Submission
No 22

To: The Honourable Mr Kevin Greene, 2/5/05

MP and Committee Chairman of the Inquiry into Infrastructure Provision in Coastal Growth Areas;

I wish to make some suggestions as to proven methods to reduce the cost of providing infrastructure in coastal growth areas. My proposals, will, I feel, not only provide suggestions for cutting the money needed for these projects, but also create some very welcome side effects in the new communities built along the coast. The following methods are methods that may be employed in any suburban development.

Village Homes

The early 1970's in California was a time of political ferment as people who had "graduated" from the hippie era of the previous decade began to move into responsible positions in mainstream society. Two of these people, Michael and Judy Corbett, had a dream. They dreamed of building an environmentally sustainable suburb in the heart of the Californian town of Davis. When progressive candidates were voted into office in the Davis City elections of 1972, their dreams advanced a step closer to realisation. Their purchase of seventy acres of farmland for sale in West Davis was the next step. Now the Corbetts had to convince government officials to approve a suburban housing development called Village Homes that would contain so many unconventional features that they would need to use all their negotiation skills over and over again. What made their proposal so unusual?

Houses in Village Homes were to be clustered together, not in even rows along streets. The streets were much narrower than normal. Some of the houses were fitted with solar power, and many were covered by grass sod and landscaping. Much of Village Homes' open spaces were given over to small-scale agriculture; part of the dream was to enable people to live as self-sufficiently as possible. One of the most controversial features, and the one that interests us, was that the conventional stormwater infrastructure associated with urban development, such as drains and underground pipes, was to be abandoned in favour of a series of open streams and swales designed to hold much of the rainwater runoff in the ground. Over the initial objections of government officials, this form of water management was put in place at Village Homes. [1]

These swales, long mounds of earth that retard the flow of runoff so that it will tend to percolate into the earth, [2] were such a radical departure from the norm that Davis' planning review board forced the Corbetts to lodge a performance bond on their stormwater system. They got their money back quite quickly once a hundred-year flood came to Davis; Village Homes' drainage system not only saved it from flooding, but also absorbed huge water runoff from the surrounding suburbs, where their own stormwater piping failed to drain enough water to compensate for the deluge. The whole suburb's landscape was cleverly shaped so that runoff absorbed by the ground was directed to irrigate community food gardens. [3] Michael Corbett says that his style of natural water drainage cost eight hundred dollars less per house to install than the cost of traditional stormwater piping, which paid for most of the costs of landscaping Village Homes' parks and greenbelts. [4]

The benefits of urban farming

The Mayor of Chicago is developing a plan to make his city "the greenest city in America." A major part of his plan is to revitalise Chicago's farming industry with organic farming. Local food distributors and organics experts predict that a quarter to a half of the organic food consumed in the Chicago area may be able to be produced locally. This local expenditure will result in a market for local food processors and associated service industries to set up, providing many local jobs. [5]

George and Vicky Ranney, the owners of the Prairie Crossing housing development in Grayslake, Illinois, have commissioned a report which shows that the demand for organic food in the Chicago area is 30 times more than is currently supplied locally. These figures are relevant to the Ranney's mission, and to a discussion of local infrastructure, as part of Prairie Crossing's design includes an organic farm that is contributing significantly to local food supply. The aims of the developers are manyfold. They wish to use this farm to increase biodiversity in the local area, preserve open space, and draw Prairie Crossing's community together by selling their produce at regular farmer's markets. [6]

Linked to this concept of local farming is the Community Supported Agriculture movement- a system of food supply where people become shareholders in a local farm. A great example of this is to be found at Lismore, where on a half-hectare of city land, a low technology intensive farm has been running. As at June 1996, they were supplying thirty boxes of fresh produce to families every week, with plans to increase that to 120 boxes per week. Families who buy these boxes pay a monthly subscription to the farm, and volunteers may come and work if they wish. A large variety of fruit, vegetables, herbs and exotic crops are grown there. Water for the farm is sourced 50-50 from a bore and also from the runoff off of the nearby roofs of sheds and houses. Waste water is treated biologically on site in ways that grow crops to produce a profit! [7] Another example of this happened in 1993, when a farmer in Rockford, Illinois began running his 22 acre farm as a CSA called Angelic Organics, and started with 220 shareholders to whom he made regular fresh food deliveries. These shareholders pooled their money in 1998 and bought 38 acres of land adjoining the farm, leasing it back to the farmer. Now Angelic Organics is America's largest CSA, supplying over a thousand shareholders who pay $480 for up to a year's supply of food. Members regularly help out by weeding, picking vegetables, and packing produce. [8]

Note that with food being largely consumed near where it is produced, a community's dependence on long distance supply chains of food diminishes greatly. The large number of trucks delivering food to local shopping centres will also shrink. It is true that this change will negatively impact on some jobs, but the recycling of local money in the local economy will create many more jobs. The authors of a report into local economies have calculated, for example, that if everyone in the English county of Cornwall shifted just 1% of their spending from distant companies to local ones, 52 million extra pounds would be then circulating in the local economy. This is 4 million more pounds than has been supplied by a European Union grant to Cornwall! [9]

Thus local development of job opportunities can reduce the need for governments to spend vast sums on attempts to improve local economies and sustain their infrastructure.

