

STATES OF JERSEY

SCRUTINY COMMITTEE BLAMPIED ROOM, STATES BUILDING

DRAFT WATER RESOURCES (JERSEY) LAW 200-

Present: Senator Jean Le Maistre (Chairman)
Senator Ted Vibert
Deputy Gerard Baudains
Deputy Phil Rondel
Deputy Rob Duhamel
Deputy Bob Hill

In attendance: Dr Stuart Sutton (Panel Adviser)

EVIDENCE FROM:

Dr John Renouf
and
Dr Ralph Nichols

on

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- 2 Historical basis of Group's involvement**
 - (a) Appointment of Group**
 - (b) Riley report recommendations 1992**
 - (c) Groundwater Review Group Position Paper 1994**
 - (d) Conclusions and recommendations of Position Paper**
 - (e) Trinity Catchment Study**
 - (f) No further involvement of Review Group**
 - (g) Trinity study did not address complexity/diversity of Jersey's geology**
 - (h) Was there a change in assessment of water shortage situation after Trinity Study?**
 - (i) Trinity Catchment Study did not address deeper water implications**
 - (j) Information Paper on Jersey's Water resources**
 - (k) Recommendations apparently not addressed**
 - (l) MODFLOW**
 - (m) Evidence of stress much reduced after 1994**
 - (n) No mention of reservations of geologists in EPSC submission**
- 3 Apologies from Dr Sharp - happy to reconvene group**
- 4 Comparison of Jersey with Armorican Massif**
 - (a) Marjolet paper**
 - (b) 20% of water supplied from boreholes**
 - (c) Upper and deeper zones**
 - (d) Geological conditions for deeper resource**
 - (e) Comparison with Jersey**
- 5 Network of drilling required**
- 6 Wide zones**
- 7 Difficulty of exploiting resource in Jersey**
- 8 BGS Reluctance to investigate deeper zone**
- 9 Vertical recharge from rain or surface water**
- 10 Drilling through layering**

- 11 **Head of water required**
- 12 **Significant water supply through fissured rocks**
- 13 **Fissure systems**
- 14 **Effects of weathering**
- 15 **Position Paper and assessment of BGS Survey**
- 16 **BGS treat Jersey as unified piece of rock in upper zone for purposes of water movement**
- 17 **Laws of transmissivity of water**
- 18 **Use of terms 'groundwater' and 'surface water'**
- 19 **Double zonation of rocks**
- 20 **Meteorological and juvenile water**
- 21 **Borehole producing 300m³ per hour**
- 22 **piezoelectric effect**
- 23 **Importance of data collection**
- 24 **Volcanic rocks and vacuoles**
- 25 **rhyolites**
- 26 **Exclusion of deep groundwater by BGS**
- 27 **BGS terms of reference - *"essential to have a good understanding of the water resources"*.**
- 28 **Great variability over small distances**
- 29 **BGS focus on upper zone - deeper level: an area of uncertainty**
- 30 **Should look at deeper resources - Cotes d'Amor proves the case**
- 31 **Lack of information about boreholes**
- 32 **Major resource in upper levels**
- 33 **Drilling at deeper levels**
- 34 **Water diviners claim to detect moving water**
- 35 **'Streams' of water**
- 36 **Assessment of the BGS Survey Report**
- 37 **Minden Place car park**
- 38 **Fort regent**

- 39 **Flow is taking place**
- 40 **aquifer under St Helier**
- 41 **Need for more information**
- 42 **Dialogue with well drillers**
- 43 **moon phases, tides and the North Pole**
- 44 **Interactive system**
- 45 **Variable Recharge from below**
- 46 **Artesian wells**
- 47 **Underground water from France**
- 48 **Layering**
- 49 **Head of water driving water movement**
- 50 **Offer of test borehole on Ecréhous**
- 51 **Putting dye in the water**
- 52 **Well at La Moye not artesian?**
- 53 **Slow movement of water**
- 54 **Borehole on Les Ecréhous - wouldn't prove a link with France**
- 55 **Scattered points of water**
- 56 **Fresh water from the sea bed**
- 57 **Hot water boreholes from volcanic rocks**
- 58 **Need for legislation**
- 59 **Working with landowners through co-operation rather than coercion**
- 60 **Geological log**
- 61 **Ongoing monitoring**
- 62 **Question of charging**
- 63 **Usefulness of data collection**
- 64 **Control of extraction**
- 65 **The objectives of legislation**
- 66 **Cost/benefit analysis - selective/voluntary sites instead of overall compulsion**

- 67 Non co-operation - resistance to interference**
- 68 Powers to be exercised only when there is a problem**
- 69 Minimum requirement for well log**
- 70 Continued monitoring**
- 71 Present co-operation with well drillers and water diviners**
- 72 Reducing regulation in the States**
- 73 Involvement in talks with well drillers and diviners**
- 74 Need for legislation/compulsion**
- 75 Part of consultation process**
- 76 Study the Law as it stands**
- 77 Requirement on drillers to supply information**
- 78 Possible Recommendation from Groundwater Review Group**
- 79 User pays through drilling charge**
- 80 Ownership of water resources**
- 81 Benefits to borehole owner**
- 82 Deep Groundwater proposal**
- 83 Sledgehammer to crack a nut**
- 84 Water scarcity table**
- 85 Formation of group**

1 Welcome

SENATOR LE MAISTRE: May I, first of all, on behalf of the Panel, offer you a very warm welcome, albeit a little wet. It is a bit ironic really, isn't it, that we are talking about water shortages, but it is all par for the course. Now, by way of starting the Scrutiny Panel meeting this morning, I have to read to you, as Dr Nichols will know, this statement which you have in front of you. It is important that you fully understand the conditions under which you are appearing at this hearing. You will find a printed copy of the statement that I am about to read to

you on the table in front of you.

Shadow Scrutiny Panels have been established by the States

So we will go straight in and I will actually call on Senator Vibert to lead off with the questions.

2 Historical basis of Group's involvement

SENATOR VIBERT: Yes. Good morning, gentlemen.

DR NICHOLS: Good morning.

SENATOR VIBERT: Basically what I plan to do to start is to walk you through the historical basis of how your group became involved, just so that we have it on the record, so that the public are aware of how you came to become involved in it. We have gone through the various minutes and asked for information from the Department to tell us exactly how you became involved.

(a) Appointment of Group

It would appear to have started in October of 1989, when the Committee decided to undertake a hydrogeological survey of the whole of the Island during 1990. The Committee also noted the receipt of a letter from Dr Sharpe of GEO Engineering, setting out his proposals for the establishment of a Review Group composed of a number of local experts on the basis that his firm should provide the necessary administrative and reporting services to the group. So the decision was made in 1999 that they were going to get BGS to do the work and they were asking this Review Group to actually review it as they went along.

DR NICHOLS: 1989. You said 1999.

SENATOR VIBERT: Sorry, 1989. And that Review Group consisted of Dr Sharpe, Dr Nichols, Dr Renouf, Dr Andrews and Dr Maurant. Then, of course, things then proceeded and the work was beginning to start. In 1991, the Committee received the group to discuss their views on the results of the survey that had been done. Then, of course, we then moved to the Riley Report and they set up the working party under John Riley, who was made ... he was actually ... they set them up to safeguard ... the report was on safeguarding the water resources of Jersey. That report then went to the Committee and the Committee discussed it in March of 1992.

(b) Riley report recommendations 1992

Now, in that report, Major Riley, his working party made a whole series of recommendations. Those recommendations were based on all the information that had been given to them by BGS and there was this immediate concern about the Island's water supply, that it appeared to be under threat, and the recommendations were quite wide and sweeping as to what really needed to be done. It would appear that the major recommendation of the report was that more information was going to be required and the recommendation here was "*In an island such as Jersey it is essential to have a good understanding of the water resources in order for them to be protected and managed for the long term security of supplies. Failure to do this could have a catastrophic consequence on its economy, ecology and environment.*" So that report then went to the Committee in March 1992 and was endorsed by the Committee, that that was necessary to be done, that work was essential to be done because there was this great danger to the Island's water supply. So are we okay with that historical perspective?

DR RENOUF: Yes.

(c) Groundwater Review Group Position Paper 1994

SENATOR VIBERT: Thank you. Then we move on then. The Riley Report had been presented and we then got to, I think it was, 1994. In 1994, the full report from the BGS was brought forward and your Committee then did a review of it, which is what you had been charged to do. You then presented your report to them, which was a report headed "*Position Paper, February 1994*". So you then actually took all the information that had been given to the Committee in their report and you reviewed it. In that, you dealt with the principal relevant reports, which was from BGS of '89 through to '93, which was item 1, and then you did the Riley Working Party Report and then you did Dr Sutton's note, which was an assessment of the BGS Survey Report and you were reviewing that and the documentation provided by the Water Diviners and Engineers Group. So that made really the bulk of the report that you were working on.

(d) Conclusions and recommendations of Position Paper

I wonder if I could just ask you a few questions about that review that you did, particularly the area where you spoke about the things that you were not happy with? There were things in the report. Although you endorsed the general recommendations, there were a

number of areas that you were not happy about and you actually listed those in your conclusions and recommendations 1 to 6. If I could just read those to you, you said: *‘We have confidence in the basic approach employed by the BGS but would wish them to:*

“[1] modify their resistance to considering deeper levels of water resources, [2] consider geological conditions and associated structures as important controls on water storage and movement and draw up a programme of investigation to address these, [3] provide a more detailed appraisal of effects of weathering, [4] look closely at the MODFLOW computer model”, which you had previously been quite critical of in your earlier comments, where you had said *“We would like BGS to take the uncertainties both of recharge and geological complexity more into account when estimating resource potential and using computer modelling. This is particularly important if they persist with MODFLOW which we do not accept as a sound computer model for Jersey.”* So that was your recommendation and the reason why you were making that recommendation to look more closely at the MODFLOW model. Then *“[5] have geologists at new water bore sites and [6] take greater account of drillers’ depths.”* So those were your six recommendations that you actually made in your report.

(e) Trinity Catchment Study

I would just like to ask you one question on that area. On item 2, did you consider the Trinity Catchment Study to have satisfied condition 2?

DR RENOUF: No.

SENATOR VIBERT: No.

DR RENOUF: No, because it wasn’t available at that moment.

SENATOR VIBERT: No, but since ... but having had ... what I mean is, having had the Trinity Catchment Study done, do you consider that that study actually satisfied condition 2?

DR RENOUF: Well, the situation was that we were not in fact after 1994 seriously consulted again.

SENATOR VIBERT: Yes, I wanted to deal with that a little later, if I may.

DR RENOUF: Hmm.

SENATOR VIBERT: So, in fact, from your own perspective, the fact is, after this came out, they

then did the Trinity Catchment Study, and really the question that I wanted to put to you is did you consider that that satisfied condition 2?

DR RENOUF: No.

(f) No further involvement of Review Group

SENATOR VIBERT: Fine. Now, I will ask the next question, which is the one you anticipated. That is something that surprised the Panel, that, from then on, having said that you were ... that it was important that it had the input from local geologists, after 1994 what you made there were quite serious recommendations to them, nothing was ever heard of you again. Was it ever explained to you as to why?

DR RENOUF: Well, Roger Culverwell, who was running the ... from the Public Works at the time, he in fact continued to send us the documentation that was produced, but never in fact required us to do anything as such. It may have been that they felt, or we also felt, that things were ongoing and the final work, you know, wasn't at a stage where it needed that, but I think it then slipped. It slipped into out of action.

DR NICHOLS: It was never explained though, as you asked.

SENATOR VIBERT: That is the question, yes. You never got an explanation as to the ... or as to whether they were going to take up any of your recommendations.

DR RENOUF: No.

SENATOR VIBERT: Because, on its face, it would appear to the Panel that the reason you were not asked back could have been the fact that you were critical of the way in which they were doing their work.

DR RENOUF: I don't think so.

SENATOR VIBERT: You don't think so?

DR RENOUF: I don't think so, no.

SENATOR VIBERT: Okay. Thank you.

DR RENOUF: No. I think in fact Roger Culverwell was always a 100% supportive of what we were doing.

SENATOR VIBERT: Hmm hmm.

DEPUTY RONDEL: Through the Chair, Mr Chairman, could you both speak up because it is all being taped and obviously it is important that it is all well recorded?

(g) Trinity study did not address complexity/diversity of Jersey's geology

DR NICHOLS: I think I might add that, with respect to the Trinity Catchment area, we had mentioned in our position paper that, item 1, the issues to be addressed (on page 2), the complexity of Jersey geology and the need to investigate each of the formations, rock formations, or consider them in their composition, their structure and any other structures that affected them independently. One water catchment area was not sufficient or was not indicative of what might pertain in the north east of the Island around Rozel in another rock formation. That in particular had not been mentioned in one of the reports.

SENATOR VIBERT: We are going to move into the geology area once I have done this.

DR NICHOLS: Sure. That will just explain why we are not quite happy with the Trinity one.

SENATOR VIBERT: Yes.

DR NICHOLS: Because it was not indicative of the other parts of the Island.

SENATOR VIBERT: I understand that. We are actually going to actually have a spell on the geology in the next section. Thank you.

DR NICHOLS: Yes.

(h) Was there a change in assessment of water shortage situation after Trinity Study?

SENATOR VIBERT: It would appear that, once the Trinity Catchment Study was done, there was a complete change in assessment of the Island's water situation, because it would appear to us that the Trinity Catchment Study actually showed that the Island's water position was not under stress. It then became "We need this law to get information about the Island's water resources" rather than "We need this law to save the Island from running out of water." Would you agree with that assessment?

DR RENOUF: No.

SENATOR VIBERT: You wouldn't?

DR RENOUF: No.

SENATOR VIBERT: I see. Could you give us your assessment of how it changed?

DR RENOUF: Well, what that report did was it in fact supported to a greater or lesser extent the previous contentions of the BGS reports, which said that there was a serious risk when during drier periods and that you could not just extract water from the groundwater zone that they talked about as being the effective source of Jersey water without running the danger of exhausting it and that there was in fact a very great need to control it, or to have the ability to control it.

SENATOR VIBERT: Yes. The reason why I made the comment was in fact the evidence from the Committee is that they no longer regard the Island's water resources as being under threat in that respect and really they want this law to enable them to get the information to manage the Island's resources. In other words, there has been a shift in their position on this as a result of the Trinity Catchment Study.

(i) Trinity Catchment Study did not address deeper water implications

DR RENOUF: I think that ... I mean, the Trinity Catchment Study was still only really addressing the ... well, what they say it was not doing was not addressing the deeper water implications and that is another thing altogether.

SENATOR VIBERT: Right.

DR RENOUF: Which one needs to address.

