MULTI STATE WATER TRANSFER PROJECT (Australia Oct 2010)

The recent Murray Darling Basin Authority plan to buy back irrigation water to protect key environmental assets comes at a time when global food demand is expected to double by 2050 and Australians are looking at ways to play their part in adjusting to a future carbon constrained world. Both issues will be difficult to adapt to without adequate water and we simply ask is there a better way. We say yes, take a look at the Northern Australia tropical region where most of our rain falls almost every season and goes to sea by rivers. "Moving water from North to South is the long term answer." The immediate thought of many on how to move this water south, is to transfer by pipe. While this is feasible, when one looks at making and delivering suitable pipes to move the volumes of water needed, the cost is indeed very high. A lower cost and proven option we need to look at is lined canals which the western states of USA have been using for over 100 yrs to move water from melting snow to meet the needs of agriculture and urban cities.

Canal Technology

But what about evaporation loss, when moving water a long distance in open canals. We have been in contact with the operations & engineering personnel of the Central Arizona Project canal (CAP) that moves water 600 km from the Colorado river through the hot arid Arizona desert, to Phoenix and Tuscon with only 2% annual water losses (3% in summer and 1% in winter). This canal also supplies water to farms and communities on route via privately run pipe systems. Lower cost water for agriculture is subsidized by higher water charges to city residents and industries. This canal also recently replaced its central control system cabling with fiber optic cable and allowed local communication groups to rent capacity. Is this an opportunity to introduce backbone fiber for NBN for our inland towns. We estimated costs to construct similar canals in Australia by using USA excavation and canal lining estimates of head count, materials, fuel and power per km of finished canal. However, building canals in remote areas of Australia will require slightly different techniques as we do not have the population and facilities that can be readily called upon for supply of labor, concrete, excavation etc. We have identified new and improved methods of excavating and lining plant that are available in Australia now and will prove successful in reducing the time and costs of local canal construction.

Canal water demand, route topography and route options

Without going into the detail of our studies we figured S/E Australian long term demand for new water was 4000 -8000 GL pa, this is quite close to water the MDBA is looking to buy now (ie 3500 GL now up to 7600 GL in future) to meet long term environmental flow demands. We estimate up to 33% of river water just before it flows to sea in the Gulf of Carpenteria and/or N/E Qld could be diverted into canals for transit to areas of need. CSIRO climatic studies on future rainfall indicate N/Qld rainfall patterns should hold on for 90 yrs while southern rainfall could diminish 15% within decades. This could lead to a one third reduction of surface water availability in the southern states. Our canal water will run by gravity in graded aqueducts, and when grade runs out, pumps will lift water to a new section to maintain flow. Power requirements are significant and we expect to be initially using gas engines or turbines to power canal. When carbon charges become an issue, power from geothermal, hydro, wind, solar, biomass or nuclear will be considered. We identified that water markets in Qld, NSW, Vic and SA will come from irrigators, environment and urban demand. Two off "stage 1)" route options have been identified, both starting at the Burdekin Falls dam in N/E Qld which is located near Ayr.

Option 1) moves water down Western Qld/ NSW into the Darling river at Menindee, from where it flows to the Murray at Wentworth (We also see a possibility to modify embankments on the Warrego river to reduce losses and convey water part of the way.

Option 2) runs down Central Qld/NSW finishing at Tocumwal on Murray. (See sketch)

The former route has potentially lower construction costs but because it runs through a region with few established farms or towns its customer base is limited. To maximize community contact our preference at this stage is to take the central Qld/NSW option. Either option will have subsidiary canals to Brisbane and Sydney to meet future urban demand. Once canal water gets into Murray, Victorian and South Australian regions can both benefit from additional river water to meet their irrigation and urban demands..

Annual Pay Back Calculations

Preliminary capital expenditure estimates for either canal option, amount to approx $9-10Bn. To obtain pay back we estimate water to irrigators be charged out at $250/ML, water to environment at $128/ML (cost price), and water to city dams at a little under charge rates required to get returns on desalinated water, ie $2.00/ KL or $2000/ML. To make all this happen we estimate the project should be funded by the Federal government over 50 yr at 2.5% interest via a public private partnership (PPP) with majority federal control, (We think the public wont go for full privatization).A first stage project would divert 4000 GL pa of water from the Burdekin Falls dam in N/E Qld and ending at the Murray, (with 40% of water to environment, 40% to irrigators and 20% to city dams). At these rates, returns of 17% pa should come to a Fed Government PPP from water sales, lower desalination and water buyback savings, plus reduced drought relief. If large scale carbon farming techniques are used to irrigate crops for eg grain production, 11% returns could come from soil carbon offsets, plus taxes on sales of grain and ethanol produced from straw. This provides a total of $ 2.7 Bn or 28% gross returns pa. Additionally $30bn of GDP multiplier benefits to the community would be generated from value added gains, welfare, new employment, tax revenue plus 7% reduction of Australian carbon emissions.

