P.A.Yeomans

The City Forest

THE KEYLINE PLAN
FOR THE
HUMAN ENVIRONMENT
REVOLUTION

Keyline

Sydney

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To Jane and Julie

Acknowledgements

To my three sons for reading and discussing the manuscript.

To Ken, the youngest, for five years of dedication; I am greatly pleased he has chosen Keyline for his career!

To Neville and Allan, for 25 years of help and wide debate; Neville, as psychiatrist and sociologist, for keeping me up to date on the social and community implications and Allan for his skills on the engineering-industrial side.

Together we have completed the horizons of Keylihe.

A A. Yeomans

October, 1971.

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Color Plates: 17 plates by Douglass and Elaine Baglin, with valuable commentary; they download as a single document of around a megabyte.

Foreword

A major change in values and in behaviour is beginning to occur in Australia. For too long we have been exploiting both our continent and each other. Patterns of human living based on selfishness and ruthless competitiveness are becoming self-destructive. A new era is dawning--equality between the sexes, generosity in human relationships and honesty in negotiation. With this goes a respect for the environment that sustains us.

Humankind is a bio-social species. His biological survival depends on harmonious working with Nature. Harmony comes only when we give as well as take.

The world has paid a terrible price for the Industrial Revolution and the advance of science. We had to be ruthless to control and harness the forces of Nature; to become machine-like to make machines and to think like computers to conquer ignorance. But the battle is won. Now we must re-humanise ourselves and share the fruits of our labour. The swing away from the mistakes of the chemical solution of biological problems, is beginning. Natural food movements suggest we are searching for a healthier way. The growth of community groups in ecology, welfare, education and the arts suggest we want to become better and happier humans.

Australia is the only continent on earth never split by warring nations or states. We are fortunate in being unimportant in the great power competition. As inheritors of the industrial era we are on the periphery of both European and Asian civilizations.

We alone are in a position to accept the best from all continents in ideas, people and ways of living.

History took humanity from the tribe to the City State, to the Nation State. The next step is the Continental Nation at peace with itself and with its neighbours. It is our unique opportunity and duty to become the example to the rest of the world for that next step. In this process the Machine City must be replaced by the Human City. The exploited landscape must be husbanded with loving care. The soil which gives us life must be developed in its own living processes so that it grows richer year by year rather than poorer. The beauty and freedom of personal space depends on caring for the integrity of all our environment. We may not be the most varied and beautiful continent on earth, but we can and must be the most human.

My father's work and the contributions of all Australians is needed for the task ahead.

Neville Yeomans.

CHAPTER ONE

H.E.R.

There is a wide feeling of pessimism about halting pollution which is frequently accompanied by an individual sense of guilt; there have been too many shocks!

It seemed simple enough to clean-up smog; it was only factory smoke and stuff! But it was a shock to learn that the worst air pollution was caused by the invisible gases from our own motor cars.

Water pollution seemed just a matter of being careful with drinking water and treating all sewerage; but it was another shock to discover that after treatment, the effluents which look quite clear still pollute the rivers and the seas.

It was a shock to learn that the milkman delivers the D.D.T. every morning and that it is in everything we eat.

The disclosures about how the chemicals concentrate along the living food-chains was very interesting. The crunch came when we realised we were the final link and got the bigeest dose.

D.D.T. in penguins in the Antarctica gave cause to wonder how much we eat in a meal of fish caught along our coastline. And in October, 1971 there was a locust plague and 20,000 square miles of our country was sprayed with tons of synthetic chemical poisons and not an alternative suggestion or a word of protest from anyone until it was too late--just a fatal acceptance of the inevitable? Hell! What a world and there is sure to be worse to come!

Pollution in this country was not an inevitable part of progress or of over-crowded cities.

Pollution is the result of the normal functioning over many decades of an inefficient, arrogant and impersonal establishment. The environment is polluted because it is made up of the chaotic landscapes of the establishment.

WE NEED A HUMAN ENVIRONMENT REVOLUTION. Not until there is health and harmony in all our landscapes can there be humanity and common sense in the society of man. This book is concerned with correcting the two fundamental causes of our rapidly deteriorating environment.

THE FIRST CAUSE IS THE COMPLETELY INEXPLICABLE FAILURE OF MANKIND TO DESIGN HIS LANDSCAPE--HIS TRUE LIVING PLACE.

THE SECOND CAUSE IS THE BASTARDISATION OF AGRICULTURE. (see Chapter 14).

Mankind ages ago used his skills to design a shelter from the rain where he could sleep safely at night, but he lived in the natural landscape. Eventually he designed a house, his castles and cathedrals, even a place for the repose of his corpse, but he did not design the landscape which he came to completely dominate. He became an architect but still he ignored the architecture of the natural landscapes. But if he had used his developing skills and had learned to understand the landscape design of Nature and also had come to terms with the soil which fed him, he could have avoided his crimes against Nature which have caused his problems of today.

He could have designed a landscape that was; healthy, pleasant, efficient and clean by using his skills and arts as they developed and combining them harmoniously in his living environment. If he had, he

could not have fallen prey to the utter foolishness of divorcing his advancing knowledge into separated compartments. The fragments of science, which are his principal downfall, would surely in such an environment, have been combined in wisdom and common sense. if he had remained at peace with Nature he may have been able to live more peacefully with his fellow man and have avoided his problems of pollution and of perpetual fear.