(j) Information Paper on Jersey's Water resources

SENATOR VIBERT: Okay, good, thanks. Now, in 1994, which was after you had done your study, the Chief Executive of Public Services presented a report to the Public Services Committee headed "*Information Paper on Jersey's Water Resources*" and it dealt with much of the background really to the Committee, to try and bring them up to date as to what was happening, because there had been changes in Committee etc, etc. Now, in that report, he talked about the research and the Consultation Group and actually said that your group approved, in their report approved, the BGS work and there was absolutely no reference in that report to your recommendations and some of the fears that you have. Could I just put this question to you? Does that surprise you, that a report should go to a committee and not include the recommendation that your Groundwater Review Group had actually ... or your reservations that

you had expressed about the way in which the report had been done?

DR RENOUF: Yes. It surprises both of us.

DR NICHOLS: Yes.

DR RENOUF: And, more than that, we wonder why we weren't informed of that.

SENATOR VIBERT: Hmm. So you would never have seen a copy of this?

DR RENOUF: I have not seen a copy of it.

DR NICHOLS: No.

SENATOR VIBERT: I suppose the value of Scrutiny is that we are able to get all these documents and we can actually find out just what has been going on, which is very handy. I will actually come back to that position a little bit later. So, from 1994 things then continued on, but you were not involved in any Review Group from the moment you did your reporting, you put your report in, so we can establish that situation? I think that really lays most of the groundwork that I need to lay and enables other Members to ask whatever questions on that area that they want to ask. Thank you.

SENATOR LE MAISTRE: Thank you very much.

DEPUTY HILL: Can I just come in here very quickly?

SENATOR LE MAISTRE: Yes, Deputy Hill?

(k) Recommendations apparently not addressed

DEPUTY HILL: And just ask why, when your report wasn't included, have you any reason to think why it wasn't included or taken into consideration?

DR RENOUF: No, I haven't. I mean, this is the first I have heard of this, but I have no idea why. I mean, you know, the six points there are clear enough and, whether one subsequently agreed with them or not, they are clear there and that is what I would have expected to have had taken into account and addressed. Even if it was address them to dismiss them, I would have expected them to have been addressed.

SENATOR LE MAISTRE: And would you agree that normally a group set up like your own group, which was intended to have significant input into the process, that those who would subsequently be making decisions, i.e., the politicians, normally should be made aware of the

relevant elements, not necessarily have the full report perhaps, but it is very strange and in fact it is almost dismissive not to produce that. I mean, you may not wish to comment, but it seems strange at the very least that that should not be included.

(l) MODFLOW

DR RENOUF: Well, I mean, we did have quite a lot of argument with Nick Robins and his group over these issues like MODFLOW, which he was convinced was, you know, perfect for the job, as it were, and also on this business of the deeper water resources. We definitely did not agree on either of those two points. Whilst, you know, we were always very friendly about it, those reservations were always there and, in a sense, you know, if we weren't called again for whatever reason -- it may have been nothing to do with him -- I think that wouldn't have bothered him.

SENATOR LE MAISTRE: No.

(m) Evidence of stress much reduced after 1994

DR NICHOLS: Also, in subsequent years, post-1994, I think the rainfall increased and increased and the stress or the distress was not apparent and things just seemed to calm down, as it were. Further enquiry did not take place.

(n) No mention of reservations of geologists in EPSC submission

Apropos that, I would like to make the comment that, on page 13 of this Shadow Scrutiny Panel Draft Water Resources paper, it says "*Final submission 7th October 2004*", of which I have got a copy and, on page 13, item 14(1), "*highly qualified Jersey based geologists supporting the conclusions reached by BGS*". This is a quote from something prepared by David Evans, I think it is. That statement is really rather bald when you consider the six statements from our one.

SENATOR VIBERT: Yes, absolutely.

DR NICHOLS: I would like to make that point for the record.

SENATOR LE MAISTRE: Yes, yes. Well, that is important, so thank you for making that point.

DR NICHOLS: Apropos of what you have been saying.

SENATOR LE MAISTRE: Deputy Rondel?

DEPUTY RONDEL: Yes. In the information paper on the Jersey Water Resources by the Public Services, it says *“Throughout its research BGS has consulted closely its claims with a group of eminent local geologists, the Groundwater Review Group, consisting of Dr Sharpe, Dr Nichols, Dr Renouf, Dr Andrews and Dr Mourant. The conclusion of the BGS studies and the need for water resources management have been strongly supported by this group.”* Can you confirm that?

DR RENOUF: Yes. Yes, I mean, what we were after throughout, and still are, is this business of water control and management of the resource.

DR NICHOLS: From that point of view, yes, with the proviso that these six items were not addressed.

DEPUTY RONDEL: That is right. That is the extra.

SENATOR VIBERT: Because it actually gives the impression, if I can intercede here, it gives the impression that you fully support everything that they are saying.

DR RENOUF: And that is incorrect, of course.

DR NICHOLS: That is incorrect, because there were three aspects of it, or four if you include the deep water. There is the pollution aspect and the management aspect, which follow from the geology or the information, the data collection aspect of it.

DEPUTY RONDEL: Right.

DR NICHOLS: And you can see from there.

DEPUTY RONDEL: Okay.

SENATOR LE MAISTRE: Deputy Rondel, have you finished?

DEPUTY RONDEL: That is fine for the moment, thank you.

SENATOR LE MAISTRE: Could we perhaps move straight into your expertise?

3 Apologies from Dr Sharp - happy to reconvene group

DR RENOUF: I wonder, Mr Chairman, if I might just say a word about Dr Sharpe?

SENATOR LE MAISTRE: Yes, indeed. Sorry, I should have ... yes.

DR RENOUF: Dr Sharpe, who is the leader of our group, I was on the phone to him -- he was in Sweden yesterday -- and he phoned me to say that he had received the information that I had sent

him and considered it and he wanted to send his apologies to you, Mr Chairman, and the Scrutiny Panel that he couldn't be here on this occasion, but he did wish to emphasise the fact that he would be very happy to reconvene the group for any future work.

4 Comparison of Jersey with Armorican Massif

SENATOR LE MAISTRE: That is very helpful and, for the record, I think it is very important that that should be noted, so thank you very much for that. So if we can perhaps move straight now to your expertise, the expertise you have brought to that Review Group. There have been assumptions made in terms or comparisons perhaps between Jersey and the UK. Perhaps for the record, would you be able to explain the position of Jersey in terms of the geology of Jersey and how that is either similar or different -- I am trying to take a neutral stance at this stage -- either between the UK and ourselves or between the position of Jersey and its neighbouring mainland which we call France?

(a) Marjolet paper

DR RENOUF: Yes, certainly. It is impossible, in my view, to compare Jersey with the UK, with France or with any other large area. The closest comparison that I would be happy with would be some other area within the Armorican Massif, lower Normandy and Brittany. Just recently I have in fact come across a paper which I supplied Mr Haden with for you arising out of conference at Saint Brieuc in 2001, looking at borehole control in the Côtes-d'Armor, just opposite us here.

(b) 20% of water supplied from boreholes

Whilst I was in Brittany in August, I went into their local water board and had a very useful conversation with one of the people there, and he explained to me about their approach to borehole management there. As far as I can make out, they take up to 20% of their water in that area from boreholes. This is a bit different from Manche, by the way, opposite us, because Manche has greater supplies of surface water than the Côtes-d'Armor, which is a much more broken up area in terms of relief and drainage.

(c) **Upper and deeper zones**

But the very particular point which this paper by Monsieur Marjolet -- as I say, you have the paper there -- the very particular point that he makes is he also describes, as the BGS do for Jersey, this upper zone in which the main groundwater flow which we draw upon for our reservoirs is located. He definitely clearly identifies that without any problem. He divides it into two zones, which is going a bit further than in fact the BGS did locally, but he also speaks very clearly of deeper resources which are pumping at ... what was that figure, I gave you? It was 70 something. Yes, it is up to 100m³ an hour, which, you know, are quite substantial resources and they have a network of 20 in that particular catchment area of Tregor. They are drawing -- the one particular one that he quoted -- was 70m³ an hour and that is at a depth of 90m, between 70 and 90m. So this is way below -- and this is the important point -- way below this upper zone which the BGS have concentrated on and where I think everybody accepts our main water resources come from.

(d) **Geological conditions for deeper resource**

The point about that lower, that deeper resource is this, that you need special conditions for it. Armorican geology, including our own here in the Island, is composed of a great variety of very old rocks. These very old rocks are further differentially fractured and broken up. Also, their actual composition, their petrological and mineralogical composition varies very considerably over short distances and the combination of this means that there are some areas affecting, where some formations occur, where you have a significant (for want of a better word) aquifer deeper than these surface layers.

(e) **Comparison with Jersey**

The interest in this particular borehole is that it is in rocks which I would estimate -- I mean, I obviously haven't investigated it fully scientifically -- I would estimate are entirely comparable with the andesite volcanic rocks of Jersey which occupy a great swathe across Trinity. These rocks are volcanic and in their initial formation they had little (sort of) cavities inside them and also they had low temperature minerals as well, which have altered and, in fact, often been washed out, you could say, [1] over time, because we are dealing with hundreds of

millions of years here. In that sort of formation you can have a significant water resource.

5 Network of drilling required

He further goes on to say something which emphasises the problems that you face with the exploitation of such a resource, in that they have two boreholes 60m apart at the same depth which don't communicate one with the other. So there is what he calls an "*ecran*", a screen of impervious rock between the two. I mention that because that is that sort of pattern, where you have vertical divisions and horizontal as well occurring over very relatively short distances, which means that it is very difficult to predict what you are going to have. Therefore, any exploitation of that resource depends really upon drilling. It requires a network of drilling if you are going to try and actually ascertain the degree of resource that it can provide. But, as I say, in the Côtes-d'Armor they are supplying up to 20% of their water, their mains water, from boreholes of that sort.

6 Wide zones

I should add that there is one additional factor in that area, which we don't have in Jersey, and that they are comparatively wide zones, and I am talking here about anything from 400m to several-kilometres-wide zones which have dropped down between faults in the past and different sediments, younger sediments, have come in and occupied this double fracture zone. These are often filled with sands and these sands do provide good aquifers.

7 Difficulty of exploiting resource in Jersey

This is not the case in Jersey. There is no such zone in Jersey existing. I mean, we know this from our geological investigations. There is one quite close, that is the Col de Côtentin between Portbail and Carentan, where there are these sands occupying a narrow fissure zone. Certainly the same fissure system across Jersey, both on a more or less east/west strike, is defined here and the north/north west, south/south west zones, these fractures exist in Jersey. But equally, combined with the base rock geology, this creates almost what one might call a nightmare situation where there is such variation over short distances.

SENATOR LE MAISTRE: And do you think that it has been difficult for that to be taken on board, as it were, in terms of the deeper resource, that there is such variation across such a small

area of land that the normal assumptions which would be made by the experts in this field, without having local knowledge, would be to treat it as they would a bigger area?

8 BGS Reluctance to investigate deeper zone

DR RENOUF: I think that is absolutely the case. I mean, Nick Robins and his group have never, I don't think, been sympathetic to the notion of seriously investigating these deeper resources because they considered that their model, imperfect though it may be (and they accepted it wasn't perfect) did speak for the effective water supply of Jersey and that, if you went below that, then you got into problems which would make it very difficult to exploit it for major supply in Jersey.

SENATOR LE MAISTRE: Could we just, on the example you have quoted in Brittany, is there any evidence in terms of recharge of that resource and what is it if there is evidence of that?

DR RENOUF: Yes.

SENATOR LE MAISTRE: Because clearly they are reliant on their 20% from these boreholes, aren't they?

9. Vertical recharge from rain or surface water

DR RENOUF: I mean, the recharge in the upper zone, this altered zone, as it were, down to about 40m, this is exactly similar to Jersey. It is rainfall and so the conditions that they have laid out, that the BGS have laid out, apply. Also lower down (and this, I think, is noted in fact by the BGS somewhere, although I can't quite remember where) certainly in France Marjolet speaks in passing -- it is not his main concern -- that recharge is vertical. In other words, these deeper bores are also recharged from rain or surface water, not from anything coming from a distance.

SENATOR LE MAISTRE: Right.

DR RENOUF: This is precluded by the mechanics of water movement and, in this case, precluded by the geological nature of the impervious barriers which are there.

SENATOR LE MAISTRE: So, just finally to try to wrap that one up from a layman's point of view, effectively what you have at a deeper level, with these vertical separations, are tanks almost. [\[2\]](#)

DR RENOUF: Hmm.

SENATOR LE MAISTRE: Where the water can't escape and permeates down to that level and is held there presumably, or continues to permeate down. I don't know, how would you explain that?^[3]

DR RENOUF: Well, I mean, it basically fills up the space available and, when it is filled up, it spills back up to the surface, it just doesn't go any further down.

SENATOR LE MAISTRE: Right.

DR RENOUF: You know, if you fill a basin, then it overflows the top.

SENATOR LE MAISTRE: Yes.

DR RENOUF: It is fundamentally no different in this situation that there is a lock reservoir. That fills up. It connects. I mean, it is in continuous connection, or it can be sporadic. No, not sporadic, that's not the word, but it can be ----

SENATOR VIBERT: Intermittent?

DR RENOUF: Hmm?

SENATOR VIBERT: Intermittent?

DR RENOUF: Yes. It is more of a question that, quite apart from the vertical screens or whatever separations there are pathways also, because many of the vertical fractures offer pathways^[4].

SENATOR LE MAISTRE: Hmm hmm.

DR RENOUF: Not all are sealant.

SENATOR LE MAISTRE: Right.

10 Drilling through layering

DR RENOUF: Not all seal in, but there are some which do seal in, but there is also horizontal or sub-horizontal layering which can create impervious layers so that your borehole, when it goes down, will go through the surface groundwater and then it may pass into a completely dry rock for any depth and, below that, it will then come into a water bearing layer. This often accounts for, this effect, the artesian effect because that water lower down is under pressure, so that when you pierce it, it comes up.

SENATOR LE MAISTRE: Hmm hmm.

11 Head of water required

DR RENOUF: But you still have to have somewhere or other a head of water to drive that compression upwards. It doesn't exist in a vacuum really. It has to have a head of water.

SENATOR LE MAISTRE: Right.

DR RENOUF: So you have horizontal impervious and permeable, sort of porous layers and also you have the same thing happening vertically with permeable and impermeable vertical fissures.

SENATOR LE MAISTRE: Thank you very much.

DR NICHOLS: Could I add a couple of things to that?

SENATOR LE MAISTRE: Yes, please.

12 Significant water supply through fissured rocks

DR NICHOLS: The two water bores that are mentioned in the article are in rocks which they describe as "*les roches fissurées*", these fissured rocks, and they are 60m apart, as John said, but they supply, each of them supplies, 300m³ of water per hour. It is quite significant.