This compares with a suggested MDBA spend of $6Bn on water buybacks plus $5.6 Bn on water saving infrastructure designed to return 3500 GL to the environment. The public needs to understand, the future dry years projected for southern Australia will reduce return of buy-back water for environment needs. Whereas, northern water from monsoon rainfall can be reliably delivered most years for irrigation, environment and urban usage. The real benefits from new water are more with what you can do with it than the initial gains from water sales. Satisfying demand for future food and bio-fuels is a good start

Environmental constraints
Most of canal environmental concerns are covered in our more detailed overview We are evaluating effects of the diversion of 13% of total river water going over the barrier reef. In last 20yrs coral density has decreased and is associated with wider variation of rainfall and higher average temperatures, typical climate change factors. This subject still needs further independent study. Findings may come down to which is the greater public risk, southern river and environment needs or reef health Reef recreational fishermen consider catch will be down without seasonal flows, and Ayr irrigators may also want more water.

Future Murray Darling Basin and Urban needs for new water
In August 2010 a senate committee report on food production in Australia indicated as a result of population increases the global community faces a challenge to feed itself by the middle of the century. From an Australia perspective, it is important we maintain water resources and productive agricultural land to meet a doubling of demand for cereals, red meat, and dairy items that could be with us within the next 10-20 yrs. If the challenge is not met the consequences for global peace and security could be grave, and Australia will not be immune. Increased water availability will also be valuable for new opportunities in the mining and bio-fuel sectors. To meet these challenges we are seeking support from government and/or investors to turn our concepts into plans. An independent study is needed to confirm our pre estimates on water infrastructure while looking at issues of future food in-security. To cover all bases the study should also take into consideration issues such as water and food wastage, transport, and labor availability within regions.

Terry Bowring
Director, T Bowring and Assoc Pty Ltd,

Stage 2 water from Gulf
Townsville
Cloncurry
Burdekin Falls Dam
Winton
Longreach
Rockhampton
Barcoo River
QLD
Warrego River
Charleville
Brisbane
Cunnamulla
Toowoomba
Ballone River
Bourke
Inverell
NSW
Warren
Port Macquarie
Sydney
KEY
Main Canal
Subsidiary Canal
Pipe
River Crossing
Water from Gulf
VIC

Multi State, North to South, Water Transfer Project (Australia) Oct 2010

1) Overview

Australia's southern states are facing water shortages when world food demand is about to double from global population expansion. State governments are investing up to $14bn on desalination plant for coastal city needs but so far, little on inland infrastructure. Ql'd rivers which once delivered water to southern regions from big rainfall events are drying in transit over arid land. To maintain and expand agriculture and communities dependent on water, we need to tap into huge reliable volumes of northern water going to sea and to strategically move it to areas of need. CSIRO climate change modeling indicate rainfall in N/Qld will hold at current levels for 90 years, while 15% reductions in southern states in decades, may cut back surface water for irrigation by 35%.The aim of this preview is to show the economic, social and ecological benefits of investing in N to S water transfer. With a 60% population increase projected in 40 years and increasing global food & fuel demand, reliable northern water can assist crop and industry developments and enable de-centralization policies to work. Northern water will be a more reliable source of water for the environment than water- buybacks, which return little to environment in dry periods. New crop and plantation carbon farming initiatives can start <u>now</u> to reduce emissions (via bio-fuel & soil carbon sequestration) to levels that allow renewable energy programs to catch up before rises in atmospheric CO2 levels increase global temperature significantly.

2. a) S/E Australian water transfer opportunity:

It is estimated that on <u>average</u>, 173,000 GL pa of river water in N/E Qld and the Gulf of Carpentaria goes to sea each year. Part of this volume, which amounts to ~100 times southern city needs, could be better utilized by moving it to areas of need. Others have suggested southern irrigated agriculture should be moved to the north where all the water is. While the lower north has potential, few have made the move to the top end because of higher evapo-transpiration rates than rain delivers. We looked at infrastructure costs to move 4000 GL pa of water 1500 km south by pipe or canal and it soon became obvious that the cost of making pipe in cities, trucking it to site by road, and laying it, at $32bn, was unlikely to be economic. We next looked at constructing concrete lined canal to move the same volume from a Burdekin dam source through either a Western Qld-NSW route to the Darling &/or a central Qld-NSW route to the Murray in Victoria. From either option, a combination of rivers, subsidiary canals and pipe, could move water to major irrigation areas and city dams in Qld, NSW, Vic and SA. Canal route, length and outlets would be determined by market need and topography. Water delivery to farm/town users must be designed to minimize wastage. It will be desirable to hold seasonal water in upper Burdekin water storage dams prior to moving it to permeable aquifers, or, to dams covered by safe mono-layer films to reduce evaporation losses. We also see long term potential to recover and treat some of the 65million GL of stored brackish and quality water in the Great Artesian Basin. Where quality / pressure can be balanced with natural aquifer inputs, this water can be treated to a potable standard by new economic modified osmosis technology and then added to canal. Power to run canal pump stations will initially come from gas engines or turbines using coal seam or basin gas available in Queensland. Gas pipeline is already in place on part of proposed canal routes and where it isn't, new pipe will be installed. In the long term, we also see potential to use wind, solar or geothermal power sources on or near route, and/or utilize the wastes from grain crops or plantations to produce power and bio-fuels from proven Syngas processes.

