your presentation, which is that at Appendix A, starting at paragraph 26, there is a discussion of what does or does not constitute the travaux préparatoires, with references to statements made by Professor Crawford and Professor Lowe in the Kishenganga proceeding. That discussion seemed to be suggesting that it was important to discern what constitutes a part of the travaux and what does not. But then at paragraph 31, Pakistan says that even non-travaux materials fall within the scope of VCLT Article 32.

Can you clarify why it's important to determine what is and what is not travaux?

11:03 MS REES-EVANS: Well, yes, I think certainly the discussion of this in Kishenganga is a little bit confusing because, as you say, it seems to take two separate tacks: on the one hand, there's a discussion about whether something is formally characterised as travaux; and on the other hand, there's this acceptance that in any case it can be taken into account under Article 32.

I think the reference that you cited in paragraph 31 is to a footnote in the partial award where the Court effectively is saying, we, the Court in Kishenganga, don't think that the distinction is actually all that important because either way we think that this material from the record can be taken into account under Article 32.

So I think where the Court came out, after having this discussion during the course of the -- I believe it was the hearing on the merits -- yes, in the hearing on the merits -- I think where the Court came out was that it didn't need to pay too strict attention necessarily to the distinction, because actually it could take into account materials under Article 32 even if they weren't strictly defined as travaux.

But I suspect that part of the reason it reached that conclusion was because it wasn't necessary in that case for the Court to take a very rigid, formal approach

because it actually didn't rely on the travaux particularly extensively in its award. There's a couple of aspects where they do rely on the travaux, but in general they don't form a huge part of the Court's award. So I suspect that's why the Court, in its partial award, didn't end up entertaining this distinction too much in its analysis.

But it may be also worth saying that if something can be characterised as "travaux", I think for a Court it is easier to give that weight than something that doesn't strictly fall within the concept of "travaux". And so it's a question of really the weight which you give the materials that you're looking at. And you would give something that formally constitutes travaux more weight than something that doesn't, obviously as a reflection of the negotiating positions of the parties.

THE CHAIRMAN: So there's a range of materials that we could take into account as a part of a supplemental means of interpretation, but perhaps the travaux préparatoires -- defined, perhaps, as the materials that form a part of the negotiating record of the Treaty -- might be given more weight than those other materials because they speak more to the intent of the parties; is that the way you understand it?

MS REES-EVANS: Yes, I think that's right, although just a slight clarification on one of the points that you made, because in this case we're obviously looking at a negotiating record that wasn't entirely generated by the parties, and in fact largely it was not generated by the parties.

So formally speaking, I think as we've set out in these paragraphs here, you're not giving such weight to materials that were produced by a third party. So the materials that were produced by the negotiating parties are formally the travaux, and then you've got to look at the specific circumstances surrounding documents generated by third parties -- so in this case the Bank -- to determine whether those materials should properly be described as reflecting the parties' views, and therefore whether they constitute travaux.

THE CHAIRMAN: So in this instance, would you view the materials generated by the World Bank as a part of the travaux, or would you say that it's not actually part of the travaux because it's not the parties expressing their own views?

MS REES-EVANS: I don't think it's possible to give a general answer to that; I think it depends on the specific document. Because as we set out, I think, in these paragraphs, it depends on the extent to which each

of the parties was aware of the particular document that was generated.

So I think that the overarching point here was that the Bank had been very good in its approach to the parties and very transparent with both parties. So as a general approach, you could say you can take the documents produced by the Bank as travaux for that reason, because they were transparent with both sides.

But I can't think of a particular example. But if there is an example where really this is a record of a conversation with one party, which at the time the other party was completely unaware of, for instance, I think it is more questionable whether you could characterise that as part of the travaux.

THE CHAIRMAN: So let's take as an example an issue that you've raised in the Memorial and also today, which is the idea of the let-flow principle operating. And in Appendix A at page 8, subparagraph (a), you say:

"... throughout the negotiations, the pivotal 'let flow' principle remained relatively constant."

And you have that also at paragraph 41, I think. And today you've reiterated that, and I think I heard you say it was fortified over time as part of the negotiating history.

It seems clear that Pakistan took that type of

approach throughout the negotiations. It seems relatively clear to me that India did not take that approach throughout the negotiations; that they began with an idea of existing uses within India need to be preserved and maintained, and then over time they moved towards an approach of: non-consumptive uses should be permissible, and then eventually we get the exception that we currently have in the Treaty. And I think you've recognised in Appendix A and in your statement today that Pakistan was, as you put it, forced to accept ultimately this idea that there would be uses of the waters that in some sense impede the flow of the Western Rivers.

So when I look at that, I see one party perhaps channelling a let-flow concept, even if those words themselves weren't used at the outset, but the other party not so much accepting that.

So if we then go to the World Bank's statements and perhaps give them some weight, it doesn't appear to be the case that in the World Bank's statements there's an indication that the purpose in this Treaty was to ensure that there would be an absolute let-flow of the rivers. There's references throughout the materials to at least some uses of the upper part of the rivers by India. But when I look at Mr Black's letters of

11:11 September 1951 or November 1951, I see principles being articulated there, but I don't see the let-flow principle. And when I look at the subsequent correspondence of the Bank with the two Prime Ministers, I don't see a let-flow principle being articulated.

And when I look at that 1954 proposal that you pointed out to us, which, as you indicated to us, Pakistan resisted initially, there's certainly language about avoiding control by India over waters on which Pakistan is dependent. That's not quite the same thing as a let-flow principle. Instead it seems like there is the introduction there of the concept of an "entire flow", but with exceptions. In that instance, there's reference to "insignificant use", I think. But still, it's not an absolute let-flow. Likewise, in the [1956] aide-mémoire, I don't see that principle being articulated.

All that to just say: it feels like we're getting to a point where, rather than a fortification of a let-flow principle, we have an increasing, perhaps, fortification of a Pakistan position of wanting relatively unrestricted, if not completely unrestricted, flows, and an Indian position that there do need to be exceptions, and eventually an acceptance that there would be exceptions, in the form of hydroelectric power and

11:13 certain other uses on the upper parts of the river.

So I just advance all of that to invite you to tell me where perhaps that recounting of what happened in the negotiating history may not be entirely correct.

MS REES-EVANS: I think just in a sort of brief answer to that -- but I think it would be useful for us to go away and look at some of the documents you specifically referred to and come back maybe with a longer answer with more time. But just as a sort of high-level response to that.

I suppose the fortification, as we say, of the let-flow obligation is as I set out, I think, in some of the -- I can find the slides -- but some of the slides I set out today, which is essentially the movement in the language as between the 1959 heads of agreement to the final terms of the Treaty, and the recognition during that evolution in the language of India of the way that the terms are couched. So initially I think we have a description of the waters being "available for the use", and then we have India "shall make the waters available", and then we have India is "under an obligation to". So there is that evolution, which, over time, incrementally fortifies, we say, the let-flow obligation.

But I think to your wider question, which goes

11:14 beyond just that period between August 1959 and the final Treaty, I think it would be useful for us to come back to you on that.

THE CHAIRMAN: Yes, certainly feel free to do that.

I suppose I was pressing you a bit on this idea that throughout the negotiations the let-flow principle was pivotal, because that latter bit doesn't speak to the broader story of the negotiations. But even on that latter bit, the shift from the 1959 heads of agreement to the 1959 draft, it looks somewhat as though there is a fortification of a let-flow concept, a right for this to happen, but also a fortification, a drilling-down on what are the exceptions going to be -- what rights, if you will, India has with respect to hydroelectric plants -- and thus a hardening, if you will, on both sides of the equation.

MS REES-EVANS: Yes, I can see your point, and I think we will address it sort of in longer time.

But in relation to the first point, I suppose one thing that certainly comes out from, as you say, the Pakistan materials is that Pakistan simply wouldn't have entered into this Treaty but for the kind of overarching obligation of India to let the waters of the Western Rivers through to Pakistan. That was really the fundamental premise. That was really the fundamental

11:16 premise of Pakistan's agreement to the bargain as a whole.

THE CHAIRMAN: Judge Al-Khasawneh.

JUDGE AL-KHASAWNEH: Thank you, Mr Chairman.

I don't really see the "let flow" expression as anything more than a shorthand for a principle that had already existed. And we can probably trace the beginning to one of the earlier drafts, where there was talk of allowing historic withdrawals to continue, for example. So it's not a new principle; it's just one way of expressing the thing. That's how I look at it. Of course I would be very happy to look at further information.

The other thing that I wanted to say is: the question of the travaux préparatoires, this is a very old debate. I remember the first time I was in the Sixth Committee, there was a debate as to what constitutes travaux préparatoires, and there was a statement by the late Shabtai Rosenne that I still remember. So I don't think we can really settle it here. Anyway, the Neutral Expert thought that everything was clear and there was no need for supplementary means of interpretation.

So this is what I thought. But I don't have a very firm position on this. I would be very happy to hear

11:18 and to look at any further information. Thank you.
THE CHAIRMAN: Judge Al-Khasawneh just prompts one further question and I think we'll let you go.
Is it the case that from the outset of the negotiations on through to the end, there was an acceptance on both sides that historical use should be preserved; that is, that there were uses by India upstream for certain purposes, Pakistan downstream for certain purposes -- I'm talking of the Western Rivers -- and that these should be preserved as we move along in the negotiations? Is that correct?
MS REES-EVANS: I think that's right. I think it's referred to as "existing uses" in both cases, the term "existing uses" is used. Certainly that was one of Pakistan's concerns about the 1954 proposal, whether existing uses were in fact protected by that proposal. But I believe -- and we will double-check that -- but I believe that that was a concept that applied equally to both sides.
THE CHAIRMAN: Great. Well, thank you very much, Ms Rees-Evans. That was very helpful.
So I think we will now take our coffee break, and why don't we plan to come back at 11.45.
MS REES-EVANS: Thank you.
(11.19 am)

11:19 (A short break)
(11.48 am)
THE CHAIRMAN: Professor Webb, the floor is yours.
Submissions on Principles of Treaty Interpretation
PROFESSOR WEBB: Thank you very much. And if my presentation could be shown. Thank you.
Mr Chairman, members of the Court, it's an honour to appear before you on behalf of Pakistan. I will be addressing you three times during this first round, and today I will covering the principles of treaty interpretation. For some members of the Court, this will be very familiar, almost instinctual; but for others it is relevant because these are well-established rules and they differ from the interpretation of domestic law or contracts.
I'm also going to address questions that arose yesterday and this morning, in the course of where they arise during my presentation.
(Slide 2) The starting point is the Indus Waters Treaty itself. As the Court observed in its Competence Award, the primary source for this Court to interpret and apply is the Treaty. Whenever necessary for the Treaty's interpretation and application, however, the Court may apply international conventions and customary international law.

11:49 This was provided for and cited in paragraph 29 of Annexure G of the Treaty. I'm going to come back to this in detail.
(Slide 3) So I will proceed in four parts. I'm going to set out the key principles, engage with the issued raised in the discussion so far, and lay the groundwork for Pakistan's analysis of the Treaty in the coming days.
So first I'm going to look at what's called the "general rule" of treaty interpretation, Article 31. And I'm going to develop some of the points that Sir Daniel has highlighted: the special meaning given to terms, the principle that an exception to a rule is to be interpreted restrictively, and I will address the issue of subsequent agreements and practice.
Second, I'll look at supplementary means under Article 32 of the Vienna Convention, building on what Ms Rees-Evans has set out on the travaux préparatoires.
Third, I will come to paragraph 29 of Annexure G, and I will show that recourse by the Court to relevant rules of international law is possible, but only when necessary for the interpretation or application of the Treaty. And in this context I will address, among other things, the question of climate change and the Treaty.
Fourth, I will look at the interpretation of peace

11:50 and boundary treaties. And in response to the discussion yesterday, I will develop the points made by Sir Daniel, and distinguish the Indus Waters Treaty from treaties that have been determined by international courts to be living instruments. And I will also set out how these arguments were addressed and dealt with in the Baglihar and Kishenganga proceedings.
(Slide 4) So turning first to the general rule. This is laid out in Article 31 of the Vienna Convention. I'm not going to read out the text, but I will be going through it in sequence.
(Slide 5) I'm going to be spending most of my time on that first paragraph, Article 31(1). And it has four elements: ordinary meaning, context, object and purpose, and good faith. The Vienna Convention does not establish an order of priority among these criteria, and the consistent case law has been that they are to be considered as a whole.
(Slide 6) So turning first to "ordinary meaning", Article 31(1) provides that:
"A treaty shall be interpreted ... in accordance with the ordinary meaning to be given to the terms ..."
The ICJ has dealt with this a number of times recently in the preliminary objections judgment in Qatar v UAE. It emphasised that interpretation must be

based, above all, upon the text of the treaty.

The Kishenganga Court followed this approach by commencing its interpretation of paragraph 15(iii) of Annexure D with the statement (PLA-3, paragraph 402):

"... the text of Paragraph 15, and specifically with the ordinary meaning of the terms there used."

(Slide 7) There's an important temporal point to highlight here: the "ordinary meaning" is generally the meaning attributed to the terms at the time the Treaty is concluded. This is the principle of contemporaneity. Sir Gerald Fitzmaurice, who was a special rapporteur for the ILC's work on treaties, defined that principle as follows (PLA-63):

"The terms of a treaty must be interpreted according to the meaning which they possessed, or which would have been attributed to them, and in the light of current linguistic usage, at the time when the treaty was originally concluded."

(Slide 8) The International Law Commission said this requirement is one of both common sense and good faith. And the principle has been confirmed by the ICJ and other international courts and tribunals, and I will just illustrate this with two examples.

The first is the case of the Rights of Nationals of the United States of America in Morocco, a dispute

between France and the United States. And the word there that was being interpreted was "dispute", that appeared in treaties concluded in 1787 and 1836. And the court said (PLA-64, page 189):

"It [was] necessary to take into account the meaning of the word 'dispute' at [those] times when the two treaties [were] concluded."

And the result of that is that they found that "dispute" covered both civil and criminal proceedings.

The second case is an arbitration between Argentina and Chile concerning the frontier line at a certain point. And here the word was "water-parting", and it was used in a treaty of 1881, with an 1893 protocol concerning the boundary dispute between them. As you can see, the tribunal concluded (PLA-67, paragraph 130) that:

"... the concept of 'water-parting' ... is not susceptible of ... subsequent change through usage, evolution of the language, or acts or decisions of one of the Parties to the dispute."

(Slide 9) So the terms of the Indus Waters Treaty must be given their ordinary and natural meaning, understood at the time of the conclusion of the Treaty. The exception to that is if a special meaning is intended, and that's also addressed in Article 31 of the

Vienna Convention in paragraph 4.

At the time the Treaty was negotiated -- and we've heard about the sequence in the previous presentation -- the drafters of the Treaty, and in particular the expert engineers on both sides and for the World Bank, were well aware of contemporary usage of the terms that they were including in the text, including the contemporary publication, for example, of Creager & Justin in 1950.

Yet, as Sir Daniel mentioned and as Pakistan's Memorial sets out, some of the Treaty's terms depart from their conventional contemporaneous usage and they have a distinct and unique meaning. We will be addressing these in context when we go through the paragraph 8 criteria. But I just wanted to give an example, and it goes to a question that Mr Minear asked before the break.

(Slide 10) So this is the meaning of "Firm Power". And here I'm talking about it in the context of Annexure D, where the ordinary meaning would be: power calculated by reference to demand, plotted on a load curve; power intended to have assured availability to the customer to meet their agreed needs and requirements.

However, the Treaty defines it with a special meaning, in paragraph 2(i) of Annexure D, as:

"... the hydro-electric power corresponding to the minimum mean discharge at the site of a plant ..."

So it is calculated by reference to the flow of the river.

Now, Mr Minear asked whether the reference to "firm power" in paragraph 21(a) of Annexure E has the same meaning. And we say that it does not, and that is in a very lawyerly way: because it doesn't have capital letters. It is clear from that provision in 21(a) that "Pondage" is intended to have the special meaning: it is capitalised, it is cross-referenced to Annexure D. But "firm power" is used in the ordinary meaning, we say, in that provision.

MR MINEAR: Professor, sorry to interrupt you so early in your presentation.

PROFESSOR WEBB: Not at all.

MR MINEAR: I do have a question though that goes specifically to this question of special meanings. My question is whether there is an analogue to a domestic rule that's followed in the interpretation of statutes in the United States, and that is -- I'll quote the statement:

"In settling on a fair reading of a statute, it is not unusual to consider the ordinary meaning of a defined term, particularly when there is a dissonance

11:58 between that ordinary meaning and the reach of the definition."

This comes from a case called Bond v United States, which was interpreting a statute that implemented the Chemical Weapons Convention. And the point that was made in this case was: "chemical weapons" had a meaning -- the Treaty meaning and the statutory meaning was very, very broad, but it could be read more restrictively based on the general sense of "chemical weapons".

The same principle was applied in another case called Sackett v EPA, and in that case the term "navigable waters" was defined as "waters of the United States".

PROFESSOR WEBB: Yes.

MR MINEAR: And the question was: does "navigability" still provide some insight into that definition?

Now, in both of those cases, the ordinary meaning was used to restrict what was a very broad defined meaning.

PROFESSOR WEBB: Yes.

MR MINEAR: My question is simply this: is there a similar principle in international treaty interpretation? This might be something peculiar to the United States law, and I just wonder if this is present in treaty

11:59 interpretation, in your experience.

PROFESSOR WEBB: So the particular way in which we explain that the ordinary meaning has restricted the defined meaning is not a core principle of treaty interpretation in international law, and I would say it would be fairly unusual. I can't think of examples now.

But I think the two cases that you cite, and the process that's gone through, we do see a broad analogue with the process of treaty interpretation under the Vienna Convention, but not restricted to ordinary meaning and special meaning, that binary choice, but in terms of the holistic analysis that I mentioned at the beginning.

So it sounds like -- and not being familiar with the cases, but from your summary of them -- it sounds like the principle of effectiveness played a role there, that that narrowed the meaning, or perhaps the context or the object and purpose, all of which are familiar concepts in international law and could have led to a similar outcome, but not just through this contrast between ordinary and special meaning.

MR MINEAR: Thank you. I just want to make sure I'm not importing principles that I'm familiar with into the international context.

PROFESSOR WEBB: Yes, I think we have to be careful of that.

12:00 MR MINEAR: Thank you.

THE CHAIRMAN: Professor Webb, before we let you continue, you've set up this idea that Article 31 of the Vienna Convention, in paragraph 1, when it speaks of "ordinary meaning", is essentially speaking of a static interpretation of terms. Of course, Article 31, paragraph 1 itself doesn't say that. And it does seem to be the case that separate from Article 31, paragraph 4, there is the possibility of an evolutive interpretation of terms within a treaty, and there are cases, of course, that would support that: the Aegean Sea case, the Navigational Rights case and so on.

So I'm wondering if you accept that there is not necessarily a static approach in Article 31, paragraph 1; and if so, whether your argument is going to be that a treaty as a whole is either static or evolutive, or whether you would accept that terms within any given treaty might be viewed as having been intended to have either a static or an evolutive interpretation.

PROFESSOR WEBB: I'm going to be coming to those exact cases in the fourth part of my presentation. So I'll answer now, but I will come back to more detail on why the treaties in those cases can be distinguished.

But in answer to your question now, it is true that "ordinary meaning" as defined in paragraph 1 is not

12:02 a static meaning. But the starting point, going back to Fitzmaurice and the drafting of this treaty, is that "ordinary meaning" is associated with its meaning at the time.

Now, that may be displaced by other factors of treaty interpretation, object and purpose, or the express intention of the drafters as expressed in the treaty, the character of the treaty itself: that can displace that starting point. But what I'm saying is that that is the starting point based on the drafting of the Vienna Convention.

And then --

THE CHAIRMAN: Well, if I could just respond on that.

PROFESSOR WEBB: Yes.