DEPUTY RONDEL: Clarification, please, Chairman? 300m³ per hour? Can you just give us that in gallons or in litres, please?

DR NICHOLS: No, not off the top of my head, I can't, sorry.

SENATOR VIBERT: 300 times 220.

DR NICHOLS: We can do the recalculations, but it is ----

SENATOR LE MAISTRE: It is significant, I suppose.

DR NICHOLS: It is significant.

SENATOR VIBERT: Dr Sutton's got it.

13 Fissure systems

DR NICHOLS: What I am trying to get at and what John is trying to say too was that these can be recharged from the remaining three dimensional area or volume, if you like, below. We have got these two examples separated in Brittany and it is the same here. What we also have is big fissure systems, where the rocks will have been crushed in these zones -- they are either single

planes or they are crush zones -- which act as suppliers. Again, as John has just said, to give you a better picture of the horizontal and the vertical problem, in the horizontal plane we have got the bedding planes or we have got schistosity planes. We have got plains along which water can move under pressure, as John said, with its head as its push-pull. But, until we get a three dimensional picture of the region, we won't know the distribution of these independent boreholes, the separate screens, whether they are vertical screens, as they are called. It is a French word, "*ecran*". It is an impermeable barrier in our terms, both vertical and/or horizontal.

14 Effects of weathering

The last thing I would like to mention apropos of this, which we mentioned in item 3, which adds to the available water, is the effects of weathering. In addition to the fracture systems that we have just mentioned, there is the weathering that we know existed in between the depositions of the various volcanic units, called sub-aerial. When they were deposited as volcanic rocks, there was a period of time when they were weathered as modern volcanoes are weathered and the decomposition that John talked about, the cavities developing and so on, could have happened then. They could also happen within the formation, after it has been deposited and hardened, by percolating groundwater which could dissolve those minerals and provide pore spaces for water storage, and then obviously subsequently -- and John knows more about this than I do -- what we call a deep Tertiary weathering, deep Tertiary being in the last 10 million years or so, or more than that probably, and that also will have altered the rocks. But until, and I think this is why you are asking this, until we have all this information, we won't know how things are specifically recharged.

SENATOR LE MAISTRE: Deputy Baudains?

15 Position Paper and assessment of BGS Survey

DEPUTY BAUDAINS: Thank you, yes. Unfortunately, you have been darting about all over the place here, so there is a danger I may be covering some ground twice here. What I would like to do is to go through and seek clarification on the two papers which you supplied in 1994, the position paper and also the assessment of the BGS Survey Report, going through them in the order in which they appear. Of course, I fully realise that these papers are written a decade ago

and obviously your position may have changed on certain areas and I appreciate that we are obviously not expecting you to say that you stand by everything that is in there. You know, things have moved on in certain areas, so I am not expecting you to do that.

Starting off on the position paper, I have a question which has already been covered to some extent, because my understanding is that BGS believed that Jersey's geology is relatively simple. Now, my understanding is that it is probably the most complicated 45 square miles one can find. I take it, from what I have heard so far this morning, that that is roughly your position.

16 BGS treat Jersey as unified piece of rock in upper zone for purposes of water movement

DR RENOUF: Well, I think, in fairness to the BGS, what they are saying is that, for the purposes of water movement in the first 40m, then you can treat Jersey as a unified piece of rock, because, although there are variations here and there, nonetheless the movement of groundwater is straightforward and can be treated by such a modelling device as MODFLOW.

DEPUTY BAUDAINS: Yes.

DR RENOUF: I would further add that their work on the aging of the water, from north to south, supports this view, in that sense.

DEPUTY BAUDAINS: So long as you only look at the upper 40m or so.

DR RENOUF: And even there, you know, there obviously is the possibility of having quite big differences. I mean, I think, for instance, the west of the Island and the north west is quite different from the centre of the Island in terms of that.

DEPUTY BAUDAINS: Thank you. Moving on to the top of page 3, there are a couple of areas here where I clearly haven't understood it properly because there seems to be almost a contradiction. At the top of page 3, "*This has resulted in rocks which are one and all cut by a multiplicity of clean fractures such as joints and an abundance of more complicated fractures*", which you have already outlined -- faults and shears and crushed rock. Then it goes on in the last sentence of that paragraph: "*It is these varied fracture systems that water can be stored in considerable quantity and can be transmitted relatively easily.*"^[5] Now, what I don't understand there is that further on there are suggestions that only slow water transmission seems to be suggested. I believe that is actually about two-thirds away down the page.

17 Laws of transmissivity of water

DR RENOUF: Yes. I mean, I think our explanations there are weak, you know, in retrospect looking at it. I think when we talk there about “*water can be stored in considerable quantity*”, well, I think what we were saying just a few minutes ago explains how we view that storage. “*Transmitted relatively easily*”, this is only to be read in the scientific understanding of the transmissivity of water. In other words, Darcy’s Law and various other laws govern the movement of water and, even when the rock is relatively porous, it is still going to be governed by those laws. Those laws mean slow movement. If you are talking about these deeper zones in Jersey, then there is no effective distance of movement involved. The movement is up and down, not side to side.

DR NICHOLS: In the second paragraph on that page there, that is a general statement you have just identified at the end there, but if you go on to the third paragraph there, you will notice in the middle that we qualify that: “*The effect of this is to close up fractures at significant depth*”. So, firstly, it is a general statement where, in that particular fracture system situation, you do get relatively easy movement. I think the word there would be “*relative*”. We go on to say -- I know I am repeating myself -- that with depth these fractures close up and water is less easily transmitted and flows less easily.

18 Use of terms ‘groundwater’ and ‘surface water’

DEPUTY BAUDAINS: If I could perhaps move on to page 4, paragraph 3. The query I have here (because it pops up in the other documents which I have referred to in your comments on the assessment of the BGS Survey Report) is the misunderstanding between the well drillers and yourselves because the same terminology is not used. I am referring here to surface water. You state here that “*hydrogeologists understand [this as] groundwater.*” My question here is how do hydrogeologists differentiate between this upper layer and the deeper layer because clearly the well drillers are referring to the deeper layer as groundwater and the upper layer as surface water and all that is differentiated between the two because they are really not interested in the upper layer because it is unreliable and it is prone to running out in periods of drought, there is no real volume there and it is often polluted and they actually, when they are sinking a borehole, try to

exclude that from the bore by lining. What terminology ----

DR RENOUF: I think, no. I mean in terms of the definition of “*groundwater*”, there is the water table which represents the top of the groundwater. There is a seasonal fluctuation and that is taken account of in how one defines that water table. Then below that seasonal variation -- I mean, it may be annual also to fluctuate over longer periods than just a season -- but any water which is held in the rock in continuity^[6] is termed groundwater and even that notion of continuity has to be modified to the extent that I have just explained how, when you drill a borehole in such areas as Jersey -- in fact, anywhere, any layered strata -- you may go through a dry stratum and come to one which has water. But that is still groundwater. So it is any water, groundwater, which is held in the rock.

SENATOR VIBERT: That comes from rain?

DR RENOUF: To your point ----

SENATOR VIBERT: That comes only from rain?

DR RENOUF: Well, that is another question.

SENATOR VIBERT: All right, okay.

19 Double zonation of rocks

DR RENOUF: Because, I mean, that could come from any source. So, no, assuming that it is there and just ascribing it, then the upper levels are defined not by the water they contain but by the nature of the rock. This French paper, for instance, makes clear a double zonation. They use the word “*altérites*”, meaning rocks which are altered, you could say, which is quite a good term. There is an upper zone, where specific geochemical conditions apply. The rock has been broken down chemically into a particular state. Then you have a zone below that^[7], where the rock is more rigid but is still altered significantly to hold significant amounts of water which are cycling with the surface. So that is the water that BGS are mostly talking about. Then there is what the French describe as, and what we have described as, a perfectly comprehensible term, deeper water, deeper water resources, which are below that. But that is still groundwater because it is water held in the ground. It is no more, no less.

SENATOR LE MAISTRE: Hmm hmm.

DEPUTY BAUDAINS: No, I think there has probably been some confusion there, because obviously the well drillers at some time in history have looked for a means of differentiating between the two and found a different word for that which they don't want and the water that they use.

SENATOR LE MAISTRE: Yes.

DR NICHOLS: Geologically we would describe everything that John has said, but for you to visualise what we are talking about, we have also got terms like "soil" and "subsoil" and "overburden", which is, if you like, the unconsolidated material, and these may be derived from a variety of sources. Then below that is the solid part rock, which John has said the upper part is weathered or altered, where you go down and down, as we have just described. We would then, in terms of hydrology go on to talk about the unsaturated zone, where there is no water above the water table, and the saturated zone, which is below, which speaks for itself, whether it be in the loose unconsolidated sense, it is still groundwater, or whether it be in the rock. We then would go on to subdivide further into confined aquifers and unconfined aquifers. A confined aquifer is, again, as it is stated. It has got impermeable strata above or below, and we find the vertical impermeable barriers. The unconfined ones are open, obviously.

SENATOR LE MAISTRE: Hmm.

20 Meteorological and juvenile water

DR NICHOLS: To answer your question, the greater part of the water, we think, comes from meteorological water, as it is called, rainwater, but you can also get what is called juvenile water, which is water that was originally in the rock when it was formed and you can get water from volcanic sources at a later date. But primarily the head that John is talking about and the water recharge comes from the rainwater.

SENATOR LE MAISTRE: Deputy Rondel?

21 Borehole producing 300m³ per hour

DEPUTY RONDEL: Yes. Can I go back to what you said earlier about if we use 1m³ of water per hour it equates to a thousand litres or 220 gallons?^[8] I think that is about the figure.

DR NICHOLS: Right.

DEPUTY RONDEL: Something that is producing 300m³ per hour, we are talking about something in the region of 66,000 gallons per hour or a 1,000 gallons a minute. What size bore are the French using on this, please?

DR RENOUF: They don't specify it, but, I mean, it is rare to have a borehole as wide as that.

DEPUTY BAUDAINS: More than nine inches.

DR RENOUF: And, of course, as it goes down, it becomes narrower. I don't think that ... I mean, I'm not quite sure what the significance of varying ... I mean, in your terms, what sort of answer you are wanting from me.

DEPUTY RONDEL: No, the reason I put the question is because we have been, or the water diviners were challenged on the volume of water that could be extracted from any particular bore and the amount of volume you are giving us there ----

DR RENOUF: Is considerable.

DEPUTY RONDEL: Is considerable compared to what we have actually been given to believe would actually happen, or the way I have read it from the BGS and others, because they actually ... I am trying to think of the correct word. They were challenging the water diviners on the volumes of water at 300 and 500ft. Now, these volumes that you have given us were at 300ft on the 100m³ per hour. The one at 300m³ per hour, is that also at ... I say at 300ft or thereabouts, 100m, 90m?

DR RENOUF: The thing here is, yes, I can see perhaps more clearly what you are saying. Those figures from Brittany are for the better ones, because this has to be averaged out.

DEPUTY RONDEL: Of course.

DR RENOUF: And that is a very high yield one. That is very high indeed and would be ... you

know, I mean, if one could sort of locate a similar source in Jersey ----

DEPUTY BAUDAINS: You could get rid of the reservoirs.

22 piezoelectric effect

DR RENOUF: ---- even 20 or 30 of those, you would be drawing significant amounts of water.

But you also have to understand from what level in the borehole this water is coming from. This can only be determined precisely by putting in geophysical equipment which measures -- but here you are losing me technically -- the piezoelectric effect. You put down these piezometers, which measure where the water is actually coming from. It is not as simple as that, but you nonetheless can determine where the water is coming into the borehole.

23 Importance of data collection

One of our concerns has always been that it well may be true that a borehole is down to 100m, that is fine, but is the water coming into that over, you know, the whole distance, just the lower part, just one or two layers and to draw the distinction between, as Deputy Baudains has said, these upper levels and the deeper levels. This is important. But this goes on to a point which, of course, we do want to make. I mean, it is one of the major points that we want to make this morning, which concerns data collection and monitoring, but I won't enter into that now because I have just answered that question.

SENATOR VIBERT: We will deal with that later.

DEPUTY BAUDAINS: Could I just interject there and refresh my memory? I am sure you told us. The borehole which we have just been discussing, or the two, as I understand it, what rock type were they into?

24 Volcanic rocks and vacuoles

DR RENOUF: They are in volcanic rocks, which I am 90%, perhaps 99%, sure would equate in the most general terms with our andesite series in Jersey. They are not the same rocks, but in terms of their mineral composition and behaviour I would equate them and they are volcanic rocks of approximately the same age as well, which is interesting.

DR NICHOLS: If I can support John there, and this is not over to him and back to me.

SENATOR VIBERT: No, that is fine. Go ahead.

DR NICHOLS: These are volcanic rocks. They are described as *vulcanique vasculaire*. These are similar to our volcanic rocks, as John said, but they are volcanic rocks with cavities in, with pore spaces in, which allow migration. If they are linked, you then have to have permeability, obviously, to get the water out.

To support one situation here -- we can come on to this later for the drillers' records -- when the water bore was drilled at the Grainville Cricket Pitch area at so many metres down and the driller I think was Neville George's son, I think the figure was something like 4,500 gallons an hour from a rock similar to this, because I looked at the chips and I could see there were cavities within the volcanic rocks and that is quite a high rate, but that is only obtained -- you were talking about volumes a moment ago -- by actually putting flow meters in and actually pumping the well dry to see how much it will produce and then obviously measuring how long it takes to recharge ----

SENATOR LE MAISTRE: The recharge rate, yes, yes.

SENATOR VIBERT: The recharge.

DR NICHOLS: ---- to the standing water levels.

DEPUTY RONDEL: Thank you. On top of that then, can you please reiterate -- I think you mentioned it earlier -- but please for my own peace of mind remind me where the similar volcanic rocks are found on Jersey? I think you said St Martins.

DR RENOUF: Yes. It is in a broad band running from the northern edge of town, Grand Vaux, up towards sort of Trinity Church and beyond and then out to beyond La Hougue Bie on the east and virtually ending at about Mont à L'Abbé, not far from Mont à L'Abbé, so it is quite a significant area there.

DR NICHOLS: That is the outcrop, isn't it?

DR RENOUF: That is the surface outcrop.

DR NICHOLS: That you can see. I am not being rude now or impertinent, but we have a geology map and the width of that outcrop, even where it is under soil, is shown. But it also

descends, doesn't it? It dips under other volcanic rocks which are a little less porous further east and north east towards, if you like, Gorey and Bouley Bay etc and then, even again, under the conglomerates.

DR RENOUF: Yes. It should be said here that, you know, we have focused on those volcanic rocks because, in my view as a geologist, in our view as geologists, those are the rocks which will have these vacuoles, these significant cavities in. They are also highly susceptible, although variably, to alteration, so that, given great variation in the alteration, that creates a situation where water storage becomes quite potentially likely.