2. b) Water source statistics:

CSIRO estimates of rainfall trends indicate N/Qld will maintain or slightly increase current patterns for 90 years, while southern regions, starting in the west, continue to dry out. Capturing water from rivers such as the Mitchell & Flinders and/or the Burdekin & Herbert could supply up to 24,000GL pa of base-load water to move south. However our aim is to take no more than 33% of rivers flow (4-8000GL) before it goes to sea. A good water source point for a start off major canal would be the Burdekin Falls Dam which has a current storage capacity of 2100 GL. This dam has engineering potential to hold 7600 GL and upstream storage sites could hold up to 17,000GL The mean flow to sea (at Clare) from Burdekin (less 1300 GL to irrigation) is 8250 GL pa. There is potential to join the Herbert to the Burdekin (at latitude 18-25 & longitude 114-25) By so doing, combined flow over the Burdekin Falls dam could go up to ~11,700 GL pa. Tropical areas around the world are experiencing increased climatic cyclonic activity which may explain two ~28,000 GL flows down the Burdekin in 07/08 and 08/09. By usage of mono-layer films to reduce dam water loss, these occasional big flows could be held over in upstream dams, to even out flows to sea, thus reducing concerns reef ecology will be effected by loss of catchment water to sea

2. c) Preliminary Costs/ returns, environment issues and route options

Costs- We estimate the combined main and subsidiary canal/pipe costs of either canal route option, delivering 3750 GL of water to crops, environment flows and city dams in Qld, NSW Vic & SA would be approx $9 Bn each.(see 2.c maps for canal route options) Irrigators on the Warrego consider it possible to modify river embankments where water break-outs occur. By so doing the river could reduce peak flow losses to Darling by 95%. If proven, this will allow major reduction in infrastructure costs for a W/Qld–NSW route.

- We estimate if 3750 GL of water was sold only to irrigators and for environment flows at $250 /ML, returns on main & subsidiary canal capital would be ~10% pa
- If 3150 GL was sold to above groups at $250/ML and 600 GL was sold for city water at $1.80 KL (same as desalination costs) returns could go to ~31% pa
- If double the water or 7500 GL pa was put down the same routes, canal capex would rise by approx 55% and delivered water cost would reduce by approx 20%

These preliminary costs were based on USA canal construction data of material, labor, equipment and energy usage with long term finance provided at 2.5% interest as in USA If finance rates rise to 7.5%, canal costs will go up by 20% and delivered water cost by 66%. We have EOI's to design/build canal from US canal contracting groups as well as Boral (for concrete) and Jemena (gas pipe line). These and other groups have contributed to our pre-estimates but we still need funding support to further evaluate factors such as,-

: Route plans are spatially/geologically surveyed to ensure best fit with land and clientele.

: Ensure canal routes can economically work around flood plains and river crossings.

: Check availability of easily accessible sand and rock for on line concrete production,

: Potential of dams & aquifers to store large volumes of water and recover economically

: Suitability of land near canals to improve vegetation, future plantations and agriculture.

: Potential of various surface cover or mono-layer techniques to reduce dam evaporation.

: Potential of syngas fermented bio-fuels to produce ethanol/power and recycle nutrients

: Usage of surface mining and new lining techniques to reduce canal construction costs.

: Evaluate Warrego river modifications to reduce peak water break out losses by 95%

Returns, Australia's premier research organization the CSIRO, has identified key forces that will shape the world. **1)** We live in an increasingly food in-secure world, **2)** We live in an increasingly urbanized world, and **3)** We live in a future carbon constrained world. N/E Qld seasonal water can play a part in adjusting to these challenges in S/E Australia. By capturing and distributing water to a central Qld-NSW route crossing major rivers in the MDB we can provide a more reliable source of water to top up rivers and wetlands in dry periods, than water buy backs have so far demonstrated. By strategically infiltrating water to a landscape set up on carbon farming principles we can improve water retention, fertility and begin to create a bank of soil carbon offsets. Based on concepts indicated in this report and available cost benefit analysis we estimate ~ 31% pa gross returns could come to a Federal PPP from a Central Qld-NSW canal delivering 3750 GL pa of water, 20% to city dams, 40% to environment and 40% to irrigators in eastern states. On top of this, GDP multiplier benefits of $30bn and 7% carbon reduction are projected. Returns come from water sales to city dams & irrigators, bio-fuels & power, taxes, carbon offsets, reduced drought relief etc. By supplying top up water to rivers flowing west, we can help protect key MDB environment assets. While protecting the environment is important, it has to be paid for. There are large revenue earning projects under consideration which could benefit from new water. Large coal and coal seam gas projects proposed in the Qld Gallilee basin and the Darling downs, both need water and could benefit from agricultural carbon offsets in this region. As the country continues to dry out, SA & Vic will be most in need of new water. By starting the first stage of a canal project between the Burdekin Falls Dam and the Darling Downs we can prove up new systems to reduce construction costs while confirming potential for carbon offsets. Irrespective of route chosen, adequate compensation will be provided to QLD catchment authorities for water delivered.