The principal difficulty in eliminating pollution may be the mental attitudes of people. The older members of the population have been brainwashed and conditioned all their lives to believe in doctrines which in today's crowded world are false and anti-landscape. There has been no preparation in their education or in their lives for understanding the problems of today which have seemingly rushed at them so quickly! It is difficult to accept that modern science is often different from wisdom and that technology sometimes loses itself in its own clever creations. They do not fully understand why their own kids are so different from themselves as youths. They have not yet appreciated that the revolt of kids against the establishment. represents the dawning of sanity and common sense in a society otherwise hell-bent on its own destruction.

Those who were born after the Second World War entered the new world of man's unlimited. power of annihilation. And during the years since then, the great nations have been equipping themselves for just that purpose. And if not the military, there is pollution--the second road to annihilation! Youth had no part in causing it, yet they are suffering the most from its health-destroying and life-shortening effects.

Thanks to the attitudes of the establishment over the past few years, youth has been robbed of any reason to be proud of its country. But still the real hope lies today in the questioning disbelief of young people and in their contempt for authority, whether traditional, financial, scientific or government, which does not make sense. They know the things that are wrong; they are searching for truth and real freedom, and many are devoting themselves to changing society for the better. It is a healthy sign that the wisdom and intuition of these people in Australia is leading them north in the search for a new frontier of life style. In the more heavily populated and over emphasised south eastern corner of Australia, where we have copied the exploitation of the environment from other countries, the situation looks hopeless. But Northern Queensland appears to offer a chance to move in bold new directions and to influence future cultural, industrial and population advances in the quality of life. Countless others would like to follow them out of the environs of the big city and live in the country where they could grow their own food free from artificial fertilisers and poison sprays and collect their drinking water from the rainfall.

BUT IT IS TOO LATE! The poison wave is too all pervading for them to find either health or life satisfaction in any form of isolation.

The young people of today are the most important to world survival in all human history and their destiny offers them only two courses of purposeful action: Firstly, that they select and, by using their voting rights, take over a place and build an environment of humanity and healthy balance as a demonstration of living; secondly, that they start the Human Environment Revolution now wherever they are; get with it and stay with it, no matter what!

They have the numbers and the strengths to do it. They have what no other age group ever possessed; a capacity to organise their thoughts and their actions to proceed almost spontaneously both as individuals and as a multitude. And they have a mutual integrity which is not a particular characteristic of the Establishment.

In the past, the great revolutions came from empty bellies. The Human Environment Revolution is different. The dissatisfaction of youth and its demanding search for a better way of life is the power. Of course the Establishment is the enemy, where the stupid and the complacent within government, and the evils and the avarice of finance, science and big business, can never be reconciled in a common sense solution to the problems of the sick landscape or the inhumanity of society.

The chemical sciences which have been debauched by business to make billions from polluting the Planet will continue to out-shout the healthy but financially crippled biological and social sciences. Business will fight strenuously and as ruthlessly as ever against changes which threaten their influence and

their profits, while at the same time, they will advertise with the power of their money, that they will save the world.

Youth has a task on its hands but they do not have to fight everyone. The strangers, the confused and the lost in this world are not the young people, but their parents. Youth should not dismiss them but should guide and teach their elders. Their most valuable ally may be the 'healthy' farmers and their wholesome food. It could well be that city kids and these 'rebel' farmers will create the human environment revolution.

There was variety and durability in the natural landscapes, but mankind has merely imposed his smothering clutter on Nature's living environment. He failed to design the special purpose landscapes for himself. The older professions and each of the new professions which had to do with land use, merely added their random pieces. Even the English countryside has no logical basis of design. Its pleasing appearance today arose from an era of tree planting which engendered a consciousness of landscape, at the end of the seventeenth century and continued through the eighteenth century. There were fears that the nation was in danger of running short of hardwood for the fleet and for building purposes generally. Evelyn's book on forestry, "Silva", was published in 1678 and exerted a strong influence on the landed gentry.

I saw these landscapes during the spring and summer of 1958 and visited some of the majestic homes, manors and castles. These buildings with their mature trees and artificial lakes seemed to lord it over the lush green fields with their copses, hedgerows, and planted forests. Even the fences and gateways possessed their measure of conceit. The near perfection of each individual factor had combined in a mild and gentle climate to create a mosaic scene of great beauty.

The fragile nature of the landscape was apparent in the drought of 1959 when it reminded an Australian of his droughty homeland.

This book shows that the harmony of pure design in the landscapes of Nature has always been overlooked. It offers a simple extension of Nature's way for the design of the environment of man.

CHAPTER TWO

The Proposition

For reasons which become apparent later, pollution started with water. Rectifying the water position is the starting point for designing the elimination of pollution. The City Forest refers to a specific area of the remedy. As a first step, it is proposed that the filtered effluent from sewerage treatment works and other used waters of town and city, be delivered via pump and pipeline to selected areas of land and not to the rivers and the seas as it is today. On the selected land these waste waters would be re-used to grow forests in the likeness of Nature's rain forest. The growth stimulants of the effluents would stimulate the growth of the trees. The water would be cleaned and reconstituted in the natural processes of the forests and flow from the forest soil to join the common waters of the land and the seas as clear fresh water.