THE CHAIRMAN: Fitzmaurice was not the final rapporteur in the project and it's a question as to whether his views worked their way into what became the Vienna Convention, including the ILC's commentary. So it may be worth looking at that.

PROFESSOR WEBB: Yes.

THE CHAIRMAN: But the reason why I did raise this now -- I realise you're going to, in your final part of your presentation, address this. But it seemed to me that in the Memorial, there was this approach to static interpretation, and then: oh, by the way, at a later

point in time, let's acknowledge that there's evolutive, but that's to be limited to very specific kinds of treaties.

PROFESSOR WEBB: Yes.

THE CHAIRMAN: I think Sir Daniel yesterday referred to the living instrument-type treaty.

I'm just curious whether you would accept that it is a part of a possibility of an Article 31, paragraph 1 interpretation that's not treaty-dependent; it may be provision-dependent.

PROFESSOR WEBB: Yes, I would accept that. And I think the character of the treaty as a whole or the specific provisions could each be subject to evolution. And as I said, I'll come back to the features that may show that, including the object and purpose or the intentional use of generic terms, as in the Navigational Rights case.

But I think there is a consistency in our approach in the Memorial and what we're saying now, which is that this is a Treaty that has limited its ability to be interpreted by incorporating extraneous sources and by departing too much from what was very much the bargain of the parties in 1960.

THE CHAIRMAN: So there would be some provisions of the Treaty that perhaps are more generic in nature -- "sound

and economical design" or "customary practice", whatever the term is --

PROFESSOR WEBB: "Customary and accepted practice".

THE CHAIRMAN: -- that you would say could be regarded as evolutionary in nature, but other terms that are not?

PROFESSOR WEBB: I wouldn't say it as definitively as that. I would say that looking at the terms "sound and economical" -- and this will become more real when Dr Miles and I go through each of these provisions and how these terms have been interpreted and applied, and should be interpreted and applied.

But "sound and economical" we wouldn't say is a completely generic term in the way that "commerce" was in Navigational Rights, because it is still impacted by paragraph 29(g), by the object and purpose of the Treaty, by the travaux préparatoires, by the three bargains underpinning the Treaty, and all of that restricts what you can do in terms of defining what "sound and economical" is, in a way that "commerce" in Navigational Rights was not so restricted.

THE CHAIRMAN: Very good. Thank you.

PROFESSOR WEBB: (Slide 11) So now coming to the next aspect of Article 31(1), which is looking at the terms of the Treaty in their context.

There are two main roles for context in treaty

interpretation. The first is the role as an "immediate qualifier" of the ordinary meaning of the terms used in the Treaty. The Kishenganga Court used this type of context in interpreting paragraph 15 of Annexure D, and it observed (PLA-3, paragraph 407) that:

"A review of the context of Paragraph 15 makes clear that the provision is placed within a continuum of design, construction and operation that cannot properly be separated into watertight compartments."

And given that context, the Court went on to say (PLA-3, paragraph 409) that:

"... the various paragraphs contained in ... Annexure D must be interpreted in a mutually reinforcing manner ..."

(Slide 12) I'm not going to read it out, but I'm just going to bring to your attention the paragraph of the partial award (PLA-3, paragraph 407) where the Court applied that contextual interpretation, and also brought in this idea of not "render[ing] ineffective" certain provisions.

So that's the first aspect: an immediate qualifier.

(Slide 13) The second aspect is looking at the structure of the treaty as its context, so looking at the preamble and the annexes and any agreements concluded in connection with the conclusion of the

treaty. And the Kishenganga Court also looked at that second type of context in its Treaty interpretation, specifically considering the permissibility of depletion of the dead storage level, referring to looking at the context of the Treaty as a whole.

(Slide 14) So then we come to what could -- if Article 31 is the general rule, you could say object and purpose is the golden rule because it has so many knock-on effects to treaty interpretation. And as foreshadowed by Sir Daniel, the three bargains at the heart of the Treaty -- the peace bargain, the Treaty bargain and the hydro bargain that I will be turning to tomorrow -- are crucial to the identification of the object and purpose.

So the reference to "object and purpose" has two related implications. First, it brings into the interpretation process the principle of effectiveness that I already mentioned in response to Mr Minear. So this is the idea that you do not pursue an interpretation that would render parts of the treaty superfluous or diminish its practical effect.

And the second aspect is that object and purpose requires that account be taken not only of the rights and obligations created by the treaty, but also of the general result that the parties wanted to achieve. And

12:08 we've heard about that from Ms Rees-Evans in the context of the travaux.

(Slide 15) So turning to the preamble of the Indus Waters Treaty. First of all, unusually again for a treaty, and part of the very comprehensive framework it creates, is Article XII(1), which defines the preamble as being an integral part of the Treaty.

Then we come to the preamble itself. And I won't read it out, but I'll just highlight what was the position of the parties in Kishenganga and what would, I assume, be India's position today.

So India's argument in the Kishenganga proceedings was that the most important part of this preamble, and therefore what defined the object and purpose of the Treaty, were the orange highlighted words: that the parties were "equally desirous of attaining the most complete and satisfactory utilisation of the waters".

Pakistan, in contrast, read the preamble as a whole and emphasised the importance of what follows in the yellow:

"... therefore, of fixing and delimiting, in a spirit of goodwill and friendship, the rights and obligations of each in relation to the other concerning the use of these waters ..."

The word "therefore", in Pakistan's submission at

12:10 the time and now, meant that it was only by fixing and delimiting the allocation of the waters that the object could be achieved. And I'm going to come back to this idea of delimitation when I look at peace and boundary treaty analogies in my fourth part.

So drawing this together, how does the object and purpose relate to the text of the Treaty?

An interpretation of a provision that does not align with a treaty's object and purpose is unlikely to be accepted or to be justified. At the same time, the relevance of the treaty's object and purpose is limited by the ordinary meaning of the text of the treaty. So it has this dual effect.

Let me give you an example to illustrate that. In the Certain Iranian Assets case between Iran and the United States -- you don't need to turn it up, but to have the reference, that's at PLA-0041 -- the ICJ had to interpret the provisions of the 1955 Treaty of Amity. And the key phrase here was "requirements of international law" in Article IV(2) of that treaty.

Iran argued that "requirements of international law" imported into the treaty all of the rules of customary international law concerning sovereign immunity. The ICJ rejected that interpretation as not consistent with the more limited object and purpose of that Treaty.

12:12 That Treaty of Amity, Freedom and Commerce was for the purpose of encouraging mutually beneficial trade and investments, and closer economic intercourse, and regulating consular relations. And the court held that immunities did not fall within that object and purpose. So it therefore defined the "requirements of international law", that phrase, more narrowly: as the minimum standard of protection for property belonging to one party's nationals and companies.

(Slide 16) The object and purpose of the Indus Waters Treaty has been considered by the Kishenganga Court, and as you've heard, its findings are dispositive. I'm just going to run through what they have said in the partial award (PLA-3) on the object and purpose, and I won't read out everything, just the emphasised points.

So in the context of interpreting and applying paragraph 15(iii) of Annexure D, the Court said the following in terms of how the object and purpose influenced its interpretation of that provision. It said (paragraph 407):

"The deliberate division and allocation of the six main watercourses of the Indus system of rivers between the Parties is a defining characteristic of the Treaty."

And it went on to say:

12:13 "The right is subject to expressly enumerated Indian uses on the Western Rivers, including the generation of hydro-electric power to the extent permitted by the Treaty."

And finally:

"... although the chapeau of Annexure D confirms India's right to generate hydro-electric power on the Western Rivers in language similar to that of Pakistan's unrestricted 'let flow' right, it is circumscribed by the terms of Annexure D itself."

(Slide 17) And the Court added (paragraph 418), with respect to the object and purpose relevant to the interpretation of Article III and Annexure D, that:

"The Treaty allocates the use of the waters of the Western Rivers ... to Pakistan, curtailing, sometimes quite severely, India's freedom to utilize the waters of the Western Rivers for the generation of hydro-electric power ..."

(Slide 18) The Kishenganga Court also made a number of determinations regarding the object and purpose of the Treaty as part of its decision on drawdown flushing. And there it said (paragraph 504):

"... one of the primary objectives of the Treaty is to limit the storage of water by India on the Western Rivers ..."

12:14 And it noted that this was "a careful balance between the Parties' respective negotiating positions", reflecting the role of travaux préparatoires in interpretation.

It also said (paragraph 506) that:

"... in many instances the Treaty does not simply restrict the Parties from taking certain actions, but also constrains their entitlement to construct works that would enable such actions to be taken."

And that is a key principle for each criteria that we are going to be assessing under paragraph 8.

(Slide 19) So the Court was very aware of the careful balance that is struck in the Treaty, the peace treaty and hydro bargains. And it pointed out (paragraph 522) that:

"It is not for the Court to apply 'best practices' in resolving the dispute ... any exercise of design involves consideration of a variety of factors -- not all of them technical. Hydrologic, geologic, social, economic, environmental and regulatory considerations are all directly relevant, and the Court considers the Treaty restraints on the construction and operation by India of reservoirs to be such a regulatory factor."

And in a very key finding, the Court said:

"... the optimal design and operation of

12:16 a hydro-electric plant is that which can be practically achieved within the constraints imposed by the Treaty."

The Court reiterated this finding in its decision on India's request for clarification or interpretation, saying that "it is for India to secure appropriate locations and to draw appropriate designs for its Run-of-River Plants", bearing in mind the "constraints that are part of the Treaty's essential bargain" (PLA-21, paragraph 34).

(Slide 20) So I now turn to the restrictive interpretation of exceptions to a rule. Now, this is not there in terms in Article 31 or 32 of the Vienna Convention. But during the travaux préparatoires of that treaty, the Vienna Convention, there was an understanding that exceptions to general rules should be strictly interpreted in order to promote the stability and security of treaties. And I would just refer you to our Memorial, paragraph 8.29, which clearly shows a number of delegations reiterating this rule.

(Slide 21) But it even predates the negotiation of the Vienna Convention. Nearly a century ago, the Permanent Court of International Justice, in the Certain German Interests in Upper Silesia case, held that the liquidation of rural estates pursuant to treaties was an exception to a general rule of international law and

12:17 has to be interpreted restrictively. So the Permanent Court said (PLA-22, page 76):

"... the liability to expropriation of rural property constitutes, under the Geneva Convention, an exception; in case of doubt as to the scope of this exception, its terms must therefore be strictly construed."

(Slide 22) In 1960, the same year as the Indus Waters Treaty was concluded, the International Court of Justice gave an Advisory Opinion on the Constitution of the Maritime Safety Committee of the Inter-Governmental Maritime Consultative Organisation. The question there was whether that committee, which had been elected the previous year, had been constituted in accordance with the convention. And the court was interpreting the meaning of the word "elected" there. And it looked at the context in which it was used, it looked at the object and purpose, and it said:

"If the context requires a meaning which connotes a wide choice, it must be construed accordingly, just as it must be given a restrictive meaning if the context in which it is used so requires."

So in that case, the context of that convention was that the largest ship-owning nations should dominate the committee, and therefore the court concluded that the

12:18 committee was not constituted correctly because Liberia and Panama were not included.

(Slide 23) The object and purpose of a treaty will sometimes call for a restrictive interpretation, where the rule purportedly derogated from is of particular importance to the parties' agreement. And that is an ICSID case, Enron v Argentina, which said (PLA-92, paragraph 331) that:

"... [an] interpretation resulting in an escape route from the obligations defined cannot be easily reconciled with that object and purpose. [And] a restrictive interpretation of any such alternative is mandatory."

(Slide 24) So in this case, we have a relationship between the object and purpose of the Indus Waters Treaty, the rule, and the exception, which is to be interpreted restrictively.

This brings me to the Chairman's question in the previous session on "let flow". There was some discussion about the role of "let flow" and exceptions. And I would just like to take this opportunity to say that Pakistan accepts that we have a rule and exceptions. And whether rooted in the text of the Treaty or the travaux préparatoires, we are not saying that there are no exceptions, evidently, to the let-flow

obligation. But we can't look at the phrase "let flow" detached from what is also said in Article III: "unrestricted use" and non-interference. Those concepts operationalise the idea of "let flow".

I'll be setting this out in more detail in the presentation tomorrow on the hydro bargain. But just to say, as is evident on the slide, that we do see this very much as a relationship, not one rule with no exceptions, but exceptions that do have to be interpreted restrictively.

THE CHAIRMAN: Thank you, Professor Webb, for that explanation. Let me just ask you about this principle of exception being construed narrowly.

There is arguably a different story one could tell in this regard, which is that that particular canon of interpretation is one that was considered by the International Law Commission along with a number of other canons of interpretation, one of which is the opposite to it -- I will dust off my Latin from grammar school -- generalia specialibus non derogant, which is the idea that the general should not derogate from the special, if you will.

And I believe it was the final rapporteur for the ILC, Sir Humphrey Waldock, who looked at these competing canons of interpretation and said: these are certainly

tools of the trade for lawyers, and perfectly reasonable to employ in legal argumentation; but as a general proposition, aren't core canons that should work their way into what became Vienna Convention Articles 31 and 32; that the core canons of "Look at the treaty language, look at the object and purpose" and so on, these are the ones that, if you will, should be applied systematically when one does the interpretative process.

So I suppose that's just a general way of asking whether there is a story here that would say: there is a competing canon of interpretation, it's obviously not the one that Pakistan thinks should be employed in this context, but that perhaps if India was here, it would make the argument that we've got an exception that is relatively detailed in nature, and that the core of what we need to be doing is interpreting that exception in and of itself, without regard to some idea that it needs to be narrowly construed.

PROFESSOR WEBB: Thank you. I'll just say that we will go back to Humphrey Waldock and look specifically at that point.

But I would say that using what is in Article 31, what is completely undisputed in international law, which is ordinary meaning, good faith, context and object and purpose, all of that in this case, applied to

this Treaty, also affirms the restrictive interpretation of the paragraph 8 criteria. And an argument -- as you've put forward on behalf of India -- that you would only look at the detailed criteria and interpret them sort of in a vacuum would be completely contrary to the general rule of the Vienna Convention and contrary to what the Kishenganga Court held, how the Kishenganga Court approached these questions.

THE CHAIRMAN: So I'll just follow up. If you do go back, I think it's Waldock's third report, in 1964. But let me pursue it a little further.

Is the principle you're advocating for, that we should construe exceptions narrowly, applicable only in a situation where you have multiple possible interpretations of the exception -- that is, you've looked at the exception and you've determined that there is two or three or more possible interpretations, and we should pursue the one that's the narrowest because of the principle that you're advocating for -- or even if you've settled upon what you think is the proper interpretation, you somehow should be trying to pursue an even narrower approach to the text at hand?

PROFESSOR WEBB: So it would arise in a scenario where there are multiple possible interpretations, but it would not only arise in that scenario. And I think the examples

that we have given of Upper Silesia, of the Constitution of the Maritime Safety Committee, of Enron v Argentina, and also we referred in our Memorial to Whaling in the Antarctic, are all cases that have approved of the restrictive interpretation.

There have been varied reasons for adopting it. Once again, going back to Article 31, it might be that the parties' agreement clearly hinged on this restrictive interpretation, that was Enron v Argentina; or it could be the context, that was in the Constitution of the Maritime Safety Committee; or it might be more a sense of the object and purpose; or it might go back to the travaux.

So I think there are multiple routes to a restrictive principle. And it is a principle -- as I said, we will go back to what Waldock said in his third report. But since then, it is a principle that has been accepted and applied multiple times.

THE CHAIRMAN: Thank you.

PROFESSOR WEBB: (Slide 25) So turning to the fourth aspect of Article 31, paragraph 1, which is good faith. This, as we know, is a cornerstone principle of international law: it is to be applied to every aspect of the process of interpretation.

(Slide 26) It is reinforced by Article 26 of the

12:26 Vienna Convention, which refers again to good faith as part of -- and now I can bring up some Latin -- pacta sunt servanda. This means that as long as a treaty remains in force, it must be observed as it stands, and good faith would not be served by interpreting a treaty as broadly as possible. And in the case of uncertainty or of divergent interpretations, good faith calls on the interpreter and the decision-maker to look to the proposal that led to the text of the treaty and the good faith of the parties in negotiating on that basis.

(Slide 27) So I now move on from the first paragraph of Article 31 to the third paragraph, which is subsequent agreements and subsequent practice.

Now, what constitutes an agreement or practice is not always clear. But a similar test applies, which is: in order to be "taken into account" -- the language of Article 31(3) -- it has to be a practice or agreement that embraces all the parties to the original treaty and a practice that occurs in the application of that treaty.

Now, yesterday, in the Court's exchange with Pakistan's Commissioner, three agreements that were made subsequent to the Indus Waters Treaty were identified. And I'm just going to now place these in the context of Article 31(3), building on what Sir Daniel said

12:28 yesterday.

(Slide 28) So the first is the 1976 agreement. This is a new document, but we did explain its content yesterday.

The context for this is that on 31 March 1967, the Permanent Indus Commission submitted to both parties a report on five disputes concerning Article IX(1) of the Treaty. And the two states appointed negotiators and they held four meetings and resolved all five disputes about the functioning of Article IX(1), and they were distilled into this resolution.

Now, these disputes were about clarifying the role of the Commission; they are not relevant to the provisions of the Treaty that we are looking at in these proceedings. Just to give you an example of one of them, "Can the Commission examine a claim for financial compensation?", and the answer was "Yes".

(Slide 29) The next agreement was the 1978 agreement regarding the design of the Salal plant, and that's at PLA-0053. As was said by Pakistan's Commissioner yesterday, this is a plant-specific agreement; it is very much under the auspices of the Treaty. So I've extracted Article III and Article IV there that clearly state that this is not changing the Treaty, this is not developing the Treaty; it is very much governed by the

12:30 Treaty.

(Slide 30) The third agreement was the 1989 arrangements about communication of flood flows (P-331). So it was codified in 1989 and then renewed annually for 20 years. And as Pakistan's Commissioner explained yesterday, this was an arrangement for the implementation of the Treaty in a very specific aspect; it is not a position regarding a changing interpretation of the Treaty.

So we would say that these three agreements do not need to be taken into account for the interpretation of the provisions of the Treaty in these proceedings.

Mr Chairman, yesterday you noted that India pointed to hydroelectric plants constructed between 1968 and 1990 and Pakistan did not protest the same method of calculating pondage as it later protested in the context of the Baglihar proceedings. I just wanted to come back to you on that. I have three points in that regard.

So first, over the decades there have been extensive discussions in the Permanent Indus Commission, and it may be -- and it has been -- that disagreements about the compliance of certain HEP designs with the Treaty reoccur over the years, being discussed in various meetings, and then fade away. In our submission, that would be unlikely to constitute conduct in the

12:31 application of the Treaty or an agreement between the parties on an interpretation of the Treaty.

The second point is a practical one, which is that five of the six plants that fell within that period had very small pondage: between 0.1 and 0.9 million cubic metres. So it may be that they just didn't rise to the level of importance to create any subsequent practice.

(Slide 31) And finally, the absence of protest by Pakistan cannot be considered acquiescence, let alone a subsequent practice. And this is reinforced by the provision that Sir Daniel referred to yesterday, Article IV(14) of the Treaty, which states that:

"In the event that either Party should develop a use of the waters of the Rivers which is not in accordance with the provisions of this Treaty, that Party shall not acquire by reason of such use any right, by prescription or otherwise, to a continuance of such use."

THE CHAIRMAN: Thank you, Professor Webb, for that follow-up on the question I asked yesterday. It's very helpful.

My own reaction on this particular provision that you have on the screen, Article IV, paragraph (14), is that it's a bit circular. We're trying to determine what the Treaty requires. And to the extent that the parties, through their practice, have determined that

12:33 there's a particular interpretation that's appropriate, then that's what we are trying to determine, and it doesn't trigger this particular provision.

You're correct that I asked in the context of the Baglihar proceedings, where India, in its counter-memorial, pointed to several hydroelectric plant constructions. But at the risk of giving you more homework, it does strike me that in your Memorial at Appendix C1, you do provide a list of 54 completed hydroelectric plants on the Western Rivers.