Environment issues

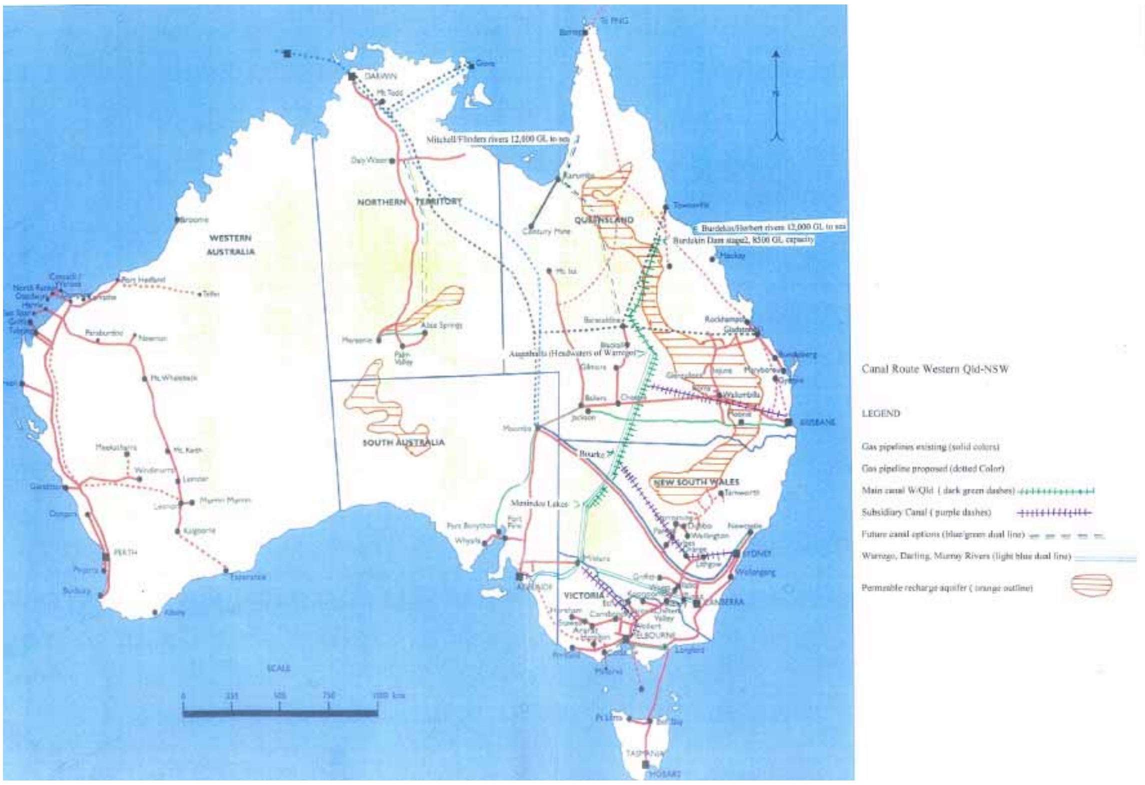
Water Services Australia projections of future need for 1.5 trillion litres (1500 GL) of desalinated urban water and Wentworth group projections of 4200 GL of water to sustain the Murray Darling Basin are so high, that a N to S transfer of northern water now going to sea must be considered an option, provided, the ecological impact of doing so is minor. All the source N/E QLD rivers under consideration carry agricultural silt which infiltrate tributaries of the Barrier Reef Lagoon. Diverting 4000 of the 29,000 GL pa mean flow of all rivers to sea over the reef should part reverse this impact, with little effect on ecology.