While nothing which man has devised for either getting rid of water or for reconstituting used water approached the efficiency of the natural rain forests, the designed City Forest will far excel them in effectiveness for the purpose.

This is the immediate action suggested for today's cities in order to partly offset the mistakes of the past and the problems of water pollution now. But because air, water and soil are the trinity of life and indivisable, this is also an attack on air and soil pollution.

The prospects for tomorrow are brighter. A balance of the water budget in our take and return of good water would extend to balance and health in the total environment.

Cities on their own cannot be made pollution free; the problem is continent wide and world wide. The City Forest and a Strip Forest for every farm, would be an integral part of the new landscape design for city, town and country. New cities can then be made pollution free and function with a degree of efficiency not now approached. The wide agricultural landscape can be redesigned economically and profitably in farmscapes with complete control of water, with trees planted to enhance and improve the land and with fertile soil to add the final elegance to the countryside. Instead of farming land being the greater polluter it is now, it would become the perpetual guardian of the health and balance of the environment.

Even great industrial complexes and large mining enterprises can be designed to remain in balance with the landscape and not destroy and degrade it.

Our Australia is a divergent land. It has landscapes and plant life and animal life which are unique. Those who have controlled its land polities and those also who have occupied so much of this land in the past, have not always discharged their responsibilities to it or to its peoples.

Australia is a damaged land. There are places which few Australians have seen where the surface to several feet has been taken by wind from thousands of square miles.

The tough land has proved to be a fragile land.

The impaired landscapes can be recovered and made the most attractive land on earth both for Australians to live in and for the world's people to visit and enjoy. But all our landscapes have to be guarded and enhanced, because even now big business interests are planning the "development" of land

where the destruction of all trees over vast areas, together with other orthodox agricultural practices, will inevitably lead to further wide landscape destruction.

The acquisition of low priced land in Australia by overseas investors, has placed a value of a few cents in the dollar on our land, compared with similar land in their own countries. Already the areas lost in the North are than the states of Victoria and Tasmania combined. This is a form of pollution by the Establishment which needs to be reversed.

First, The Farm

I became involved with the problem of designing a healthy landscape when I bought 1,000 acres of poor land in a region of unreliable rainfall in 1943 and tried to farm it. The objective was to produce 1,000 acres of fertile soil in a landscape which was planned logically. I was singularly unsuccessful for a time. But eventually I found a quick way to convert very poor earths into fertile soil and a logical way to design a landscape.

The relevances of these experiments and experiences on the land, which were recorded in my three earlier books and various papers, are many. For instance, the first special purpose landscape of man was the farm, where everyone lived on the land. It was not only the place where the food was produced, it was also the home of the arts and skills which were the foundation of the industries. Therefore, if the soil of the farm deteriorated and lost its fertility, or the land was wrongly designed or lacked design altogether, thus weakening the balance of the natural landscape, there was little chance that later and far more populous landscapes would be better. On the other hand, if the farming of land was right and the design of the farm was in balance, the wider landscapes of city, town and country could not be in such a plight today.

THE FARM WAS AND STILL REMAINS THE CRITICALLY IMPORTANT LANDSCAPE OF MAN. However a healthy and well designed farm is almost as rare as the sensibly designed city--nevertheless it is on the farms where the problems of unhealthy soil and good landscape design must first be solved and where designs for health and balance must be integrated. Many of the arts and skills of good farming are important to the design and workings of the clean city.

Fertile soil is a precious thing. it has also been found to very temporary; its fertility can be lost by faulty management in a few decades. But it will be shown that the process can be reversed and the impoverished soil be made more fertile and deeper than it ever was, and in a few years. The responses of the disordered landscape to good design and management can likewise be rapid. The redesign of the landscapes for health and efficiency can be approached with optimism.

The professions have produced many masterpieces of design within the environment but for the landscapes of town and country, which should have been planned to last indefinitely, there is no logical basis of design. The best of cities appear to be Topsy planned--they just grew and grew out of a series of accidents into the malignancies they are now.

Landscapes

There are two classes of landscapes. Class one is the Wide Enfolding Landscapes of Nature. Class two is the Special Purpose Landscapes of Man.

The landscapes within class one are the larger of the two. They are the landscapes of the great mountain chains and river systems; of coastal plains and shore lines; of the great rain forests to the savannah type of grassland with its few scattered trees; of the wide grasslands of the continents of the world--the pampas, the great plains, the steppes and the prairies--of the marshes and the wet lands, of the semi-arid lands and the deserts.

They are the landscapes of the geographer, the geologist and the anthropologist; the landscapes of the migrating birds, of our emu and kangaroo, of the elephant and the giraffe, of the lion and the leopard, and of the herds of the grasseaters.

The landscapes within class two--the special purpose landscapes of man--have been imposed on the natural landscapes of class one and now appear to dominate them; even climates have been affected and land shape has been altered by great movements of soil and earth. These landscapes are the cityscapes and townscapes; they are the landscapes of the grazing properties and the farms, of the planted forests, of the rail systems and the roads, of the nature reserves and the parklands, and of the many smaller landscapes within them, down to the house block with the dog-house in the backyard.

They are the landscapes of the city dwellers and townsfolk, of the farmers and the foresters; of the sociologists, the biologists and the doctors; of the industrialists and the miners; the golfers and the skiers; of the scientists and the artists--of all of us. This is our world.