Advanced biological wastewater treatment

An amazing technology has been developed by the American biological scientist Dr. John Todd. Called the Living Machine, it is an artificially designed ecosystem designed to take up sewage and other forms of water contamination. Water plants, aquatic animals and insects, as well as microbes all play their part in cleaning up black- or greywater. [10] A United States Environmental Protection Agency report has found that the use of Living Machines for wastewater treatment has many advantages. They can achieve tertiary treatment of water, cost less to operate than conventional water treatment techniques, and do not use any harmful chemicals in processing the water. [11]

There are two main disadvantages of this system. The first is that in colder climates the system may need to be enclosed by a greenhouse to keep it within an optimal temperature range. The second is that it only removes half of the phosphorus residues in contaminated water. One major advantage of the Living Machine system is that it is beautiful. Unsightly and malodorous conventional sewage plants can be replaced with something that resembles a lush garden. [12] However, the additional technology for removing one single contaminant from water would be far cheaper than that used for treating raw sewage.

Given that this system uses many biological organisms, it becomes a system that fosters biodiversity. A senior high school in Wisconsin has built a Living Machine on its grounds and uses it as a base for teaching science subjects to its students. [13]

John Todd has developed another parallel water treatment technology that is even more beautiful and effective- the Ocean Ark Restorer. Todd's company, Ocean Arks International, has described these Restorers as:

"…an assembly of engineered ecologies incorporated into floating rafts to perform three main tasks. They can treat wastewater and sewage in constructed lagoons or canals. They can help maintain pond or reservoir health. Additionally, they are used to "restore" stressed or polluted bodies of water back to health. These 'floating islands' are not only functional, but quite beautiful." Restorers oxygenate the water, support rich biological communities that consume water-born pollutants, and attract even more species of life. [14] A city in Southern China had a canal running through it, and over three quarters of a million gallons of raw sewage and stormwater flowed into it each day. The city could not afford expensive piping and treatment works to remove this waste, so they turned to Ocean Arks. You may find some stunning pictures of how beautiful the new Restorers in the canal are by downloading the files at the following Internet addresses: http://www.oceanarks.org/restorer/casestudies/pdf/baima_sheet1_med.pdf and http://www.oceanarks.org/restorer/casestudies/pdf/baima_sheet2_med.pdf.

It is possible that many of the biological organisms in the Living Machines and Restorers could, if harvested in a sustainable way, provide saleable items that could further create local jobs.

Protecting waterways and roadworks with grass

Another way in which to protect coastal waterways from urban stormwater contamination is to plant a special kind of grass called vetiver in areas prone to erosion. Vetiver grass forms a thick narrow hedge that significantly impedes water and sediment runoff, can survive water and nutrient stress, does not grow invasively, and can survive pests, animal grazing and fire. Its' roots can grow up to five metres deep, [15] and have a tensile strength one sixth that of steel, which makes them even stronger than tree roots! [16] In India on land with a 1.7% slope, vetiver contour hedges reduced runoff from 23.3% to 15.5%, and soil loss from 14.4 tonnes per hectare to 3.9 tonnes per hectare. In Queensland vetiver has been successfully used in several projects, including flood erosion control on the Darling Downs, erosion control in acid soil, and contour bank replacement in steep sugar cane lands. [17] Vetiver is also widely used to stabilise soil around roads. [18] A very useful plant indeed!

How urban infrastructure can alleviate the drought

A recent CSIRO report has said that the flow of water vapour through the atmosphere of Australia has decreased by 10% since 1788, due to forest clearing. This decrease, around 339 cubic kilometres per year, is very close in volume to the current estimated surface outflows of water, around 379 cubic kilometres per year. Meanwhile croplands, the largest user of liquid water in Australia, only generate 2% of the total volume of water vapour in this country. These figures prove that most of the water used by Australian crop farmers simply flows away, and does not assist in creating the conditions for rain. [19] In our wasteful suburban life, we use water once, and let it flow into the sea! Oh yes, we treat it so it does not pollute our waterways, but still, every litre of water that flows down the pipes and sewers of our suburbs is basically water lost to our land. Here is why.