Canal Design factors to protect environment

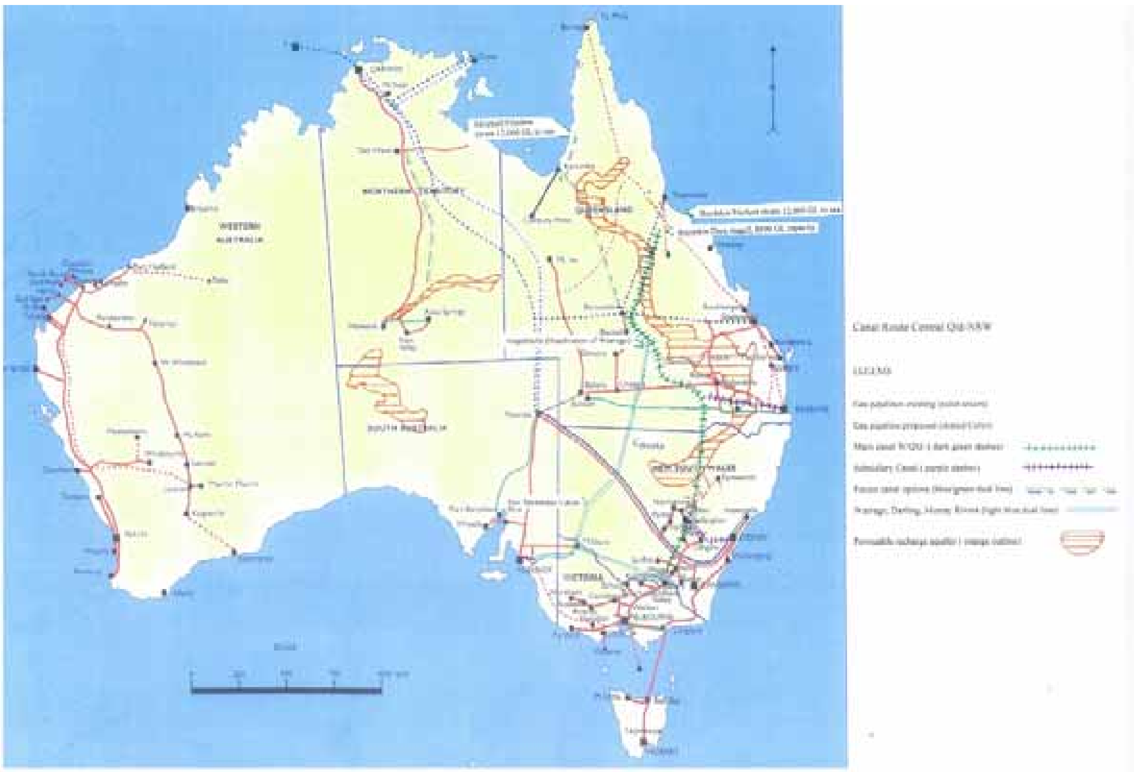
Canal contracting groups in the USA who we suggest could oversee our project have been working to tight USBR environment controls on multiple installations. Energy to move water a long distance is a major cost and emissions factor and we have selected a route to minimize lifting, while still providing ease of water distribution to online users. Where practical, stock routes will be used to reduce easement costs, while still providing user benefits. Unsealed Roads will be on canal embankments and fences built on either side. Needed cross-roads and animal crossings will be built into the design. Radial gate flow structures on canal will control water levels and when needed, isolate canal sections to allow drainage and repairs. Cross stream flow will be directed by levees & contouring into canal cross- drainage structures. Inverted siphons and/or bridges will be used to cross large rivers and streams. Out-turns will direct water to subsidiary canals, pipe, rivers etc.

Integration of water with multi-basin carbon reduction innovations

Over the years there has been much criticism of the role of indiscriminate water usage on the past deterioration of the MDB. We have learnt many lessons from this and see large potential to integrate water transfer and usage with carbon farming techniques that will improve water retention, rehabilitate landscape and control salinity. Cane toads & Tilapia fish can be removed by filtration, and dry/hot southern climates will stop toad movement. Items 4- 8 describe how new water, integrated with agriculture can improve land fertility that lead to carbon offsets that could cut total Australian carbon emissions by up to 7%pa.



Canal route western Qld-NSW



Canal route central Qld-NSW

3.) Solar and renewable power

Studies of future opportunities indicate - 1) Use of thin film PV covers over canal or solar towers could generate power needs. Day solar power can be stored by holding water in elevated storage areas and metering it out at night. Technology is now under consideration to make this happen. The use of PV solar covers over the entire canal could generate up to 1.5 Gw of exportable power This power when combined with the potential for hydro power from stored Burdekin dam water, future power from waste crop biomass and reduction of power needs for desalination on the coast, should result in large renewable power and carbon offsets coming from northern water transfer.

4. USA canal experience:

For over 100 years the United States Bureau of Reclamation have been building concrete lined trapezoidal canals to recover seasonal river water from melting snow and moving it thru suitable land to make it profitable for agriculture and industry. Most USA canals have been financed by the Feds at 2.5% interest rates on condition that “user-pay” water charges are to recoup capex and operating costs over 50 yrs. By opening this land, canals have led to the development of W/USA cities such as Los Angeles, Tuscon, and Phoenix, plus associated industries, to which they still supply water. Canal construction costs are less than pipe for equivalent volumes and transmission loss from evaporation & seepage when run through eg the Arizona desert at 100Km/day, are repeatedly found to be rated at approx 4% per 1000 km of transit. Canals are easier to maintain than pipe which can have air supply problems during inspections, also, unlike pipe, they can be upgraded in volume flow as demand develops. In recent years demand for water in Western states has begun to exceed supply and authorities have begun saving seasonal water, excess to needs, by storing same in aquifers along canal routes. Water charges to growers along canals are around $60/ML but can be as low as $30/ML when subsidized by hydro-power or higher city water charges when the water is also servicing major cities. Use of centre pivots etc, to minimize water usage, can add ~$50/ML from Capital/ Power/ R&M costs. Problems of algal development in canals have been solved by usage of sterile fish to eat algae and weed. The main benefit that has come from canal infrastructure within the inland regions of the western states of USA has been large industry and economic growth not only from agriculture but with resultant influx of other industries once population increases develop.