25 Rhyolites

The other sorts of volcanic rock, which spread from Frémont Point across to Gorey Castle, Mont Orgueil, these are rhyolites, and these rhyolites are much more acidic -- the same composition in fact basically as granite, but much more acidic -- and much more resistant to alteration. So one would not expect these to provide a similar sort of reservoir, which is not to say that there aren't zones in them which cannot contain some water because they are variable also. It is in the nature of volcanic rocks to be very variable over short distances so that, you know, you cannot rule out getting a significant small area with water supplies in it.

This, of course, is one of the points that BGS make, that when you drill down through the Rozel conglomerate, which in itself certainly wherever we see it at the surface it is fissured by major joints -- that is a major feature of this rock -- so that it would drain water very rapidly. But whether it would hold it lower down, to some extent perhaps, but then you go through the conglomerate and you come into volcanic rocks, so that we don't know what those volcanic rocks are. I mean, projecting, one would expect them to be of the rhyolitic sort, but we don't know because we haven't any evidence of it.

DEPUTY RONDEL: Thank you, Chairman.

SENATOR LE MAISTRE: Deputy Hill or Deputy Duhamel?

DEPUTY HILL: No, I am a bit lost on this actually. It is a bit deep for me.

DR RENOUF: I am sorry.

26 Exclusion of deep groundwater by BGS

SENATOR LE MAISTRE: Yes. Senator Vibert then?

SENATOR VIBERT: Thank you. You have actually given us a very clear, certainly as far as I am concerned, a very clear exposition this morning, but something has been troubling me personally, which is the definition of “*groundwater*” because it would appear that the way things have been put to us is that BGS are only looking at the shallow part of the groundwater and have totally disregarded the deeper groundwater in any of their discussions.

DR RENOUF: In terms of a useful resource.

SENATOR LE MAISTRE: Absolutely, yes.

DR RENOUF: They haven’t totally disregarded it.

DR NICHOLS: Not totally, no.

SENATOR VIBERT: I see, not totally.

DR NICHOLS: They came into ----

SENATOR VIBERT: Considerably, considerably.

DR NICHOLS: In terms of the brief they were given for it to be a depth at which supplies could be reliably used for ----

SENATOR LE MAISTRE: Yes.

27 BGS terms of reference - “*essential to have a good understanding of the water resources*”.

SENATOR VIBERT: Well, you see, this is what I want to deal with, which is the terms of reference that were actually given to BGS and, indeed, the terms of reference or the final observation of the Riley Commission, which actually caused all of this to happen. The Riley inquiry said it was “*essential to have a good understanding of the water resources*”. Those are the words. Now, surely “*water resources*” has to mean all water resources without any prevarication about it whatsoever.

DR RENOUF: Yes, so that in fact ----

SENATOR VIBERT: So it has to take into account all of this.

DR RENOUF: Yes. I mean, BGS, I think could be criticised for taking that statement and ----

SENATOR VIBERT: As shallow.

DR RENOUF: ---- and interpreting it in a particular way to suit what they perceived would

supply a good answer for us. I mean, I don't think ... I mean, I wouldn't dream to say that they had set out to actually exclude that for any other reason than they didn't consider it important.

SENATOR VIBERT: That is right.

DR RENOUF: But nonetheless you are correct that the terms of reference they should have made clear statements on.

SENATOR VIBERT: No, that was actually the Riley reference, but after this, of course, the Committee produced a term of reference for the whole of this work to be carried out and item 1 reads: "*Establish a hydrogeological database for the Island to determine location and quantification of available groundwater resources together with yield and response to abstraction rainfall and drought, including risks of marine invasion.*" Now, on the basis of item 1, it would be impossible to exclude the water at a lower level. Would you agree with that statement?

DR RENOUF: Yes.

DR NICHOLS: Yes.

28 Great variability over small distances

SENATOR VIBERT: You would. The other thing I would like to ask you is in your report, and it is on page 3, you have given a very good explanation of the geological basis of Jersey and, in the fourth paragraph, you actually say "*Within the interplay of these factors, there is room for valid differences of geological opinion and emphasis.*" So I take it that what you are saying there is that this is not a precise science and that within those factors there are grounds for quite valid disputation and differences of opinion.

DR RENOUF: Yes.

SENATOR VIBERT: Within those factors.

DR RENOUF: Yes, yes. I think, I hope, from the explanation I have given you of the geological sort of set up in Armorica, Jersey and Brittany this morning you can see that the complexity is such that over small distances you have got great variability.

SENATOR VIBERT: Very much so.

29 BGS focus on upper zone - deeper level: an area of uncertainty

DR RENOUF: So that is always going to be a problem in that prediction. Therefore, one still has to go back to the fact that the BGS approach was to say “Well, the water that you can actually control and handle and be sure about is in that upper zone. If you are going to go into lower levels, you are entering an area of uncertainty where it is unlikely that you are going to have any significant water to put into the public system.” I think then they took a step which was probably unjustified and said “Therefore we are going to largely ignore it.”

SENATOR VIBERT: Ignore it, exactly, and you can understand why they did that.

30 Should look at deeper resources - Cotes d’Amor proves the case

DR RENOUF: Yes. In fact, you know, they should have been a little bit more willing to consider it. This work from the Côtes-d’Armor shows exactly this, that, you know, if the Côtes-d’Armor are taking 20% of their water supplies from groundwater in a situation where locally in the Côtes-d’Armor it is very similar to Jersey, well, you know, perhaps we should look at that.

SENATOR VIBERT: You have to be taking note of that, don’t you?

DR RENOUF: Yes.

31 Lack of information about boreholes

DEPUTY BAUDAINS: I wonder if I could interject there? I think the well drillers have indicated that they believe, or they estimate, that 95% of the water drawn from boreholes comes from the deeper water, not what they call the surface water, the top layer of saturated rock that appears to have an impermeable layer beneath it, 40m or wherever.

DR RENOUF: Yes. I don’t feel able to comment seriously on that because, again, this looks forward to what we would now have sought to have recommended, in the sense that we don’t have sufficient information from boreholes to actually justify a meaningful comment on that.

DEPUTY BAUDAINS: I was merely bringing it into the context of the subject which Senator Vibert was raising, because it appears that the BGS have only really taken account of the fact of 5% of the water and have disregarded 95%, which, on the face of it, would seem to be a serious omission.

32 Major resource in upper levels

DR RENOUF: No, I couldn’t go along with anything like that sort of thing. I mean, by and

large I am sure that we both agree that the major resource of Jersey water is what the BGS has defined in the upper levels, because that is accessible to the public generally. Boreholes are supplying point sources and this is another matter entirely and the amounts that they are going to supply are still, in terms of the overall Jersey supply, going to be small.

SENATOR VIBERT: On this ----

DR NICHOLS: Sorry.

SENATOR VIBERT: No, please.

33 Drilling at deeper levels

DR NICHOLS: If I could answer that, we don't know, although we keep coming back to this, and I have been with Lewis de la Haye when he has drilled with no problems whatsoever, but he has just done a water bore for my father-in-law and we got water in the first 100ft and he stopped drilling -- fine, no problems, the water was great and pumping and that was fine etc. I would like to know, and I haven't talked with him about this and it would be great to have this exchange of information, in the places where he had gone for deeper water, he and George had gone for deeper water, did they not get very much water in the upper, except for the 40m that BGS are talking about and were they relatively dry and did he therefore go on, which is customary practice in the oil and gas industry everywhere, because you don't stop at your first supply. You go down and you assess the rock pile for these isolated or perched or individual reservoir rocks.

SENATOR VIBERT: Yes.

DR NICHOLS: Similarly I would like to know, again -- we need to garner this information -- as to why they had gone into the deeper water and where they get this figure, therefore, of 95 to 5%. As far as we know, no qualification has been done.

34 Water diviners claim to detect moving water

SENATOR VIBERT: We are actually going to deal at a later stage with what our proposals are, or what your proposals are because we want to hear from you on that. So if I can just stay on the geological thing for the minute. The water diviners are basically decried by the professional experts mainly because they claim that they can only divine water that is moving, they can't divine still water. Your explanation this morning about the waters moving **this** way as well as

that way, I wondered whether that is not what they described as the “*streams of water*”, when they talk about streams down below, down in this area, that this could in fact be the water moving **this** way.

DR RENOUF: This is obviously a very difficult thing. I would have no problem in employing a water diviner to drill a well for me. I might not do so, but I would have no problem with that because they have considerable expertise.

DR NICHOLS: Yes.

DR RENOUF: But I do not think that they have expertise in how water moves at 100m down.

SENATOR VIBERT: No.

DR RENOUF: They have experience of how water behaves when they tap into it, and that can be more scientifically assessed than they are able to by just drilling.

SENATOR VIBERT: Sure.

DR RENOUF: And so recording flow. So, in that sense, there is no problem whatsoever. But what one must realise about the movement of water is that water is always moving. What you define as water movement which is ----

SENATOR VIBERT: In other words, if I do **that**^[9], the water moves.

35 ‘Streams’ of water

DR RENOUF: Yes. I mean, what is detectable by a water diviner and what is not. There are studies that have been made and there is, I sense, at the back of the scientific investigations the feeling that there are unexplained phenomena. But wherever it has been scientifically investigated, water diviners have never been consistent in what they have been able to actually do. Whereas the science, in a sense, up to its own limitations, is consistent and if you think of streams of water, it is an unfortunate term because, whatever the situation down there in fact underneath us, it is not moving in the normal person’s concept of a stream.

SENATOR VIBERT: Not moving^[10]

DR RENOUF: But if you take “*stream*” in the more sort of metaphoric sense of sort of movement of water masses as slowly or whatever you would like to say, well, that is happening. You know, I don’t think any scientist would say otherwise. But the BGS come back on that one

and speak with, I think, a sound voice of scientific authority when they say that there are laws which are obeyed by water and you cannot gainsay these laws. Where you can prove the actual movement of water, it always has obeyed those laws.

SENATOR VIBERT: I suppose that is the frustration that the water diviners themselves find in trying to find an explanation themselves as to how it happens.

DR RENOUF: Yes.

SENATOR VIBERT: They know when they drill that the water is there and they must get very frustrated -- we know, we heard about their frustrations in this Panel -- about the fact that, you know, the experts with the scientific background were virtually saying to them "Well, it's not happening. Water's not there" or "It's not moving" and we sensed their frustration here in not being listened to even about their borehole experience, that the officials took the view back in 1994, I have to say, but we will come on to the modern situation when we talk about the plans for the future. But I can understand their great frustrations, whereas in France they are treated with great respect and they are used a great deal and they are considered to be professional people; whereas over here, and I would suspect in England, they are regarded as being something rather mystical.

36 Assessment of the BGS Survey Report

DEPUTY BAUDAINS: I think this is an appropriate point to come in here on your second paper that I referred to earlier, the assessment of the BGS Survey Report and comment by the Groundwater Review Group. I am looking at page 4. Coming in on your note 14, it says: "*We do not understand the concept of streams of underground water*", which is precisely what we are talking about here.

37 Minden Place car park

Now, I think, as Senator Vibert has alluded to, the well drillers can't understand why people don't understand the term "*underground stream*". In fact, I would refer you to a paper which we have. In fact, it is a cutting from the *JEP* of 1970, where the engineers who were

building the multi-storey car park at Minden Place actually stated the main problem for the delay had been in the ground, for the contractors encountered amongst other things underground streams. So obviously the construction industry uses that terminology as well.

38 Fort Regent

If I could just move on slightly from that, because it is connected, on page 5, note 18 -- and this is also something which we have been discussing -- is that, at the end of your note 18, it says: “Flow in and along them^[11] would be slow.” Now, my question to you is what is “slow”? Has anybody measured the flow rate? Are we talking about 1mph or 5mph or 10mph because I will give an example? I just looked it up late last night actually. The Fort Regent well, we are told by the engineers who made it, that, on striking the stream at a depth of 235ft, as a matter of interest, the water poured in like a torrent and immediately rose in the shaft to a height of 70ft scaring the workmen suspended in the bucket. Now, this is a well of 10ft diameter, so it is not a seepage slowly flowing through the rock. Clearly there is some capacity to do that. I am at a loss to ----

DR RENOUF: Yes. I mean, Fort Regent well is near the surface. It may be 240ft down, but it is still effectively near the surface.

DEPUTY BAUDAINS: Sorry, could I ask what you mean by that?

DR RENOUF: Well, you have a hill which sticks up like **this**.

DEPUTY BAUDAINS: I understand.

DR RENOUF: Therefore, when you are 240ft down, in fact from the sides in, it is relatively close ----

DEPUTY BAUDAINS: In relation to sea water level.

DR RENOUF: Yes. The feature of the Fort Regent granite ... I mean, you could refer to my paper with Clive Bishop written in 1969, where I in fact logged the road tunnel. The feature of it, and this is actually generally a feature of Jersey granite, is that the joint systems in them, they go -- and I am going to demonstrate this with my hands, so it will not pick up very well on the microphone ----

DR NICHOLS: The joints are the fractures.

DR RENOUF: The joints are the fractures in the rock, and I am talking about vertical ones now, but there are horizontal ones.

DEPUTY BAUDAINS: There appear to be four vertical ones.

DR RENOUF: You will get close set joints and then you get increasingly wider spaced joints and then out there it goes back to close space and wider. Now, these close space joints within something probably of anything up to 50/60m of the surface are effectively open. In other words, the cracks are sufficiently open so that water can move through them. What happened with the Fort Regent granite is they went into ... they must have breached from one of the more competent zones of rock into one of these fracture zones and the head of water on the side pushed it up. I find nothing strange in ... and there, in fact, you know, this is in fact where terminology can create enormous problems because you might speak of that as a stream of water, but still to me it is an unfortunate term because a stream in people's minds is a quantity of water which is moving ----

SENATOR VIBERT: A babbling brook.

DR RENOUF: And this is in fact water moving in cracks and fissures and to me the word "*stream*", except in a more sort of metaphorical sense, isn't the word to apply.

DEPUTY BAUDAINS: No.

39 Flow is taking place

DR RENOUF: But I would agree with you that the flow is taking place. I am not disputing that.

DEPUTY BAUDAINS: Just picking up, just to finish this particular subject, picking up again on what Senator Vibert has said, the water diviners, I think, would generally tell you that they can only detect flowing water, which is why they do not detect what they call the surface water and would say that the water is flowing continually through the fissures, cracks, joints or whatever you want to call them.

DR NICHOLS: That seems strange ----

DEPUTY BAUDAINS: Is that something that you would disagree with?