For rain to happen, there must first be a large mass of air that has become so humid that it cannot hold all of its water as water vapour. When such an air mass has to give up its store of water vapour, that vapour turns into rain. However, there first has to be a place from which the air can take water vapour.

A body of water in nature has a flat surface. If a water feature such as a lake has an area of ten square kilometres, then there will be ten square kilometres of surface between the water and the air. Ten square kilometres of an area where the air may take up water vapour. However, a problem arises when water vapour rises from a flat interface between air and another medium.

In a closed system, water will evaporate from a water surface until water vapour pressure is so great that the air becomes completely saturated. Once air is saturated, it cannot take up any more water. However, as the atmosphere is unbounded, wind will continually strip water vapour away from the water's surface. This creates a situation where a still body of water has directly above it a thin film of saturated air. [20]

In the human body's attempts to cool itself down by sweating, it too creates a film of saturated air over its surface that in the absence of cross ventilation will inhibit further evaporation. This decreases the effectiveness of our body's natural method of cooling itself unless some kind of air movement is present. [21]

Evaporation from a flat water surface thus only creates a thin film of water vapour that is not enough to trigger rainfall, but merely gets uselessly whipped away by constant winds. In contrast, it has been said that "a rainforest spreads because its vegetation holds moisture, thus attracting more rain clouds which hover over it, circulating the moisture up from the ground, through the cycles of plant life, into the clouds and back down again as rain." Contrast the lush profusion of life in the Amazon jungle with the appearance of the land once that jungle has been cut down. This is the way that the formerly lush area of Rondonia in Brazil has been turned into a wide expanse of dusty red desert. [22] Forests multiply the surface area from which water can evaporate by an incredible degree. Every surface of every leaf becomes an interface between water and air. The three-dimensional masses of saturated air necessary for rain's creation come largely from the breath of plants through billions of their leaves. And we in Australia, with our dire need for rain, use our water only once and then literally throw it away by pouring it down drains? Utter madness.

What we should be doing is something else entirely. Whatever biological methods we may use to treat our waste water, the final step should not be to pipe it into a waterway. We need to stop throwing water away in the ways that we do, because by draining it into rivers and oceans we are stopping it from evaporating quickly enough into the air so that it can generate rainclouds. We need instead to find ways to take the water we have used and pass it through something that will send it into the air quickly. As the rainforests tend to create much of their own rain, *so can we*. In these days where most of what we do has to be sustained economically by paying its own way, we can do much better than merely participating in tree-planting days.

What do we need? We need to pass our wastewater through the kind of plants that have a high transpiration rate, so that water may be breathed into the air *fast*. We need the kind of plants that can be commercially useful, so that local communities can create jobs by growing and harvesting them. We need the kind of plants that grow quickly, so that we do not have to wait long before we can use them.

Commercial benefits of biological wastewater treatment

The environmental movement has been promoting the regeneration of degraded lands through plantings for some time. However, they have become obsessed with one particular plant: trees. For our purposes, there is something much better. A plant with more uses than can be imagined. Bamboo.

An American environmental group called Sustainable Strategies has recently met with pig farmers, federal agencies and state officials in North Carolina to discuss plant-based solutions for the problem of water contamination from the state's huge pig farms. The traditional method of disposing of the huge amounts of pig manure these factory farms generate has been to store it in huge effluent lagoons with overflow pipes. As these lagoons often release wholly or partially untreated sewage into

waterways, faecal bacteria are multiplying in the rivers, causing the death of many fish and infecting people who come into contact with the contaminated water. Sustainable Strategies was asked to provide a solution, and that solution was a bamboo forest.

Bamboo is a phreatophyte- a plant that both takes up water very fast and grows at a rapid rate. In so doing, it also absorbs a vast amount of nitrogen, the primary element in manure. Sustainable Strategies envisages a system where treated effluent is drained into a forest of bamboo that will take up the manure and breathe out the water to the point where neither the manure nor the water leaks outside the forest. A zero discharge system. Not only is a huge amount of wastewater pumped quickly into the air where it is needed to make rain, but in the very act of getting rid of pollution, the forest is creating a great deal of economic value. The floor timber of houses will have come from bamboo that has converted sewage to a marketable product! [23] Meanwhile, a soil scientist at Oregon State University named Rich Roseberg has been studying bamboo's capacity to suck up nutrients from the soil, and has discovered that a mature 30-foot clump of bamboo could take up ten gallons of sewage sludge per day. With bamboo being used in building construction, furniture, laminated flooring and decorative fencing, sewage waste polluting our waterways could be easily turned into many kinds of marketable products. Roseberg has also found other phreatophytic plants that can rapidly suck up sewage. Poplar trees for paper and timber. Kenaf (a member of the hibiscus family) for paper, carpet backing, a substitute for plastics and vinyl in the interior linings and panels of cars, and even for kitty litter. Giant Chinese silver grass for biomass to use as fuel for power stations. The possibilities are literally ever growing. [24] However, bamboo holds especial promise.