Now, some of those may have existed at the time of the Treaty, in which case they wouldn't be so relevant, but presumably some number of them were constructed with the understanding by Pakistan that they were occurring. They would have included some amount of pondage within them; they would have included outlets of one kind or another; they would have included a freeboard of some sort.

It may be in all instances you would say that it sheds no light on the parties' interpretation of the Treaty. But it just feels as though there should be some degree of practice operating here that the parties were in relative harmony on, up until the point where you get to Baglihar. And if that's true, then it seems like it should give us some insights into how the

12:35 parties were jointly interpreting the treaties up until that point.

So if you were able to look at that issue as well, I'd welcome that. Perhaps the answer will still be that the pondage was minimal; perhaps that there were no issues of the kind that are at stake in this proceeding. But it feels as though there's a bit of a gap in our understanding of this element of the way in which we might be interpreting the Treaty.

PROFESSOR WEBB: Certainly, and we will come back to you on that.

I would just say that this is also part of the exercise of document disclosure that Sir Daniel addressed yesterday, and we very much have this point in mind as we're reviewing all of these materials, including the pre-Baglihar materials.

(Slide 32) So this now brings me to Article 32, "supplementary means" of interpretation. And you've heard from Ms Rees-Evans on the travaux préparatoires.

I would just make the point, reflecting on the discussion that you had near the end of Ms Rees-Evans's presentation on non-travaux materials from the time, that these may fall within Article 32, as she stated, because preparatory work is just one example of a so-called "supplementary means". And I fully agree

12:36 with what she said about: the next question, once it falls within Article 32, is what weight you give to it, which will really be on a document-by-document basis.

The use of supplementary means of interpretation is not restricted to such cases in which the result of the application of the general rule under Article 31 would be ambiguous, obscure, or lead to an absurd or unreasonable result. As you can see in the chapeau to Article 32, it is also to determine the meaning or confirm the meaning, and that is where it can play a role in illuminating what was the intention.

The Kishenganga Court had recourse to supplementary means to confirm its interpretation of Article IX of the Treaty and paragraph 15(iii) of Annexure D; and this Court also had recourse to supplementary means in interpreting and applying Article IX of the Treaty.

(Slide 33) So I'm now going to turn to paragraph 29 of Annexure G, the applicable law provision.

So the meaning of paragraph 29 of Annexure G is that while a court seised of a dispute concerning the interpretation or application of the Treaty may look beyond the terms of the Treaty, it may do so only when this is "necessary" for the interpretation or application of the Treaty, and "only to the extent necessary for that purpose". So this is a restrictive

12:38 provision on bringing in rules of customary and conventional international law.

And this is consistent with the approach of this Court in its Competence Award. It recognised that resort to the customary rules of treaty interpretation that we've been discussing was possible only because it was necessary for interpreting the Treaty.

Here I want to come to the Court's questions about climate change and the Treaty that arose yesterday, and I'm also going to come to Dr Blackmore's question about innovation and cloud seeding at the end of this section. And I'm going to take you to the analysis of the Kishenganga Court in its final award, which Pakistan submits is correct and dispositive.

So Mr Fietta will soon -- after lunch -- develop the idea of water usage and sustainability and make the point that Pakistan and India are vulnerable to the effects of climate change. Climate change can be taken into account in the interpretation and application of the Indus Waters Treaty, but within two parameters. The first is that climate change does not require a different interpretative approach from what I've set out and from what the Kishenganga Court adopted; it does not require an evolutionary interpretation. And second, we do not need to amend the Treaty through

12:39 interpretation; indeed, that would be impermissible.
In Kishenganga, the Court found it necessary -- going through the gateway of paragraph 29 -- for its interpretation and application of the Treaty to determine the minimum flow, and in this respect it had regard to the customary requirement of mitigating significant harm to the environment in a transboundary context. This was necessary. But the Court said that going further than that, and starting to enter into the precautionary approach and starting to enter into a balancing exercise between environmental considerations and express treaty obligations, would impermissibly put the Court in the role of policy-maker. So it restricted itself, based on paragraph 29, to the requirement of mitigating significant harm.
(Slide 34) So I'm just going to take you to the emphasised lines in the key paragraphs of the final award on this point. So in paragraph 87, the Court noted that:
"... in fixing this minimum flow, the Court must give due regard, in keeping with Paragraph 29 of Annexure G, to the customary international law requirements of avoiding or mitigating trans-boundary harm and of reconciling economic development with the protection of the environment ..."

12:41 And in paragraph 111:
"... the Court notes that the place of customary international law in the interpretation or application of the Indus Waters Treaty remains subject to Paragraph 29. Unlike the treaty at issue in Iron Rhine ..."
And I'm going to come to that shortly:
"... this Treaty expressly limits the extent to which the Court may have recourse to, and apply, sources of law beyond the Treaty itself."
(Slide 35) The key paragraph is paragraph 112 of the final award. And just to emphasise again, Pakistan submits this is the correct approach to paragraph 29 and customary rules:
"... the Court does not consider it appropriate, and certainly not 'necessary', for it to adopt a precautionary approach and assume the role of policymaker in determining the balance between acceptable environmental change and other priorities, or to permit environmental considerations to override the balance of other rights and obligations expressly identified in the Treaty -- in particular the entitlement of India to divert the waters of a tributary of the Jhelum. The Court's authority is more limited and extends only to mitigating significant harm. Beyond

12:42 that point, prescription by the Court is not only unnecessary, it is prohibited by the Treaty. If customary international law were applied not to circumscribe, but to negate rights expressly granted in the Treaty, this would no longer be 'interpretation or application' of the Treaty but the constitution of customary law in place of the Treaty ... That Paragraph 29 does not permit."
(Slide 36) And in applying this, in paragraph 115 it concluded that a minimum flow of 9 cumecs was the right outcome.
This brings me to Dr Blackmore's question about whether there is room for innovation in the Treaty, and you gave the example of cloud seeding. You also noted that the Treaty is of its time and dealing with very specific issues. There are issues that the Treaty does not address: either deliberately, or could not address because they did not exist yet.
There is scope for innovation, but within the constraints of the Treaty. So if sound and economical design or satisfactory construction calls for such innovation -- and we will, as I said, make this real during our analysis of the paragraph 8 criteria -- then that is acceptable under the Treaty.
Now, evidently cloud seeding is not mentioned in the

12:44 Treaty and we cannot read it into the Treaty through interpretation. That's an example of a new technology or a new technique that would have to be addressed in further negotiations between the parties, a protocol or a new agreement.
But the more important point is that this exercise of interpretation is not innovation in the abstract. Whether innovation is required for a provision of the Treaty will depend on the specific wording of those provisions.
So in the disputes before this Court, which concern paragraphs 8(a), (c), (d), (e) and (f) of Annexure D, it is not apparent that climate change requires a new approach to interpreting these provisions. And as we will explain, the components covered by these provisions reflect the means by which a HEP operator can control water that has been stored, and we don't see at the moment a clear link there to climate change. There may be other provisions of the Treaty in which a climate change analysis could play a role, such as information-sharing requirements.
(Slide 37) So paragraph 29 of Annexure G is not a licence to import customary international law. It circumscribes the circumstances in which this Court may have regard to sources of law external to the Treaty,

and it should be viewed as a lex specialis.

We can turn here to the Kishenganga order on interim measures (PLA-42, paragraph 130), which was looking at the relevance of broader practice on provisional measures, including Article 41 of the ICJ Statute. And it found that paragraph 29 is "a kind of lex specialis" that makes it unnecessary to impose further requirements that you may find in statute or custom outside of the Treaty.

So I now come to this idea of a boundary treaty, a delimitation treaty, a treaty akin to a peace agreement. Paragraph 29 reflects the Treaty's status as akin to these types of treaties.

Mr Chairman, yesterday you observed it may not be obvious that one can extend the reasoning of the Temple of Preah Vihear to this Treaty, and you asked: how far can we go in the idea of a treaty for stability? And I want to answer those concerns now, including how this was addressed in Baglihar and Kishenganga.

(Slide 39) But let me just go back to the Temple of Preah Vihear statement which Sir Daniel brought you to (PLA-101, page 34), which is saying that if you have a treaty that is establishing something stable and permanent, like a frontier, then you cannot have "a continuously available process" that can be calling

that agreement into question.

(Slide 40) Building on that in the Bay of Bengal case, which was not dealing with land but with maritime delimitation, the tribunal accepted and followed that reasoning, saying (PLA-102, paragraph 216) that:

"... maritime delimitations, like land boundaries, must be stable and definitive to ensure a peaceful relationship between the States concerned in the long term."

The Indus Waters Treaty is also a kind of delimitation treaty. This is expressed in the preamble that I showed you earlier.

(Slide 41) And this precise point was made by Pakistan in its reply in the Baglihar proceedings. And I'm just going to read from the second half of this paragraph:

"The Preamble to the Treaty itself records that the parties intended to achieve the development of the Indus basin not through cooperative development but through the 'fixing and delimiting' of each other's rights and obligations. It is this statement of intent which self-evidently governs the whole Treaty, not any other."

(Slide 42) India did not address the point in Baglihar in its written pleadings. But as Mr Minear pointed out yesterday, the Neutral Expert did refer to

this in his determination. This is at page 14 of his determination, and I'm going to read from again near the bottom:

"Sovereign rights cannot be exercised without consideration of the limits imposed by the Treaty. In this context, it is not appropriate for the NE to qualify the Treaty as, inter alia, a 'delimitation' or a 'boundary' Treaty. The task of the NE with respect to the present difference is not to qualify the Treaty but to decide on a question posed by Pakistan with respect to Annexure D, Part 3 of the Treaty which deals with New Run-of-River Plants."

As we have already stated, and was clearly dealt with in the Competence Award, the Neutral Expert has no competence to enter into systemic issues of treaty interpretation. So any comment that he makes about a boundary treaty analogy cannot be given any weight. But in any event, reading this paragraph in context, it seems that Monsieur Lafitte was actually recognising that it was not appropriate to his task to qualify the Treaty, whether as a boundary treaty or something else. So Pakistan's argument in that respect was not touched.

(Slide 43) Turning to the Kishenganga proceedings, Pakistan and India did exchange and engage arguments on the boundary analogy. And this comes from the

transcript.

The first extract is from P-0488, and this is quoting Professor Crawford, as he then was. I am going to quote it in full because I think this makes the point real:

"The fact is -- and this is the point of the word 'therefore' in the preamble -- it was only by fixing and delimiting the allocation of waters that the agreement had ... a reasonable chance of success, a reasonable chance to survive. And central to that delimitation, a sort of hydraulic boundary treaty, was the obligation on India to let flow the waters of the Western Rivers subject only to the expressly permitted uses as per Annexures C, D and E. That is what the second part of the preamble refers to, the part of the preamble that India doesn't like and won't read.

... it says 'most complete'."

That's referring to "most complete ... utilisation of the waters":

"The fact is there isn't enough water to go around, and therefore there is some need for compromise. The question was whether the compromise was to be achieved through the ongoing work of an executive commission, with presumably tie-breaking rules, and so on, or whether it was done by a priori, by delimitation.

12:51 That's why I describe the Treaty as a hydraulic boundary treaty."

In his closing statement, which is at P-0129, he said:

"I said in opening that the Indus Waters Treaty was like a hydraulic boundary treaty, and I come back to that idea. Its concern was to delimit the uses of the Western Rivers, and of course to give to India the very considerable benefit of the use of the Eastern Rivers, which has been taken to its full extent."

Mr Nariman, for India, replied during the closing, he said that:

"Professor Crawford [has] also stated in rebuttal that the treaty was a hydraulic boundary treaty; his own assessment. I respectfully submit it is not, see Article XI: it is a treaty for water uses, not a boundary treaty."

Article XI(1) of course says that:

"It is ... understood that ... this Treaty governs the rights and obligations of each Party in relation to the other with respect to the use of the waters of the Rivers ..."

Of course, we would say this has to be seen in the light of the object and purpose, context and travaux of the Treaty.

12:53 Now, the Kishenganga Court did not directly address this phrase "hydraulic boundary treaty". But as I hope I've shown you, in its approach on the object and purpose and its approach to the interpretation of the provisions and the role of Article 29, it appears to have accepted Pakistan's position.

(Slide 46) It's also worth noting the second paragraph of Article XI of the Treaty, which says:

"Nothing in this Treaty shall be construed ... as in any way establishing any general principle of law or any precedent."

This is because the Treaty was bespoke. It was the product of three specific bargains, and could not, therefore, create a precedent for others.

(Slide 47) Mr Chairman, I'm coming to my last point, which is that yesterday you noted -- and also earlier today -- that we have cases where treaties are viewed as a "living instrument" where the meaning isn't fixed. In Pakistan's submission, those cases can be distinguished from the Indus Waters Treaty. And I'm just going to highlight three of them, and I can also address Aegean Continental Shelf.

The first is the Gabcikovo-Nagymaros Project (PLA-94). That was a treaty of 1977 regarding a specific construction and operation, and the court,

12:54 the ICJ, did indeed find that its meaning was evolving.

But that is not analogous to the Indus Waters Treaty. That treaty had specific provisions, Articles 15 and 19 in particular, that called for taking into account the evolution of environmental norms. And there was also an ongoing process there which was called a "joint contractual plan". There was also no equivalent to paragraph 29 of Annexure G.

The Iron Rhine award was cited in the Kishenganga final award at paragraph 111 as a contrasting type of treaty. So whereas the Kishenganga Court rightly said that this is not an evolutionary interpretation, in Iron Rhine there was a living instrument approach.

But again, the treaty differs. The object and purpose of that treaty called for new technological developments relating to the operation and capacity of the railway to be taken into account by the parties. There was no equivalent to paragraph 29 of Annexure G.

Finally, Costa Rica v Nicaragua, Navigational and Related Rights, was an 1858 treaty fixing the boundary along the right bank of the San Juan River. But the real dispute before the court was the navigational rights of Costa Rica under that treaty and the interpretation of the word "commerce": whether it had the meaning in 1858 or the meaning in 2009, at the time

12:56 it was decided.

And there the court said this was a deliberate use of generic terms: not special meaning, but generic terms that were meant to evolve over time. And they also had no equivalent of paragraph 29 of Annexure G.

In that same judgment, they referred to the Aegean Continental Shelf case that you referred to earlier, Mr Chairman. That's where we also had generic terms: "domestic jurisdiction", "territorial status". And it's interesting that in that case, the Aegean case, the court said the legal regime of perpetuity in the Aegean case was premised on evolution. That is not our scenario. Our legal regime is premised on stability.

If there are no further questions -- and I realise we are up to the lunch break -- that concludes my submissions.

(12.57 pm)

Questions from THE COURT

THE CHAIRMAN: So just one question from me, Professor Webb.

Again, just looking at the approach you've taken in the Memorial and the way that you proceeded today with your presentation, it seems as though you may be arguing that there are certain treaties that, as a whole, are not susceptible to evolutive interpretation. But that clearly isn't the lesson of, say, the 2009 Navigational

12:58 Rights case, which is basically a boundary treaty that did have within it terms that the court regarded as evolutionary in nature.
PROFESSOR WEBB: Yes.
THE CHAIRMAN: So it seems to me that it's relevant to think about this Treaty as a whole, and its object and purpose, which presumably is to create stability on a very significant level; but that within it, there could easily be terms that might be regarded as evolutionary in nature. And then the question becomes: are there any such terms? And in the context in which they appear in the Treaty, are they to be regarded in that way? And I assume that's what we will be talking about in some of your later presentations.
So I'm just trying to follow up on clarifying. You're not making the pitch that the Treaty as a whole has to be approached through a static interpretation, but that there may well be provisions that are evolutionary in nature. And in that regard, if that's correct, I'm wondering if you draw any significance from the fact that there are several provisions within the Treaty where the reference to what is customary specifies "customary on the Effective Date", which, pursuant to the definition of "Effective Date", is 1 April 1960; whereas in other places, including in

12:59 Annexure D, paragraph 8, that language doesn't appear.
PROFESSOR WEBB: Yes. So we would not say that it is completely static in nature. We have set out how it is meant to provide security and stability. It is akin to peace, it is akin to a boundary. It cannot, in the words of the Temple of Preah Vihear case, be subject to "a continuously available process". But that's not to say that it can't be applied to current conditions, and certainly it has to be.
As I said, this will become more concrete as we look at the specific provisions of paragraph 8, including this reference to "customary and accepted practice" and the reference "on the Effective Date".
But I would just like to clarify: we wouldn't say that there are specific terms that are generic in the sense that "commerce" was in the Navigational Rights case. We wouldn't make it as broad as that, because that was very much in the context of the court looking at the intention the parties that this had to keep evolving. That's not the intention that we see from the parties, nor the object and purpose of the Treaty, when we look at terms like "sound", like "economical", like "satisfactory".
There is room within them to, of course, look at current engineering practices and potential future

13:01 innovations, but they always have to serve the bargains underpinning the Treaty and the understanding that this Treaty was meant to provide a legal regime of perpetuity premised on stability.
THE CHAIRMAN: Very good. Thank you very much.
During the course of your presentation there was a crowd outside the window that applauded, so you had certainly a receptive group behind us, and certainly the Court was very receptive to your arguments as well. So thank you very much, Professor Webb.
As you say, we are at the lunch hour. So we will break, and see everyone at 2 o'clock this afternoon. Thank you very much.
(1.02 pm)
(Adjourned until 2.00 pm)
(2.04 pm)
THE CHAIRMAN: Welcome back, everyone. I hope you had a pleasant lunch.
There was an application received that Pakistan be allowed to refer to two articles, one by Dr Morris and one by Mr Ren, and we certainly are agreeable to them being referenced. Was the application to introduce them into the record as well?
SIR DANIEL: Yes, I think it was an application to introduce them into the record, because Dr Morris is intending to

14:04 refer to them in response to the questions raised by Dr Blackmore.
THE CHAIRMAN: In that case, the application is granted. So please do introduce them into the record with appropriate numerical designation.
SIR DANIEL: In the next two minutes they'll be there.
THE CHAIRMAN: Very good. Thank you.
Okay, I think at this point we are ready to hear from Mr Fietta. So whenever you're ready, please proceed.
MR FIETTA: Thank you.
(2.05 pm)
Submissions on Water Usage and Sustainability
MR FIETTA: Good afternoon, Mr Chairman, members of the Court. It's an honour for me to appear again on behalf of the Islamic Republic of Pakistan to address you on the subject of water usage and sustainability on the Western Rivers.
Before we start, I have delivered to you -- or my colleagues have -- a slide pack which should be in front of you; I think it may be behind tab 4 in your folders. All of the slides of course will appear on the screen, but you will want to keep it to hand, possibly, particularly when we get to some of the presentation on irrigation -- and I will flag it when we get there --

because we have some A3 illustrations at the back.
So when we get to that, you'll see at the back of the tab there are four A3 sheets relating to the irrigation network, and the reason we've blown them up is to make them legible for you. And it may be helpful to have those open when we get to it, and of course you're free to open the remainder of the slideshow as you see fit as we go through.
THE CHAIRMAN: Why don't we let the Secretariat distribute those before you keep going, Mr Fietta, just so that everyone has it in front of them before you address the substance.
SIR DANIEL: Mr Chairman, may I also just say I think the audiovisual is not working for some reason. So I don't know whether it needs to be turned on. We can't project slides just at the moment.
There we are. Thank you.
THE CHAIRMAN: Okay, I think we are all set now.
MR FIETTA: Very good.
So this topic of water usage and sustainability is essential context to Pakistan's right under Article III of the Treaty to "receive for unrestricted use" the waters of the Western Rivers, and India's, of course, concomitant obligation under that provision to "let flow all the waters of the Western Rivers".