These are the landscapes of mismanagement which are offending Nature and polluting the planet.

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CHAPTER THREE

The Landscape Design of Nature (1)

THE GEOGRAPHY OF LANDSCAPE

There is a landscape design of Nature. It is made up of three water lines and three land shapes. It includes also three land forms and one special pattern.

We start a trip to the origins of landscape in order to learn how to design better landscapes for ourselves.

In the beginnings of the world there was chaos. There were no forms, no design and no life. Then there was a great change; the land was divided from the water; the continents and the islands became separated and defined from the seas.

The dividing line around each was a contour. THE FIRST LINE OF NATURE'S LANDSCAPE DESIGN IS A CONTOUR WATER LINE. The natural contour lines show where the surface of still water makes contact with the land.

Now the water attacked the land with the blitzkrieg of sea tides and tidal waves, the artillery of storms and the infantry of raindrops. The water drained off the land back to the sea to attack again. THE SECOND LINE OF NATURE'S LANDSCAPE DESIGN IS THE WATER-DRAINAGE LINE. It is the line of the water courses, the streams and the rivers.

Here in the drainage lines of the land, Nature made first use of the branching and joining pattern which became one of her favourites.

The draining of the water back to the sea also divided the land surfaces into watershed regions. THE THIRD LINE OF NATURE'S LANDSCAPE DESIGN IS THE WATER-DIVIDE LINE. It separated all the lands of the Earth into great regions and divided all the land within them into lesser regions.

The attack by water on the land and the draining of the water back to the sea, aided by the other forces of land disintegration, fashioned and sculptured the surface while much of the land was lost to the sea. The result was the foundation for the GREAT REGIONAL DESIGN OF NATURE, and for the shapes and the forms of the land.

The grand strategy of Nature was the creation and the deployment of life to protect the land from the agression of water. The movements of the water over the land were slowed down by the soil, the grass and the trees. Slowly thereafter the natural landscapes developed as the life forms within them became numerous and varied. Nature sided with the land against the water to create great variety in life and durability in Her landscapes.

* * *

THERE ARE THREE SHAPES OF LAND; THE MAIN RIDGE, THE PRIMARY VALLEY AND

THE PRIMARY RIDGE.

The main ridge is the first land shape. It carries the water-divide line and is thus the boundary of all the regions of Nature's landscape design. Look at the skyline; it is the line of a main ridge.

A main ridge almost surrounds the catchment areas of the great river systems of the world; a main ridge almost surrounds the catchments of every water course and stream within these regions. The 'almost' indicates there is a low place where water escapes from the confining region and main ridge, as it does where two streams join and where a river flows into the sea.

Just as all the low places within the great regions are connected up by the joining of every water course, stream and tributary river to the main river, so also are all the higher places--the ridges, with their water-divide lines--connected up from the smallest ridge to the largest main ridge. This fact was vividly demonstrated with a hollow and thin fibre-glass model of an actual landscape. When turned upside down and sprayed with water, it disclosed what could have been the working model of a different landscape. The valleys and ridges were reversed; the stream courses became the main ridges, the main ridges became stream courses. The hills became lakes--a lake is an upside-down hill. The branching and joining pattern of the ridges was clearly disclosed.

In Nature's landscape design the branching and joining pattern of the two water lines--the drainage lines and the water-divide lines--are intertwined. Together they form an almost never-ending interlacing, yet the two different water lines do not touch each other. They disclose the anatomy of the landscape.

The water drainage lines are obvious in the water courses, the creeks, the streams and the rivers. The water-divide lines of the ridges are not so readily seen.

To illustrate the water-divide line and to examine the shapes of the land, imagine we stand between two creeks where they join on the cleared and undulating land of a farm. We turn out backs on the junction and walk up-hill away from it following the highest land between the creeks; the land widens out as we go. We are walking along the crest of a main ridge--on a water-divide line--but we cannot see it. If it were raining heavily we could see it. The rain water would be flowing away from the water-divide line in both directions, some to flow to the creek on our left, the rest to the creek on our right. Eventually the water would join up and flow together at the junction we left behind us.

The crest line of a ridge and the water-divide line are synonymous. The centre of a road and the ridge of a roof are water-divide lines; water flows in opposite directions from both.

From the main ridge the two creeks are in view. The sides of the main ridge slope more or less uniformly to the creeks below. Valleys form into the sides of the main ridge. They are named primary valleys. The side slopes of the main ridge left standing, as it were, on each side of these valleys are also called 'primary'--primary ridges.

There will be a few or many primary valleys and primary ridges belonging to each main ridge. Since the primary valley has a primary ridge on both sides of it, there is always one more primary ridge than there are primary valleys in any main ridge system.

The primary valley is the smallest of the three shapes of land. It is the first valley and the only true valley shape in the landscape. The so-called valleys of streams and rivers are in reality, watershed areas--Nature's regions--and they contain both primary ridges and primary valleys.

The primary valley has a special shape. The start of the valley at the top end is the steepest slope in the landscape. This first steep slope at the head of the valley is short, then the slope changes to a flatter and longer slope which extends to the creek below.

I named the point of slope-change in the primary valley, the Keypoint. A contour line around and across the valley from side to side though this point is the Keyline of the valley. ONLY A PRIMARY VALLEY HAS A KEYLINE.

