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REPLY



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Although we had hoped authorities in Queensland might discuss our paper after careful examination, we do welcome the Discussion of our macroproject by Finlayson, advisor to various governmental agencies and commissions, the infrastructural expert Peel, and hydrology consultant McMahon, all Australians working in Victoria. It is unusual, and desirable, that useful comments (positive and negative criticisms) are offered in print to macroengineers trying to improve humankind's lot within the earth biosphere. Certainly, the availability, quality, and reliable delivery of freshwater to humans and their cultivated and grazed property is a top-priority macroproblem affecting almost everyone on this planet (McDonald *et al*., 2011). We accept their positive comments but for brevity will confine ourselves herein strictly to addressing their negative comments as best we can.

We never suggested/calculated the "specific details" of the undersea freshwater pipeline macroproject proposed because such technical details are not required in a broad-scale proposing outline that was clearly meant and definitely intended not to inhibit the future development of views on the subject macroproject by the significantly better informed Australians and citizens of Papua New Guinea.

As to the monetary cost of freshwater to consumers, as the Discussion rightly points out several times, such costs are extremely variable, depending as they do on so many factors as to be virtually unknowable even by those persons closest to the macroproject planning. For example, Victoria—and Melbourne in particular—evidently saddled taxpayers with a huge public debt payable only by taxpayers after the construction of the Southern Hemisphere's (and Australia's) largest seawater desalination plant in Wonthaggi. At a still estimated cost of A$3.5 billion, ultimately producing 150 GL of potable freshwater annually, this plant is now being labeled by Australia's national news media as eventually a "A$19 billion white elephant" because rainfall suddenly and unexpectedly refilled drought-dry public reservoirs in Victoria. Interesting, before this uneconomical plant was undertaken, a macroproject to pipe-harvest freshwater directly from Tasmania to Melbourne was considered by government officials but, finally, rejected when prognostications of impending rainfall total decline in Tasmania became known to planners. We were taken aback that Finlayson, Peel, and McMahon demand, literally, that far-distant outsiders stationed in the United States make such ultradetailed infrastructural assessments for Australians! Perhaps if we had, then their negative criticisms would have been "Americans are dictating to [nationally touchy] Australians"?

We think, not believe, that Australian farmers and stockmen currently operating in Victoria and New South Wales are likely to migrate northward to Queensland because they will need to do so to produce the crops/cattle they chose to nurture. For example, Frederiksen, Sisson, and Lee (2011) agree with us and Finlayson, Peel, and McMahon, that climate change may necessitate changes in farm and ranch land use especially as the forecast for a 10% reduction in future precipitation over southeastern Australia is expected to be an inevitable continuing climatological trend. In other words, the climate in Tasmania and southeastern Australia is probably going to become harsher, less conducive to outdoor agricultural pursuits.

We derived a generalized picture of geographical conditions from Tisdell (2010) and we did not attribute any particular insight to that cited author's publication. Perhaps our method

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should have been more distinctive. As to the Finlayson, Peel, and McMahon complaint about absence of "storage sites", we think such sites are unnecessary if run-of-the-river extraction is widespread in practice in Queensland. Such is the case, for instance, along the Mississippi River in the United States as well as other locales worldwide. Finlayson, Peel, and McMahon in their draft Discussion, misuse the word "like". We must suppose that they actually meant "likely". Farmers may never enjoy moving from currently farmed, and Victoria-taxed, real estate (farms and ranches) to other Australian states. However, if they wish to remain farmers and ranchers, it is possible that they must migrate northward toward or to Queensland! We assert that we did not "dismiss" anything. Rather we are realists. Finlayson, Peel, and McMahon used a highly emotional, journalistic phrase to once again trivialize our original macroproject-proposing paper. Furthermore, as to their demand for "sterilization" of imported freshwater, we did suggest fine-scale filtration in our paper. If, at little additional cost, we make Fly River runoff utterly abiotic before its delivery to Queensland, that seems perfectly doable as well as cost effective.

The Finlayson, Peel, and McMahon pronouncement of "no relevance" is easily misread. Do they really wish to dismiss real-world examples from elsewhere as irrelevant? We consider such infrastructural examples as opening the door for further discussion of our macroengineering proposal. Subsequently, they claim also that examples of underwater pipelines within Australia make our motives and thinking unclear. All the pipelines mentioned by us are submarine and within the national territory of Australia. We cannot ever agree with Finlayson, Peel, and McMahon that the Papua New Guinea–Queensland macroproject had "virtually nothing to do with the coastal zone" since we do address most all of the major problems associated with installing a freshwater pipeline through three coastal zones (one in Papua New Guinea and two in Australia)! Nevertheless, we do admit overlooking one macroproblem in Papua New Guinea—the Fly River's tidal bore, which can affect shipping (Chanson, 2011). [Hubert Chanson is at the University of Queensland, Australia.]

The Victoria-built seawater desalination plant at Wonthaggi, allegedly capable of providing 150 billion L of potable freshwater yearly, is soon to be connected to Melbourne Water reservoirs by an expensive overland pipeline. The freshwater provided will be costly, especially when compared with the very-low-cost freshwater we suggested be bought from Papua New Guinea to serve consumer needs and wants of residents of Queensland, Australia. If farmers, say, leave Victoria and move northward to New South Wales or Queensland, that would be a net loss of taxable income and real property taxation to Victoria. In addition, if the Wonthaggi seawater desalination plant really proves over time to be a "white elephant", then those heavily taxed Victorians remaining will really be up to their ears in Victoria's publicly incurred state debt. Just as in the United States, Australia's states compete with one another! Melbourne and Victoria will be more hard-pressed to remain truly prosperous during the early 21st century.

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