I will demonstrate Pakistan's overwhelming reliance on the free flow of the Western Rivers, especially in light of India's total exploitation of the Eastern Rivers, which now essentially run dry in Pakistan.
I will explain also the substantial growth in demand for water from the Western Rivers in Pakistan, both since the 1960s and projected into the future. And alongside that increase in demand, I will identify supply-side pressures created by a reduction in flows on the Western Rivers received since 1960, which threaten to become significantly worse later this century due to the impacts mainly of climate change.
Much of my presentation today elaborates on submissions made by Pakistan at chapter 3 of its Memorial dated 22 March 2024. That chapter was entitled "The Indus Basin -- Topography, Hydrology, Demography, Water Security and Climate Change". However, some of the more technical aspects of that chapter of the Memorial will be picked up by my colleague Dr Morris, who will address you immediately after me with an engineer's perspective on the design and operation of Himalayan run-of-river HEPs. In particular, Dr Morris will address you on issues of geology, sediment and sediment management, and relevant issues of hydrology in the Indus Basin. So I will go light on some of those

issues.
My first slide sets out the structure of my presentation.
I will start by giving an overview of the Indus Basin and the Western and Eastern Rivers.
I will then discuss how -- in my second part -- India has worked to maximise its hydroelectric and irrigation development on the Eastern Rivers since 1960, such that those rivers now run dry in Pakistan.
The third part will look at seasonal flows, and agricultural usage and irrigation on the Western Rivers -- and this will probably be the most substantial part of my presentation -- including Pakistan's irrigation network on the Western Rivers in order to supply water to large areas previously supplied by the Eastern Rivers.
The fourth part of my presentation will give an overview of Pakistani and Indian power generation usage on the Western Rivers; the latter of which, the Indian usage, is of course closely regulated by the Treaty.
The fifth topic will address demand-side pressures on the Western Rivers in Pakistan, caused in particular by dramatic demographic changes and associated growth in agricultural and other use in Pakistan.

The sixth topic, the penultimate one, will address the reduction in flows on the Western Rivers over recent years, and the potential impacts of climate change.
And then I will make some brief concluding remarks in the final part.
So I will begin by presenting an overview of the Indus Basin, and a brief refresher on the six rivers which are the focal point of the Treaty. This is slide 2. I can do that by reference to my first map, which will be a template for a number of maps that will follow.
Here we see the Indus River system: the Indus River, with its six principal tributaries, the Jhelum, the Chenab, the Ravi, the Sutlej, the Beas and the Kabul; the last of which of course, the Kabul River, is not regulated by the Treaty.
This map also shows the location of all of Pakistan's major cities, most of which are located within the drainage area of the Indus Basin, as we will see. This fact is, of course, unsurprising, because the Indus is Pakistan's only river system of any note. It supplies approximately 95% of the country's water; that's Exhibit P-248, page 2.
By contrast, India is able to exploit over 20 major river systems on its territory. These are illustrated

14:12 at map 3.3 of the Memorial; we don't need to go to that now. And the Ganges-Brahmaputra-Meghna river system accounts for almost 60% of India's water needs, while the Eastern Rivers of the Indus Basin here, allocated to India under the Treaty, account for just 4% of India's needs. That's Exhibit P-247, page 265.

So my next slide (3) shows that Pakistan administers the vast majority, that's the green area: approximately 59% of the Indus River Basin. India, by contrast, administers just over 20%, 21%, a large part of which -- approximately 100,000 square kilometres of which -- comprises Indian Administered Kashmir.

This slide and those that follow also show India's position as the de facto upper riparian on each of the three [Western] Rivers, and of course each of the Eastern Rivers as well.

My next series of slides introduces each of the three Western Rivers.

(Slide 4) So we start with the Indus itself, here on the slide. This rises in the Tibetan highlands of Western China, it flows through Indian Administered Kashmir, entering Pakistani territory through Gilgit-Baltistan, before flowing approximately 2,000 kilometres through the entire length of Pakistan, and discharging into the Arabian Sea near Karachi.

14:14 The second Western River is the Chenab, which has just appeared on the slide, slide 5. This is a tributary to the Indus. It originates in Himachal Pradesh in India. It passes through Indian Administered Kashmir, before descending from the mountains to enter Pakistan on the plains of the Punjab province. You can see the topography of the Chenab here on this map.

The fact that the Chenab enters Pakistan having already descended from the mountains of Kashmir is an important topological aspect of the Chenab River, to which I will return later.

My next slide (6) shows the third Western River, the Jhelum, which is a tributary of the Indus that originates in Indian Administered Kashmir, and is joined by the Neelum-Kishenganga tributary in Pakistan-administered Kashmir, before descending into the Punjab province of Pakistan and merging with the Chenab.

You can see the route of the Jhelum there on slide 7.

So that's the Western Rivers in overview.

Then we come to the Eastern Rivers. They comprise the Ravi, the Beas and the Sutlej, of course. The Ravi has just appeared on my next slide, slide 8. And the Beas alongside the Ravi, they rise in Himachal Pradesh

14:15 in India.

The Ravi flows through India's Punjab province, and then meanders along the India-Pakistan working boundary for approximately 100 kilometres or so, before finally entering Pakistan and converging with the Chenab. So there you can see the Ravi joining the Chenab in Pakistan's territory on the slide.

(Slide 9) And the Beas merges with the Sutlej before entering Pakistan. The Beas has just appeared. You will see that it enters the Sutlej River -- it's a tributary, effectively, of the Sutlej -- and it joins the Sutlej before crossing the boundary into Pakistan.

The Sutlej is much longer, therefore, than the Beas. It rises in the Tibetan highlands before flowing through Himachal Pradesh and the Indian Punjab, then passing into the Pakistani Punjab and converging with the Chenab downstream.

So these slides show the historic course -- the natural course -- of the rivers of the Indus. However, the waters of the Eastern Rivers of course no longer reach Pakistan due to Indian development upstream. With the exception of occasional floodwater released by India, the only water that ever reaches the riverbeds of the Eastern Rivers today is actually supplied by waters transported from the Western Rivers by the world's

14:16 largest irrigation network, a topic to which I will return.

My next slide, slide 10, shows the areas of glacier and permanent snow cover in the Indus Basin. This extends over an area of more than 20,000 square kilometres, approximately. It's Exhibit P-264, page 45.

Snow and glacier melt amounts for between 72% and 80% of the total flows in the basin's rivers, making the Indus Basin one of the most meltwater-dependent river basins in the world. There's a number of exhibits on that point: P-265, P-263 and P-244, elaborated in the Memorial.

The remainder of the water in the basin comes from rainfall, and a disproportionate amount of that rainfall falls in the Karakoram foothills, which are of course upstream. Most of these critical areas of glacier, snow and rainfall, including those feeding the Chenab and the Jhelum Rivers, are located in India or in Indian-controlled territory. Consequently, but for the Treaty, it is no exaggeration to say that India, as the upper riparian, would have the potential ability to control the flows of the Western Rivers.

My next slide, slide 11, shows the catchment areas of the Western Rivers, in green. Now, note that the vast majority of the course of the Western Rivers and

their catchment area is located in Pakistan. However, a disproportionate source of the waters comprising the Western Rivers is located in, or flows through, India, the upper reaches of the Indus Basin in Indian-administered areas. This is because the major contributor to the flows in each of the Western Rivers is meltwater from snow and glaciers in the Hindu Kush, in the Karakoram and in the Himalayan mountain ranges in India or Indian-administered areas.

My next slide (12) adds to the Western Rivers the catchment of the Eastern Rivers. This catchment area is split almost equally between India and Pakistan, but includes three of the five largest cities in Pakistan. So it's much more heavily populated on the Pakistani side.

These cities include the ancient city of Lahore, which is the capital and largest city of the Pakistani province of Punjab. It is the second largest city in Pakistan. And according to the World Population Review, a public source, it's the 21st largest city in the world, with a population today of over 13 million people as of the last census in 2023.

Lahore was founded on the River Ravi, one of the Eastern Rivers, more than 1,000 years ago, and was one of the largest cities of the world between the 16th and

18th centuries in particular, thriving as a commercial centre for river-based commerce during the time of the Mughal Empire.

Following partition in 1947, as the upper riparian, India has the ability to control the flows of the Eastern Rivers, including of course the Ravi that passes through Lahore. India has done so to such a degree that those rivers now run dry in Pakistan almost permanently due to Indian development upstream. And I'll talk about India's post-partition and post-Treaty development works upstream shortly.

As a result of those works, and the corresponding loss of water supply on the Eastern Rivers, Pakistan has had to expand its irrigation network enormously since 1960 in order to supply these large areas, in yellow here -- including around Lahore -- of the Eastern Rivers catchment, together with its huge population, with waters from the Western Rivers.

The fact that Pakistan has had to expand its use of the Western River waters in order to replace waters lost from the Eastern Rivers adds further resonance to India's obligation under the Treaty to "let flow" the waters of the Western Rivers, and highlights why the uninterrupted flow of the Western Rivers is just as, if not perhaps more important to Pakistan today than it was

in 1960.

I'll discuss all of this in more detail shortly. But before that, I want to move on to my second topic, which is India's development of the Eastern Rivers. And slide 13 shows the Eastern Rivers in isolation here.

As the Court is aware, Article II of the Treaty states:

"All the waters of the Eastern Rivers shall be available for the unrestricted use of India, except as otherwise expressly provided in this Article."

Article II then sets out the relevant exceptions, which extend variously to domestic use, non-consumptive use and agricultural use in Pakistan, together with a series of provisions concerning the ten-year transition period between April 1960 and March 1970.

Now, during that ten-year transition period, but only during that period, only during that period under the Treaty, Pakistan was entitled to receive unrestricted use of the waters of the Eastern Rivers, to be released by India in accordance with Annexure H of the Treaty. Although we don't need to go to that annexure now, it's plain from its face that its overriding purpose was to safeguard Pakistani agricultural needs from the Eastern Rivers during the Kharif and Rabi crop seasons, until such time that

Pakistan was able to replace those waters from the Western Rivers.

Since the end of the transition period in 1970, India has exploited its right of unrestricted use of the Eastern Rivers, and it has done so to the full, by building a series of enormous structures, often for combined hydroelectric and irrigation purposes.

India's upstream projects have included the Thein or Ranjit Sagar Dam on the Ravi River, upstream of Lahore, which was commissioned by the Government of Indian Punjab in 1999. That project comprises a 160-metre-high, 600-metre-long dam with gross storage of 3,280 million cubic metres. It is capable of irrigating almost 350,000 hectares, or 860[,000] acres, of Indian agricultural land, and of generating 600 MW of power.

This is just one of a number of such combined irrigation and hydroelectric projects commissioned by India on the Eastern Rivers since the creation of the Treaty. And on the Ravi alone, India has completed at least five further HEPs upstream of the Thein Dam, with a total installed capacity of more than 1,370 MW. That's Exhibit P-578.

India has also dramatically expanded its irrigation network on the Eastern Rivers so as to supply waters to

14:25 Jammu and Kashmir, India Punjab and even Rajasthan. For example, India's Indira Gandhi Nahar Project, or IGNP, is fed by the Sutlej and Beas Rivers. That project supplies water to the vast Greater Indian Desert, also known as the Thar Desert, in Western Rajasthan. That Indian network, which was completed in 2010, includes the longest canal in India, which runs for 650 kilometres, and which supplies an area approximately 60 kilometres wide and 1,000 kilometres long, spread over a gross command area of 2.5 million hectares. That's Exhibit P-578.

India's development of these rivers, the Eastern Rivers, is such that those rivers now run permanently dry downstream in Pakistan, except during periods of heavy flooding. India's complete appropriation of the waters of the Eastern Rivers has been deliberate, and based on an understanding that Article II of the Treaty entitles it to run those rivers dry before they enter Pakistan.

Now, in its Memorial, Pakistan wrote that the Eastern Rivers run dry for 335 days per year. It cited a 2011 study for that purpose, indicating a reduction of more than 90% of the Eastern River flows into Pakistan by 2010, as compared to flows before the Treaty. And that was with reference to Exhibit P-263.

14:27 (Slide 14) We see that on the slide. The reference was made then to the average flow of the Eastern Rivers into Pakistan having been reduced by 75% and 92%, respectively, during the periods 1985-2002 and 2007-2010. And you can see there the reduction of flows highlighted of the Ravi and the Sutlej Rivers as they enter Pakistan: a significant reduction.

But those figures are now outdated. By 2019, a press release by the Indian Ministry of Water Resources, Development and Ganga Rejuvenation (P-563) -- this is my next slide, slide 15 -- stated that India's works on the Eastern Rivers had "helped [to] utilize nearly [its] entire share" of 95% -- or 95%, they said -- "of the waters of [the] Eastern Rivers" at that time, in 2019.

So there we can see the reference to the current status of development in India at the time in the Eastern Rivers: an exploitation of nearly the entire share.

But then the Ministry of Water Resources noted that:

"... about 2 MAF of water annually from [the] Ravi [was] reported to be still flowing unutilized to Pakistan below Madhopur."

And then the ministry said:

"To stop the flow of these waters that belong to

14:28 India for its utilization in India, following steps have been taken: ..."

And there are three steps in the document, but the most significant one by some margin is the first one, which is the Shahpurkandi project, which Sir Daniel Bethlehem mentioned briefly yesterday. And as the ministry said:

"This project will help in utilizing the waters coming out from [the] powerhouse of [the] Thein dam to irrigate 37000 hectares of land in [Jammu and Kashmir] and Punjab and generate 206 MW of [electricity]."

In February of this year, India completed construction of the Shahpurkandi Barrage. And there is a picture of it, I think, on my next slide, slide 16. This is the latest in a line of large Indian multipurpose irrigation and power generation projects built on the Eastern Rivers since the 1960s. And the completion of the barrage was reported in India as having "effectively ceased the flow of water from the Ravi River into Pakistan". That's Exhibit P-559.

Despite all its construction works since 1960, however, the flows of the Eastern Rivers within India still have significant untapped potential, particularly hydroelectric potential. We know that because in 2022, consultants at the Indian government-owned company that

14:30 runs five large dams on the Ravi wrote, in Exhibit P-578, that India had developed 2,177 MW of an available 3,229 MW of the hydroelectric potential of the Ravi River alone. So India retains the possibility, the paper reported, of expanding its hydroelectric generation capacity in the Eastern Rivers.

With the opening of this barrage, the Shahpurkandi Barrage, India's appropriation though of the waters of the Eastern Rivers is complete. It's open to question whether India's cumulative conduct since 1960 on the Eastern Rivers, which has run those rivers dry as they enter Pakistan, is compatible with the Treaty or applicable customary international law, but this is not a question arising for decision in the present proceeding.

In any event, the dramatic impact downstream in Pakistan of India's aggressive development of the Eastern Rivers is confirmed by flow data. And we summarise that on my next slide and the one to follow.

On this one, slide 17 -- both slides are based on data using the flows of the Eastern Rivers as they enter Pakistan. This one shows cumulative flows over time on the Sutlej and the Ravi as they enter Pakistan. You can see very quickly the flatlining of those flows over time, and particularly after the year 2000.

14:31 And the next slide (18) similarly, in a different way, charts the level of the flows over that period each year. These show the significant drop-off in the flows, measured on the Eastern Rivers in Pakistan since 1960.

So, Mr Chairman and members of the Court, all of this essential context in connection with the Eastern Rivers we say is a critical counterweight in the Treaty to India's unrestricted use of the Eastern Rivers. So there's a counterweight to that unrestricted use in the Treaty, and that is Pakistan's unrestricted use of the Western Rivers under Article III. That was the broad hydro bargain, if you like, that we've heard about before.

So having discussed the Eastern Rivers, I'd like to move on to discuss Pakistan's use of the Western Rivers, following the Treaty.

The Treaty, as you know, provides in the same way that it provides essentially for unrestricted use, subject to some exceptions, by India on the Eastern Rivers, it provides for unrestricted use by Pakistan, subject to different exceptions on the Western Rivers, under Article III.

The critical importance of the free flow of the Western Rivers for the people, environment and national economy of Pakistan cannot be overstated. A 2021

14:33 publication of the World Bank entitled "Groundwater in Pakistan's Indus Basin" -- and that's Exhibit P-248 -- calculated that the basin contributes 95% of the total water resources in Pakistan.

(Slide 19) Another World Bank publication of 2019 -- that's P-249 -- calculated that two thirds of this water comprised inflows of the Western Rivers from India. And that's shown in the slide. That appears at figure 3.1 of the Memorial. You can see here the reference to "external inflows" on the Western Rivers at that time, in 2019, constituting 66% of the total water resource -- or renewable water resource -- in Pakistan. The Eastern Rivers at that time made up only 1.5% of the resource.

Of course, after completion of the Shahpurkandi Barrage, the Eastern Rivers will be essentially contributing nothing to Pakistan's water resources going forward; and Pakistan's reliance on the Western Rivers will only increase, as compared to the illustration of that reliance here in 2019.

The average annual flow of water into Pakistan on the Western Rivers is measured at monitoring stations situated close to the Line of Control with India. The flow data appears -- it's before you -- at Exhibit P-402. It's extensive, and it's been analysed very closely particularly by Dr Morris for purposes of

14:35 his submissions. And Pakistan has provided analysis of that data in Appendix D to its Memorial, again thanks largely to Dr Morris.

The data shows that over the past 30 years, the total annual flow on the Western Rivers is just under 104 million acre-feet. Of this, approximately 57% of the flow enters Pakistan on the Indus, 23% enters Pakistan on the Chenab, and the remaining 20% enters Pakistan on the Jhelum.

All of these flows on the Western Rivers are highly seasonal because of their heavy dependence on glacier and snowmelt upstream during warmer months. And this seasonality can be seen on my next slide (20), which shows ten years of daily discharges of the Indus and Chenab Rivers at the Tarbela and Marala monitoring stations, respectively. This is figure 3.4 in the Memorial.

The seasonality of flows dovetails with Pakistan's national crop seasons, namely the Kharif crop season, which runs between April and September, and the Rabi crop season, which runs between October and March. More than 80% of the seasonal flows on the Western Rivers occur during the Kharif crop season, with the remaining 20% occurring during the Rabi season. Even in the Kharif crop season, most of the flows occur during the

14:37 three-month period between mid-June and mid-September. That's Exhibit P-268 at page 192.

The maintenance of flows during the critical earlier part of that crop season, while the crops are being sown and while the availability of water is relatively low, is critical. Without the let-flow obligation under Article III of the Treaty, Pakistan would be unable to irrigate its national crops, particularly during that early period of the Kharif season, when the rivers run low during April, May and early June.

Pakistan's crops receive their water from the Western Rivers via a national irrigation system that forms the centrepiece of the Indus Basin Irrigation System, or IBIS. The Indus Basin Irrigation System is the largest on Earth; or the largest contiguous irrigation system, certainly, on Earth. It services more than 25 million hectares of agricultural land, the vast majority of which is in Pakistan: approximately 84%. That's figure 3.8 in the Memorial.

I will spend a few minutes -- perhaps more than a few minutes -- describing Pakistan's irrigation system shortly. For now, the critical point is that by means of that irrigation system -- largely constructed, as we'll see, since the Treaty -- the Western Rivers are truly the lifeblood of Pakistan's huge agricultural

14:39 sector.

That sector consumes approximately 93% of the country's available water resources annually. Other uses of the Western Rivers, such as non-agricultural activities like domestic and industrial use, including power generation, pale into relative insignificance compared to the agricultural demand: they consume only 7%. That's all Exhibit P-280.

According to the Pakistan Economic Survey 2022-23, published by the Pakistani Ministry of Finance, the agricultural sector contributes approximately 23% of Pakistan's national GDP and employs approximately 37.5% of its labour force; Exhibit P-281, page 19.

So, members of the Court, Mr Chairman, it's no exaggeration to say that Pakistan has a water-based economy; there's no doubt of that. And that economy is based itself on the Western Rivers.

In fact, 90% of Pakistan's agricultural production relies on irrigated water, of which about 70% is provided by the Western Rivers. That's Exhibit P-244 at page 231. Up to 80% of those Western Rivers waters are derived upstream from the glaciers and snowmelt in Indian-administered territory. One can estimate that up to half, therefore, of the agricultural production of Pakistan relies on waters flowing into Pakistan from

14:40 India on the Western Rivers.