DR NICHOLS: Well, it seems strange in itself, doesn't it, because all the groundwater is fine and BGS has proved that in the ... and when you do your surveys and map, then you have got

standing water levels and you can produce these what are called pressure surface maps and they show in their report that it flows in the top 40m or the “surface” part of the groundwater -- in inverted commas “surface” -- that it does flow. Going back to Fort Regent, they just breached it. It is what John said before. They released pressure that had been in this head of water either side of the fracture system. They just released it. Of course it rushed in. What I would love to know is whether they actually pumped the well dry, as it were, and then found out whether the water would still flow in at the same rate.

SENATOR VIBERT: A recharge.

DR NICHOLS: You have got to wait. Yes, the recharge. Of course it would in the first instance. It is like you see the films of the oil wells blowing wild and that is just because they have released the pressure in the impermeable cap rock and that is what John has just said there. Going to the Minden Street Car Park though that is ----

DR RENOUF: That is a bit different.

DR NICHOLS: I would like to see the engineer’s report and see what the footings were and the foundations and so on because that could be part of the marsh land area and that was the base of the St Helier region before you get to the bedrock of the hills out of town. If so, then are at least three streams running through there.

SENATOR VIBERT: Springfield is another example.

DEPUTY BAUDAINS: If I remember correctly, wasn’t there a dairy or something just across the road where there was a spring?

DR NICHOLS: Possibly. We are looking at streams, but can you see what I mean about the interpretation.

SENATOR LE MAISTRE: Different types. Different types, yes.

40 aquifer under St Helier,

DR RENOUF: At the interface between the superficial deposits at Minden Place Car Park and the solid rock, as I would call it, underneath, there is normally, over the whole of St Helier Basin, I mean it does vary slightly, but there will there will be a thickness of gravel, coarse gravel, anything from **that** ^[12] or even more. This gravel just holds water. I mean, it holds a lot of

water. If you disturb that, the water will pour in and then you can talk about almost a stream of water, so that wouldn't surprise me. But there we are talking about something we haven't discussed this morning akin to St Ouen's Bay aquifer. There is an aquifer under St Helier, but that only goes through recent, relatively recent, deposits which probably date back to the last Ice Age, even at the base.

41 Need for more information

DR NICHOLS: We are getting into the realm now, aren't we, of our request in our position paper for more information concerning the variable rock types, whether they are superficial or not, the various bits that need examination, because, as you are identifying now, you can get individual cases and the danger is to transfer that information and interpretation across the Island.

42 Dialogue with well drillers

DEPUTY BAUDAINS: Could I ask -- this may be an opportune moment -- there seems to have been a lack of dialogue for whatever reason between the well drillers and BGS. They seem to be poles apart. They are coming together now slightly, I believe. Have you had ongoing dialogue with the well drillers, or do you think ... if not, do you think that would be useful?

DR NICHOLS: Yes, personally, I have had some and I would welcome more. As our recommendation in item 6 was to have ... no 5, to have geologists at water bore sites, yes, but we haven't had that dialogue. The ones I have mentioned have just been purely personal or family situations and where I have come across them, having regard to your question.

DEPUTY BAUDAINS: So if there was a body to which a well driller could report and say "I am drilling a bore next week, would you like to come and have a look", that would be useful?

DR RENOUF: Yes, but, I mean, this looks ahead again to what we would recommend about the handling of the water resource in the Island and the bore holes.

SENATOR VIBERT: It might be appropriate to move on to that as a specific subject now.

SENATOR LE MAISTRE: Yes.

DEPUTY RONDEL: I have been waiting to get in on a supplementary earlier on.

SENATOR LE MAISTRE: Yes, sorry, Deputy.

43 moon phases, tides and the North Pole

DEPUTY RONDEL: I have probably missed it now, but when you were talking about water moving etc, do you as scientists, because that is what you basically are in your own field, do you take into account things like moon phases, tides and the North Pole pull and all the rest of it when you are doing any of your calculations?

DR RENOUF: I would say off-hand no.

DEPUTY RONDEL: Right.

DR RENOUF: No. It is purely based upon the pressures involved and the nature of the rock and the rock structures through which the water is moving. Those are the only things which actually affect it and, of course, you know, as part of that is the height of the head of the water.

DR NICHOLS: We wouldn't take those into account unless, from the monitoring and the measuring, there was a fluctuation in any of the parameters we use, any of the assessment criteria we use, and it can be shown to coincide with or vary with moon phases, high tides etc. But that, again, only comes through monitoring and close monitoring and obviously on a monthly if not a fortnightly basis.

DR RENOUF: I mean, certainly these things affect the rocks. The storage faults in the salt lake that the Mormons use in Salt Lake City is a nearby granite mountain and they installed in their faults a seismograph. They were able to show that this whole mountain was moving with the phases of the moon.

DR NICHOLS: And we know the Island moves with high spring tides.

DR RENOUF: Yes.

DR NICHOLS: High spring tides. Whether this would have an effect on any of the fracture systems in the adjacent area or throughout the Island and, therefore, change the speed of flow we don't know until we monitor.

SENATOR VIBERT: Do you want to come in there?

SENATOR LE MAISTRE: Could we move on, yes?

DEPUTY BAUDAINS: I don't know if Dr Sutton has any questions.

44 Interactive system

DR SUTTON: There is just one point. If I simplify what I think is the conceptual picture of

what you said, within the top 30 or 40m, however deep the weathering is, there is a broadly continuous body of groundwater linked through stress relief and surface features, which is recharged by the rain. Beneath that, controlled by geological structure, by faults, by the distribution of volcanic rocks, there are deeper reservoirs of groundwater which also receive the bulk of their volume through downward seepage. This deeper reservoir in turn almost acts as a balancing tank. In dry years, when there is very little recharge to the surface, the actual sustaining of the near surface water levels is assisted. They will fill, but they won't fill as much because they have this rather diffuse and diverse connection with the deeper water levels, so the whole system is interactive at different periods of time. We don't have the deep levels on Jersey but they do help sustain the upper levels through drier periods^[13]. Would that be a fair summary?

DR RENOUF: Yes, because I think, if you look at it from the reverse point of view, if you removed that deeper reservoir of water, then the water in the to 40m would immediately start draining back down into it, so, yes, what you have said is a very good summary of what we feel.

DR SUTTON: If you took out more than you put in.

45 Variable Recharge from below

DR NICHOLS: If you are talking about Island-wide though, given the constraints that we have mentioned about the impermeable horizontal layers or units and the vertical impermeable ones, that recharge from below would be variable, wouldn't it, throughout the Island. So the general statement that it recharges the whole 45 square miles has got to be qualified by the fact that we don't know where these impermeable horizontal strata or units are, or even vertical.

DR SUTTON: It will be very slow, sort of tens of metres a year that the groundwater might move up.

DR NICHOLS: Yes.

DR RENOUF: And it would depend upon head. I think that is what Ralph is basically saying, that if you removed surface recharge, then you would have a static water source. It would find its own pressure level, but it wouldn't necessarily recharge upwards unless there was some other factor built into it.

DR NICHOLS: If you dropped the "surface"^[14] water pressure though you may change the

gradient.

DR RENOUF: It is going to be variable. We have stressed again that these are volcanic rocks and we would dearly love to know -- and, again, this is looking forward to the next stage -- what is underneath the granite rocks and the other volcanic rocks and the shale series. I mean, we can make a reasoned statement about these andesites now, I think, but for the other rocks we still can't.

SENATOR LE MAISTRE: It has been suggested that before we move to the next topic we can have a ten minute break and we can enjoy a cup of coffee perhaps, which should be quite useful.

SENATOR VIBERT: You look as if you're gasping.

DR RENOUF: We are.

DR NICHOLS: He is right.

SENATOR LE MAISTRE: So could we just stop the recording, please, and have a break for ten minutes?

Adjourned between 11:30:27 and 11:48:50

SENATOR LE MAISTRE: Shall we start again? We can reconvene and move on to the next aspect of this Panel meeting. Maybe I will call on Deputy Baudains.

46 Artesian wells

DEPUTY BAUDAINS: Thank you. If I could refer everyone to the paper, the second paper that I was on previously, the comments by the Groundwater Review Group. I am looking at page 5 and note 20 because this is, I think, a fairly important issue to what we are trying to get at. It relates essentially to the possibility of water reaching us from France. We appreciate it is not going to have an enormous impact on the water balance, but nevertheless there are some ramifications to it. Now, what I am unable to understand and I am looking for clarification on is the suggestion that if there were to be an underground flow it is not possible because I think there needs to be water coming out of the ground because of the head required to drive it. That is as I understand it. The reason I am having difficulty with this is because of the number of artesian wells that we have in Jersey, and by "*artesian*" I am using the well driller's definition and not the dictionary one, meaning that it is overflowing the top of the well. "*Artesian*" means

that it rises up the well, which practically every well or borehole that is drilled in Jersey has done when they have struck water. I do not know of any where they have gone down 80ft and the water is at the bottom without rising.

Now, we have artesian ... well, I mean, to take one example, non-artesian but at La Moye, the radar station. I do not know if you are very familiar with that borehole, but it is 300-odd feet deep and the water is only about 30ft from the top, so the water at the bottom must be about 150-odd pounds a square inch to support that volume of water. At Trinity there is a borehole that we went to see on a site visit, which is artesian. It overflows the top. It is almost on the highest part of the Island. So it is difficult to see where the head of water driving that might be. But, seeing that clearly the water on the high points is under pressure and it is not coming out of the ground, as far as we are aware, in Jersey, that doesn't quite square with the fact that it would if it was coming from France, if you follow my thinking.

47 Underground water from France

DR RENOUF: The thing is that it is worth stating, just without ... I am not going to support this, but to my mind it is totally out of the realms of scientific possibility that water comes from France underground at all. I mean, it has no relevance at all to the Jersey situation.

48 Layering

Speaking about the levels to which water rises in boreholes, we have in fact touched upon that a bit this morning, in the sense that you have forms of layering and you pass from, speaking in general terms, pervious layers to impervious layers. By a pervious layer, I mean one through which water can pass and impervious would block the passage of water. If you have this situation, and I would ask you to bear in mind this notion of compartmentalisation, that because you get water **here** it doesn't mean to say that it is linking with a borehole **here** even though they may be, as in the case of this French one, only 60m apart. Bearing that in mind, you have this form of layering. I almost object to the word "*layering*" because that implies regularity. Because of the situation of the nature of the volcanic rocks and the nature of other rocks of the structure of granite, it is not like that. It is sporadic occurrences of impervious layers which can then seal in water in fact below it. Now, that water then is under pressure and this will result in

water rising up the borehole.^[15]

What is not actually possible, and I am afraid that I cannot believe that that could ever exist, is that any borehole could come out at the highest point in the Island. Anything below the highest point is theoretically possible, but in fact you take, say, one of the narrow interfluves in Jersey -- I was quoting to Deputy Rondel, say, one of those narrow zones like between St Peter's Valley and Cap Verde Valley at the back of St Lawrence there, where you have very steep slopes and a very narrow top, where usually the road runs in Jersey. In that sort of situation you could in theory bore into one which would, say, be near the Underground Hospital, if you are taking that narrow a one, down towards that end of Cap Verde. It could be feeding a pressure from higher up on the plateau of the Island. But what you cannot get -- it is a contradiction in scientific terms -- is you can't get water rising higher than the highest level of water with which it is in contact. That is a non-starter. So your "artesianity" or whatever you care to call it, the rising of water above the level where it is struck, is driven by head pressure.

DEPUTY BAUDAINS: I think that perhaps you misunderstand my confusion, and that was that I was merely stating that an artesian well does exist quite high up in Rozel. It is almost the highest point in the Island but not quite -- I am guessing probably within 20 feet or so of whatever the highest point of the Island is -- it is that high a point. It is overflowing the top as opposed to coming up, just simply coming up. What I was getting at is, given the height of that water, clearly there is a head close by maintaining that. Therefore, why don't we have water coming out in fountains -- I hope I am using the right word -- because the idea that we can't have water flowing between France and Jersey is because, as I understand it, the head required to drive it would cause water to come out of the ground in places and yet it is not coming out of the ground apparently in Jersey despite these high heads of waters. This is what I don't understand.

DR RENOUF: No. I am not ----

DEPUTY BAUDAINS: I don't know if I have made myself clear or not.

DR RENOUF: I'm finding it difficult to grasp exactly the problem. The water table, if you imagine it as a surface and you imagine the contact of the surface of Jersey with the air above, you have two surfaces. You have the surface of Jersey and you have the surface of the

groundwater table, which fluctuates, as you know, from season to season. So in fact there is a temporary water table and there is a permanent water table. But if you take that surface at any moment, it would be a subdued version of the surface-air interface so that, to exaggerate, if you have got a structure like that coming out of a surface, like one of these narrow interfluves, the water table underneath would be rounded.

DEPUTY BAUDAINS: Hmm hmm.

DR RENOUF: At a flatter zone than the top. This is just because of the way that water percolates down, that in fact as you go down towards the side it pushes out towards the edge and there is more surface for it to go down on the top so it goes in. So you have a subdued surface. But nowhere -- I come back to this and this is why I am a little bit unclear about what you are trying to say -- nowhere can you have water rising higher than water within which it is in contact. So if water on the interfluve near, for instance, the Underground Hospital (which is fairly high up) is reached at, say, 20ft, if it comes up to the surface, what it means is that somewhere higher up the interfluve, up towards St Mary's or St John's, you have actually got water at a higher level which is in direct contact with that and, therefore, it pushes it up to the surface.

DEPUTY BAUDAINS: This is what I am getting at. Why ... what is the reasoning behind, for example ... For argument's sake, why should the water from, let us say the water that goes out, not flow out as far under the sea as the Ecréhous, for example? What is to stop it?

49 Head of water driving water movement

DR RENOUF: Well, it is a question that the actual rock underneath will have been saturated, but there is no head driving it because the pressure driving water movements is head.

DEPUTY BAUDAINS: Hmm.

DR RENOUF: And that means that there must be continuous contact. Now, if you go out underneath the sea level you lose that continuous contact in a meaningful timeframe because the movement is just not fast enough to cause them to be effectively in contact. That is the best I can

50 Offer of test borehole on Ecréhous

DEPUTY BAUDAINS: Even then I don't understand it. It does seem to me that the offer of the borehole on the Ecréhous would have solved a lot of problems, because ----

DR RENOUF: I am sorry, but there is no borehole on the Ecréhous.

DEPUTY BAUDAINS: No, let me finish. The well drillers had offered to put one free of charge about 10 years ago. I presume you were aware of that? Given that we are told it costs about £8,000 to drill a borehole, I wouldn't have thought they would have undertaken it lightly unless they were confident of achieving what they said they would achieve, which was probably something in the region of 1,000 gallons an hour permanently. I mean, where would you suggest that water would come from?