The primary valley collects its water only from ridges; from the main ridge out of which it was born and from the primary ridges on either side of it. Water flows down the primary valley when it is raining. It is the first water course to cease flowing after the rain.

In the wide agricultural areas the primary valley was grassed over and of a smooth rounded bed, down which the run-off waters from rainfall flowed--that was before so many became eroded into gutters and gulleys, to bleed the moisture from the surrounding land.

The primary ridge is the largest of the individual shapes of the land. Because there are many more primary ridges than main ridges and because the primary valleys are the smallest shape, the primary ridges include more of the land surface than the other two shapes combined.

From the crest line of the main ridge it will be plain to see that the main ridge is not level or even uniformly rising. It may depart from its general rise and dip down, then rise again. The low place is a saddle in the main ridge and it often shows where a primary valley has intruded deeply and reached the crest line of a main ridge. When the saddle is deep the first steep slope of the primary valley may be gone. The Keypoint of such a primary valley is the saddle point.

A saddle is a unique land form which has significance for land planning. Road makers make use of the saddle of a main ridge to cross over from one watershed region to the next.

The saddle has left a higher piece of land sticking up on the main ridge. This land form is a hill. It often has a saddle on each side of it.

The third land form is displayed in the depression of lakes and ponds.

Continuing along the crest of the main ridge, a place is eventually reached where it appears to go two ways, as indeed it does. To the left the main ridge continues to almost surround the creek on our left and the right branch goes on to almost surround the creek on our right. But the main ridges of the watershed regions of the two creeks have now joined up with other main ridges, which surround other creeks and streams and provide the boundaries for their separate watershed regions. They have become a part of the main ridge system of Nature's design.

Each of the two junctioning creeks has its own region bounded by the crest line of its own main ridge. These regions thus include all the land from which rain run-off water flows to each creek. The land covers the one side of the surrounding main ridge which slopes towards the creek and the series of primary valleys and primary ridges which likewise fall from the side of the main ridge to the creek below. This is the basic, the single, THE UNIT-REGION OF THE LAND. It may contain only half a square mile or many square miles.

The main ridge which started between the creeks at the junction, divides, and the two branches become widely separated before they come closer together at the single stream below the junction of the two creeks. This main ridge without the branch between the creeks is thus the boundary of a larger region--a twin region--which includes the two single unit-regions of the two creeks. In like manner all the regions of Nature expand in numbers of unit-regions within them, where each larger region has its own main ridge, up to the largest region of Nature. It may contain half a million square miles and embrace the entire watershed region of the great river.

This is the landscape design of Nature. It is repeated endlessly to cover the land surface of the Earth. But what is the purpose of this design?

The purpose of Nature's landscape design must surely be the protection of the land from the attack of the waters. The waterline design and the land shapes appear to be designed for no other purpose than to get rid of water as quickly as possible. The shapes of the land reach the absolute in efficiency for achieving this objective.

The harmony of the landscape has been produced over aeons of time by the evolution, interaction and fusion of the three shapes of land.

THE HARMONY OF PURE DESIGN IN THE LANDSCAPES OF NATURE IS THE RESULT OF LAND'S LONG BATTLE AGAINST WATER'S CONSTANT COMMAND--"COME BACK TO THE SEA."

The evolution of the design of Nature on the many and varied geological structures below the surface of the land, has provided the natural landscapes with character and variety. But there is hidden in the three shapes of land--the main ridge, the primary valley and the primary ridge--something more to add to the wonder of the landscape design of Nature; for each of the three shapes of land there is a unique and constant geometry which is disclosed in their contours and which will shortly be reviewed. In combination with their depths, lengths and widths, there is endless variety. But multiplied by the effects of the profusion of climates, variety approaches infinity. Yet our man-made landscapes so often reflect only monotony and boredom.

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CHAPTER FOUR

The Landscape Design of Nature (2)

THE GEOMETRY OF SHAPES AND FORMS

The contour lines of Nature's seas and lakes have been borrowed and are used as a device by the many professions concerned with land-use, so as to illustrate in a practical and accurate manner on paper, the shapes and the forms of land surfaces.

A contour line surrounds the land. A contour line surrounds the water--of lakes and ponds. The water line around a swimming pool or a bath are contour lines.

For the purpose of illustrating land on paper, the lines are used on 'contour' maps where the individual contour lines show where the land is the same height as indicated by the contours. The lines are placed to show set vertical distances below each other, such as one foot or ten feet.

On a map the highest contour line is placed as if all the contour lines which indicate lower land, were under the water of an imaginary lake and this first contour line was part of the shoreline of the lake or of an island in the lake. The next contour line of the map, say ten feet vertically lower than the top line, is again part of the shoreline when the water of the lake has dropped ten feet--and so on downwards.

The contour lines on a map show the shapes and the forms of the land and the positions and relationships of water courses and ponds. They show also how water will behave anywhere on the land, because the natural path of water flowing over the surface is always at right angles to the contours of the land. This natural path of water is the steepest and fastest route, but it is never a straight line; it always forms a flat S curve from ridge to valley.

The main ridge is the top of the land, the backbone and the outline of the landscape. Look again at the skyline!

The contour diagram of the main ridge displays the contours as a series of elongated loops, one outside the other downwards, with the distance from loop to loop wider at the crest line of the main ridge and narrower elsewhere.

