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Ms Louise Gell

Senate References Committee
for Environment, Communications, Information Technology and the Arts
Parliament House
Canberra ACT 2600

Dear Ms Gell,

Inquiry into the extent and economic impact of salinity

Please accept this submission for the Inquiry from the Water for Australia group: we will be pleased to submit further details, as required by the Committee, and are prepared to attend Committee hearings to answer questions from the Committee.

Salt Pasture

One method of reclaiming salt affected land: using a mixture of saltbush, halophytic grass and halophytic clover

Summary

Introduction

A civil engineer with an extensive career, Laurie Hogan, has considered throughout his working life how he might apply his engineering knowledge to finding a solution to Australia's problems of water supply and salinity.

He has refined a system that involves the desalination and re-use of ground-water for irrigation and afforestation. He has also designed the equipment necessary to install the system, which – he has calculated – will reverse the trends of water-loss through river drainage and agricultural land loss through salinity. The Water for Australia system would not just slow, or prevent, further deterioration within our agricultural sector, it would considerably raise farm productivity, and contribute to the stabilisation of agriculture in both dryland and wetland farming areas.

A CD explaining the WfA concept is available. L. Hogan has submitted his scheme to a previous salinity inquiry, which was called by the House of Representatives: this submission containing detailed illustrations of installations and agricultural layouts together with tables of income and costs.

Q & A – Present Inquiry

Although this Senate Inquiry pointedly asks for feedback on specific ploys put in place to overcome salinity in agriculture, the answers all seem to be in the negative, or close to it.

(a) Have goals of national programs to address salinity been attained?

Clearly, we would have heard of such results had they been achieved: no solutions have been reported yet.

(b) What role are regional catchment management authorities required to play in the management of salinity-affected areas, and has suitable legal and financial support been made available to assist them in achieving the national goals?

Again, without a clearly defined theory of salinisation and its effective long-term treatment, catchment management authorities are hamstrung in acting to clear up the unwanted salt. Also, without an overall national plan of definitive action to eliminate salt from groundwater, individual CMAs are lacking in guidance as to the best course of action, and, thus, will not be able to work comprehensively – and in unison – on the problem. Similarly, the Members of Parliament, who make the legislation aimed to bring salt-affected agricultural land back into production, are doing little more than applying band-aid support – if they act without a comprehensive plan.

(c) What action has been taken as a result of recommendations made at the House of Representatives' Science and Innovation Committee's inquiry _Science overcoming Salinity: Coordinating and extending the science to address the nation's salinity problem_, and how those recommendations may be furthered?

While much research is duplicated, and the extent of salinity is measured yet again, what is being overlooked is the range of alternative suggested solutions… like the one presented in this submission. If eventually, the WfA system is recognized as a possibly promising concept worthy of being trialed in a pilot project, then who will count the cost of lost opportunity, were such a trial to prove convincingly successful?

The Right Questions?

Were the right questions asked in the House of Reps' inquiry into salinity, and are the questions that are being asked in this present, Senate Inquiry the ones that should be being asked? Perhaps the Senators could have asked what was wrong with the Science and Innovation Committee's Inquiry in that it failed to turn up positive, salinity-defeating ploys worthy of being run as pilot studies. The Senate Committee might have given to its Inquiry the task of finding out how one of the House of Reps Inquiry's 'six key messages' was:

> **The best that can be hoped for from recharge control treatments is a slowing down of the rate of future salinisation. Rehabilitation of existing salinity damage is generally not economically viable, owing to the sluggish response of watertables to recharge reductions.**
>
> (Appendix E – Key lessons from the National Dryland Salinity Program)

Not putting too fine a point on it, a large part of Australia's food-producing land is on its way to joining the Sahara, which, itself, was once a 'breadbasket'… and our top agricultural brains cannot find a way or reversing the process. Rapidly encroaching salinity is not an interesting research puzzle; it is a catastrophe that threatens Australia's national survival – and one that demands urgent remedial action. The time for reflection is past: no stone should be left unturned in the search for one, or more, genuine solutions to this problem – even if their implementation might involve a measure of national planning beyond the capacity of individual farmers and private corporations.