This is confirmed by scientific commentary on the importance of mountain water -- and meltwater, more specifically -- for production of early Kharif crops, such as cotton, which is of course particularly thirsty, and rice and sugar cane. There's an organisation -- based in Nepal, I think -- called HI-AWARE: it's aimed at enhancing climate resilience in the mountains and floodplains of the Indus. This is a different one; this is not the Nepalese one, I'm sorry. But that organisation, that focuses on climate resilience in the Indus, observed in a 2018 study that food production in Pakistan is "heavily dependent on water originating from snow and glacier melt at high altitudes"; Exhibit P-283.

The irrigation system in Pakistan is crucial, due to the combination of the seasonality of river flows on the Western Rivers, the arid climate in much of the country outside of the monsoon season and, following the Treaty, the non-availability of the Eastern Rivers.

The Memorial, at paragraphs 3.39 to 3.49, gives a brief history of the irrigation system in Pakistan, which originates several thousand years ago. That system has though seen two periods of substantial expansion. The first, which is not so important to us, is the expansion during the late 19th century, under

14:42 colonial rule. And following Pakistan's independence, the second significant expansion took place immediately before and during the transition period under the Treaty. That phase of expansion was focused, of course, on the formidable task of transporting waters vast distances from the Western Rivers into large areas of Pakistan which had previously been supplied by the Eastern Rivers.

These works conducted following the Treaty in 1960, these irrigation works, were described by the World Bank at the time as "the largest programme of its kind ever to be undertaken anywhere in the world". That's P-277, paragraph 7. They were undertaken by Pakistan pursuant to its obligation at Article IV of the Treaty, and they were undertaken with estimated costs of just over US$1.1 billion at the time, which equates to roughly US$12.5 billion today. That's Exhibit P-244 at page 231.

They were financed by multiple countries. And those countries contributed to the Indus Basin Development Fund, which was established under the Treaty in September 1960. India alone contributed in those days £62,060,000, which equates to more than US$1.5 billion today, so just over 10% of the cost of the irrigation expansion, as it was required to do by Article V of the

14:44 Treaty.

(Slide 21) We can look at Articles IV and V, the relevant parts, now. They make detailed provision for the expansion of Pakistan's irrigation network so as to supply areas previously irrigated by the Eastern Rivers with irrigation from the Western Rivers.

So there you can see Article IV(1) required Pakistan to:

"... use its best endeavours to construct and bring into operation, with due regard to expedition and economy, that part of a system of works which will accomplish the replacement, from the Western Rivers and other sources, of water supplies for irrigation canals in Pakistan which, on 15th August 1947, were dependent on water supplies from the Eastern Rivers."

You can see then in the provisions of Article V India's large contribution to the funding of those works was "In consideration" -- and they were the words used -- "In consideration" for the fact that they were required in order to replace water supplies in Pakistan previously received from Eastern Rivers, with supplies to be transported, via the new canals, from the Western Rivers.

As a result of those works, the Western Rivers irrigation network today supplies water to more than

14:45 21 million hectares of agricultural land in Pakistan alone. As the table in my next slide, slide 22 -- which is also Memorial figure 3.8 -- shows, this comprises more than 84% of the total irrigated agricultural land in the Indus Basin.

The areas served by the Western Rivers irrigation network in Pakistan are illustrated in my next slide (23). Here it is. This is based on Memorial map 3.7 and it shows the total area of agricultural land in Pakistan that is irrigated by the Western Rivers.

(Slide 24) It is split into three. The green part, the first part there, is the areas that are irrigated and are located within the natural catchment area of the Western Rivers. So they are, if you like, naturally irrigated by the Western Rivers.

(Slide 25) But there are two significant additional areas. The first is the yellow one that we can see now, and that is the area irrigated by the Western Rivers today that [is] located in areas previously irrigated by the Eastern Rivers. This is the area that was the focus of the post-Treaty irrigation works, to which I'll return shortly. It covers approximately 50,500 square kilometres or 5 million hectares.

(Slide 26) Then the second additional area is the pink one in the Lower Indus Valley. But this is outside

14:47 of the natural catchment of the Indus actually, so I may have misspoken by describing it as being in the valley. It is therefore an extension from the natural irrigation and catchment area of the Western Rivers. And that is another very significant area of agricultural land in the south of the country and the centre of the country which is irrigated now exclusively by Western Rivers water.

The remaining areas of irrigation in the Indus Basin are shown on my next slide (27), if you look carefully. The blue one is easy to spot. This is the area of Indian irrigation, comprising approximately 14.3% of the irrigated area in the Indus Basin, and of course that's irrigated from the Eastern Rivers.

Between them, the blue area in Indian-administered areas and the remainder in Pakistan comprise 98.5% of the irrigation in the Indus Basin. The remaining 1.5% is located in Afghanistan, on the Kabul River. You can see that if you look carefully in the top left -- it has just appeared -- in the extreme north-west of the Indus Basin.

(Slide 27) So the Indian area of irrigation is marked blue, and this is an area supplied exclusively by the Eastern Rivers. Of course, this map does not include though the additional areas outside of the basin

14:49 in India now also irrigated by the Eastern Rivers, including those canals I mentioned earlier, which extend hundreds of kilometres into India, as far away as Rajasthan.

(Slide 28) there's an additional small area of long-standing Indian irrigation upstream on the Western Rivers; this is the red one. This predates 1960, and was explicitly preserved, under Article III of the Treaty and Annexure C, as an exception to India's let-flow obligation in relation to the Western Rivers.

And finally, the 1.5% or so in Afghanistan is in purple, as I mentioned.

THE CHAIRMAN: Mr Fietta, I don't know if anything turns on this for our current case, but I'm curious whether the diversion of water from essentially the green area here down to the yellow area, and perhaps the pink as well, resulted in a decrease in the waters that normally would have been in the green area in a manner that worked to the detriment of those in the original catchment area, if you will.

MR FIETTA: Yes, thank you for the question. I will come to that; I was going to address it briefly later. But the answer, essentially, is: yes.

The expansion of the irrigation network, the very substantial expansion east into the yellow area, has

14:51 placed stress -- significant stress, at times -- on the waters of the Western Rivers within their natural catchment, such that sometimes when the eastern area, the yellow area, is in particular demand for water, the rivers, or stretches of the rivers or canal network in the green area will run dry.

So, as I'll discuss when we get to the irrigation network in more detail, this is a complex system of irrigation which is run at a national level, of course, and then a provincial level, below the national regulator, and which essentially works hard to distribute the waters as needed across the entirety of the irrigation areas of the basin. And that does mean that at times some areas, including areas that would otherwise have been more plentiful with water in the western catchment, have to make sacrifices for other areas.

This map, perhaps more than any others that you'll see this week, shows the overriding dependence of Pakistan on the free flow of the Western Rivers under Article III of the Treaty, both in the vast natural catchment areas of the Western Rivers themselves and beyond, into the similarly vast yellow and pink areas on this map, also irrigated by the Western Rivers today.

Just to give you a sense, the total irrigated area

14:52 in green, yellow and pink is over 206,000 square kilometres. It's roughly the same size -- almost exactly, actually, the same size -- as Great Britain. And the yellow area alone at 50,548 square kilometres, previously irrigated by the Eastern Rivers and now supplied by the Western Rivers, that yellow area alone is about 25% larger than the Netherlands. So these are very large areas.

My next set of slides takes us to the handouts actually. What we're going to do is chart the expansion of the irrigation network and the major steps in that expansion since independence, and in particular since 1960.

It's at this point that you might want to open your folders for orientation purposes, because on the slides these diagrams are harder to read, I think, than they are on the paper. But when we talk about specific features of the network, we will zoom in on them on the slides.

So there are four A3 sheets in your folders, and they take snapshots of the system in 1947; in 1960, the date, of course, of the Treaty; 1970, to coincide with the end of the transition period; and 2020, to give you a reflection of the system as it stands now.

I think just by comparing those -- and we'll get to

14:54 the detail -- but by comparing those four snapshots, you will appreciate the huge expansion by Pakistan of its irrigation network since its independence in 1947 and since the Treaty in 1960 so as to utilise waters from the Western Rivers throughout the agricultural areas of Pakistan, and in particular throughout the former catchment of the Eastern Rivers.

So these diagrams are based on figure 3.7 of Pakistan's Memorial and they're broken down over those four time windows. We've simplified them a little bit: we have removed extraneous or irrelevant aspects of the network, particularly on the Kabul and Swat Rivers, where there is significant irrigation in its own right. But to make them a little bit more user-friendly for you and focused, we've taken those elements out, although they do appear in the version of this figure at 3.7 of the Memorial.

So these illustrations show the scale and the speed, as we'll see, of Pakistan's irrigation network expansion during the years immediately leading up to the Treaty and following the Treaty. I don't have time today to explain each and every expansion, but I am going to focus on some key elements of that expansion.

So the first illustration is slide 29. This shows the irrigation network in 1947, on partition, largely

14:56 built by or under the British colonial rule between 1857 and 1947. And you can see that the connections between the Western Rivers -- which are isolated here on the illustration -- and the Eastern Rivers, between the Western and Eastern Rivers at that time the links were relatively rudimentary, with only a handful of barrages and link canals in operation, and no reservoirs at all at this point on the Western Rivers. So that's our starting point, if you like.

The next illustration you have, which is slide 30, and if we go again back between the 1947 and 1960, you will see the changes -- they leap out -- made, and you will see the changes on the paper versions between 1947 and 1960. Now, these were a number of expansions made, if you like, in anticipation of the Treaty and following the 1948 water crisis which we've discussed before. Pakistan did not delay in starting to make its water system, its irrigation system, more immune to intervention that it had suffered in 1948.

(Slide 31) A particularly significant development during this period between 1947 and 1960 was the construction of this link canal. We've circled it in yellow. It's a link canal between the Marala -- it's called the Marala-Ravi Link Canal, between the Chenab River and the Ravi. And this was built to

14:58 transport waters from the Chenab directly to the Ravi upstream of Lahore, close to the Line of Control between India and Pakistan. And we've zoomed in on the next slide (32) on that link canal.

Now, this was the first of a number of link canals you're going to see that have been built. These are not for irrigation themselves, because they are vast: they look like rivers, significant rivers, in their own right. They are purely for the purpose of transporting water from one river into the catchment of another for onward distribution through a network of canals.

So the link canals would typically join up with main canals, and you see the main canals here in green on these illustrations. But these main canals would then split into branch canals, and those branch canals will split into smaller distributaries, which are, if you like, the capillaries of the system. And it's those distributaries which distribute the water at a farm-to-farm level within Pakistan.

So this was the first construction of a link canal following partition, and in anticipation of the Treaty, to replenish flows in the Ravi and in the Eastern Rivers basin. In fact, an interesting fact is: today, if you're in Lahore, and you see the River Ravi flowing in Lahore, that water has come down, invariably, the

15:00 MR Link Canal. So it's Western Rivers water, it's not Eastern Rivers water.

So that's 1947 to 1960. But the period we're particularly interested in is the next period: between 1960 and 1970. And this is, of course, the transition period under the Treaty.

(Slide 33) As you can see, that period saw an enormous expansion of irrigation works, that required, in the words of Article [IV], paragraph (1):

"... [to] accomplish the replacement, from the Western Rivers and other sources, of water supplies for irrigation canals in Pakistan which, on 15th August 1947, were dependent on water supplies from the Eastern Rivers."

So if we again just flick between those two, you can see the difference between 1960 -- that's 1960 -- and 1970: substantial development in that ten-year period.

We can't focus on all of it, of course, but we can focus on a couple of examples. It included, for example, the construction of multiple of these giant link canals between the Western Rivers and areas previously irrigated on the Eastern Rivers.

(Slide 34) We're going to highlight one of the main links there, which is a new link, which runs from the Jhelum through the Chenab and the Ravi and the Sutlej.

15:01 So across those four rivers, two Western supplying all catchment areas of two Eastern Rivers.

So this is a triplet of link canals and associated barrages. These barrages are new, and they are substantial of course in their own right; those barrages are critical for the control of these waters. So we have the Rasul Barrage on the Jhelum; the Qadirabad Barrage on the Chenab; the Balloki Barrage on the Ravi, just downstream of Lahore; and the Sulemanki Barrage on the Sutlej, as shown in the slide. And we zoom in on the next slide (35) so you can see those features more clearly.

These link canals were, and remain today, a mainstay of the infrastructure put in place following the Treaty, in order to use waters from the Jhelum and Chenab to irrigate agricultural areas of Pakistani Punjab that had previously been supplied by the Eastern Rivers.

A similar set of link canals were constructed downstream -- I think that may be the next slide there (36) -- between the Trimmu Barrage at the confluence of the Jhelum and the Chenab on the Western Rivers, and the Sidhnai Barrage on the Ravi. This is the "TS" and "SMB" link canals you can see there.

(Slide 37) I am told that the difference between a barrage -- the barrage effectively allows control of

15:03 the waters, so some of that water may be diverted down a main canal, for example, where they're illustrated here. And then you have syphons: there's a syphon there, the Mailsi syphon. That is a more basic structure to facilitate the transit of the water across the Sutlej riverbed there, into areas beyond, in the southeast of Pakistan, for irrigation.

This period, between 1960 and 1970, also saw construction of Pakistan's first dam and reservoir on the Jhelum at Mangla, to help regulate flows upstream of the new barrages and link canals.

It's important to note that these reservoirs and dams, the three of them now on the Western Rivers, their main purpose is for irrigation. They do also generate electricity, but their main purpose is to assist with the control of flows, and to provide storage -- critical storage -- on the system for when it's needed.

The Chashma-Jhelum Link Canal, which I think might be on the next slide -- maybe it's not on a slide, that one, actually -- that supplies additional water upstream of the Trimmu Barrage, and that's for onward distribution to areas previously supplied by the Ravi and Sutlej. And that was also completed in the 1970s.

I think I may have jumped actually from the 1960 to 1970 period. So I think this was my last slide on the

15:05 expansion between 1960 and 1970. So that's the most substantial period of expansion.

(Slide 38) And the fourth period, shown on my last A3 printout, takes us up to today, shows the irrigation network as at 2020. Most of those changes actually made between 1970 and 2020 are hangovers from the transition period. It's completion of infrastructure that was begun during the transition period.

(Slide 39) This included the completion of the two further dams, the Tarbela and the Chashma Dams, both of which assist regulation of flows. And you see those here circled.

Also in that period during the 1970s the Chashma-Jhelum Link Canal was completed, as I say, which supplies additional water to the Eastern Rivers.

Now, that link canal actually goes to your question, Mr Chairman, of earlier, because it was built slightly later. And it was crucial to allow replenishment, from the Indus, of waters in the Jhelum, another Western River, to compensate the Jhelum for water lost to the Eastern Rivers. And as I mentioned, the pressure on this irrigation network is such that there are times when parts of the Western Rivers run dry in order to supply the Eastern Rivers.

(Slide 40) So today this network, if we look at it

15:06 at the 2020 snapshot, it comprises a vast network of 3 major dams and reservoirs; 23 barrages or headworks, which themselves are substantial pieces of infrastructure, which manage the flow of irrigated water across the country.

There are 12 of these major link canals facilitating the transfer of water between rivers, and hundreds of smaller branch canals. The branch canals alone extend 60,000 square kilometres. Those branch canals -- which, if you saw them, would be substantial: they're much bigger than the canals I'm used to seeing in the UK -- those branch canals lead into more than 1.6 million kilometres of ditches and streams, which collectively irrigate the 21 million hectares, or more than 50 million acres, of Pakistani farmland, thereby ensuring the country's food security.

But it's not just food security that this system ensures: it also supplies drinking water. One of the very small features -- which is actually vast -- on this illustration in 2020 is circled there. We can zoom in at slide 42: the Karachi Urban Supply Canal. That supplies Karachi's drinking water. So it directly supplies drinking water to millions of people through a channel fed by the Kotri Barrage, downstream on the Indus.

15:08 Just a few other points on these illustrations, just so you know exactly what they show. They distinguish between two separate zones. You may have noticed as you went through them that there is a shaded area. If we go back to the 2020 version (slide 43), you see the grey area and then the remainder.

The most relevant area for our purpose is the grey one, which is the Jhelum-Chenab or "JC" zone, and the rest of it is known as the "Indus main stem". The JC zone is most relevant because it regulates the bulk of the transfer of water from the Western Rivers to the Eastern Rivers, into areas previously supplied by the Eastern Rivers.

This doesn't mean to say the two zones are separate and independent because as needs arise, Western Rivers waters are allocated from one zone to the other, using an intricate network of barrages and canals.

The system operates as one huge integrated structure, coordinated at national level by the Indus River System Authority, or IRSA. That regulates and monitors the distribution of water across the country, and then the four provinces distribute the water within their provinces accordingly.

As I mentioned, it is important to note that these illustrations show only the most substantial parts of

15:09 the system. They do not show the close to 2 million kilometres of branch canals and other small distributaries that are the lifeblood of the system.

(Slide 44) Each of the canals shown here is what's called a "main canal": these thinner lines, which are separate to the branch canals. And each of those main canals is substantial, very substantial, which may feed into the discussion about cutting off two canals, what the effect of that might be.

(Slide 45) For example, the Kachhi Canal. This is just an example which we've circled there, downstream on the Indus. That canal alone extends around 500 kilometres and it supplies water to approximately 1 million acres of agricultural land in Balochistan, which is some distance from there.

So these are very substantial main canal features that you can see here, which feed into the branch canals and the smaller parts of the network.

Finally on this irrigation network, I should mention the role of groundwater. Of course it does play a role when there is a shortfall of water available in canal networks. But even the country's groundwater resource is reliant on sustained flows in the Western Rivers, because as the World Bank has observed in Exhibit P-279 at page 1, in research that it undertook, it said:

15:11 "Throughout the [Indus Basin Irrigation System], fresh groundwater exists primarily due to widespread leakage from [the] canal network."

These are not impermeable canal beds, and they are very important to supply of groundwater, including again around Lahore.

Slide 46 is the diagram of the system as a whole. It shows that the timely and reliable inflow from India of the Western Rivers is critical in order to keep this irrigation system working and in order to continue the supply of water throughout this vast network to areas of Pakistan previously supplied by the Eastern Rivers.

If India were able to operate HEPs upstream so as to restrict flows on the Western Rivers or distort the timing of flows on the Western Rivers, contrary to Article III of the Treaty, then, especially if this were done during the early crop season, as happened in 1948, this would have a devastating impact on Pakistani agriculture and on Pakistan as a whole.

(Slide 47) One way we can see that, just by way of example, the vulnerabilities which Pakistan faces on the Chenab, circled there -- we zoom in on the next slide (48). Chenab there enters Pakistan and hits the Marala Barrage, where there is that link canal, which was one of the early ones, to replenish the Ravi River, and also

has significant main canals running from it.

Now, I mentioned earlier that the Chenab enters Pakistan on the plains. It has already descended from the mountains in Indian Administered Kashmir by that point, and that means that it's effectively not feasible to build any reservoir or dam in that area to store water. So the flows through the link canal and the main canal there, which are very significant, and replenish waters in the Eastern Rivers, are directly reliant on the inflows of water -- and the undisturbed inflows -- on the Western Rivers from Indian-controlled areas.

There are no link canals either, as you can see here, to supply the Chenab: the topography prohibits that too. So the entire system that flows downstream from the Marala Barrage, for example, is dependent on the maintenance and reliability of flows on the Chenab River.

Without any reservoirs or incoming link canals, there's nothing to mitigate, even temporarily, the catastrophic effect of any reduction in flows from India on the Chenab. The net result would be catastrophe for the network downstream.

The position would be hardly any better on the Indus and Jhelum Rivers. There are some reservoirs on those rivers -- we've seen there are three -- but those

reservoirs would offer only minimal protection if India were to interfere with the flows or the timing of flows of those rivers.

