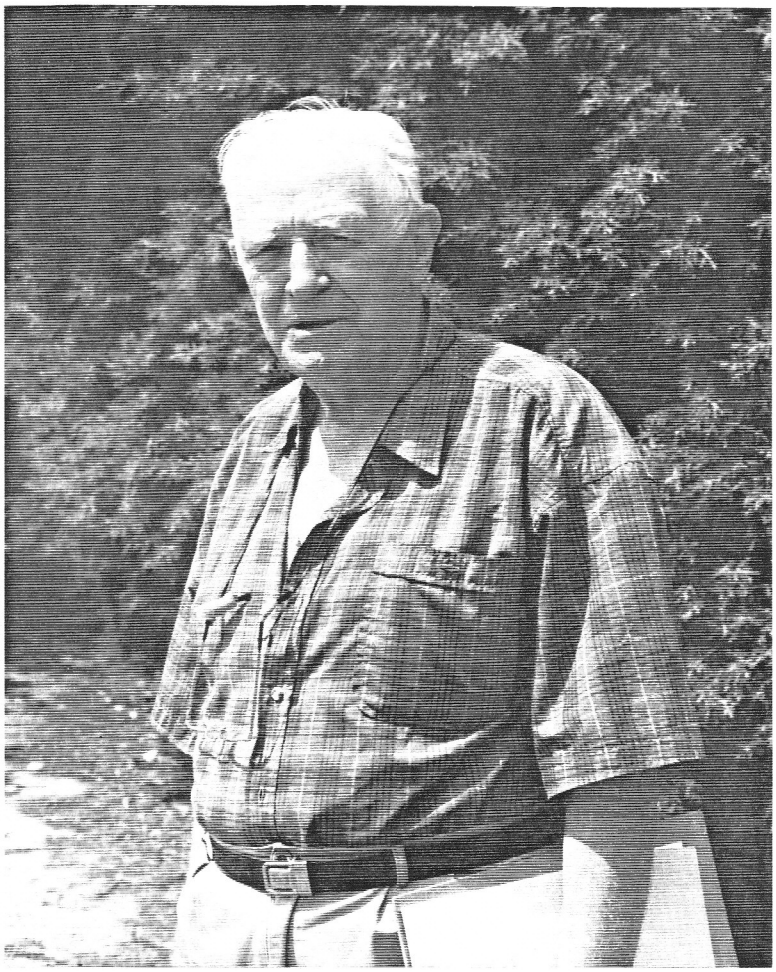
ARN FOKKEMA

Anne (pronounced Arn) Fokkema was born in Friesia, Holland, in 1919. He graduated as an engineer from Delft University in 1947, and for the next three years worked in Indonesia. He arrived in Australia in February 1951 and began work with the Commonwealth Department of Works in Melbourne. In August he went to New Guinea with the Department, and he married Joan there in 1953; they had two children. Arn and Joan came to Canberra in 1958. Arn assisted with the design of Bendora Dam, and was the head of the design team for Corin Dam. He subsequently worked for the department on assorted engineering projects (including Googong Dam), retiring in 1982. Arn and Joan live in Queanbeyan, in the house they moved into when they arrived in 1958.



Tape 1 Side A

Arn came to Canberra from Port Moresby in 1958 and at first worked under Norm Sneath on designs for buildings. A while later George Redmond came down from New Guinea as principal engineer and he asked Arn to design the Bendora Gravity Main. However 10 days later the pipeline project was put on hold for 10 years owing to lack of finance. So Arn then joined the Bendora Dam design team; under Ken Harding, he worked with Nick Trahair, Brian Kearsley and Tony Condon. Bendora was 'a nice thing to be involved in'.

The four worked on a trial load analysis to establish the stresses in the dam. Thin arch, double-curvature dams had been built in Italy, France and Portugal. The trial load method had been developed by the US Bureau of Reclamation in the 1930s for the Hoover Dam. A very time-consuming exercise, the analysis involved cutting the dam into five vertical and five horizontal slices, and working out equations for the twenty-five points of intersection. It took a month. The University of NSW computer was

then used to work out the 'unknowns' resulting from the calculations. The first result showed a stress that was unrealistic, so new figures were fed into the computer and the result was more reasonable, but still not wholly satisfactory.

Consequently a structural model study was undertaken for more rigorous analysis of the dam shape. Executive Engineer Keith Jack went to Rome to seek Italian help with the study. The model was concrete and jacks were used to simulate the water load. The result was that the dam could stand many times the load to be imposed on it (theoretically). In the meantime the contract had been let to Clementsons.