The Problem – Salination

Apart from the recent igneous rock formations to the nation's east, the rest of the continent's plate is sedimentary rock, which was formed in salty primeval seas.

Where groundwater fills the space between bedrock and the root-zone of surface vegetation, primeval salts reach ground level, and kill all but the hardiest halophytic plants. Since European settlement the process has accelerated, through excessive irrigation (in wetland areas), and through excessive tree-felling (in dryland areas).

The Solution – Desalination

The problem caused by the addition of unwanted salt in the root-zone of herbage is reversed by the removal of this salt, primarily through drainage.

The regular placement of large deep wells throughout a salt-prone farmland lowers the water-table, and ensures an air-zone around the roots of surface plant – as long as the saline water, which has drained into the wells is pumped out of them, again, and sent somewhere else. Where, else, should it be sent – through purpose-laid, subsurface pipes – but to a desalination plant. When the water and its dissolved salts are forcibly separated, unusable saline water is converted into two usable products: potable irrigation water and a mixture of salts for commercial processing. So, the originally salty water is pumped through standard PVC pipes to the Desalination Unit; then, after desalination, it is pumped back through wide-bore pipes to the fields, where it will irrigate a crop.

Win/win Situation

For the cost of teasing apart the salt and the water in saline groundwater, salinity-prone land is converted into irrigable fields; and, a valuable, industrially-usable resource is produced: salt. Needless to say, one efficiently running Desalination Unit will service a number of agricultural properties, and will produce a steady supply of salt. The presence of irrigation crops (including timber) in association with the availability of commercially-usable salt will attract people to the countryside to work in the food-processing factories, timber mills and chemical plants that will be set up in areas that, at present, are economically depressed and solely agricultural.

The Water for Australia System

The engineering aspects of this concept have been fully thought out and drawn up, with both the equipment for the digging of deep, wide drainage wells and that for the production of 30cm diameter subsurface pipes having been designed, drawn in detail and patented. For maximisation of flow, a 10 cm diameter pipe to carry saline water to the Desalination unit, would be laid in the same trench as the 30cm diameter pipe taking desalinated water to irrigate crops and trees.

Wells are bored on a one kilometre-square pattern; the shallow-laid PVC pipes link the wells with one another and lead on to the Desalination Unit; pipes inter-connect at the pumping stations. These pumping stations draw water from the well they are associated with, and also form a grid whereby they send water from one station to the next. By a system of electronically-controlled valves, such pumping stations might send fresh water to irrigated fields, and at the same time, through other pipes, gather water from wells to send it to the Desalination Unit.

For reasons of efficiency, grids linking pumps, agricultural fields and Desalination Units can be quite extensive – forming a major system, which relocates water around the map according to demand. Within dryland farming areas, such water grids would parallel the electricity grid: one having the flow reinforced by pumps, as water passed through its pipes; the other having the flow of electricity in its wires boosted by transformer boxes.

The WfA system does not involve open-plains cropping methods. Instead, to maintain low watertables, it uses wide forestry strips interspersed between equal-width cropping strips: the treed areas represent a plant rotation phase of long duration.

A National Water-Grid

Assuming that such an innovation proves its worth – starting with a single Desalination Unit and associated grid – soon, farmers, in other salinity-prone areas, would also press for having the insurance of their own water purifying and recycling systems, and demand their own Desalination Units.

Depending on the right blend of political will and common sense, the application of desalination technology would prove to be both a necessity for farmers and a successful experiment for agriculturalists. Scientific monitoring would discover that areas, which, prior to desalination, were losing production, had, after joining a water grid, turned their economies around.

After some desalination systems have been installed overseas, and the remaining unconnected Australian pastoralists have realised that, in the face of encroaching salt, they have no alternative but to become part of a desalination water grid, the nation's agricultural land will be covered by a small number of large, regional water grids.