5. Market Opportunities:

With large demands coming out of N/Asia for agri-commodities, bio-fuels and mine resources both agriculture and mining should continue to be industries of major focus. Below are economic and environmental benefits made possible from making new water available.

5. a) The Murray Darling River's needs for 1500 GL of environmental flows: Based on historical sales high security water would cost ~$2800 /ML or $280 on a 10% return basis. If Government financed canals as suggested, the delivery charges for environment water @ $128 /ML would be approx 50% less and could save $230 mill pa. This is a cost effective option to buying out water rights whose volume may reduce as climatic drying takes hold. Water right buyouts can lead to loss of towns, no longer supported by farms.

5. b) Supply coastal city dams at prices well below costs of desalination. ie, $1.80/KL: Estimates indicate water delivered by canal/ pipe to city dams, could average ~$0.55/KL

5. c) $100bn pa grain and fuel sales from new water, to supply Asian markets:

The GRDC are projecting by 2020, grain output of 100 million TPA could come from value added areas of demand such as ethanol, starch, feed concentrate, meat substitutes etc. The main requirement to grow a quarter of this volume, is a temperate climate and reliable rainfall and/or irrigation water. If a North to South 7500 GL pa canal system as described above, was set up to irrigate 3.2 million ha of land with new irrigated wheat varieties yielding 9T/ha (6T in north -12T in south) it could produce 26 mill T of wheat. (ref- S Kearns GRDC). With variable growing costs of $2000/ha (inc'l $750 for water) and a grain price of $350/T, the crop could generate $9.1bn pa revenue and $3.0bn pa of grower margins. It is possible to concurrently recover 12T/ha of straw from above crop while retaining stubble. This could be converted to 12bn litre of ethanol & generate 7.5 million Mwh of base load power. Ethanol sold at 70c/L would generate $8.4bn revenue, (60% of our fuel demand) giving a $3.4bn margin. To meet larger demand, more canals sourcing water across the top end from Qld toWA would be required. While these plans are ambitious, as Asia urbanizes grains and bio-fuels will become higher value export items. Taxes at 30c/Dollar and GDP multiplier effects will create large economy benefits. By rotationally growing other grains, legumes or camelina (an oil seed for bio-diesel crop which double crops with wheat) we can potentially develop up to 150 million TPA of CO_2 carbon offsets coming from soil carbon, energy and bio-fuels. These offsets could be useful in protecting coal mining and other large CO_2 emitters from carbon charges. If plantings could be expanded using water further west, they could offset all our emissions.

5. d) Ethanol and Bio-diesel

Projections are by 2015, $30 bn of Australia's trade deficit will be due to oil imports. We plan to introduce a proven ethanol from cellulosics technology via www.brienergy.com. This syngas fermentation technology can produce ethanol and power from carbonaceous feed-stocks such as waste plastics, straws and MSW. It also can recycle essential P and K crop nutrients in a ash form, (a solution to peak phosphorous concerns). NSW has already mandated introduction of ethanol into fuels and by 2012, it will reduce costs to motorists by allowing purchase of a lower cost E10 fuel with lower carbon charges. Cars can be fitted in NSW with a $350 fuel conversion kit to use regular fuel or purchase E85 fuel at approx 2/3rds the current cost of regular fuel. (yesterday's cost, who knows tomorrow?)

Considerable selective breeding work is underway to adapt a local tree species Pongamia Pinnata for production of bio-diesel from annual harvest of its oil bearing seeds. Oil yields of 3-10 T/ha/yr are possible when plantation trees are grown at rate of 250 trees/ha This project www.pacificrenewableenergy.com.au also has potential for carbon offsets.

Opportunities are developing to produce oil from algae grown in covered ponds or clear pipes. Demo plants using CO_2 from ethanol fermentation and cement kilns are planned.

We note a non-gasification low GHG, oil from coal process, is now available from Exxon in USA. When combined with bio-oils it could be an interim low emission transport fuel.

5. e) Meat: $revenue traditionally triples the value of grain used to lot feed animals. As populations in Asia urbanize a 80% increase in world meat demand by 2030 is expected. The methane ex cattle/sheep is responsible for 18% of our GHG. We should reduce meat usage, but its amino acids are important to health. More intensive cattle feed-lot shedding and effluent plant can be designed to capture methane and use it to develop power. Cereal based meat substitutes, poultry, pork and even kangaroos, do not produce methane output

5.f) Dairy Farmers in recent dry periods have found it less expensive to feed cows grain than on pasture grown using expensive irrigation water. Dairy farms could triple feed /Ha while halving water usage /litre of milk by using intensive farming systems to grow grain for feed**. (see7.0),** US grain fed cattle tend to yield 2 times more milk per cow than ours. Demand for dairy products and stock is already high and expanding in China particularly.