A model at the Snowy lab in Cooma was used for spillway studies. The water had to fall so as not to undermine the wall, and needed to fall so as to be contained in a narrow area and its energy had to be dissipated. The need to reduce negative pressure on the crest (to stop the overflowing water sucking concrete off the crest) was also taken into consideration. Arn feels 'it was very interesting work' and comments on the resulting dam being pleasing to the eye. An arch dam looks good in mountain country, he says. Later Arn comments that an arch dam 'feels right', whereas an earth dam is 'just a heap of dirt'.

Dams have to last 'a long, long time'. Mechanical equipment (eg valves) have a limited life. Concrete dams do not last forever either. Factors influencing design include location of dam relative to population areas, shape of the valley, size of maximum floods, size of reservoir, etc.

It was Keith Jack who first decided on an arch dam at Bendora. Then Ken Harding became a strong proponent of arch dams, and he believed in them even more strongly than Arn.

There were close links with the Snowy throughout the project, and Snowy people like Ivor Pinkerton and Johnny Hunter were involved. A carload of Canberra engineers would travel to Cooma: 'Everyone was keen to talk to the specialists...They were a great help to us in what a dam should be, what a dam should do, what are the traps in the design of dams'.

The French dam which collapsed at the time did so because of a small weakness in the foundation. Foundation rock is cleaned with high pressure air and water, then grouted to fill cracks etc. In the French disaster, cracks of a few millimetres filled with clay weren't grouted sufficiently and the foundation gave way.

Tape 1 Side B

In Italy another catastrophe occurred when a landslide went into a dam reservoir and pushed a huge wall of water over the arch dam wall and drowned a village downstream. The dam wall however survived, indicating its strength. A gravity or an earth dam would have failed.

During construction, Arn went out to Bendora a few times per month, whenever Dug Tonissen needed to discuss a design matter on site. Trips were usually day ones; he stayed overnight a couple of times. The access road was fairly rough, and difficult in wet or snowy conditions.

The formwork was pre-fabricated and its positioning was carefully checked by surveyors, like Bill Tweedie in particular. The contractor worked well in this process.

Arn recalls the cableway: 'It always looked quite businesslike with these concrete buckets running from one side to the other, lowering down, people on the bottom ready to receive them, pushing buckets to the place where you place the concrete. Vibrators rattling'. Engineer Rom Katauskas [also interviewed] was hit and injured by a bucket. Dam sites are quite dangerous because of the energy in a swinging bucket.

The walkways on the wall were 'a bloody long way up'. Although Arn says he was not afraid of heights, some others tried to avoid going up the ladders. On the other hand, some workers rode the concrete buckets for thrills.

Regarding protection of the river from pollution at the site, Arn says a concrete dam is a 'clean operation' compared to an earth and rockfill dam. He did not see the period of cleaning the abutments which would have been a dirty process. A settling basin was downstream. Arn confrms that anyone working on the dam had to have a certificate saying he did not have certain diseases. Arn got his from a health officer in town, but he was never asked to show it when in the Cotter catchment.

Ken Harding was an excellent engineer and a 'good bloke'. He expected a lot from you, and believed strongly in his views but was willing to discuss yours with you.

John Dalgarno was in charge of establishing the site, then Dug Tonissen arrived from the Northern Territory. Known as 'the wild man', Dug dressed like a derelict and looked like a navvie on the site. He was enthusiastic and could be hard on his staff but was a good engineer and organiser. Dug liked drink, cards and horse racing. He and the workers identified with eachother. He could mix equally well with the contractor's workmen, with his supervisor staff and with the Canberra departmental hierarchy. He enjoyed life.

Dam workers, says Arn, were 'something special'. The Snowy scheme had given them status, and they felt elevated above other construction workers. They moved from dam to dam. Department of Works clerk Val Dunn had his young son at the dam once and the son talked of 'Daddy's dam', so the pride was shared by clerical staff too.

Arn did not know John Muir and the other Clementson staff all that well because it was protocol for Dug, not the designers, to deal with the contractor.

John Dalgarno had expected to be resident engineer but had a difference of opinion with the Director of Works over the type of gravel used on the Bendora road. Dalgarno was pleasant but with a temper, and he rarely forgave others.

Arn recalls hydrologist Jack Edwards. Edwards was involved later with Corin's hydrological studies. He loved to fish when out in the field doing his river studies. Once he brought a frying pan into the office in Canberra. 'Why are you carrying a frying pan?' someone asked. 'I'm fed up having to fry my fish on a bloody shovel', was the reply.