The head of the primary valley intrudes into this contour pattern of the main ridge where part of a contour line swings in closer to the contour line above. The change of pattern shows the first slope at the head of the primary valley to be steeper than the nearby slope of the main ridge.

The elongated loop pattern of the main ridges changes to a series of flatter loop patterns of the primary ridges between the closer together contours at the head of the primary valleys. The loop pattern of the primary ridge contours approach more the shape of the arcs of a circle than the hair-pin like loops of the main ridge. The contours are widest apart at the centre or divide line of the primary ridge and narrowest at the head of the primary valley.

The primary valley has two slopes which change from steep to much flatter at the Keyline of the valley.

At the Keyline the contour pattern changes. The contours become closer together near the primary valley before they open out to display the flatter slope of the primary valley below the Keyline. Then they converge again on the other side of the primary valley to open out again to display the next primary ridge shape. A line through the contours, joining the points of greatest convergence on each side of the primary valley, marks the boundary between valley and ridge shape.

This combined contour pattern of the three shapes of the land may change again near the creek below, by the contours coming closer together near the centre of the primary ridge and being wider apart in the primary valley. This new pattern indicates that the primary ridge has 'nosed over' just above its lower boundary--the creek below.

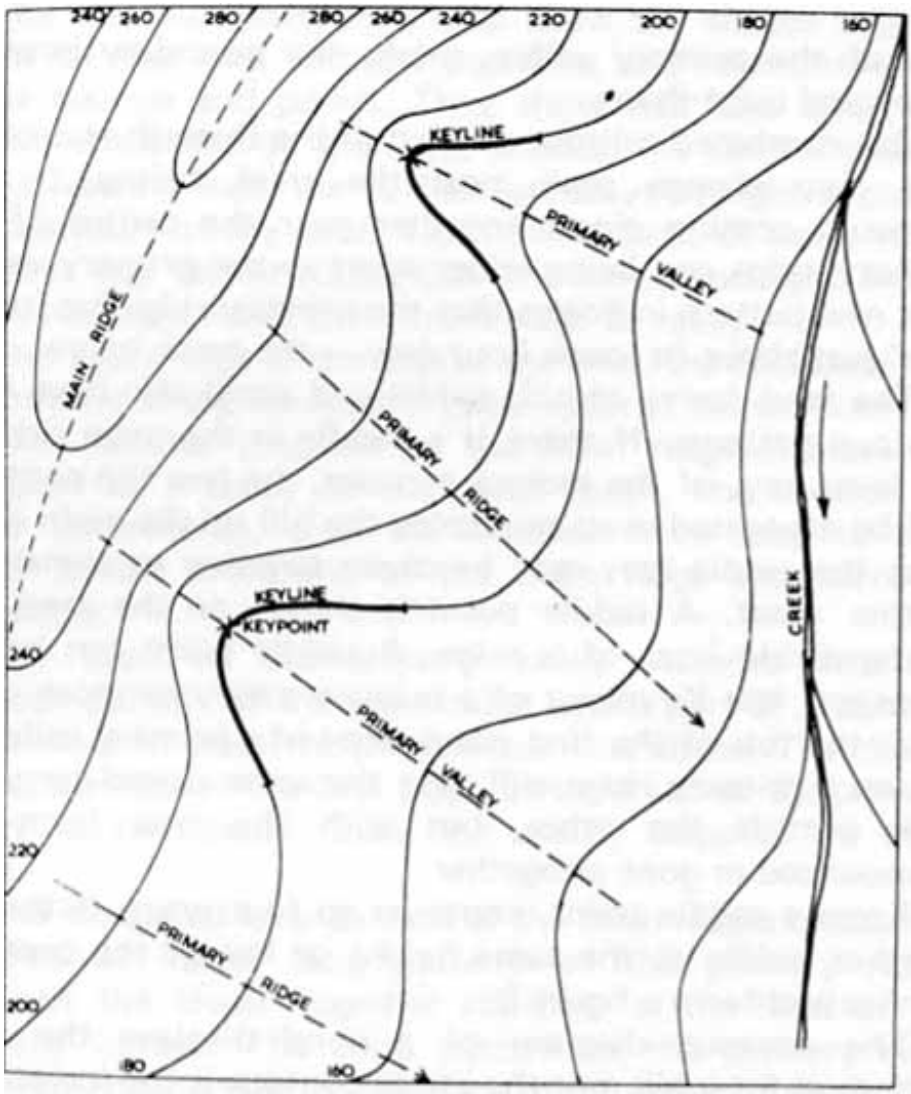
The land forms of hill, saddle and pond also have their contour patterns. If there is a saddle in the main ridge at the level, say, of the second contour, the two top contours will be elongated ovals to display the hill on the main ridge. Near the saddle they may be closer together or sometimes further apart. A saddle point is always on the crest line (water-divide line) of a ridge. A saddle point can be, on iiiiiioccasions, the Keypoint of a primary valley or more often be at the top of the first steep slope of a primary valley. A hill on a primary ridge will have the same closed contours, each outside the other, but with the oval form less pronounced or gone altogether.

From a saddle point, contours go four ways. If there is another saddle at the same height or lower, the contours join up and form a figure 8.

The contour diagram of a pond displays the same pattern as for a hill, but the inside contour is the lowest line and the outside contour, the highest.