5. g)**Wine& Fruit**: Low water allocations in NSW, Vic & SA grape districts put $3bn pa of wine exports at risk. Many in this industry are now looking at how to tap into huge markets in Asia. Many vignerons desperate from prolonged drought are selling water rights at low prices.

5. h) Mallee Eucalypts to control salinity, sequester carbon & produce industry products:
Mallees are a fast growing local tree that survives in dry conditions of 125mm rainfall or

can yield 10 dry T/ha/yr in 550mm regions. Growth will taper off, when not harvested at 4 YO maturity. They are grown to sequester carbon & mallee alleys are used to lower salinity in WA wheat cropping areas. By harvesting coppiced tree tops 1 in 4 yrs on plantations irrigated with 7500 GL water we could produce biomass for 20% of Australian base power needs or 55% of our liquid fuel needs (via ethanol). By growing without harvesting they could sequester 10% of Australian carbon emissions. Other uses of harvested wood are for panel board products, or to extract lignin via a solvent paper pulping process to be used as a binder for production of carbon fiber suitable for light weight car panels, competitive with steel. Fiber can reduce car weight by up to half and Nissan and Honda are planning to go this way within 10 yrs. Pyrolysis systems can convert mallee biomass into bio-char and bio-fuel. The fuel can be used to generate turbine power and the char can be usefully added to soils to improve long term fertility. Bio- char can also be used now as a 33% substitute to coke from coal when converting iron ore to steel, (Brazilians are already doing this). 100% coke substitution is possible from stronger chars adapted to suit blast furnaces. In the long term char could also be used to convert high temperature CO2 emissions from industries such as cement and shale oil into carbon monoxide and then to ethanol. Wood char may be a substitute for CO2 geo-sequestration from coal if it fails to gain wide acceptance in China, Japan or Sth Korea. It is worth noting that power plants in central NSW are now growing mallees to part replace coal in power stations.

6:) New Mining sites

Qld,-uranium, shale oil, zinc, copper, rare earths, gas, coal **SA –** uranium, gold, copper **NT-** uranium, gold, phosphates, rare earths. **NSW**: coal. All require water for viability and all can benefit from future carbon offsets resulting from agricultural soil carbon etc.

NEW DEVELOPMENTS

7:) Bush-fires need to be put out while still small. NASA in conjunction with USA forest services has devised systems to use multiple small unmanned air vehicles (UAV's) fitted with cameras to transmit fire images to base and quickly direct water bombers to pick up water in dams located on roads in fire prone regions. Water needed for these dams can be moved from canals by tankers off season. Bushfires are known to markedly reduce water output from burnt catchments, while greatly increasing output of carbon emissions

8.) Soil fertility& soil carbon offsets (CSIRO Research projects now underway to validate) Many broad acre farms in the southern half of Australia are swinging over to "no-till/liquid fert" pasture farming techniques to grow crops and feed livestock on same land. Wheat when planted in cooler months out-strips growth of below foliage shading it as a competitor. In a few seasons grain yields return to normal as a result of improved soil carbon, water retention and fertility. Vic growers are improving yield on duplex soils by using an initial cultivation technique that does not disturb top soil, when adding gypsum and nutrients into the clay base. They then stabilize soil with a perennial rye grass. Irrigators using this technique are dramatically increasing crop yields while sequestering soil carbon at rate of 30 T CO2e/ha/pa. Providing the land is not compacted this technique has potential to rehabilitate land, improve yields and generate large carbon offsets. With a future need to consider recycling of crop nutrients such as phosphate fertilizers, intensive carbon farming techniques, in conjunction with adequate irrigation and recycling of crop wastes, offer potential to re-vegetate land, improve crop yields & recycle nutrients while reducing GHG.

9.) National Broadband Network and Other Services Large Telco's have problem with the costs and returns of introducing fiber optic cable communications to scattered inland clientele. Canal infrastructure, controlled by fiber, could provide a trans-sectoral fiber backbone for inland communications, to aid distribution of water and power from solar, wind, geothermal, biomass. Optical fiber based broadband integrated with wireless will improve inland medical, educational, and other services, similar to those living on coast. Services such as communications, water and transport will be essential to develop <u>regional industries</u> that attract people away from working in over populated coastal cities.

10.) <u>Project team</u>

T Bowring and Associates wish to use their USA/Australian experience and contacts in agri/food development, crop planning, manufacturing and engineering to introduce large scale N to S water transfer projects that will begin to meet Australian future water needs. We see introduction via a federal government PPP as the most likely way forward and are seeking expressions of interest from a range of government and industry bodies.