Mr Chairman, members of the Court, I have spent some time on the Indus Basin Irrigation System, of course, and thank you for bearing with me. I've done that in order to illustrate the enormity of the works undertaken by Pakistan, following the Treaty, in order to make up for the loss of the Eastern Rivers to India, and to illustrate the critical role of full and timely flow of the Western Rivers under Article III of the Treaty in order to keep the irrigation network running. It is those full and timely flows on the Western Rivers that India's enormous HEP programme upstream threatens to disrupt, in violation of the Treaty.

So that's the end of my presentation on irrigation. I can move on now to speak about, more briefly, power generation.

THE CHAIRMAN: Let me just check to be sure we have no questions for you on this part of your presentation.

Dr Blackmore.

DR BLACKMORE: Thank you. (Pause)

Thank you. A very comprehensive presentation, and lots of numbers and the like. So just, first, an observation about table 19, and I'm just asking for

a clarification really.

The table is in bcm, billions of cubic metres, but the number you gave us for water use was 104 million acre-feet. I'm not sure whether that was a slip; we'll have to check the transcript. But I did check the transcript, and it was acre-feet. So just for my benefit, if it's bcm, I think I can probably understand that.

MR FIETTA: Yes, I think that's a valid observation. I believe the data points for those -- the 104 I mentioned at a different point, didn't I, of my presentation? -- is using different exhibits, which probably referred to a different source and a different point in time. But I can check that for you and come back.

DR BLACKMORE: Yes, could you just do that? Because when I looked at it in the context of where I thought it landed, I had a little trouble rationalising it. So that's one.

The second point is an important point, I think, just in terms of the general discussion. And I like the way you've laid out the roll-through of the growth of the irrigation systems. But my understanding -- and I think it's the same as your understanding, but might lead into what the consequences are -- is that there are

1.2 million groundwater bores embedded in this surface water system that supply, my memory is, about 50% of the surface water.

Now, you've made the point, rightly, that there's only 12 bcm that comes from rainfall that recharges the groundwater, so the rest of it has to come from seepage in the surface water system. It's basically an alluvial floodplain, and they leak.

The point though is you were making a point about: at the start of the irrigation season, if there was a change in flows from the Western Rivers, that that would be a significant issue. And it potentially is; I'm not buying into that. The question I'm asking is that you have a system with 1.2 million groundwater bores, which are independent, certainly for a period of time -- three months, six months, nine months -- of what's happening either with rainfall or channel flow.

What's your assessment of the buffer that provides Pakistan in terms of critical water supply through a -- whether it's a climate emergency or something else? I'd just like your judgment on that, please.

MR FIETTA: Well, thank you for the question. The groundwater is important, of course, in this basin.

I think it's quite a technical question; I want to be precise in my answer to you. So I'm going to have to

15:20 go away and have a look at that, and come back to you on it. Perhaps next week we'll come back to you on that question with a precise answer. I don't want to prejudge the specifics. Because just as you like numbers, and I want to give you numbers and I want to give you specifics, I don't have them at my fingertips.

I will come back to you on that.

DR BLACKMORE: Okay, thank you.

THE CHAIRMAN: Professor Buytaert.

PROFESSOR BUYTAERT: Thank you. But actually my colleague already answered the question I was about to ask you about the balance between groundwater and surface water irrigation: the number is about 50%. Is that a number you agree with, or any comments you can give on that balance?

MR FIETTA: Well, we have -- I think this may go to the table showing the water resource, the total water resource. Let's have a look at that.

DR BLACKMORE: Table 19?

MR FIETTA: Yes, exactly.

I will double-check the reference to the internal Indus. This looks at the total average annual renewable water resource in Pakistan, and as I mentioned, it indicates that about two thirds of that total resource enters Pakistan on the Western Rivers.

15:21 I think the answer to your question may relate in part to the Indus internal number, the 20%, but I would need to check, because obviously there is additional water which would certainly form part of that Indus internal, which would be, for example, the product of precipitation within Pakistan which flows into the rivers within Pakistan.

I think on this issue I'll need to come back to you in combination.

PROFESSOR BUYTAERT: I think I'd be particularly interested in the balance in water use for irrigation, groundwater versus surface water. I think this table shows the groundwater recharge; it obviously doesn't show how much of that, as I understand it, is taken out and actually used for groundwater.

MR FIETTA: Yes. (Pause)

PROFESSOR BUYTAERT: Then I had another small question on slide 14. There you show a table with the temporal trend in flow, where you draw attention on the reduction of the flow of the east-flowing rivers, obviously, but also the west-flowing rivers show a decline, and I wonder whether you have any opinion on the potential cause for that decline. Might that be natural, or is that because of increasing use by India?

MR FIETTA: Yes, I'm going to come to that shortly. I will

15:23 address the decline in flow of the Western Rivers. And you're right, and it was also shown in slide 14.

But I can answer your central point there: no, it's not Pakistan's case that the reduction in flows that has been seen, it's not Pakistan's case that that has been caused by Indian conduct to date. It's caused by other factors, which are debated. And it's not clear whether these are cyclical changes to the flows of the Western Rivers, whether they're caused by perhaps climate change and increasing evapotranspiration, different land use upstream, perhaps.

But it's not caused, certainly, by any of the conduct that we are most concerned with in this case as at this point in time. It's not as if the HEPs upstream have declined the flows of the Western Rivers. That's a point on which I have taken specific instruction beforehand, and that's not the case.

PROFESSOR BUYTAERT: Thank you.

Then the last, hopefully quick, question: would you know the current level of stress on the Indus Basin as a whole; in other words, what is the percentage of total flow of the Indus main stem that is abstracted for irrigation and other uses?

MR FIETTA: Again, I may come back to that. We have 93% of the usable water resources used for irrigation and

15:25 agriculture. Whether that is comparable on the Indus main stem, I'd have to check.

PROFESSOR BUYTAERT: Okay, thank you. That's all for now. (Pause)

THE CHAIRMAN: I think there's no more questions on the first part of your presentation. So please proceed, Mr Fietta.

MR FIETTA: Okay. We're about two thirds of the way through, or a little bit more than that.

The next topic is Indian power generation and Pakistani power generation, so another form of usage, of course, on the rivers of the basin.

I've mentioned that the Western Rivers are the lifeblood of Pakistan's agricultural sector. They are also essential for its domestic and industrial water use, albeit those usages only consume about 7% of the resource. And they are essential to Pakistan's hydroelectric power capacity. Following India's depletion of the Eastern Rivers, Pakistan's primary source for generation of hydroelectric power is the Western Rivers.

By contrast, as explained in the Memorial at paragraph 3.13 and map 3.3, the Eastern Rivers supply only 4% of India's water resources. As Sir Daniel Bethlehem explained yesterday, of the 5,000 or so major

15:26 dams constructed or planned in India, only around 200 or so are located on the Indus Basin. India can rely on 20 or more other major river basins in the country for its water and hydroelectric needs. These include the vast Ganges-Brahmaputra-Megha Basin, which accounts for almost 60% alone of India's water resources.

A report by the Indian Ministry of Power in August 2023 estimates that the total hydroelectric capacity in India was 148,701 MW in 2023, of which only 31.56% had yet been harnessed, with another 11.26% to be harnessed by projects which were under construction. This leaves a substantial proportion, or approximately 85,000 MW, of India's hydroelectric capacity unutilised at this point. That's Exhibit P-579 at page 17.

I'm going to show you the Pakistani and Indian HEPs on the Indus Rivers. My first three slides in this segment concern the Pakistani HEPs on the Western Rivers, of course.

(Slide 49) Pakistan has 31 of those. They are mostly run-of-river, but of course they're not constrained by the Treaty. And they have a combined generation capacity of 9,150 MW. They are the green ones on this slide.

(Slide 50) There are an additional 24 projects under construction. This is a slight correction to the number

15:28 given in the Memorial, which was 21. The Memorial had misanalysed the table of projects under construction. There are 24, not 21.

(Slide 51) And there are a further 99 Pakistani projects in the planning stage, in various parts of the planning stage. So the green ones are existing, the red ones are under construction and the purple ones are at the planning stage.

Like its irrigation network, Pakistan's HEPs are directly reliant on the free flow of the Western Rivers. They are the anticipated result of Pakistan's right under Article III to the "unrestricted use" of the waters of the Western Rivers.

Notwithstanding Pakistan's right to unrestricted use, India has seized upon the exception at Article III(2)(d) and Annexure D of the Treaty to build or plan a staggering number of HEPs on the upstream stretches, in a relatively small area of the upstream stretches of the Western Rivers.

My next three slides show India's HEPs on the Western Rivers, again broken down. So the first slide (52) shows the ones which have been constructed to date; the second slide (53) shows those under construction, in red; and the third (54) shows those that are planned.

And there are additional ones planned. Sir Daniel

15:30 gave the figure of 200 yesterday as a total. If one were to isolate each of these, we'd have slightly less than 200: that's because Pakistan doesn't know the location of every single planned HEP, so they're not all shown on this illustration.

To the extent that these HEPs -- the Indian HEPs -- to the extent that they violate the strict limits of Annexure D, which of course is the issue before you, essentially, which Pakistan fears that a significant number will of those under construction or planned, there will be a violation, of course, of India's overriding and fundamental let-flow obligation under Article III, because those plants will not fall within the exception to the rule. And the more HEPs that India designs and builds in violation of Annexure D constraints on the Western Rivers, the more egregious will be that violation of Article III and, perhaps even more importantly, the more grave will be the impact of those violations downstream in Pakistan, as we have seen.

Dr Morris will explain on Thursday how India's cascading HEPs threaten the free flow of what is effectively Pakistan's only water supply -- at least river-water supply -- on the Western Rivers, or its main one, with the Kabul River, of course, as well to

15:31 a lesser extent.

I think following Dr Morris's presentation on the back of this one and this illustration, you will see why the systemic oversight of this Court is so important: in short, to ensure that India's boundless -- almost boundless, at least -- hydroelectric ambitions on the Western Rivers comply with the critical requirements of Article III and Annexure D of the Treaty.

I'm going to spend the remainder of my time addressing demand- and supply-side pressures on the rivers. I think -- have I been going for just under an hour and a half?

THE CHAIRMAN: Yes, we would normally take a break at this point. So it may be a question of how much more time you would like to ...

MR FIETTA: I think I can scoot through and finish, and that way we can have a break and start afresh with Dr Morris for the last session.

THE CHAIRMAN: Let's do that. Thank you, Mr Fietta.

MR FIETTA: So I'll spend the remainder of my presentation looking at demand-side pressures, on which I can be brief, because they're quite obvious, and probably uncontested, on the Western Rivers. But they do go to the importance of the let-flow obligation again for Pakistan.

15:32 Now, a starting point is that Pakistan has, since 2005, been classified as "water scarce"; that is, a country with water resources of less than 1,000 cubic metres per capita, according to something called the Falkenmark indicator. This is one of several indicators commonly used to measure water scarcity, and it provides a relationship between available water and the human population in any given country.

Pakistan was downgraded to that "water scarce" status in 2005, before which it had been classed as "water stressed", which is a less serious form of water stress. But it's projected that Pakistan will approach the most critical category of all, namely "absolute water scarcity", with water resources of less than 500 cubic metres per capita, as early as next year. And of course climate change, which I'll address shortly, will make the situation even harder for the people of Pakistan.

India itself is not immune, of course, to these problems, but it is in a less perilous position. The Indian Government has projected that per-capita water resource might drop to 1,341 cubic metres by 2025, compared to 500, as we've just heard, in Pakistan, which would classify India as "water stressed". But this is some way from being "water scarce", which is the current

15:34 classification of Pakistan, and a long way from reaching "absolute water scarcity" under that indicator. And these details are given at Exhibits P-300 and P-301.

So the Indus Basin is one of the most depleted water basins in the world, and there are times at which, even since 2010, the waters of the basin do not reach the Arabian Sea.

The two main challenges to the basin on the demand side are, first, population growth, and second, climate change. I'll address the two of them briefly.

First, on population growth.

Since 1960, Pakistan's population has multiplied by approximately six times. Since the Treaty in 1960, the population is approximately six times larger: it has grown from 43 million to around 241 million today. And this is shown on my next slide (55). This shows the growth in the population of Pakistan between 1961 and today.

This population growth is disproportionately located of course in the Indus Valley, where most of Pakistan's major cities are located. And here you can see the population density, which, unsurprisingly, is focused on the rivers. But I think it's important that you note that perhaps the most dense area of population is between the Chenab and the Ravi River, and particularly

15:36 around Lahore, which is itself on the Ravi River, so areas irrigated -- previously supplied by the Eastern Rivers.

(Slide 56) As my previous slide showed, looking forward, Pakistan's population growth is expected to continue equally rapidly over the remainder at least of the first half of this century. The UN's Population Fund has estimated a further growth of 67% to more than 400 million by the year 2050.

India's statistics are shown on the right-hand side of the slide. Its population nationally has roughly tripled since 1961, so a significant rate, but half of the rate that we've seen in Pakistan. The UN Population Fund estimates that in future, as you'll see there, the growth is predicted to decelerate significantly, to about 17% growth from today to 2050, compared to the 67% projected by the UN in Pakistan.

The growing population of Pakistan has generated, of course -- and will continue to generate -- substantially higher demands on agricultural output, on energy supply and on water generally. And urbanisation has only increased these pressures. A 2021 World Bank paper projects that Pakistan's domestic water demand will nearly double by 2050, and that industrial water demand will potentially triple by 2050. That's Exhibit P-248.

15:38 Meanwhile, also on the demand side, rising temperatures due to climate change will also increase agricultural demand for water in the Indus Basin. This is because increased water loss through evapotranspiration -- so that's evaporation from the vast irrigation network and transpiration from plants -- will increase, as a result of which essentially more units of water will be required in the future to generate the same amount of agricultural output today.

They're the demand-side pressures. But the ever-increasing demand-side pressures are only half the story.

On the supply side, we've seen, as Professor Buytaert noted, first of all, a reduction in the amount of water flowing into Pakistan on the Western Rivers. My next slide, 57, illustrates the observed downward trend. This again has been compiled by Dr Morris -- who of course will be available to you if you have detailed questions on it -- on the basis of the gauge data which appears in the Memorial. And this shows that since 1960, the annual volumes of waters flowing into Pakistan on the Western Rivers have reduced about 8%. That is the trend across this period of 60 years.

Now, there is a statistical reliability gauge for this sort of data: I'm told it's called the Mann-Kendall

test. I'm not an expert on it, and if there are questions on it, perhaps Dr Morris can answer those. But the output of that test is that this trend is 90% reliable according to that test, which analyses trends that increase or decrease over time and how reliable they are. This seems to be a reliable trend. The causes of this trend, however, are less clear, and I'm not going to speculate on them beyond my answer to Professor Buytaert earlier.

The important point though is that climate change promises to reduce the flow of the Western Rivers further over the decades ahead, at least potentially. Pakistan is responsible for less than 1% of the world's carbon footprint, but is highly vulnerable to the impacts of climate change. India is responsible for a bit more: nearly 8% of global emissions. But of course climate change does not distinguish between those states like India which are more responsible, perhaps, than Pakistan for climate change.

The Global Climate Change Risk Index identified Pakistan as the eighth most climate-change-affected country in the world between 2000 and 2019. That's Exhibit P-292. India was 20th on that list. So India is affected, but not quite as much.

It's not yet possible to identify with confidence

the precise effects that climate change will have in the Indus Basin, whether to this point or in the future. The topic is highly complex and subject to ongoing scientific study. But some broad observations can certainly be made.

One summary that I found for this purpose of perhaps the current state of the science is at Exhibit P-295, and it's on my next slide (58). Here it is. This paper cites a large number of other papers and modelling studies undertaken before it was published in 2019. So in that sense it's an agglomeration of the studies done by that date, and it summarises the takeaways of those studies.

It says that certainly the warming in the Indus Basin, and particularly in the Upper Indus Basin, has been well above global averages; and there's been a loss of glacier mass, which will continue for decades, even if temperatures remain as they are today. And it continues in a passage which appears on this slide, commenting as follows:

"The majority of the flow comes from glaciers, so the Indus basin is particularly vulnerable in terms of climate change that causes higher warming trends and loss of glacial mass. Global warming will initially creature the water flow, causing flash floods and

glacial lake outburst floods, but will be followed by a reduction in the water flow. However, the future response of the glaciers in the Indus Basin to the runoff is not very clear ... Any changes in precipitation and temperature in the basin are important parameters and must be taken into consideration ... Although several studies have been carried out to project future temperature and precipitation, a comprehensive assessment of the current state of climatic components is largely missing."

So in short, the reduction in size of the glaciers, particularly in the Himalaya and Hindu Kush, is significant. That's clear: that's going to happen. The Karakoram has a slightly different trend of glacial reduction, but the long-term is still reduction. They're the three glacial areas that feed the rivers. But the impact on flows is less certain because there are many other factors, including the precipitation, of course.

What is very clear is that the timing of flows will become less predictable, and may be more dramatic. We may see more drought and more floods.

In fact, we can make four high-level observations which do seem to reflect the scientific consensus.

The first is that surface temperatures will increase

substantially: between 1.7° and 6.3° by the end of this century, with the higher temperature changes expected in the Upper Basin, which is more vulnerable. In that region, temperatures are projected to increase by at least 5° by the late 21st century, as compared to the late 20th century. That's Exhibits P-294 and P-295. That's the first headline conclusion.

The second is that in the short term, the Western Rivers will become less predictable and more volatile. There will be increased periods of flooding and drought. We've seen that in the past two years, in fact: there was a significant drought last year during the Kharif cropping season; and the year before, there were almost unprecedented floods. At the time of the drought last year, a spokesman for the Indus Rivers System Authority attributed the drought to "the dangerous impact of climate change on water availability in the [Indus Basin] rivers". That's Exhibit P-284.

The third high-level conclusion is that there will be a significant reduction in glacial areas which supply the vast majority of the waters of the Western Rivers today, which will likely manifest itself in periods of increased flows during the melting process, followed by reduced flows, especially during dry summer months, ordinarily supplied by glacial melt.

15:46 And the fourth high-level conclusion is that while the rate, timing and extent of glacier loss associated with reduction in river flows will depend on precise temperature and precipitation trends, which varies enormously through the basin, all scenarios do indicate serious consequences in the basin.

My final slide (59) is a table indicating the level of glacier loss in the Hindu Kush and Himalayas by 2100 anticipated according to different levels of global warming. So this is warming global-wide. As you'll be aware, the target is between 1.5° and 2°. In that scenario, the glacier loss in the Hindu Kush and Himalayas would be between 30% and 50%, so very significant. But if the Paris targets are not met, then the amount of glacial loss promises to be even more dramatic.

Increased evaporation from Pakistani rivers and its extensive canal network and increased transpiration, or water loss, from Pakistani crops due to warmer temperatures will also exacerbate the challenges of climate change. The level of Western River flows that will be required in order to maintain, as I've said, any given unit of agricultural production will increase due to these evapotranspiration factors alone.

So alongside the ever-growing pressures on demand

15:47 for water on the Western Rivers, Pakistan faces substantial challenges on the supply side through the likelihood of reduced, and certainly less predictable, flows on the Western Rivers by the end of this century.

By way of conclusion, all of this adds up to critical threat to Pakistan's ability to sustain its agricultural sector, alongside other areas of its economy and even its population in the years to come. It will be more critical than ever that the remaining waters of the Western Rivers are allowed to "let flow" into Pakistan without unlawful interference upstream from Indian activity, including Indian HEPs. Thus the importance of this Court's systemic interpretations of the provisions of the Treaty that are designed to safeguard Pakistan's unrestricted use of the Western Rivers, alongside India's deployment of run-of-river HEPs upstream, within the carefully framed constraints imposed by Annexure D.

Mr Chairman, members of the Court, that concludes my presentation.

THE CHAIRMAN: Thank you, Mr Fietta. (Pause)

Okay, I think we don't have any questions for you, Mr Fietta, but thank you very much for your presentation.