DR RENOUF: I think that there would be nothing precluding a borehole yielding fresh water on the Ecréhous because there is a fairly large area receiving rainfall there, which is percolating down into the rock. Even under that, there will be a groundwater table. I would be unsure, and I would not like to say that there would be much water in such a situation nevertheless. [\[16\]](#)

SENATOR LE MAISTRE: Sorry, just to clarify that, if it was purely water that was being gathered at the Ecréhous, the probability, I think is what you are saying, that that was substantial is very slight. Is that a correct interpretation?

DR RENOUF: Yes.

DEPUTY RONDEL: Can I come in?

SENATOR LE MAISTRE: Well, Senator Vibert had his ----

SENATOR VIBERT: Yes, because in fact, this is exactly the question I wanted to ask about either the Ecréhous or the Minquiers. Whilst I hear what you say in that area, again, the offer was made to actually physically do it and then obviously test for water and try and get some determination as to where that water was from. Would that not be a sensible position to take, that we actually physically do it rather than dealing with theories? Couldn't we actually practically test it and drill it, find it, test it?

DR RENOUF: I mean, there are two points to be made about that. It would provide very useful geological information ----

SENATOR VIBERT: Which you have actually said.

DR RENOUF: ---- on what is underneath the Ecréhous and whatever the waterflow it will not prove a connection with Jersey^[17].

SENATOR VIBERT: No, you have said that too in your report.

DR RENOUF: So, you know, I don't see that, whatever it yields, even if it yields a vast quantity of fresh water, that it would prove a connection with Jersey. To prove a connection with Jersey you have got to identify movement, the possibility of movement, between the two ----

DEPUTY BAUDAINS: And is it not possible to do that scientifically?

DR RENOUF: ---- and you cannot do that. Hmm?

DEPUTY BAUDAINS: Is it not possible to do that scientifically?

DR RENOUF: No, it is not. There is no way in fact that you can do it. You can characterise the water. You can define it in tremendous detail, but it won't tell you that it is in any sense linked with that in Jersey. Knowing the geology between Jersey and then the Ecréhous, there are limestones in the channel there between ... off in fact the Tour de Rozel and a very substantial fault. Now, this fault may in fact provide an impervious layer to a lateral movement, but if you were going to have movement of water at that depth in the rock between Jersey and Guernsey, you would still have to have a head to drive it. Otherwise, any water that is there is static and not moving, you know. I think it would be a very interesting exercise, but it wouldn't in fact prove the water diviners' point about water from Ecréhous or France.

51 Putting dye in the water

DEPUTY RONDEL: Could we not do something really scientific like pouring 50,000 tonnes of cochineal into the borehole and see if it came out the other side?

DR RENOUF: As long as you pay for it.

DR NICHOLS: Sorry, Deputy, can I just come back on this point? Yes, there are cases in limestone country to determine which steam comes out at the bottom of which pool and so on or into which pool. They have put dyes in and they have been very surprised. There is possibly that method. I don't know whether you can use trace elements and introduce them.

DEPUTY RONDEL: Would it not solve the problem once and for all if, for instance ... No, I means in terms of proving or disproving? In other words, yes we get some scientific information

out of it. Secondly, we would find out whether there is a reasonable supply of water there. It could be very handy for us to have in the event of the Island running out of water if we knew there was a supply there. I don't know how we could use it.

DEPUTY BAUDAINS: Could I interject on the back of that because there seems to be a catch 22 situation here? The well drillers feel that their information has been disregarded and, in some cases, ridiculed. They are accused of not producing the evidence, but then, when they offered to do something which would, they think, produce the evidence, nobody wants to do it and the whole thing goes round and round.

DR NICHOLS: I don't know whether it would prove, as John said, but it would help.

DEPUTY BAUDAINS: I appreciate that.

52 Well at La Moye not artesian?

DR NICHOLS: And we really only need to finish off with this one thing. Were you asking about La Moye, why it wasn't artesian?

DEPUTY BAUDAINS: No, I was merely suggesting ----

DR NICHOLS: Because the other one is.

DEPUTY BAUDAINS: No, I was merely suggesting that that was water fairly high up, so if it is under pressure there and also on the other side of the Island there was water under pressure, why we didn't have water coming out in the middle, which I think was being suggested would happen if we had water coming from France.

DR NICHOLS: One of our points is that it is not a unified pressure surface across the whole of the Island.

SENATOR LE MAISTRE: Yes.

DR NICHOLS: To give an artesian borehole or an artesian well at the lower end of that pressure surface, that is all, sorry.

53 Slow movement of water

DR RENOUF: And also, you see, a very important point here is that just because you have ... in fact, it almost proves the point of the slow movement of water. You have head of water in the north of the Island and, as you come south across the Island, the water table, the height of that

water table drops, so there is a differential in terms of ... well, in fact, there is a head of water available at this point, which is the difference in height between the top of the water table **there** and in **there**. The fact that this doesn't stream up^[18] is due to the fact of the transmission, the slow transmission, of that head through the water pores in the rock.

SENATOR LE MAISTRE: Yes, that is very useful, very useful. Thank you.

SENATOR VIBERT: Can I stay on the Ecréhous, on the Minquiers for the moment, because I have made some notes on this?

SENATOR LE MAISTRE: Yes, go ahead.

54 Borehole on Les Ecréhous - wouldn't prove a link with France

SENATOR VIBERT: It would appear that there is a public perception that the Public Health & Works Department haven't done sufficient research in some important areas, whichever they may be, and one of these areas is, is there a connection between the water in Jersey and the water in France, because on its face it would appear to be, to the layman, a quite distinct possibility, given our closeness to it and the fact that we were once part of France. What the water diviners are talking about here is to actually physically put it to the test and if it fails, there's the answer, the answer is that it is not connected, and that solves it once and for all. It just disappears out of the equation. If it was successful, it might create a whole new theory as to how that could possibly happen, which I am sure would be of great interest to geologists. Would you not agree with that concept?

DR RENOUF: What I just said about a borehole on the Ecréhous still applies in one sense, that you will not be able to prove or disprove a link between the Ecréhous and Jersey on that. What you will be able to do is to prove the situation at the Ecréhous and determine what sort of water resource is available at depth on the Ecréhous^[19]. Moving perhaps further towards this notion of links with France, I mean, it is only an accident of sea level that we can't walk to France. In fact, during the last million years probably something -- and this is off the top of my head -- but 750,000 to 800,000 years of that million we have been linked to France. This is an unusual time when we are not linked probably.

So the situation beneath our feet between here and France is one of a river system which

is drowned. It is there, the river valleys of the Eye (sic) in the north and the other one just to the south of us which comes past Hambye. These rivers have a river valley one of which passes to the north of Jersey and one of which passes to the south. During all that time, if we had been meeting then, we would have been talking about a resource of fresh water in what is now beneath the sea. Now, that fresh water didn't just vanish. It well may be that this is beyond my competence. I don't know what that situation is because it has been long enough for quite a bit of geochemical movement to take place, and it may be that all the water down to any depths we are interested in has in fact become contaminated, you know, with salts. Until we actually drill it, we don't know.

55 Scattered points of water

In that sense, what Senator Vibert is saying makes sense, that if you in fact drill then you find out. I think we would still have the same problem that we have with point sources of water in Jersey, that they are so scattered in terms of useful resources that we couldn't pin them down in advance, so we would be on to a -- I hesitate to put it that way, but it is realistic -- on a hiding to nothing because we would not know where to drill, even though actually, we do know quite a lot about the sea floor, but then we know even more about the geology of Jersey and we still don't know exactly where to drill to actually maximise the point sources of water. Yes, I would love personally to have these boreholes put down. I shan't say no to it.

SENATOR VIBERT: So you will not object if we make that one of our recommendations.

DR NICHOLS: You would need several though. As John says -- I am sorry to go over it one more time -- you can't get the proof from one bore. Sorry.

SENATOR VIBERT: No, I accept that.

SENATOR LE MAISTRE: Okay. Deputy Rondel?

DEPUTY RONDEL: Yes, I have got two questions actually. The first one is a continuation about water and the Ecréhous or wherever else. Given I have seen a number of documentaries, whether it was made at the Open University or others, where fresh water actually exists coming out of the sea bed and we have seen divers actually having problems when they hit fresh water after being in sea water and whatever, we are talking about a long way out off the coast of any

land. How is this accounted for? That is the first part of the question.

Then the second question, before anybody else jumps in, is we have been told by the water diviners that we have got hot wells, hot springs -- call it what you will -- in the Island. Through experience I am aware of one, but that was 30 years ago when I was in business. That said, we have been told by the diviners there are several in the Island and how can this be accounted for? I would like your comments, but if you could deal with the first one on water from the sea?

56 Fresh water from the sea bed

DR RENOUF: Yes, water from the sea bed. Again, this is a question of head and, without your having specified the geology of the situation, all I can do is assume that in the areas where this is happening there is a bed of a definite layer of sedimentary rock, almost certainly, which is a pervious layer, in other words it carries water, and it goes out underneath the sea bed. Where it hits the surface, the pressure from the land pushes it up, and this can be at a considerable distance, because if you consider London, the main aquifer serving London is the chalk. I mean, it has gone down in recent years because of the amount of pumping, but that chalk is, what, some minimum to Central London of, say, five or six miles away. So you are getting the main supply for London coming from an area five or six miles away and going underneath the City, where you tap it. That is artesian in the geological sense because the North Downs and the Chilterns create the head to push it up in the middle. The same applies, in answer to your question, that there must be a situation where there is a water connection through pervious layers, where the water moves relatively easily out underneath the sea bed.

DEPUTY RONDEL: Well, I have been watching some of these programmes, Jacques Cousteau or one of the others, and we are talking about tens of miles out to sea and this could be the case.

DR RENOUF: It could be the case. As I say, I wouldn't like to be pushed too far on that, but, you know, I would like to see the geological example. But this will not apply in Jersey, except within the superficial layers where you have loose sediment on the top going offshore, where you could have a very minor situation occurring like that, but, again, it is a question of time also. It requires time for water to move through rock and it is not like water which is free to move on

the surface.

57 Hot water boreholes from volcanic rocks

DEPUTY RONDEL: And your views, although I think I probably already know that one, on hot water coming out of boreholes in the Island?

DR RENOUF: I don't know if Ralph had heard of that one before.

DR NICHOLS: Yes. We had it at the last public meeting, the last Scrutiny Panel meeting when George and Lewis mentioned it.

DR RENOUF: I have no idea. I am sorry, I just don't know.

DR NICHOLS: The only model we have got is it coming from volcanic rocks at depth, but don't ask me at what depth. I think there is a standard degree centigrade increase in temperature per 100m of depth, something like that, so it could be natural rather than it being any remnant of volcanic or magmatic source. But, again, until we monitor and collect the data, monitor it and do a chemical analysis of it and so on, we won't know. It obviously exists and that is the interesting point geologically, but not in terms of a possible supply for the Island in terms of ----

DEPUTY RONDEL: Geothermally.

DR NICHOLS: Geothermal energy, yes.

SENATOR LE MAISTRE: Deputy Baudains?

DEPUTY BAUDAINS: Could I come in on a change of subject, if I may, on the need for legislation, which in this report you believe is vital?

58 Need for legislation

DR RENOUF: Yes.

DEPUTY BAUDAINS: I am referring to your page 9, note 36: "*We agree about the need for more data but would make two points, the first that BGS know what data to collect*" -- and I think that is understood -- "*and the second that legislation is needed before it can be acquired since borehole users are not co-operating ...*" I think what we are seeing is a catch 22 situation, because borehole owners are reluctant to co-operate because of the fear of legislation. There is a feeling of, "Well, if legislation comes in, I'm not going to tell them about my borehole, so I'm certainly not going to let them know I've got one now." The whole thing seems to be out of fear

of legislation. Do you recognise that fact?

DR RENOUF: Yes.

DEPUTY BAUDAINS: I believe Dr Sutton has said previously that other countries are moving away from coercion and towards co-operation. Do you see a way that we could achieve this by co-operation with a better climate?

59 Working with landowners through co-operation rather than coercion

DR RENOUF: Yes. I think, if you read that French paper by Marjolet, it is very clear there and also is clear to me from ... I mean, I have a house over there now and I am very interested in the water situation. The water company there issue regular bulletins every three months which state what they are doing, and it is very clear from all of this that the whole thrust is towards working with the landowners, with people to achieve exactly the ends that we are after. Having said that, it is also equally clear that, in terms of boreholes, for instance, the statement clearly put here is that if they find a borehole which yields amounts which they want to use for their public system, their policy is to acquire it, is to buy it. Then they put in place around it zones of different strength to control the land use.

It would seem to me that it is not sufficient to rely on the voluntary system in this case. Had we had legislation in place in 1989 which compelled a number of things, but essentially which compelled information to be acquired when boreholes were put down and what the geology was and a continuation thereafter of monitoring, if we had had that in 1989, this discussion now would not be needed, because many of the issues were are discussing this morning would not be taking place, because we would have the scientific data which would have answered them.

60 Geological log

So we certainly feel as a group that it is absolutely vital that the legislation is in place for compulsion of certain things. Ralph may pick me up if I miss one or two out, but essentially what we would see as vital, in a slightly peripheral way but starting from the beginning, in a slightly peripheral way we would like to see it a requirement that every borehole that is put down -- how you define a borehole is something else, but every borehole that is put down -- there

should be provided a log which is in fact deposited, a geological log of that borehole which is deposited [20]. This would serve two things. It would serve to identify in water terms how water was related to the geology and it would incidentally -- and this is why I say some of these things have spin-offs -- it would also provide geological information in a general way on the Island. So how one can look at that is that in the past there are vast quantities of data which have been lost because that was not a requirement. So I think we feel that that would be a very strong thing to do, to insist that every borehole that is put down, that a log of that borehole should be deposited. That is No. 1 point.

61 Ongoing monitoring

No. 2 point is that in order to advance our understanding of the water data collection is essential, so that all those boreholes which the controlling body considered vital would be monitored in the way that they determined. In other words, there are various instrumentations that could be put down. You could do pumping tests and such like. So that is a thing that there would be legislation empowering ongoing monitoring.

62 Question of charging

However, the question of whether a borehole owner is charged for the water he takes out is quite another matter and is a political decision probably at the economic or just generally political level. In other words, people don't want to pay for something that they have had to pay for and that sort of thing. But that is a political issue. I am talking strictly now about the gathering of scientific data. But it is necessary to have the legal control which can be implemented via whatever group is empowered to do it. It might be the Waterworks, it might be Public Services or whatever, but they have this legal right so that the over time we build up the data which will answer the questions about which we have been largely speaking this morning.

SENATOR LE MAISTRE: Just one more point by Deputy Baudains.