T Bowring (Director)
T Bowring and Associates Pty Ltd,

Government revenue streams from water sales, taxes from crops, new industries, bio-fuels and carbon offsets.

Water/ New business data Annual Revenue and profit pre-estimates ICN multiplier factors /$Mill of new industry

Total water available after losses =3750 GL Capex main& subsidiary canals $8.8 Bn	Sell price	Cost price	Water & /or Product revenue	Water &/or Product Margins	Value Added $1260m	Welfare $211m	Employed Persons $900 m	Tax revenue $317m	Gov't Returns ex water sales, savings, taxes, Carbon offsets, $ mill pa
To Environment 1500GL Replace water buy backs	$128/ML	$125/ML	$192 mill	$5 mill	$11 Bn	$2bn	$8 bn	$3 Bn	$260 m savings
To City Dams 700 GL to replace desalinated water	1800/ML	$600/ML	$1.25Bn	$840 mill					$840 mill profit $350 mill offset
To Irrigators 1550 GL	$250/ML	$185/ML	$387 mill	$101 mill					$101 mill
12T/Ha of wheat from crops irrigated at 2.5 ML / Ha yields 7.5 mill TPA	$350/T	$166/T	$2.2 Bn	$1.15 Bn					$345 mill tax
Straw yield @12T/ha Gives 7.5 mill T of straw @330L ethanol /T yields 2,475 ML of ethanol ex $1.9 bn of new plant	$700/KL	$420/KL	$1.74 Bn	$0.70 Bn	$2.4bn	$0.4bn	$1.7bn	$0.6bn	$210 mill tax $129 mill offset
Power from straw @ 660 Kwh/KL of Ethanol yields 1.63 mill Mwh pa ex $0.5Bn of new plant saves 2millT CO2 excoal	$80/Mwh	$48/Mwh	$0.13 Bn	$0.05 Bn $0..03 Bn	$0.6 bn	$0.1 Bn	$0.4 Bn	$0.2bn	$16 mill tax $32 mill offset
Soil carbon increase @ 30T CO2-e /ha/yr, offsets split 1:1 to gov't/industry	$20/T CO2e		$0.19 Bn	$0.19 bn					$190 mill offset
Drought relief reduction								$0.25 bn	
TOTAL			$6.63 Bn	42.486 bn	$14bn	$2.5bn	$10.1 bn	$4.05 bn	$2.72 bn

Notes related to approx cost benefits and emission reduction estimates, associated with Multi State Water Transfer Project

Water availability Canal capex	4000 GL minus 6% pa losses~3750GL water delivered **20%** to city dams, **40%** to irrigators, **40%** to environmental flows Main canal $5.6Bn & subsidiary canal $3.2bn delivering water to Qld, NSW, Vic and SA irrigation regions & coast cities. Could take 6 yrs to build, will have 50 yr plus life, water sourced from N/Qld regions with expected 90 yr rain reliability
Environmental flows	Water out of main canal is about one third of cost of a 10% return on water purchased from buy backs in last two years $260m savings come from reduced cost of water from infrastructure- cf -to continuing current water buy back process

City dams	New coastal city water comes from desalinated water which needs to be charged out at $1.80/KL to cover costs. Power to run desalination plant @ 7Kwh/KL gives carbon charge of 1.1T CO_2 from a 50: 50 split of coal and renewable
Irrigators	Irrigated water charges based on average cost of delivering water from main canal plus charges involved in moving water via subsidiary canal to major irrigation areas in Qld, NSW, Vic and SA.
Wheat sales	We estimate as global food crisis impacts demand for grain from Asia will increase and so will price/T of wheat as dry - land farming struggles with diminished rainfall and climatic warming factors that will reduce yield
Straw to ethanol	Straw from wheat crop will be harvested, densified and delivered to ethanol plants at approx $25/T then converted to ethanol & power using syngas fermentation technology. Offsets come from reduced carbon charges on bio-fuel
Power from straw	Exportable power generated from cooling gas in boiler associated with syngas fermentation process . Carbon offsets come from renewable power credits
Soil carbon	Soil carbon dollars based on 30T CO_2-e/Ha charged @$20T/tonne of CO_2-e generated from no till irrigated grain crops. Carbon offsets split 50:50 between growers and gov't. Similar figures possible from other grains, legumes and cotton .
Drought relief	Estimate based on avge drought relief pa paid out to irrigators/dry-land farms in Qld NSW Vic SA during drought yrs
Gov't Returns from canal in a public-private JV & related industry	• Water returns $1.55bn pa from canal investment of $8.8 bn ~ 17% pa • Total returns pa from water sales, savings, industry taxes & carbon offsets less canal pumping C charges ~27% pa • GDP Multiplier benefits to economy (based on government recognized ICN factors) ~ $30 bn • Emissions reduction as a percentage of Australian total emissions ~ 7% (NB within range of Australia 2020 target)