We will now take a coffee break and come back at

15:49 4.20. Dr Morris, I take it, will be next up in the presentations. We are squeezing him rather tight, in that I do intend for us to end the day at 5.30. So my expectation is that Dr Morris will continue over into tomorrow morning, in all likelihood, and then we'll continue onward.

The good news is we have a little bit of contingency time, I think, built into tomorrow, so that shouldn't present any difficulty.

SIR DANIEL: Mr Chairman, that's perfectly fine with us. I think we are comfortable and not being squeezed unduly in terms of time.

I did want to give you the option -- but you may have preempted it with your remarks now -- if you did wish, simply because the flow was continuing beyond 5.30, to continue for a while, I'm sure that on our side we would be perfectly happy to accommodate that. We don't want to use this as an opportunity to get additional time, and we would be happy to have time docked from us tomorrow if you just wanted to continue the time to keep to the schedule.

THE CHAIRMAN: I think we would like to finish today no later than 5.30. I do suggest that Dr Morris consider whether there's a particular break in his presentation: we don't have to go all the way to 5.30, but I don't

15:50 think we want to go past it. But of course we have plenty of time tomorrow, I think, to pick up with him and then continue onward. Thank you.

SIR DANIEL: That's fine, thank you.

(3.51 pm)

(A short break)

(4.21 pm)

THE CHAIRMAN: I think we're ready to resume our afternoon second session, and we have Dr Morris up.

As indicated before we broke, hopefully, Dr Morris, you've thought through whether there's a particular point in time in your presentation where we might break for the end of the day. That might depend in part on the questions you get from the members of the Court, so you might want to have in mind two or three possible places of breaking. (Pause)

So please proceed with your presentation.

(4.23 pm)

Himalayan Run-of-River Design and Operation: An Engineering Perspective

DR MORRIS: Thank you. It's a pleasure to be here in front of you, gentlemen. And what I would like to do to begin with, I'd like to talk just briefly about my background and how I come to this.

I've been working with sedimentation problems with

16:23 reservoirs since 1974. And when I started working with this, the accepted policy, let's say, is that you design a reservoir to accumulate, let's say, 100 years of sediment and you don't worry about the future. But that's not sustainable, and I've made it basically a life quest to figure out and develop strategies that will work. And in that process, I wrote a very large, 748-page handbook for McGraw Hill, together with Professor Fan from China, and I worked on 60 reservoirs in 20-some-odd countries.

In the Himalayas, I've worked about eight or nine reservoir designs in Nepal. I've worked with the Nurek Reservoir in Tajikistan. I've worked with several reservoirs in Pakistan. We've just finished -- are just finishing a multi-year, very detailed study of Warsak Reservoir flushing and modelling. I've worked pretty extensively with Tarbela, and we're working currently with the Neelum-Jhelum. And of course I've done modelling with the Kishenganga and currently working with Ratle.

So I have a little bit of familiarity with this region, plus a number of other mountain regions, ranging from the Philippines to Andes, et cetera.

So with that preamble, I'll just start.

(Slide 2) What I want to do is outline some key

16:24 aspects of run-of-river hydro as it relates in particular to the Himalaya, and a variety of techniques that can be used to successfully manage sediment and sustain power production. There is no single best answer, so I'm going to look at several different types of strategies that have all been used successfully.

What I also want to emphasise is that hydro plants do not operate in a void. As an engineer, we always have constraints. And those constraints, depending on which country you're in, what regulatory environment, who is downstream from you, et cetera, they can vary considerably.

You have, of course, your physical parameters: you have topography, geology, hydrology, sediment load, site access. If you have a very remote site, this will limit some of the equipment that you can bring in. You have all your social parameters: laws, in this case a treaty, environmental protection laws. You have land use/acquisition problems to deal with; downstream impacts, either existing or potential.

And of course you have the financial parameters. Not only does a project need to have a good return on investment, but you have to have an investor and you have to have a financial line of credit available.

So the Treaty does establish certain constraints,

16:26 but those constraints don't make it impossible for India to develop strategies that will work in this environment in addition to flushing.

So I'd like to first talk a little bit about hydrology and sediment.

The hydrology in the Himalayas throughout the region, so the monsoon hydrology has a very dry winter, and you have most of your water coming down the river in the summer. Most of the precipitation occurs in the winter, but that precipitation is mostly snowmelt. So you don't see the meltwater coming to you until, say, April/May, and it's a combination of snow plus glacial melt. And as the summer progresses, you get increasing monsoon activity and more water from rainfall.

(Slide 4) So what you end up with is having a highly variable flow, as you can see here in the graphic.

Let me see if I can turn the laser pointer on. Here we go.

And you can see the winter: it's quite low flow. Up here in the red line, the dotted line, we have the design plant capacity. And during the summer months, you have, of course, the high discharges. So your plant runs part of the year as a baseload plant, 24/7, full power; and during the winter months, it's going to operate as a peaking plant. These particular data are

16:28 from Neelum-Jhelum, which you of course have seen.

(Slide 5) The sediment sizes we deal with in the Himalaya cover a very large range. We have clays, but clays do not dominate the sediments in the Himalaya. Clays are typically a small fraction: maybe 15%; in some places, significantly less. It's mostly silt and sand, in approximately a 60:40 ratio. It varies a little bit from river to river: some rivers are skewed more in one direction than the other. But as a general rule, that's a pretty good general rule of thumb.

We have sediment which we classify as "fines", which is stuff that's smaller than sand. In the graphic here I have the sand shown as 0.062 millimetres, which is according to the Wentworth scale, which is used internationally. The Indians use 0.075, so they use a little bit larger to differentiate between fine and coarse; actually they use a fine, medium and coarse. But these are just very general numbers to give you an idea.

The fine sediment settles very slowly. The sands are typically large enough that they can be captured, if not entirely, at least to a good percentage in a desanding sedimentation basin.

We also deal with cobbles and boulders. If you're high in the mountain, you can have GLOF events, which is

16:30 a glacial lake outburst flood; or a LLOF, which is a landslide lake outburst flood, where a landslide comes down the mountain, blocks the river, the river fills the area behind the landslide, overtops, erodes, and it's just like a dam break.

So these events, high in the mountains, you can be mobilising boulder-sized material. But down lower, where most of the reservoirs are -- and particularly the reservoirs that have any significant storage capacity -- you're talking about sediment that's typically cobble-sized on the bed. Maybe boulders have come down off of the mountainside and are sitting there, but they're usually not mobile. And so we're looking at cobbles and smaller.

The bed material in the Himalaya is surprisingly stable. This is something that is a little bit different from the traditional way of approaching things. There's no way to actually measure bed-load transport.

Let me go to the next slide (6), and this will show the difference here.

You can see that you have the suspended sediment load, which is basically particles that remain suspended as a result of turbulence in the river. The bed load is material which is lifted off of the bed material. You

16:31 see how the bed material is a material that's predominant on the bed. And the material on the bed which is lifted and moved along the bed by hydraulic action, that's your bed load.

There is a variety of different estimates of typically making bed load: some people say it's 20% or 30% or 15%. But those estimates were in many cases -- basically, the original work was derived from work in the western United States, where the suspended load is not nearly as large as it is in the Himalaya. So if you have a bed load against a not so large suspended load, the percentage is large. But if the suspended load is very large, this same amount of bed load now becomes small as a percentage basis.

So there tends to be a tendency to overestimate bed load in the Himalaya. And we've seen this in work I've done in Nepal at Kali Gandaki: a reservoir that was predicted to fill completely with gravel within ten years. And after ten years, there's a lot of sand, but there's hardly any gravel at all because we don't have the bed load transport. So these are actual things that I have observed and we have studied in the field.

(Slide 7) Himalayan sand is quite angular. But this is common to sands of mountain areas, at least everywhere I've been. I've got pictures just like this

16:33 of sand in the Andes, and it's very angular. It's angular because it's recently weathered from the parent rock. And typically you'll see parent rock -- for instance, if you look at granite, you'll see it looks like salt and pepper, and all these little crystals. And as the rock weathers, the quartz in particular will separate from the matrix, and you'll have these angular particles.

Quartz is the most resistant of all minerals to solution. So that's why you go to Florida, and you have sand beaches that are all quartz, because that's what's left after the Appalachian mountains in the eastern United States eroded tens of millions of years ago: what remains is the quartz.

So quartz is also very problematic for turbines because it's very hard. You'll see here on the diagram it says the mhos scale for hardness: talc is 1, a diamond is 10. The turbine steel, steel used for turbines, is about 4.8. And sand has a mhos value of 7. So sand is much harder than this turbine steel.

There are different types of steel, of course, and turbine steel is selected for a combination of its capacity to be worked and its capacity to absorb what you call the working of the pressures back and forth. It's not a brittle steel. You can have brittle steels

16:35 which are much harder. But for turbines, this is a type of steel which works, and it is significantly less hard than sand.

(Slide 8) The bed material in the Himalaya, as you will see here on the picture on the left, that's at Besham Qila. This gauge station is upstream of Tarbela Dam. You will notice that there are some people in the figure, and that gives you an idea of the size: these are boulders and cobbles in the bed, largely boulders. And you will also notice there's sand deposits: the arrows point to the sand deposits.

And if you look at the right-hand photo, that's the Kali Gandaki River in Nepal, where you also see the sand deposits. And what happens is that the monsoon comes, the river level rises, it transports large amounts of sand. And as the water levels drop down, then the sand gets deposited. So you basically have a bimodal system: you have a lot of sand being transported, sand and silt; and then you have a bed material which is much larger material, which is relatively immobile compared to the amount of sediment transported in suspension.

(Slide 10) The sedimentation process in reservoirs is pretty consistent throughout the world. You typically have a deposition of coarse sediment upstream, which you can see here on the left-hand side at the top;

and you have a fine sediment deposit that proceeds beyond the delta.

So imagine a river is carrying sand and clay and silt, and maybe a little bit of gravel during a flood event. And this material enters a reservoir, which is water which is standing, and immediately the coarse material settles to the bottom. And the finer material, which is sustained in suspension, continues downstream, and then gets deposited further downstream and closer to the dam, but beyond the delta.

And it's interesting because this delta phase is actually, in many reservoirs, quite a distinct change in topography. In Tarbela, for instance, it's quite distinct. And that's what we would expect to see -- and what we do see -- in any of the deeper reservoirs.

At the bottom we have the configuration of where this thing ends up after a number of years, and you'll notice that the delta has moved towards and reached the dam, in this particular example. So what happens is that when you reach an equilibrium between the sediment inflow and sediment outflow, you will have the delta deposits that reach the dam.

Delta deposits are problematic for hydropower because they contain sand. The fine sediment is not so problematic. It can, of course, produce erosion,

produce abrasion of your equipment, but it's not anywhere near as damaging as sand.

And what we're trying to do at reservoirs, both storage reservoirs as well as hydropower reservoirs, is change the concept of reservoir operation [from] "We're going to store sediment" to "We're going to move to the point at which sediment inflow matches sediment outflow", and we're trying to reach this equilibrium profile at the same time that we're preserving storage capacity and other benefits.

(Slide 11) We also have turbid density currents which can occur. This is muddy water that enters the reservoir during a flood, and it will plunge, go underneath, and flow along the bottom. And if it reaches the dam -- sometimes it does, sometimes it doesn't; it depends a lot on your site conditions -- you can pass it through turbines, or you can discharge it over the top of the dam.

And this is one way that you can reduce the accumulation of fine sediment in a reservoir, which leaves more volume available to capture the sand, the delta. And that will retard the arrival of the delta, because the delta results in more difficult management problems.

(Slide 12) Let's move now to run-of-river plants for

hydropower.

(Slide 13) I know you've seen this before. But basically, you start with a reservoir. You see we've got the reservoir, you've got the delta and the fine sediment. You've got the intake.

Typically, you will have a desander. This is the traditional way of dealing with sediment in a run-of-river hydropower plant. You may have seen from the Kishenganga case that India was alleging that the flushing of sediment is a new technology. It has been around for many years, but has been very infrequently used in the past because your hydropower plants, the run-of-river plants, use desanders. So there are many plants in many parts of the world that rely on, use desanders, and you saw the desander at the Neelum-Jhelum.

From the desander, you go to the headrace tunnel, the surge tank, and into the powerhouse.

Now, one of the things that we will talk about later is: notice that the turbine is placed underneath the generator. And the traditional design for power plants is for the Francis turbine to be removed by lifting it up. So to get the Francis turbine out to repair it or do any maintenance, you have to take the generator out. And that's very complicated.

At Neelum-Jhelum they have actually made it so that you can drop the runner from the turbine and pull the runner out without touching the generator. And that's just one of the types of modifications that you do to your design to accommodate sediment, because you want to be able to access and repair your equipment much more easily.

(Slide 14) Spillways. You always have to have a spillway: you always have to be able to deal with the floods. And different spillway configurations are available, and a single dam will frequently have multiple spillways.

At Neelum-Jhelum you saw that there was a main spillway, which was an orifice spillway, but there was also a top-level spillway. These are provided in some cases as a safety valve, but more typically to release floating debris, because you want to be able to release logs and other stuff that comes floating into the reservoir.

The definition of freeboard on the far left of the diagram shows an ungated spillway. When you are going to release your flood, flood will not flow over a spillway unless you start raising water level over the top of the spillway. So your design flood, you will typically have a fairly deep depth of water over the

16:43 spillway.
And typically what's done is that you place a gate -- as shown in the middle diagram, letter (b) -- you place a gate which can be closed to maintain a normal pool level, or a full pool level during normal conditions, and then you open the gate to release the floods. This is a very common -- perhaps the most common -- configuration that you see on dams.
And the freeboard is considerably less because now you have released the flood by opening a gate instead of having it raise up above the crest elevation. It's the same level, but in one case you have uncontrollable storage, in letter (a), and controllable storage in letter (b).
Letter (c) is the orifice spillway. And again, the design flood will be established according to the capacity of the gates, and you will again have freeboard above that level.
(Slide 15) Now, the "freeboard" concept is different from the concept of "controllable storage", which we will go to next. Controllable storage is that storage volume that you can actually control by the manipulation of gates. "Freeboard" is defined in the Treaty; "controllable storage" is not. But controllable storage is a fact of life.

16:44 So on the left-hand side, you have freeboard again defined, but you also have controllable storage, which is everything above that crest outlet. On the right-hand side, you have a definition for controllable storage for an orifice spillway. And there are two differences between the left and the right diagram.
On the left-hand side diagram, you'll see that your freeboard on top of the gate, that is uncontrollable. You can't lift the water into that zone because it will just flow over the top of the gate. But on the right-hand side, with the orifice spillway, if you don't have a crest spillway of some sort installed there, you can simply close your gate and raise the water level, and therefore convert freeboard into controllable storage. You could fill it and empty it as you wish to just by operating the gates.
The second aspect of this is the placement of the spillway. If you have a deep spillway, of course this will increase the controllable volume, the deeper you put the spillway. So anything that drives your spillway depth down lower into the reservoir, you are again increasing controllable storage.
And controllable storage, from the standpoint of Pakistan, is quite a problem because it allows the -- obviously in the dams you have more capacity to control

16:46 flow of water.
(Slide 16) The elevation capacity curve -- this is a generic curve, but they all look pretty similar to this -- is a curve showing the elevation of water in the reservoir against the capacity.
At the very left, you see that the elevation goes up quite a bit with very little increase in capacity. And this occurs because if you look at a reservoir, you can think of it like being triangular-shaped: at the bottom it's very small, and you go up higher and higher in the valley and it widens out.
And the other thing is that the distance from the dam -- if you have a dam and you only fill it 5 metres deep, the pool is not going to go very far upstream; but as you fill it higher, the pool gets longer. So as you get higher in elevation, your reservoir surface gets wider and longer, and this means that each additional increment in elevation gives you more than a corresponding increase in capacity. So that's why this curve flattens out towards the right: because you keep increasing the elevation, and the surface area gets bigger and bigger and bigger.
What this implies -- and that's shown here in red, the red dotted line -- is that the capacity of the reservoir is very sensitive to the top elevation. So if

16:48 you can increment the elevation a couple of metres, you have produced a lot of additional capacity, because each incremental metre means that you have a bigger and bigger area against which you're filling up with water.
So that's just to put into context the importance of limiting the top elevation at which you can raise a pool.
Now, on slide 17, let's talk about the annual operating cycle.
The bottom graph here is the graph which we saw a few slides ago about the seasonality of the inflows, and the top portion of this graphic shows one year, from January to December. A typical characteristic of run-of-river plants in a monsoon-type environment, where you have a dry season in the winter, and that dry season is used for power peaking. You don't have enough water to run the plant 24/7 at full power.
So what you do is during part of the day, let's say overnight, you accumulate water; and then during the morning or evening peak, you turn the turbines on -- it would typically be, say, full power -- and run them for a certain number of hours to release that water and produce power during the peak hours. Because it doesn't make any sense to release power overnight, when the demand is low.

16:49 Hydropower plants are pretty unique in the context of the overall energy system because they can turn on and off very quickly. You can bring a hydropower plant to power within a couple of minutes. A thermal plant, you have to -- if it's a gas turbine, which is like a jet engine, they can also ramp up very quickly. But conventional plants, like a coal power plant or oil-fired plant, they need to heat up, you have boilers, and it takes time to do this. In a nuclear plant, you're talking a couple of days to get going.

So these power plants, the hydropower plants, are very good for power peaking. They can come in -- if you're having a cloudy afternoon and your solar is being reduced, you can say, "Well, we need some more power, so we'll put the peaking plant online".

And typically, the grid operator will operate the hydropower plant to use as much of its power as possible. Because when a grid operator brings units online, they're bringing on the cheapest unit first, and hydropower has zero fuel cost. It's all sunk cost; zero fuel cost. So your grid operator will bring on hydropower and use that to its maximum capability.

So that is your power peak. And of course during the wet season it will be continuously operating, 24/7, as a baseload plant. It will run alongside a nuclear

16:51 plant or a coal plant.

So two types of operation: a peaking plant and a baseload configuration.

And the other interesting thing about the Himalayan hydrology: you will notice that there is a pretty dramatic and rapid transition from the baseload mode down to a power-peaking mode, with not very much water. The transition occurs pretty quickly, so it's not a very gradual thing.

(Slide 18) Two types of turbines we are typically talking about: the Francis turbine on the left. The Francis turbine is typically used in the 50-350-metre range of head. I mean, there are plants that run at higher heads. But one of the characteristics of the Francis unit is you'll see it has what's called a "scroll case" here -- the scroll case is up here (indicating) -- and it's got a draft tube, and these are all under pressure.

So it's a pressurised system, which is one of the reasons why they have traditionally not taken the runner out from below. But at Neelum-Jhelum, right around where the red dot is, in that area they have a gap in the draft tube where it's bolted together, large bolts all the way round, and they can take that apart, drop the runner and pull it out.

16:53 The Pelton, on the right-hand side, operates at atmospheric pressure. Here is a top picture -- it's a small Pelton plant. That one's in Colombia. But it's a good picture showing you that the enclosure on the buckets is just to keep the water from spraying out and around. The nozzle down here sprays water against the buckets and causes them to rotate. This shows with a single nozzle; you can have Pelton plants with up to six nozzles.

So the Pelton plant, which is not operating under pressure, is very easy to take off. If you get good at it, you can replace the Pelton runner in 24 hours. So it's a plant that's easier to maintain and do repairs on. And that may be an important consideration if you have sediment: that you want something that you can replace rather frequently.

Peltons are used typically over about 350 metres. You can use them at a little bit less. But if you get to high heads, it's a Pelton plant that you're going to be running.

(Slide 19) The sediment impacts run-of-river hydro plants, there's two basic types of problems that occur: you can have abrasion damage to your runners and ancillary hydromechanical equipment, the wickets or guide vanes, and you have stay vanes, and your shaft

16:54 bearings can be subject to abrasion.