63 Usefulness of data collection

DEPUTY BAUDAINS: Do you not see, feel that there is a bit of a tension here, because the law, as you say, would enable the collection of information, but, on the other hand, we see that BGS doesn't appear to really want to collect that data, certainly in regard to the deepwater, so would it

actually in that case be of any benefit to collect data because apparently they wouldn't look at it?

DR RENOUF: Well, the point is that, I mean, the BGS were only employed on contract with specific briefs. I would envisage any future water control to be invested in fact in the local body -- let us say with the Jersey New Waterworks -- and they would have access to the expertise needed to scientifically ----

DEPUTY BAUDAINS: So that block would be overcome.

DR RENOUF: Collect data.

DEPUTY BAUDAINS: Yes.

64 Control of extraction

DR RENOUF: But what information is made of those data is secondary to the fact that you need them before you can make any decision. Even the question ... I mean, there is a third element of control really on those boreholes that there should be empowerment, but that is not really for us as a geological advisory group. There should be, of course, some control on the amount of extraction, but that and whether any question of payment is involved, those are other decisions. Those don't bear upon the collection of data.

SENATOR LE MAISTRE: Yes. Can I just ----

DEPUTY BAUDAINS: Can I make one comment?

DR RENOUF: What use they make of the data ----

DEPUTY BAUDAINS: Could I? Could I? Sorry, but could I ask why that comment ----

SENATOR LE MAISTRE: Could we just hold with that for a moment because I suspect it is the same point. Sometimes the Chairman can ask a question as well.

SENATOR VIBERT: Always, when I'm Chairman.

65 The objectives of legislation

SENATOR LE MAISTRE: It seems to me that we need to separate out the objectives of the legislation.

DR RENOUF: Yes.

SENATOR LE MAISTRE: Now, it doesn't surprise me that, from a geological point of view, you would be very interested in collecting the data of the actual well drilling, because clearly that is

useful information from many, many angles. If we hold with the water issue, which is separate, in fairness to the ... it is connected, but it is ----

DR RENOUF: I did say there were two elements to the geological

SENATOR LE MAISTRE: Yes.

DR RENOUF: The geological information per se is spin-off. ^[21]

SENATOR LE MAISTRE: Right.

DR RENOUF: But the geology, in terms of explaining the water, is equally important.

66 Cost/benefit analysis - selective/voluntary sites instead of overall compulsion

SENATOR LE MAISTRE: Yes. I understand that. The question though that arises from all of this main thrust of legal powers is a question of cost/benefit analysis, if one can put it that way, and what is your view of the perception, the public perception, that this is just really another means of cranking up a bureaucracy which gives wide powers, usually for civil servants to come along with notebooks; whereas the actual benefit, which is the measurement and understanding the data, could perhaps be obtained by selective sites around the Island, however many that could be determined, and the cost of acquiring that information on a voluntary basis would be small compared to the potential.

I will give you a comparison. Water quality. There are something like 13 or 14 senior civil servants currently involved in water quality issues, because there is an objective in the end result. So what I'm just asking really is can you see that there may be another way, because I think the point here that was made was that at the moment ... what is it? "*Legislation is needed before it can be acquired since borehole users are not co-operating -- for whatever reasons are irrelevant.*" Well, I would have thought they are actually quite relevant.

67 Non co-operation - resistance to interference

DR RENOUF: No, no. I think we all feel that there are sufficient numbers of people who would put down boreholes who would for one reason or another not co-operate. This has to be done on a legal basis. The actual ... I mean, the specification that you would put in place for that would certainly put a cost upon the drilling of a borehole.

SENATOR LE MAISTRE: Can I just stop you there? What evidence do you have that every

person, or the majority, will not co-operate?

DR RENOUF: Well, the thing is this. There is unfortunately, I think -- I mean, it is probably true of everywhere, but certainly people recognise it in Jersey -- there is a tremendous resistance to the interference of something which people feel that they own.

SENATOR LE MAISTRE: Hmm.

DR RENOUF: And they feel they own the water underneath and, as has been said, people will not divulge information to official bodies because they think, rightly or wrongly, that this is a means of getting a further something from them, whether it is in terms of charges for water or in fact the ability to shut down their water and this sort of thing.

SENATOR RONDEL: I think they see it as a sort of nationalisation without compensation basically.

DR RENOUF: Yes.

SENATOR LE MAISTRE: But in order to make that ----

DR RENOUF: It is strong enough, I think, that it will compromise the proper scientific investigation of our water resources.

SENATOR LE MAISTRE: But that is a belief you have. Is it based on actual research in terms of people being asked whether they would co-operate -- I just want to know really -- or is it an assumption?

DR RENOUF: The BGS ... over the period that we were very actively involved, from 1989 to 1994, this is the greatest stumbling block that we met.

SENATOR VIBERT: Could I come in on this, please?

DR RENOUF: That we couldn't in fact get access to boreholes that we wished to.

SENATOR LE MAISTRE: Right, okay.

DR NICHOLS: But we haven't quantified that in terms of numbers.

SENATOR LE MAISTRE: No, and I think that would have been helpful probably.

DR RENOUF: I mean ----

SENATOR VIBERT: Chairman ----

SENATOR LE MAISTRE: Yes, but can we let the answer be given?

68 Powers to be exercised only when there is a problem

DR RENOUF: You see, I think it is one of these difficult situations where the degree of legislation that I would envisage, there would be implicit in it -- and I don't see how you can make it actually explicit -- but implicit would be that some of the powers would only be exercised when there was a problem.

SENATOR LE MAISTRE: Hmm.

DR RENOUF: For instance, I think you should have control of the amounts of water that are taken from boreholes and to be able to suppress the use of a borehole should it become necessary. I think that power should exist. Obviously, for much of the time one would not employ those powers, but the power should be there and I think, in the case of the acquisition of information, I think it is vital that those minimum requirements that a log of the well is made, whether you go to the lengths of saying that a geological log is made, I think this does bear directly on the water situation.

69 Minimum requirement for well log

SENATOR LE MAISTRE: Right.

DR RENOUF: The third point is that it also feeds into the general geology, but just concentrating on the water, it will improve our knowledge immensely of the relationship of the Island rocks' capacity to hold and yield water.

SENATOR LE MAISTRE: Yes.

70 Continued monitoring

DR RENOUF: And then the monitoring thereafter, using scientific equipment, that is going to interfere with the operation of the borehole to some extent. It won't actually sort of compromise it, but it will mean that there will be an intrusion on to a person's property and information will be taken from their borehole. Whatever it takes will have to be done, but I'm not an expert in the degree to which that will disturb a borehole. I think once the instrumentation is down it won't interfere with the borehole at all.

SENATOR LE MAISTRE: No, just a comment and then I will move to Senator Vibert. It seems to me, and it is perhaps (for the record) a comment said with tongue in cheek, but shades of

Occupation and, you know, the old Jersey people being monitored with everything they were doing perhaps comes to mind and I think that is one of the problems, frankly. Senator Vibert?

71 Present co-operation with well drillers and water diviners

SENATOR VIBERT: Can I just try and move the thing forward in terms of 2004, because in fact all that you have said is contained in your document in 1994. It was all about a lack of co-operation by borehole users. Now, when we looked at the history, I think it is fair to say we could understand that lack of co-operation, because in fact all the information that they had from the borehole drillers was that they were not being taken any notice of, so they were not prepared to co-operate with a committee that was treating them in the manner that they were treating them. That is why there was this lack of co-operation back in 1994.

Can I put to you that things had moved on considerably by the year 2004, because in fact there has been a meeting with the water diviners and well drillers which was organised at Howard Davis Farm by the Environmental Director, to which he called Mr de la Haye and Mr Langlois to have a discussion with them. The purpose of it was to open a dialogue for an exchange of views with drillers and diviners. Now, that is the first time that that has actually happened. So the comments about lack of co-operation really reflect 1994 rather than 2004. Certainly they were accurate in 1994 but things have moved on since then.

72 Reducing regulation in the States

More importantly, things have moved on from a governmental point of view, in that we have just passed a Bill in the States which is to cut down on unnecessary legislation. That has been approved by the States. The reason for it -- and I will just read this to you -- is that a *“thorough review of existing and future regulations was proposed within the Strategic Plan which was adopted by the States in June. Policy & Resources say that instead of relying on regulation, the Island could establish voluntary codes of conduct and self-regulation.”* So, in fact, the Island wishes to move away from legislation that forces people to do things to moving to discussion, dialogue and co-operation. Now, in the light of that information, do you think that

your group could really do with reconsidering your position in terms of legislation, which is based on a 1994 position?

DEPUTY BAUDAINS: Could I just plug something in on the back of that, because it did occur to me and you have actually raised a subject that I was going to raise later?

SENATOR VIBERT: Sorry, your Honour.

73 Involvement in talks with well drillers and diviners

DEPUTY BAUDAINS: No, it's okay. I'm not complaining. Do you think it would be useful if you were included in these talks which are taking place? Deputy Ferguson is assisting and there is, as the Senator says, communication now between the well drillers and Public Services. I mean, would you wish to be involved?

DR RENOUF: Yes. I think, in spite of what you say, the thing is "*unnecessary*" regulation/legislation. That is the crucial point here. I do not change my fundamental position, but you realise that we as a group have not discussed this.

SENATOR LE MAISTRE: No, I understand that.

74 Need for legislation/compulsion

DR RENOUF: The second element of what Senator Vibert said is would we go away and reconsider and I would certainly say, so I am offering a personal view here this morning, because I don't really want to speak for the others in this, but I would say myself that the acquisition of data from boreholes is too important a matter to be left to voluntary, to any form of voluntary co-operation. It is necessary to be somewhat intrusive, in the sense that you will put stuff down your borehole and that will be regularly checked and monitored, so that the owner would feel that they knew everything, they knew more about his borehole than he did. I sense that there would, in spite of any proposition of co-operation, be resistance from a sufficient number of people to make that movement forward very difficult. So I think myself that legislation for that, whether, as I say, there are caveats built into the legislation as to how it should be employed is another matter, but I think the acquisition of that data is vital. It has been something which has been standard practice in most countries, I believe, to provide, you know, to compel the registration of logs of boreholes because that is data and that is lost if it is not done. You cannot

depend upon voluntary work to get a coherent pattern of response.

75 Part of consultation process

SENATOR VIBERT: Could I put it to you that in fact the one step forward could be that in fact your group could become part of a consultation process of how best to get this information voluntarily and it actually makes that attempt and, in the event of that failing, then legislation may be necessary. That is the first point. In other words, in the light of the way things have moved on since 1994, can we give that the opportunity to test it and see whether that works? That is the first point.

76 Study the Law as it stands

The second point is have you actually studied the Water Law that is being brought forward that we are scrutinising to see whether that is an appropriate law to do what you would like to do, because the law has a whole other range of matters within the law rather than just getting information.

DR RENOUF: I think, on your number one point, there is only one real reply to that. Yes, we would be very willing to co-operate to see whether a voluntary system could be defined and could work. I think I would speak for Dr Sharpe as well, that ----

DR NICHOLS: If I could come in on this, there may be a way round it. I agree with John about the legislation. We all know what human nature is like and not everybody would co-operate. Therefore, we would get an incomplete picture. That picture that we want through the monitoring is going to determine the control of the use of the water resources in times of stress.

SENATOR VIBERT: Can I just ask you, to what extent are you suggesting that monitoring should take place, on every borehole in Jersey?

77 Requirement on drillers to supply information

DR NICHOLS: I was going to say that maybe there is a way around this, that if you made a law that the drillers -- there are only three or four who are drilling -- that they (and they have shown themselves willing to do this) have to submit a request to drill. They would be advised to ... so that would obviate this problem of personal co-operation, people saying "Sorry, I'm paying for this, it's my information, I'm keeping it" and the strong feeling of the old *grand coutumier* that

qui a le sol a le dessus et le dessous. It doesn't operate in water. You have got to get over that and get across that that doesn't exist. Therefore, for the public good, the information is going to be supplied by the driller. We give him the ----

SENATOR VIBERT: On all new drilling? On all new drilling, do you mean?

DR NICHOLS: On all new drilling, of course. You can't ----

SENATOR VIBERT: You are talking about just new drilling?

DR NICHOLS: Yes. You might, with co-operation, be able to put in a flow meter. You might be able to put in a measure for the standing water level in use and you might be able to establish something like the electricity company has, with somebody inspecting the meter each quarter.

SENATOR VIBERT: Do you realise that in the Water Law they are limiting it to boreholes that draw more than 3m³.

DR NICHOLS: Okay.

SENATOR VIBERT: So in fact that reduces it down, we understand, to about 500 boreholes.

DR RENOUF: I think that is a wrong approach, because that is trying to anticipate the results you are trying to get. I think that Ralph's notion here that in fact the drillers ... I mean, it doesn't matter what borehole they put down, they have to supply certain information which we would agree with them, as it were. As to who would actually decide that, well, if it is an informal body set up, fine.

SENATOR VIBERT: The group would decide.

DR RENOUF: Fine, but, equally, you know, there will be a body like the Jersey New Waterworks that will sort of operate or perhaps a Public Service's operation which will operate at one level and these should then call upon whatever expertise is needed.

78 Possible Recommendation from Groundwater Review Group

SENATOR VIBERT: Your informal group that we are talking about, that could actually make the recommendation, rather like your original Groundwater Review Group ----

DR RENOUF: It could, yes.

SENATOR VIBERT: ---- was reviewing the original proposals that were being put forward and they would make a recommendation. I take it that that is the point you are making. You would

talk about this and then say “Well, this is really how we would like the information so we need to do this, this, this and this.” But I am still not clear as to why you think it is necessary to monitor every borehole in Jersey.

DR RENOUF: No, I haven’t said every borehole. That is what would be decided by the expert body, whether it is a standing body via Public Services or the Jersey New Waterworks or the informal group. [22]

SENATOR VIBERT: I understand.

DR RENOUF: Because, no, it isn’t required. You know, that would be a decision taken on practical grounds.

SENATOR VIBERT: And that could then decide the basis of the law.

DR RENOUF: Yes.

SENATOR LE MAISTRE: Could we move to Deputy Rondel, because he has been trying to come in for about 15 minutes?

DEPUTY RONDEL: Well, you have gone past a lot of what I wanted to ask. It is the history --
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DR NICHOLS: Come back to it. Honestly, we are here until you say.

79 User pays through drilling charge

DEPUTY RONDEL: But what we are on at the moment on boreholes, etc, you are talking about putting in place a new law that could cover any new boreholes, that is fine, okay, but who would pay? The poor client who has got to pick up the bill, just say that the borers actually would give the information to take up the various files or whatever it is so you can have the information. So the time involved is obviously a cost factor.

DR RENOUF: Yes.

DEPUTY RONDEL: And, therefore, it would be the user, i.e., the person having the well, the borehole drilled, that would have to pay.