Science/R&D/Testing/Application/Engineering

Considering that the problem of progressive salinity is not succumbing to the traditional methods of science, it is time to widen the search, to seek solutions beyond the basic disciplines of biology, soil science and geology. With the problems of an excess of groundwater and high concentrations of salts in this groundwater, the twin solutions, of the removal of water and the removal of excess salt from this water, will yield to engineering methods rather than to agricultural ones. At the same time that engineering methods were applied to the processes of removal, full consideration must be given to the ecology above the surface, and to the microbiology below the surface, of the regenerating soil.

Sustainability

Salinity, like the reduction of fertility in farmland, is a sign that Australian agriculture is out of the pioneering, exploitative stage, when the productivity of land was simply assumed. Now, two centuries after the beginning of European style farming, the imbalances of an exploitative phase of farming are becoming clearly apparent: if farming practices suited to the unique, Australian environment are not researched, then soil fertility will continue to fall, and salinity will continue to spread through areas that have a water imbalance. Without development of a maturity in agricultural methods – including replacement of elements removed in farm produce, practices that maintain a deep water table, and maintenance of a rich microbial life in the soil – Australian farming will continue to deteriorate.

Of concern to the Senate Committee's present inquiry, if Agriculture is to be continued, while, at the same time, water tables are to be returned to pre-European_ settlement levels, then fundamental changes in thinking must be applied to our methods of using the continent's low fertility soils, which are underlain by saline bedrock.

Species

Once salinated soils have had their water-tables lowered to agriculturally-feasible levels, agricultural research into crop species, and tree varieties, which will maintain a sustainable environment, is essential.

Trees in the forestry strips would be fast-growing, hardwood species; they would be chosen for suitability to their environment from a range of hybrid halophytic eucalypts produced by the *Saltgrow* nursery in Queensland.

Rotations

The strips of trees and field crops would be rotated every twelve to fifteen years, depending on the time it took for the timber to reach millable size. In the cropping strips between the afforestation, cereals, field crops and pasture would be rotated.

Irrigation

Water would be applied to crops using drip or subsoil irrigation methods, and this would occur usually in the early mornings. The amount of water applied would be monitored constantly to ensure that the water-table did not rise unduly.

Life of the Soil

WfA would promote the use of methods that were conducive to the growth of microbes and worms in the soil: this would cause an accumulation of humus in the topsoil, ensuring retention of moisture in the root-zone. These conditions would be created through regular irrigation, subsoil ploughing, the growing of green manure crops, and ensuring that there was a reasonable plant cover cooling the soil at all times.

Economics

Digging wells, installing pumps, laying pipes, and building Desalination Units to establish the WfA, complete desalination system would be costly at the start. However, L. Hogan has estimated that a typical system would reach the break-even point after eight years; and that after the first crop of timber was harvested (12 –15 years), installation costs would have been covered, and a particular instance of the WfA grid system would go into profit.

Engineering Work

The setting up of a small WfA grid is probably beyond the resources of a single farmer, or group of farmers; it is also probably outside the operating plan of a multinational corporation.

The digging of dams, laying out and burying of pipes, erection of pumping stations and, of course, the installation of a desalination works are all cost intensive activities, which are not likely to be justified by any private agricultural enterprise – or, even, a consortium of farmers.

For this reason, it is foreseen that public sponsorship would be the only way that effective desalination systems could be installed – both for single units and for the co-ordination of single grid systems, which were amalgamating to form larger grids containing two, or more, Desalination Units.

Prior to the setting up of a first water grid, it would be necessary to tool up for the making of special-purpose 30cm PVC piping, and for the equipment that digs the deep drainage wells. This would also need considerable seed capital, which would most likely come from a government source.

Acquisition of Land/Credit for Farm Development

Farming properties, which are salt prone but still in production, becoming salinated and losing productivity, or completely salinated and out of production, could all benefit from the installation of desalination technology.

The equity of such land might be with the original farmer, still, or it could be with the lending authority or receivers. Once suitable investigation had shown that the land, if returned to production, was economically viable for agriculture, then long-term, low-cost credit could be created – for the farmer to have engineering work done so that the property could be joined to a grid and, so, to a Desalination unit. Alternatively, properties that are not in effective production, but which would contribute to the GNP if desalinated, could be acquired by the Crown to be converted into productive agricultural units by being developed by paid, farmer-managers as part of a desalination water grid.