Most Snowy workers were migrants. Thus, as a good number of Bendora and Corin workers came from the Snowy, they were migrants.

There were no women at Bendora, apart from 'visiting girls'. 'In most dam camps, I think, a room was set aside where "girl guests" served the men when they wanted it, a few times a month.'

Tape 2 Side A

Arn never saw any of the prostitutes, and says maybe a lot of the stories were just that. The Bendora camp was very basic.

He can't recall an official opening at Bendora. The dam filled slowly until a big fall of rain when it filled in a weekend. The valves had not been closed and timber from scaffolding was in the valve tower, so the valves couldn't be closed. 'The whole bloody tower was vibrating like mad', and there was a 'roar like a train'. However Tonissen was able to get the timber out and the valves were closed.

Supervisors on the dam included Keith Knuckey, Bill Sauverain and others. Mary Hough drew all the design drawings for Bendora. Terry Brady was a draughtsman in the Canberra office and usually drove the jeep out to the dam during Arn's visits.

The interview now shifts to Corin. Ken Harding had gone overseas and then returned to Works. Arn by now was above him in the hierarchy, but they worked well together regardless. Don Stockdill had replaced Keith Jack. The dam was in the early stages; it takes 10 years from investigation to completion for a dam. While Ken wanted an arch dam at Corin, Arn felt arch dams had their limitations. An earth and rockfill dam lasts a long time; dirt is the result of millenia of erosion — it can't be broken down much further, unlike concrete, says Arn.

The greatest challenge was finding good materials locally for the core, rock and filter zones. The earth has to have low permiability, but particles that are nevertheless moved by the water have to be caught by the filters. Pore pressure acts on the core. The rockfill has no pore pressure, and resists these forces. The difficulty was knowing whether sufficient quantities existed, judging from sample excavations.

A better access route was needed than the one from Orroral. Also, Kangaroo Creek needed to be explored for likely core materials. Consequently, Arn and a geologist were going to traverse the route through Smokers Gap to the dam site on horseback. But Works couldn't afford the horse hire, so the Geologist went alone. Arn later walked the route with two soils experts [Jack Baring and Bill McDevitt]. This trip confirmed the route was a good one for the road, and that the camp would have to be up out of the reservoir area. Forestry had already marked a track as far as Smokers Gap.

Arn went to Corin weekly or fortnightly during construction.

The spillway design had to be changed because of poor rock and became more expensive. The superelevation of the end of the spillway chute was designed to throw the water away from the exit end of the diversion tunnel.

The Corin camp was 'far better' than Bendora where the huts were minimum standard. At Corin they were pre-fabricated and there were separate rooms [there was room separation at Bendora too]. Alcohol was significant here as elsewhere: wherever it's men only, 'you have a lot of beer around'. The road was far better than at Bendora.

Regarding the relationship with NCDC, Arn says 'they were our bosses. They had the money'. Decision-making involved Clive Price and others; Arn was at the level where he didn't have to deal directly with them. He got on well with NCDC engineers.

Arn feels Thiess were good contractors. But he didn't deal directly with them, for the same reasons as at Bendora. At Corin resident engineer Graeme Kelleher [also interviewed] was the contact point with the contractor.

Talking of pollution control, there was a settling pond, and there was one at the borrow area as well. But 'any time it rained hard, it all came down. It was not very satisfactory.' Yet the sediment settled out before it got through Bendora Dam. It is 'nearly impossible to contain all the dirty water on a site'.

Arn has a faint memory of an opening ceremony. He points out that unlike a bridge which has a definite opening occasion, a dam isn't really open until it has filled, perhaps long after completion of actual work.

Tape 2 Side B

The severe drought prevailing at the time was very lucky for construction. Floods caused by heavy rain can destroy an earth and rockfill dam. The diversion tunnel can

only be built so big. 'You have to be a bit of a betting man' in selecting the size of the tunnel.

Arn discusses the unpopularity of dams today, in contrast to the 1960s. He likes the setting of a dam in a mountain valley like the Cotter, saying the 'nice looking lake' complements the river and bush. Should Canberra have another dam, it should be on the Gudgenby at Naas (i.e. the Tennent site), on the border of the national park and the farming area. The philosophy of land resumption for development projects is argued.

Reflecting on his career, Arn talks of working on designs for aerodromes, roads, bridges, then dams. It was the dams which gave him the greatest satisfaction and enjoyment. He used to take visitors to see Corin and Bendora.