DR RENOUF: Yes, via the driller. Yes, but, I mean, there is no way round that. If you want the data it has got to be paid for. Who pays for it? Well, you know, the States at the moment are very much on the user pays, you know. It is the person who wants a borehole ultimately who

should at least bear the major proportion of that.

SENATOR VIBERT: But it is the Government that wants the information, isn't it?

DR NICHOLS: In Australia the user paid because the driller said "It's going to cost 3,000 dollars or pounds to go down to 100ft", and that included everything.

SENATOR VIBERT: Yes.

DR NICHOLS: That included sampling every 10ft. The bags were provided by the state, the sample bags, and the drill log was filled in by the driller as he went down.

SENATOR VIBERT: Hmm.

DR NICHOLS: It takes no time, or very little time. So if the cost was £3,000, that included the sampling and the completion of the log return.

SENATOR VIBERT: In other words, the user was paying.

DR NICHOLS: Even the postage stamp to send it in.

SENATOR VIBERT: The user is paying, but he doesn't really realise he is paying because it is built in to the price.

DR NICHOLS: Well, you can tell them they are paying. It is just an integral part of collection, data collection.

SENATOR VIBERT: I wasn't suggesting there was a subterfuge.

DR NICHOLS: Oh no, no.

SENATOR VIBERT: I am only saying there was a philosophy. It is a bit like when you put your petrol in the tank. You don't realise you are actually paying a huge tax to the Government.

DR NICHOLS: Or the guy who is putting it in for you. It is easy to do and it is really not a time cost.

DR RENOUF: It isn't a major, a major major cost at all. Monitoring subsequently, if you decide ----

SENATOR VIBERT: But we are dealing with the information. That is where the cost is, I think.

DR RENOUF: ---- this borehole there is, then there is a cost, because it has got to be installed and it has got to be scientifically operated.

DEPUTY RONDEL: But there is more to it. Because we would be putting a borehole in place,

there would be a charge in the first place because Planning & Environment would be involved, or some department, to put the application in, where there isn't a charge at the moment. There would be a charge also, which is already hidden, as you are saying, in the boring. So you are increasing, possibly by 5%, the cost of drilling a borehole.

DR RENOUF: Yes, it increases.

DEPUTY RONDEL: Because there is no benefit to the actual user, to the householder, of having this information taken out. The only benefit is to the States. So there should be a subsidy.

80 Ownership of water resources

DR RENOUF: Yes, but the issue there is what Ralph just said a moment ago, that water should be owned by the States.

SENATOR VIBERT: Well, that was the big debate by Major Riley and that was rejected by the States.

81 Benefits to borehole owner

DR NICHOLS: But it seems to me that it is an advantage to the borehole owner. It could be linked in with the way any application goes in now and is charged for, for extensions to a house or conservatory or whatever, that if an application for a borehole goes in and it costs so many pounds for this application, etc. The benefit to the borehole owner is that, with the information that we get through monitoring, we know what is happening to their supply of water and we can advise them through the monitoring system, the visits to the meter and everything, that "Oh you better go carefully because your resource is drying", because they won't be in a position to measure the standing water level, and "Go frugally and you will then be able to use your water over a longer period of time during this drought." It is to the advantage of the borehole owner to know what resource they have got, what they are living out of.

SENATOR LE MAISTRE: I think there is a danger here that we are going to get sidetracked into designing the future rather than looking at what actually has been happening and the recommendations that you made. Deputy Hill wanted to ask something?

DEPUTY HILL: If I could come in. I find that you didn't answer the question earlier on. It

may be I misheard the question or it may be I misheard the answer, but I think you were asked had you read the Draft Law.

DR RENOUF: Yes, in fact that was the second point and it got sidetracked.

DEPUTY HILL: We need an answer.

DR RENOUF: The answer is No.

DEPUTY HILL: You have not?

DR NICHOLS: We only received it yesterday. Is **that** the one you were talking about?

SENATOR VIBERT: The actual law.

SENATOR LE MAISTRE: The actual law.

DR NICHOLS: The actual law.

DR RENOUF: No, we haven't.

DR NICHOLS: No. I only received this yesterday from Mr Jackson.

DEPUTY HILL: I think, from some of the answers we have been getting, it is apparent actually that you haven't, and I think, with all due respect, it would have because you would then have understood why some of the concerns are coming from the Scrutiny Panel. I go back to your report on page 9, the 1994 one, and you have under 1(e) "*Reliable data and, monitoring control. Reliable data relevant to the issue is essential for everyone to gather a true picture of the subject. Pumping volumes are quite irrelevant.*" There are big changes in the law.

DR NICHOLS: We would change that.

DR RENOUF: Yes, we would change that certainly.

DR NICHOLS: We would change that.

DEPUTY HILL: Exactly, but having not seen the law and also there is a part I am just looking at here -- again, I have the advantage of having a copy in front of me -- but Part 2 talks about administration and I can understand that some of the answers you are giving are simply because you haven't read the law and you don't know what the law is intended to do and there will be certain aspects that I think you may well agree with or not agree with. I am just wondering, Mr Chairman, how far we can go into asking some of the comments if, in fairness to both gentlemen, they haven't read the Law.

SENATOR LE MAISTRE: I think that we need to go back to ----

DEPUTY RONDEL: Through the Chair, on that point, it would be useful if we gave Mr Renouf and Mr Nichols a copy of the relevant law and possibly they might wish to give us a written submission of their views on that law.

SENATOR LE MAISTRE: Yes.

DEPUTY RONDEL: Their comments.

DR RENOUF: Yes.

DR NICHOLS: Is that this final submission? Is that the same thing?

DEPUTY RONDEL: No, no, no.

DR NICHOLS: I am sorry, I beg your pardon.

SENATOR VIBERT: This is the actual Act.

DR RENOUF: Yes, I wondered about that, yes, yes

MR HADEN: It is available on the Environment Department website, but I will let you have a copy anyway.

DR RENOUF: Yes, because, obviously, from what has been said, I would want to consider this with Dr Sharpe as well, you know.

SENATOR LE MAISTRE: Sure.

DR RENOUF: And obviously have a serious discussion on this.

82 Deep Groundwater proposal

SENATOR VIBERT: Through the Chair, could I also suggest that, as part of that discussion you have with your group, that we actually then take away a document that has been prepared for us as to how we see the way in which this matter ought to be handled and that you could consider that. It would be wrong for us to give it to you now and start asking you questions about it. If you could took that away and may that also be part of your discussion and hopefully come back to us with any changes, recommendations, additions, alterations that you think would be necessary really to get to the issue of how we should find out more about Jersey water?

DR RENOUF: Yes. I mean, I think, just going back on something I sort of spoke to earlier, I mean, I don't think that our position would change much on the need for the acquisition of

geological data from boreholes which bear upon water and on a means of monitoring water, but the means by which that might be achieved and the degree to which it might be implemented, those are matters obviously for discussion.

SENATOR VIBERT: For your group to discuss.

SENATOR LE MAISTRE: Well, that was really what I was trying to come back to, that it seems to me that the main issue of contention is the lack of recognition, for whatever reason, and information about a water resource which is deeper than that which BGS have looked at. That is one of the areas of ----

DR NICHOLS: It is all the water.

SENATOR LE MAISTRE: - of conflict between the different groups.

DR NICHOLS: There shouldn't be a conflict.

83 Sledgehammer to crack a nut

SENATOR LE MAISTRE: And there shouldn't be a conflict. The question that seems to me that needs to be answered is how those two elements can become integrated in terms of knowledge which then drives whatever legislative result. Now, you could well be right that the only way to achieve this is through legislation, but I think one is having to look at (and this is part of the challenge process) whether the legislation which has to be so watertight, if you forgive me the pun, makes it, you know, very powerful legislation and whether that is really a sledgehammer to crack a nut, to use another metaphor, or whether there is another way. I think these are questions really which need yet to be resolved and, as we work through the evidence which is coming forward, it is actually, I think, becoming clearer to us that there are these elements which are the key problems.

DR RENOUF: I mean, I think the water diviners' group should be pleased in a sense that there is an implicit recognition of the fact that the deeper resource needs further and continuing investigation.

SENATOR LE MAISTRE: Yes.

DR RENOUF: The actual reasons for that, I think, might then be debated.

SENATOR LE MAISTRE: Hmm.

DR RENOUF: But I think, within the forum that you have suggested, that is at this moment the best way forward.

SENATOR LE MAISTRE: Yes. I mean, it has been suggested that perhaps once you have had a look at the law you might feel that you wanted to come back to talk about that. You may, however, feel that you just want to make a written submission. I think that is a matter for us to make a ----

SENATOR VIBERT: I think we should also make available to them the minutes of the meeting with the water diviners because they put forward some suggestions as to how they felt the information should be obtained. I think that would be useful for you to consider at your meeting as well.

SENATOR LE MAISTRE: Are there any other questions at this stage, because it seems to me that ----

DEPUTY HILL: No, because I just felt actually, from hearing the answer, that they hadn't read the right thing. What I was going to ask actually were opinions based on the law.

DR RENOUF: Yes. What we have really done is we have brought ourselves up to date.

SENATOR LE MAISTRE: Yes.

DR RENOUF: Us and you, and now we have identified the fact that the necessary next step is for us to familiarise ourselves with the present situation which exists in terms of a legal proposition or proposals.

SENATOR LE MAISTRE: Yes. Deputy Rondel?

DEPUTY RONDEL: Yes. I don't know if you are aware that on the website there is currently all the submissions that have been given to date. I don't know if you have seen them or not. It might be ... I'm not sure if you are ----

SENATOR LE MAISTRE: It makes exciting reading actually.

DEPUTY RONDEL: It does.

DR NICHOLS: If I could advise that I think Mr Haden has advised that it is on the website, but we haven't read them all yet.

DR RENOUF: No.

DEPUTY RONDEL: But it might be advisable because then you will see what actually we have been given, which is **that** lot so far on the previous hearing.

84 Water scarcity table

SENATOR VIBERT: I wondered if you had also seen the document put to us "*Sustaining Water*", which put Jersey in 11th place above the Yemen as a water shortage place.

DR NICHOLS: I was privy to that at the last Scrutiny meeting and I think it was sidelined ultimately.

SENATOR VIBERT: Yes, but unfortunately it has come back to us as being upheld and totally decided upon as being absolutely relevant, so I wondered whether you wanted to make any comment on that from your group discussions.

DR NICHOLS: We would welcome that, yes. I have seen that one.

SENATOR VIBERT: And Dr Sutton's comments on it too, I think, might help.

DR SUTTON: Can I just make one comment on that paper, which is that it is impossible to comment on unless you go to the website, which gives the basis on which the numbers are calculated.

DR RENOUF: Yes. I am still just a little bit in fact puzzled by this because, yes, one can make comparisons, but surely our decision should be based upon what we define as what is available to us.

SENATOR LE MAISTRE: Yes.

DR RENOUF: And it seems to me -- I hesitate to use the word -- totally irrelevant that we are defined here, there or elsewhere in any league table because that has little relevance to our particular position once we have defined it. Yes, it might be that we would say "Well, this country is comparable with us and look at the legislation they have put in place, so we must do the same." That is the only way in which I can see it being of any use.

SENATOR LE MAISTRE: One can only deduce that they were trying to demonstrate how serious the situation was in Jersey if we are worse than the Yemen.

SENATOR VIBERT: That's what they were doing.

DR RENOUF: I noted something that Senator Vibert said earlier, that the general opinion now

is that our resource is quite adequate. I think it is considerably at danger.

SENATOR LE MAISTRE: But we don't have the information. That is the problem.

DR NICHOLS: No.

DR RENOUF: No.

SENATOR LE MAISTRE: Deputy Baudains, because I am conscious that we really ought to wrap this up.

85 Formation of group

DEPUTY BAUDAINS: Can I just build on the matter which Senator Vibert raised probably about 20 or so minutes ago now, because up until this point we have had about a decade of tension between the drillers and Public Services and the BGS because the well drillers were accused of only offering anecdotal and hearsay evidence, but on the other side they didn't believe that the BGS were doing their job properly because they were not investigating deep water, so nobody trusted anybody. We now have them talking together and I wondered if you would, you know, if the whole process would benefit actually from a proper group being formed, which would include yourselves as well, and whether that was worth driving forward.

DR RENOUF: Yes. Well, I mean, that is something that we will discuss and, yes, I mean, I am sure that we are amenable.

DR NICHOLS: Yes.

DR RENOUF: Absolutely.

DR NICHOLS: It is the only way to get the maximum information.

SENATOR VIBERT: And we have the information here with you people. You live here. You are part of the Island and you were cut off in 1994.

DR NICHOLS: And painful it was too.

SENATOR LE MAISTRE: The well ran dry at that point.

DR RENOUF: No, we were conserving our resources.

SENATOR LE MAISTRE: The well of experience ran dry.

DEPUTY BAUDAINS: Yes, but you weren't being monitored.

SENATOR VIBERT: That will do, guys, that will do.

SENATOR LE MAISTRE: Right, before we record too much of this joviality, may I thank you very much for your attendance and the wonderful way in which you have expressed ----

SENATOR VIBERT: Yes, thank you very much.

SENATOR LE MAISTRE: ---- the knowledge that you have. I am sure it has been extremely valuable in terms of not only the record, but it has helped us in our understanding of this very interesting issue and thank you very much.

DR RENOUF: Thank you.

[1] Weathered and eroded

[2] Not totally so - we don't know.

[3] This implies no other movement - horizontal incoming pressure may also create a head

[4] for recharge

[5] Note from Dr Nichols: but slowly

[6] as separate or perched aquifers

[7]

[8] figures given by Senator Vibert above

[9] banging the table

[10] as a stream

[11] ie lines of structural weakness cutting across Jersey

[12] demonstrates with hands

[13] Note from Dr Sutton: What I was trying to say was that we do not 'have' the deeper levels of groundwater providing supply in Jersey, (it might have been clearer to say 'use' rather than 'have' although their occurrence has yet to be scientifically verified). However these deeper groundwater resources do act to sustain the near surface or shallower groundwater levels during drought periods.

[14] upper

[15] Note from Dr R. Nichols: when the seal is pierced

[16] Note from Dr Nichols: supplied by a head in Jersey? We just don't know.

[17] Note from Dr Nichols: or France

[18] overflow

[19] Note from Dr R. Nichols: Can a pressure surface be resolved in the Rozel Group which dips towards the Ecréhous. Could a major fault be a feeder to the Ecréhous from Rozel Group?

[20] filed

[21] Note from Dr R. Nichols: Discussion point: It is essential to determine the location and distribution of the resource. The term 'spin-off' seems to imply reduced importance.

[22] Note from Dr R. Nichols: Discussion point: I would argue for a complete picture from a complete survey. Details from every borehole would give us the total picture - the linked, the isolated etc - so we can legislate for control/use in droughts.