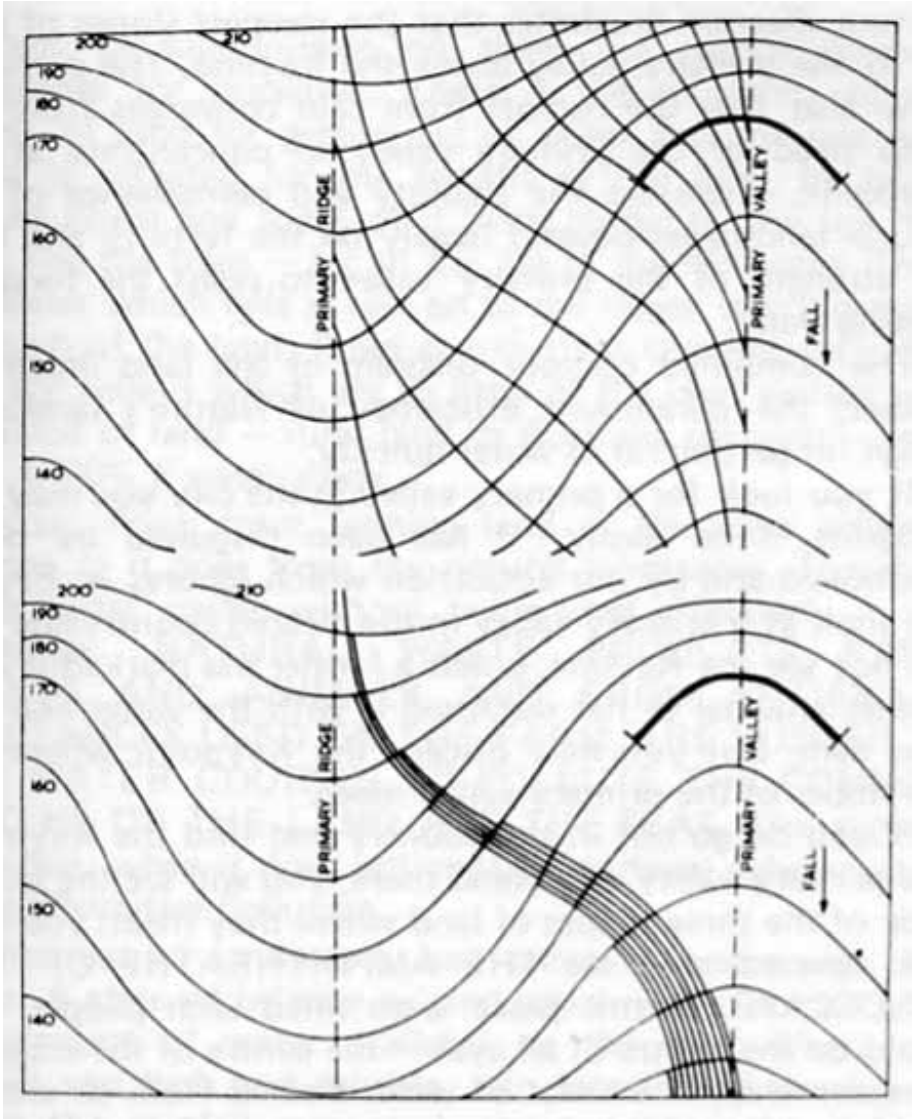
Since the main ridge rises into the rising country towards the head of the watershed, the height of the Keylines of the series of primary valleys tend to have a rising relationship also.

The creek is the lower boundary of its tributary primary valleys and of the primary ridges on each side of the primary valleys.



The contour map has contours at 20 feet vertical intervals. It shows a portion of a main ridge, two primary valleys, two primary ridges and part of a third, and the creek below.

Run-off water from rainfall on the main ridge and the higher parts of the primary ridges, flows to the primary valley by the steepest path and the fastest route. The pattern of flow is at right angles to the contours. The contour diagram illustrates that the steepest slopes of land are in the primary valley above the Keyline. The contours show also that the run-off from rain converges from the steep head of the primary valley to concentrate at the Keypoint. Therefore the stability and permanence of the natural landscapes depend largely on the fertility and thus the strength of the primary valley to resist the force of flowing water.



The diagram has contours at 10 feet vertical intervals. It illustrates the pattern of water flow. The primary valley shape is proportionately larger for the sake of clarity.

Upper: The flow paths of run-off water from the primary ridges to the primary valleys are flat S curve.

Lower: Depicts one flow path to illustrate the increasing volume of flow from the centre of the primary ridge to the primary valley.

The combined contour diagram of the land illustrates further, the paramount efficiency of Nature's landscape design for getting rid of water quickly.

If you look for a primary valley in the city you may not recognise it so easily. It has been disguised by being overlooked and by our education which ignores it. Even if you look at a primary valley in the cleared countryside you will not see the Keyline, unless a farmer has marked it with a water channel or has disclosed it with the water line of a farm dam. But you may discern the. Keypoint where the two slopes of the primary valley meet.

If you do go out in the country and find the Keypoint of a primary valley and stand there, you will see the family place of the three shapes of land where they meet; you may look upwards and see THE AMPHITHEATRE OF THE LANDSCAPE. If this place were filled with people, you would be the centre of all eyes--the centre of the stage. In the same way, if a sheet of water flowed from all around the highest tier of the theatre, you would cop the lot.