You can also have problems with the cooling system. The generator uses a cooling system, and if you use water directly from the river and the river gets a lot of sediment, your cooling system will clog. It's like putting sand into your radiator in your car, so to speak. But to get around that, you simply use a closed-cycle cooling system, where you have clean water that recycles through it. So that has a workaround. Hopefully you designed it properly to begin with, so you don't have to try and redo it later.

You can also have structural components in the dams. Part of the concrete near the gates can be abraded by sediment.

Now, in the reservoir, the problem is you lose storage capacity. And along with the storage capacity is the delta advances down to the area of the dam and to the intake.

One of the things that you need to avoid, and one of the things that has caused a little bit with difficulty in the industry, is that many plants have been designed as if the sediment is going to not be a problem, or not going to be a problem, say, in my lifetime, or my design lifetime. So there are plants that have been designed without thinking of what's going to happen in 50 or

16:56 100 years. And we're dealing with those issues now.
The Warsak project in Pakistan is one such problem, where we're looking at a plant that was designed in the 1950s and has had very substantial sediment challenges, and the idea is how to best make it work better. It works, it produces power, but the operator is always looking for a way to make things work better.
You have a sediment-challenged environment, and you will have wear on certain components of your system. The runner and the equipment that would run for 50 years in a sediment-free environment, you may need to replace it: bring it out and repair it on an annual cycle.
I worked on a small plant in Peru in a sediment-free environment. The plant was built in 1914, more than 100 years ago. They've changed the runner once in 100 years. But that's a very special case. So you do have that end of the spectrum, and then you have the other end of the spectrum. So you cannot approach a sediment-challenged environment without taking into context all of the mitigation measures that you can manage.
So what are these mitigation measures? Let's go to slide 21. In general, the little graphic on the left outlines some of the different places where you can influence the sediment that affects your equipment.

16:58 You're not going to affect the shape of the sediment; that's given by geology. You're not going to affect the hardness of the sediment; that's also given by geology. But you can influence the size and concentration of the sediment that reaches your machines.
You have pre-treatment sedimentation. You can do sedimentation in the reservoir; you can do sedimentation in your sedimentation tank. And you can also design your intake to minimise the entrainment of sediment. We'll talk about each of those. And you can do what we call sediment-guided operation, and we'll mention that in a minute.
You can modify the hardness: you can increase the hardness of your turbine by using a protective coating, a ceramic coating instead of steel. You can select an appropriate turbine design that is less sensitive to sediment damage.
And you can select your site. If you have a real sediment problem, and you said, "Well, I want to put a plant with 1,000 metres of head", maybe that's not the best idea, because a Pelton plant operating with 1,000 metres of head, you can destroy the needle valves in 24 hours. And I've seen it happen at a client's plant. So these things can happen.
(Slide 22) Reservoir management to operate your

17:00 reservoir for sedimentation. This is basically the type of strategy that India prefers to use now. And there are a couple of different ways to do this, and I've actually designed plants in Nepal that operate both ways.
The top one shows a sediment bypass tunnel. This is appropriate for, let's say, a small reservoir, a steep river. And what you're doing is you're taking the water that comes into the reservoir, and you only want to run a certain amount of water through your turbine.
Let's assume that your turbine takes 100 metres per second of flow rate. But if I have 300 metres a second entering my reservoir, I don't want 300 metres a second going through my reservoir and bringing all that sediment into it. So I can divert 200 metres around my head pond, which is shown here (indicating) -- it shows here a little head pond -- I can divert 200 metres a second around that, and the remaining 100 metres a second goes to the turbine. So I've converted this into a big sedimentation basin.
Of course, bypass tunnels cost money, but they're typically not quite as expensive as desanders.
The other graphic below that shows the option of flushing. If you have a larger reservoir, you may not need the bypass tunnel. The bypass tunnel in a larger

17:01 reservoir may be quite long. At current, the longest bypass tunnel in the world is less than 5 kilometres. We are currently looking at one in Colombia which would be 17 kilometres.
But the bottom graphic shows flushing which you can undertake with or without a bypass tunnel. And the idea here is that you empty the reservoir, and you release the sediment by passing the river through the empty reservoir, and it scours it out, and then you refill it. This has certain advantages and disadvantages which we'll go into later.
Of course, one of the problems is that you do have to empty the reservoir, you will be not producing power for however long the flushing takes, and you will be releasing potentially very high concentrations downstream. And we're talking about more than 100,000 milligrams per litre of sediment concentration.
To mitigate that -- and there have been plants that have released multiple hundreds of thousands of milligrams per litre downstream. To mitigate against that, you draw your reservoir down much more slowly, which prolongs your flushing period, which prolongs the period at which the power plant is not operating.
You can configure your intake to reduce the sediment entrainment. Now, if you go into a river and you sample

the surface of the water, or you go down close to the bottom, the concentration of clay and small silts will be uniform, because it settles very slowly. But sand, low concentration on top, high concentration at the bottom.

So what you typically want to do on a run-of-river intake is you want to draw the water from as high as possible in the water column. If you have a big reservoir, a deep reservoir or a storage plant, it doesn't really matter that much. It will matter because of downstream water quality -- those will be other constraints -- but not sediment. But at a run-of-river plant, the sediment is going to be the primary factor that will control your design.

(Slide 23) So you have two options. On the left-hand, I have a deep intake, which is basically extending my headrace tunnel to the reservoir. And the minimum operating level -- "MOL" in the diagram -- will establish, below that, an anti-vortex water seal depth, typically maybe 2-3 metres, something like that, depending on the intake configuration, et cetera.

And on the surface intake on the right, what we've done: we have the same tunnel, but we've put a barrier, a skimming wall that is in front of the intake, so that I can withdraw water from as high as possible in the

reservoir. The trash rack can be located at a couple of different locations. And you would probably have a desander located between the skimming wall and the tunnel. The desander is not shown here, but this is what you saw at Neelum-Jhelum: you had the intake, you had the desander, and after the desander came the entrance to the tunnel.

So that is just basically a strategy to work with the configuration of the reservoir to minimise the sediment entrainment by proper design of the intake.

You also want to avoid eddies. If you look at flowing water -- and water is always flowing in a run-of-river plant. It may not flow as rapidly as the river, but it's moving. And if your intake is oriented wrong, you can get these eddies which will lift sediment off the bottom.

This is typically analysed using, say, a physical model, a physical scale model, which is, say, a model -- the dam might be this tall (indicating), and the reservoir might be 30, 40, 50 metres long, and you use these physical scale models to simulate and directly observe the different configurations. And you can actually modify the geometry and see how it impacts the hydraulics of the intake structure itself.

(Slide 24) The next step in eliminating sediment is

the desander or sedimentation basin.

Now, a desander ideally works the way it's shown in the diagram here: you have water that comes in, and the flow is perfectly uniform along the length of the desander, and the sediment settles out.

Unfortunately, it doesn't generally work that way in practice. And this is something that I've noticed over the years in multiple sites in multiple countries, is that -- and we'll go here to slide 25. This compares the theoretical path to an observed flow path.

This shows a recirculating eddy. And this is caused by -- in this particular case, the inlet to the basin has a curve on it. And just like when you go around the corner in your car and you kind of like get thrown off -- if you're turning to the right, you get thrown to the left side of the car, the same thing here: the momentum carries the water to the left side of the basin and you get this big recirculating eddy.

You can also have vertical eddies. I've got a good video of a horizontal eddy from a site visit a couple of weeks ago in Peru, if you're interested in seeing that. But both the vertical and the horizontal eddies occur at Neelum-Jhelum. I don't know if you noticed it, but there was a vertical eddy. And you go a certain distance into the desander -- about, say, a third of the

distance -- and the water comes up, and then you see, like, water boiling up. Once you know what to look for, you can see it, but if you're just looking at it, you may not notice it. But you see these types of eddies.

So what you do in this type of situation is you put what they call a "tranquilliser" at the entrance to the basin, which is basically a barrier. They are typically made -- for instance, you can use like an angle iron, and put a series of these angle irons, and the idea is to produce maybe about 10 centimetres of head loss.

Because what happens is that if the water starts to pile up, creating head loss, it tends to even out. So if you have a jet of water, what you do is put it through a perforated wall of some sort, and that friction or that head loss created by the wall causes the water to pile up a little bit and spread out more evenly.

This is a strategy that's used throughout the water treatment industry. For instance, a water filtration plant, the floc is very difficult to settle, so they're very, very particular on optimising the performance of their settling basins. This is something which is typically not done in the hydropower industry. So frequently we see that the desanders have been put in place, but their operation is quite poor from the

hydraulic standpoint.

Another thing that you do is at the outlet you want to make sure that your overflow isn't too strong, you don't have too much overflow per linear metre of weir length. And you can use finger weirs. There's a couple of different strategies you can use, again, to optimise a basin. (Pause)

(Slide 26) At the powerhouse, there are several things that you can do.

You can, as I had mentioned, configure the draft tube for the rapid removal or to facilitate the removal of the runner. This is a cut-away from the Neelum-Jhelum plant which you've seen previously, and the arrow points to the segment of the draft tube that can be opened up to allow the runner to drop down and then be taken out horizontally.

You can select a low-velocity turbine of more robust construction. If you have a very rapid turbine, high velocity, the sediment impinging at the high velocity will generate more abrasion than the same particle impinging at a lower velocity.

Also if you have turbines which are a little bit more robust, in terms of being thicker on the construction, the sediment erosion will take more time to do a significant amount of damage that requires

replacement. The more robust turbines can be a little bit bigger, they're going to cost a little bit more, but it's a case of taking a cost of initial cost versus maintenance/repair cost.

There is, I believe, a tendency -- at least from my experience that I've seen -- that the designer wants to have a low-cost project, initial construction, and the long-term operational cost is maybe a little bit more secondary, because it's the initial project cost that you have to overcome to get it built.

You need to put wider spacing between the turbine blades.

If you're going to apply the protective coating, that coating can be applied by hand or it can be applied by robot. This is a high-temperature, oxygen-fed nozzle that sprays this material on to the steel. And if you do it by robot, it's going to be good, and if you do it by hand, it's much more tricky. So the preferred method is to apply by robot, but the robot needs a certain space between the blades to actually get in and coat the entire blade.

So you need to select your runner based on the maintenance that you expect that you're going to do it. Some of the plants that had severe abrasion to the runners, they basically threw away the runners and got

a new design which allowed greater space and allowed the robot to go in and then apply coatings, and that was very effective.

The duration that a coating will last, it depends, but typically we can think it will last several years. So a plant that would have a -- let's call it an unacceptable amount of abrasion in one year can run for several years.

The shaft seals are another place where you get abrasion. You can provide pressurised clean water to prevent the sediment from getting into those.

You would want to, typically, reduce the submergence of your turbine to reduce cavitation potential.

Cavitation occurs when you have a, let's say -- for instance, let's use the example of a propeller on a submarine. The propeller goes through the water, and when you look at a propeller behind a speedboat, you have these little bubbles that come out from the propeller. And those bubbles will then collapse, and that's cavitation.

So what happens is when they collapse, it's like a small explosion, and that damages the steel. If you have sediment plus cavitation, they both act synergistically to damage the steel. So you really want to be careful about doing what you can in your design to

minimise the potential for cavitation.

You want to avoid low-load operation: you operate your turbines at or near full power, because low-load operation tends to increase your abrasion.

Closed-circuit cooling for generators we've already mentioned.

So there's a variety of things that you can do in the power plant.

(Slide 27) This is the runner at Neelum-Jhelum I'm showing, after about five years, the difference between coated and uncoated. So you see that the coatings can be quite effective.

(Slide 28) Sediment-guided operation. Now, what you do with sediment-guided operation is you turn your plant on, off, or you reduce your power, depending on the sediment concentration.

For instance, you look at the sediment concentration data from a number of rivers and you see that there are certain days of the year that had a very high concentration, and those high concentration days contribute to a disproportionate part of the load of sediment on the turbines, and thus the abrasion.

For instance, we've seen this in Pakistan: we've looked at it both at Warsak and Neelum-Jhelum. At Neelum-Jhelum, we've got 1.5% of the days account for

17:17 one third of the load of sediment on turbines. So if you were to take out 1.5 times 365, it's like 5 days a year. If you turn them off for 5 days a year, you've just eliminated a third of your abrasion problem. And those days account for 3% of your total energy. So you're going to pay a little bit of energy, but you're going to have a much, much reduced abrasion problem.

Now, you don't necessarily have to turn the turbine off either, because if you have a desander, desanders work based on hydraulic load. So you have the flow coming into the desander, and you have a certain residence time that the water takes to go from the beginning to the end of the desander. So if you drop the hydraulic load on that desander by 50%, the water is going to take twice as long and you're going to get more sediment that's going to settle out.

So you can have high-sediment days where you'll say that: well, today, because we have a very high sediment load, we had a flood in the watershed, it's coming down really bad, we are going to operate at half-power. So there are ways that you can operate your plant to, again, minimise the sediment management.

Now, another problem that I've seen is that people at power plants take data. I saw this at one of the plants in Nepal. They take a lot of data. They have

17:19 a sediment laboratory on site. They write all the numbers down, they put them in spreadsheets and they send it off. Never gets graphed. No one ever looks at it.

So I took the data and I looked at it, and I said, "Wow! All of a sudden, in this particular point in time, the units are starting to have a lot more sediment at the turbines". Because you will typically measure the concentration sediment in the river, you will typically measure it after it comes out of the desander or at the turbine, because what comes out of the desander is what's going to hit your turbine. So you can pick it up at the turbine, you can pick it up at the exit from the desander.

But in this case, they were picking it up at the turbine from the draft tube, and you saw that all of a sudden there was a lot more sediment getting into the turbine. And I worked with this plant over a period of several years, back and forth, different trips, and I got to know both the operators: the old operator, the new operator. And it's a funny story because -- it wasn't very funny really. But the old operator didn't like getting moved to Kathmandu, so he didn't train the new operator. And he told me, "The new operator doesn't know how to operate the plant, but I do", and he got his

17:20 job back.

So there are all these little things that come into play. You have to have good operator training; you have to take data, you have to look at the data, you have to analyse the data. And all these come in to being part of how you operate a plant under challenging conditions.

It's like if you're driving on a Sunday morning, there's no one on the highway, and it's a clear sky, you can just breeze down the highway, no problem. But if it's Friday night, and it's raining and thunder and lightning and it's windy, you're going to be more alert because the conditions are different. And it's exactly the same with a hydro plant: if you have challenging conditions, you have to be alert, you have to be on to what's going on.

And the final point -- and I think we'll finish with this slide (29), to make it a good transition for tomorrow morning -- is the concept that runners are actually expendable.

If you've been operating plants that have very little sediment problems for decades, you have the expectation your runner is going to last forever. But runners are expendable. And there are plants that take out their runners and replace them, refurbish them, on an annual basis, and can refurbish them multiple times.

17:22 You take the welding rods and you place more steel on to the runners, you reshape it, you put it back in the plant. And you can do that half a dozen times before you actually get rid of the runner and replace it with a new one.

But let's compare to an automobile. On an automobile, the tyres are expendable: they wear out. And the tyres on a new automobile represent something like 2% of the cost. So you go buy a new car, you're going to pay, what, $35,000; and you're going to buy a new set of tyres, it's going to cost like $800. It works out about 2%, more or less.

The wearing components, the runner and the valve, the blades and the wicket on a hydro plant is not 2%: it's more like a half of 1%. So the concept that we must, must, must protect our runners at all cost is something of a misnomer.

Now, engineers I have dealt with who are from the mechanical side, they work with the equipment, they don't want to see any damage to their runners. But in truth, the runner is a component which, if you're in a challenging environment, it will experience wear. You have to minimise that wear, but don't expect that it's going to last forever.

And in a monsoon climate, when the runner efficiency

becomes reduced due to abrasion and deformation -- runners are designed for perfect hydraulic conditions. So when a runner begins to erode, you lose that shape and you start to lose efficiency. A brand new well-designed Francis runner, design capacity will run about 94% efficiency. This is from water to mechanical energy. So that 94% efficiency is going to drop and drop and drop and drop. But if you're in a monsoon climate and you have a lot of water available, you just put more water through it.

This is what we saw at the Warsak plant. Their runners are very substantially abraded, they're eroded. They run for five and a half years before replacement. They have six machines: one runner gets replaced every year. Take it out, refurbish it, weld on new steel, and they take it out and put a replacement in. These six-year repair cycles, because they have six units, so they repair the runner and the generator at the same time: it's a major overhaul. So on the six-year repair cycle.

But when I got the data on the power produced by each of the units, it's the same: the runner that has been in operation for five years is producing the same amount of energy as a brand new runner. How does that happen? It happens because they just put more water

through it. They've got the water available. Lower efficiency, it takes more water to produce the same amount of power. So just because it's abraded doesn't mean you're going to lose power in a monsoon environment, where you have most of your energy produced during the wet season when there's a lot of extra water.

Now, of course, high-head plants are very sensitive to sediment, much more sensitive than low-head plants and can, of course, experience catastrophic damage. So again, this is not a case of one rule applies to everybody. But I just hope to have been able to run through some of the options, some of the many options that are available that would be applied, and totally applied as a group of integrated procedures. You would apply all of these together to help manage your sediment at a run-of-river plant.

And what happens is that, on one hand, you have the strategy of using a larger reservoir, sedimentation in the reservoir and flushing, versus managing sedimentation in the desanders and not flushing. And those two cases have implications in terms of the amount of controllable storage and downstream consequences of sediment release.

So I think with that I will close. It is, I think, 5.28. And we can continue tomorrow morning.

THE CHAIRMAN: Thank you, Dr Morris. Before we conclude though, I'm just going to check to see if there are some questions that anyone on the Court has.

Professor Buytaert?

PROFESSOR BUYTAERT: Thank you very much, Dr Morris, for a very clear presentation.

At the very start, you mentioned density current flushing, and that requires quite specific hydraulic conditions to be able to do that. From your experience, how commonly are those conditions met at a certain site?

DR MORRIS: They are not -- a site will typically have the conditions or not have the conditions. Let me give you a couple of examples from Colombia, because I've done work on a couple of plants there that were very interesting.

One of the plants has density currents: we observed them, they enter the reservoir. Nothing reaches the dam, and it's only 3 kilometres away. Nothing. It's heavy material, it's a lot of sand; it drops right to the bottom, deposits on the delta. Another plant, Guavio, which was a large plant, 1,000 MW, and it has density currents that have a very substantial accumulation in front of the dam.

So it depends on the project site. It's rather difficult to predict what they're going to be like.

Because, for instance, most of the data that's available in the Himalaya, it grades your sediment into fines, medium and coarse. What is that fines: is it all silt, all clay, some percentage?

What is your sand? What's your gradation? If I have that -- medium sand goes from -- in the typical range used -- like, for instance, in India it's 0.075 to 0.2 millimetres. Now, at 0.2 millimetres you're not going to get density currents; it can drop pretty quickly. But 0.075, yes, that can contribute.

So even here, if we had the tools, we don't have the data.

We've got a project I'm designing right now and I've just put in a density current release mechanism. It's a storage project. And we're anticipating it's going to release maybe 15% of the total sediment load.

But the prevalence of density currents is significant. I know it does happen in the Himalayan area in different reservoirs. Nurek, for instance, has very significant density currents. Tarbela does not. Tarbela doesn't because the slope is too low, not deep enough, not steep enough. But upstream, where they're building new projects, I totally expect density currents.

PROFESSOR BUYTAERT: So would you be able to put a number on

17:30 the estimate of how frequent it occurs, and say 10%, 20%, any rough estimate?

DR MORRIS: When you have -- okay, let me try and use in context maybe something like Nurek. And I'm expecting there that maybe, just in very, very round numbers, maybe 20% to 35% of the inflow would produce density current.

PROFESSOR BUYTAERT: Thank you.

THE CHAIRMAN: Okay, I think we have no further questions for you, Dr Morris. So we'll end the day here, but look forward to seeing you tomorrow morning at 9.30.

DR MORRIS: Perfect, thank you.

THE CHAIRMAN: Thank you.

(5.31 pm)

(The hearing adjourned until 9.30 am the following day)