The International Bamboo Foundation says that bamboo produces over 35% more oxygen than trees, and as a result can sequester up to twelve tons of carbon per hectare each year. Unlike timber getting, cutting bamboo does not destroy the whole plant; it grows back quite readily. As bamboo grows in depleted or damaged soils, it is a valuable addition to the ways in which degraded soils can be repaired and replenished. [25]

Bamboo is gaining favour as a useful timber for flooring in houses. With its voracious appetite for nitrogen, its leaves are 18 to 22 per cent protein, making them ideal for cattle fodder. [23]

Bamboo has been used for construction for thousands of years. A Colombian architect named Simon Velez has developed new ways to use bamboo poles to create some incredible buildings. After he had begun building structures based on his new designs in Colombia, something happened. In a town where many of his buildings were, an earthquake struck. All the buildings that were not made of bamboo had fallen down. Every bamboo building, both those built in the traditional style and those built with Velez's methods, stayed up. Even a Velez-designed tower which stood eighteen metres high emerged from the quake unscathed. [26] Likewise in Costa Rica, an earthquake measuring 7.5 struck. While all the concrete buildings near the epicenter collapsed, all of the twenty bamboo houses remained intact. This is not surprising when combined with bamboo's flexibility, we learn that in compression tests, a short and straight bamboo column with a flat end of ten square centimeters can withstand a weight of eleven thousand pounds. [27]

Simon Velez has designed and built bamboo houses in Colombia at a cost of only $US5,000, [28] and a Hawaiian construction company called Bamboo Technologies are offering ready to build kit homes made from bamboo. [29]

Suburbs living lightly on the Earth

What looks like a model suburb in terms of sustainable development is being built on the south side of Brisbane. Called The Green, this water, energy and waste efficient residential home community [30] has been designed by Michael Mobbs, a Sydney architect famous for fitting his inner-city house with its own electricity generation, water storage, and sewage processing capacity. [31] Sala Homes, Mobbs' company, is selling kit homes for between $149,000 and $182,000 on the site. He has estimated that residents at The Green will be able to save between $1,500 and $2,000 a year on their utility bills. This is because of the large capacity of rain-filled water tanks incorporated into the house's design, as well as solar panels that are hooked up to sell power back to the grid, [32] and a clever design that maximises air flow in such a way as to eliminate the need for air conditioning. These savings obviously mean that residents are then free to spend this money on whatever they choose, instead of being forced by an inefficient infrastructure to hand it over to large utility companies. [33] On top of this, imagine eliminating the cost of building large sewage plants, large water storage dams, and sharply reducing the cost of running large power plants! With the other infrastructure developments at The Green that I have mentioned above, it becomes highly likely that the residents could spend a significant part of this into the local economy, creating jobs that are filled by local people. Along with the other projects mentioned above, many local jobs could be easily created by selling of the useful products grown by the biological infrastructure I propose for new coastal developments.

Conclusions

Thus there are a number of very strong reasons why I am suggesting a plant-based infrastructure for new coastal suburbs. Firstly, doing so will absorb most of the waste water that would otherwise pollute our waterways. Secondly, this kind of development will increase biodiversity instead of destroying it as usually happens with urban developments. Thirdly, an infrastructure can be created that does not just passively exist to service residents; it will actively create jobs in such a way that residents will be actively involved in a healthy community life in their work as well as their leisure. Fourthly, we can make every aspect of biodiversity become also a step in a chain of financial transactions so one can support the other and they can both help to support the lives of the residents. Fifthly, we can through sustainable development of the kind mentioned above increase the chance for rain that Australia so badly needs. Sixthly, as a biological infrastructure will cost far less than the conventional kind we have been using, the money saved can be spent on projects that will produce a real benefit for our society instead of on something that just sits there and costs money. Projects like schools and hospitals come to mind.

Thank you for considering the ideas expressed in this submission.

Yours sincerely, Rick Pratchett, 69 Cairds Avenue, Bankstown, 2200.

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Footnotes

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