Although the administration of such a national redevelopment scheme would be unusual, it would be more beneficial to the nation – and less costly in the long run – than to allow ever-increasing areas of the countryside to fall into disuse through salinity.

Operational Costs

Considering that agriculture in Australia must be changed to become sustainable – or otherwise have large parts of the nation's farmland become salty deserts – turning the tide on salinity is, in fact, a national emergency, and there is, in the Constitution, provision for the government to step in, in such cases.

Energy for Desalination

Discovery of a low-cost process for the desalination of saline groundwater is a valid subject for research. It is likely to involve reverse osmosis, but, if so, the method of creating the electric power for this process is open to investigation: it could involve some way of converting solar energy to electricity.

Replacement of minerals taken from the soil

A vitally essential part of a sustainable agricultural system involves maintaining the fertility of the soil, and, in large part, this means replacement of elements that leave the property in produce. With implementation of the Water for Australia system – involving the recycling of water on a farm, and a greater intensity of agricultural production – the maintenance of long-term soil fertility would require considerable investment in ensuring the replacement of minerals that were removed in crops.

To be certain that desalinated farmland did not suffer 'mineral-mining' as a result of the inadequate application of mineral fertilizer, crop analysis combined with the provision of financial assistance – to ensure a suitable level of fertilizer application – would probably be an essential part of farming within a water-gridded, desalinated area.

Monitoring of Soil Chemistry and Water Levels

As well as analyzing the levels of minerals in trees, crops and stock leaving a farm which used recycled water from a water grid, the actual soil on such farms would need regular monitoring for changes in the levels of its minerals. Such testing, together with the associated replacement of minerals lost, would be essential costs in using the WfA system – ensuring that it did not accelerate the depletion of minerals.

Ongoing Research

Implementation of the WfA system, would be a new step in sustainable agriculture in Australia, and hence, a 'work in progress.' For this reason, an additional cost in the innovation process would be ongoing research, which monitored the system for unexpected changes in the soil, such as changes to the organic matter content, or deterioration of soil structure. Of course, on the positive side, some additional research costs would involve attempts to further maximize plant and animal husbandry in water-gridded areas.

Projected Break-even Point and Profitability

While the costs of tooling-up for, and installation of, a water grid and its associated Desalination Plant, are high, correspondingly, the profitability of crops and stock grown in areas using such recycled water are similarly high. This means that the time taken for product profit to cover installation cost is relatively short: the estimation of time taken to reach the break-even point, where profit covers initial cost, is approximately eight years. After that, profitability rises quickly and the system becomes fully profitable with the harvesting of the first timber crop: this is in the range of twelve to fifteen years, depending on location and timber growth rates.

After the first cut of timber, the system should be fully paid-for, and generating wealth.

Balance Sheet – Installation of Water for Australia Scheme

While there are costs associated with the running of desalination plants and the pumping of water, the overall balance of using recycled water via a water grid system is all in the positive.

Hardwood Timber

Planting the newly developed, fast-growing hybrid eucalypts, and watering them judiciously, Australia will produce, sustainably, a valuable product that is in demand and, elsewhere, produced primarily from native forests: hardwood timber.

Increase in Productivity and Value of Land

Farmland that uses water recycling and which maintains a deep watertable, while benefiting from irrigation, is decidedly more profitable than the same land which formerly supported only dryland farming – dependent for its moisture only on rainfall.

The value of land incorporated into a water-grid will rise in value considerably, and this will offset the expense occurred in having the wells, pipes and Desalination Units installed.

Industrial Development from Recovered Salt

Salt recovered from groundwater is rich in minerals, and does not comprise only sodium chloride. Thus, an industrial complex will grow around an initial Desalination Unit; and, within such commercial concerns a number of elements will be extracted while other salt products, such as pool salt, will be refined. A valuable resource, which currently drains to the sea, or fills agricultural land, will be recovered and utilized for profit.

Decentralisation of Industry and Population

Salt produced by the Desalination Units will provide a reason for the development of chemical industries in parts of Australia , which are far from the coast, and currently solely agricultural. New workers, drawn to these more remote, inland areas will enrich the culture of the countryside and boost the economy of rural areas. With an increase of forestry in former dryland farming areas, the weather will be moderated, and people will be attracted to living, and working, in the hinterland as the climate becomes moister and cooler.

The result of this will be a renewed decentralization of population plus an increase in GNP from the new industries.

Water Grid

Throughout a water-grid system, it will be possible to redistribute water to make up for irregularities in natural rainfall. This will make agriculture in these areas much more predictable and reliable. Owing to the recycling of water and the fact that fifty percent of crop production in gridded areas is forestry, the climate in these areas is inclined to improve: installation of water grids, with their associated forests, is probably the best method of drought-proofing Australia, while also ensuring the national food supply.

Introduction of Seawater to Water Grid

A WfA water grid installed not far from an ocean, such as in southern South Australia or near the southern coast of Western Australia, could, with the laying of additional piping, draw seawater into the grid. This would add water, for irrigation, to farms within the grid, and supply the chemical complex with salt additional to that yielded from groundwater. Such a link between the ocean and a grid, would bring added benefit to the region serviced by that particular grid.

Administration

Who runs a water grid? Which administrative body would be responsible for making the decision to procede with the installation of the wells and pipes, and with the erection of Desalination Units? Would it be possible to set up a pilot project to test the theory? And what would be the most appropriate levels of input from public and private entrepreneurial sources, and should a balance between them be sought?

Funding

While funding for such an ambitious project could come from a multinational corporation, it is reasonable to think that a large private entrepreneur would only provide venture capital for a water-grid system if it could be assured that there was a good return to its shareholders for such a commitment.

It is more imaginable, however, to think that a university department with a strong commitment to the host country, would be more likely to set up an experimental pilot system to establish the feasibility of the WfA plan. After such a project had proved itself to be promising economically, public funding would be more likely to be found to install a first commercial water grid system. This could be in one of the failing agricultural areas: possibly it might be set up somewhere in Western Australia, where salinity is most extreme, and where, in some places, groundwater is saltier than seawater.

Again, it should probably be stated that the private provision of credit for the tooling-up and installation of a commercial desalination system would most likely prove financially crushing to participating land-holders and also to public bodies charged with the building and servicing of Desalination Units. Alternatively, were the government's Constitutional emergency powers called upon to create long-term, low-cost credit for both farmers and statutory bodies, involved in establishing a WfA scheme, the engineering work and factory building plans could be completed readily – as a matter of national emergency.

Ownership

This also is a fraught question. In a land where large spaces and small population originally dictated public ownership of all public utilities, perhaps a similar situation obtains again to-day. Private ownership and exploitation of much of Australia's rural land has proved already that the combination of distance, cost of production, and an extremely variable environment is now resulting in the loss, possibly permanently, of many of our rural resources.

While independently minded farm-owners might oppose any hint of the nationalization of land, the present salinity catastrophe suggests that some form of contractual, public/private ownership of the land would allow farmers to keep their properties while it empowered government to provide them with the opportunity to survive in a stabilized, publicly-funded agricultural environment. Such public funding would be more in the form of a very long-term mortgage over the farm properties that were improved through being included in a desalination water-grid system.

Repayment of such 'mortgages' would be considerably easier to make than the present, crippling ones to private financial institutions; also with vastly increased profitability of the land, owing to improved water availability and better climatic conditions, such contractual payments to government for the engineering work on their farms will be cleared easily.

With the necessity of ensuring adequate addition of chemical fertilizers and the monitoring of water levels and water content, a public/private contractual relationship between farmers and a government authority would ensure that water-grid land was husbanded adequately long after installation costs had been paid.

Conclusion

If there really is a catastrophe in Australian agriculture, and land really is being permanently lost to production – and possibly converted to desert – through salinity, can government rationally ignore the Water for Australia proposal, which offers so much?

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