The functions of the primary valleys in the landscape have been overlooked by those who were responsible for devising the special purpose landscapes of man--with one exception. By accident or by instincts developed from long and intimate association with land, a few farming families have improved and strengthened the primary valleys. In doing so they increased the fertility and the durability of their

farmscape.

There are thus special characteristics disclosed by Nature's landscape design for consideration when we attempt to superimpose on them the special purpose

landscapes for ourselves. There is the efficiency of the shapes of land for getting rid of water and the only way water is retained for the benefit of the land, by being slowed down and some of it being stored by the soil, the grass and the trees--by all the life in the landscape. Then the water which falls as rain on all the ridges, which occupy so. much of the land, flows as run-off to concentrate in the primary valleys which are so little of the land surface; yet the value of land--rural land in Australia certainly--is as high as 80% a water value.

Water flows from farming land in the same efficient manner as it does from the natural landscapes. Therefore much water passes without being used effectively in the landscape. NATURAL WASTE PRODUCTS FROM PLANTS AND ANIMALS AND FROM ARTIFICIAL SUBSTANCES USED ON THE FARM, ARE RUSHED TO THE WATER COURSES TO POLLUTE THE COMMON WATERS OF THE LAND AND THE SEAS. This type of pollution, when it does not contain artificial substances, is named Primitive Pollution.

The natural landscapes had come to terms with the water. A state of balance existed which was in accord with the amount of water available to the land. Where the rainfall was high and reliable, rain forests had developed; where the rainfall was moderate and its incidence less reliable, the grasslands of nature were found. When the man-made landscapes of farm and city were imposed on those of nature, the balance of the association of land and water was changed. The flow of water off the land was speeded-up, instead of being slowed down.

It is evident that landscape design must firstly be concerned with water to (1), to control positively and to use more effectively the water which flows from the land to the water courses and (2), to improve on or change the pattern of behaviour of water which falls on the ridge shapes.

The design which achieves the optimum control and beneficial use of water for the development of high fertility, efficiency and balance for the farmscape, will be the logical design for townscape and cityscape and for all the special purposes landscapes of man. And the control and better use of water is the first answer for the control and final elimination of pollution.

The life in the landscape of Nature was principally a process of slowly moving water: even our own bodies are 70% water. Nature slowed down the water, with the life of the landscape. Surely the next step which is up to us is to control and to use every drop of water before it reaches the streams and the rivers, for the aggrandisement of all the special purpose landscapes of man.

CHAPTER FIVE

The Fragment Between

The landscape design of Nature has been examined on undulating land, but the design and the shapes and the forms of the land are there in the 'flat' country. The shapes and forms may not always be identified by the naked eye, yet the marking in of contours on the land with the aid of a levelling instrument and many pegs, will clearly disclose them.

Then there is the primordial landscape with its vistas of mountain crags and caps and panoramas of cliffs and chasms where the hard geological structures below appear to have thrust through the landscape. There may be only a thin soil here and there which supports a few patches of scrub or scattered trees among the rocks, Even in this harsh angular land there will be the water-divide lines of the main ridges and the drainage lines of the water courses, all twisted and bizarre. With the rocky foundations of the primary valleys and primary ridges, there will be the rough land forms of saddle, hill and pond.

The wind has intervened in the battle of water and the land. The signs of its victories are the hill forms in valleys which have created many saddle forms and pond forms which may not hold water. Where the structures below are previous and on the strips of dunelands, Nature's drainage lines have been obliterated, But where water has made good its retreat to the sea to attack again in rain and has re-established the drainage lines, the wind and the water have fashioned landscapes of sparkling variety. There are occasional flood plains where deeply flowing water has fashioned landscapes like those of the dunelands--of many hill, saddle and pond forms.

THERE ARE FRAGMENTS IN THE LANDSCAPE. They have great importance but are not always of the three shapes of the land. These fragments are land which is covered with water some of the time. Firstly, there are the areas between the tides. This is land at low tide and water at high tide. Secondly, there are the flood plains of streams and rivers. This is land for most of the time and becomes water once each year over many parts of the world. In Australia it is different: the weather patterns do not produce the regular annual floodings. On the other hand the flood plain of the Hawkesbury River, near Sydney in New South Wales, was covered by water six times in five weeks in 1951.

This land-water or water-land should be kept inviolate from wrongful intrusions. Towns and buildings or stock care centres should not intrude. Towns were moved off this particular flood plain by Governor Macquarie in 1810. They are known today as the Macquarie towns--Richmond, Windsor, Wilberforce, Pitt-town and Castlereagh.

These fragments are the thickening of the vital contact lines of water and the land. They are, as it were, adored and courted by each of the antagonists in the battle of water and land. It is always the front line, the fragment between, the piece in the middle--but it must not be a no-man's land. It should be cherished and kept for the landscape.

Through all history man has battled man and illogically fought with Nature over these vital water lines. Now mankind at last should appreciate that the contact line of water and land has become his battle line of survival.

Yet in all the special purpose landscapes of man, the movement of the water off the land has been speeded up instead of being controlled and slowed down. Water moves faster off the farms than it did from the former natural landscapes, while the farms carry more animals that provide waste products which are washed to the streams and pollute them. Rainfall run-off water rushes from the roofed and paved areas

of the city and waste water is lost quickly without reuse.

Polluted water should not be allowed to cross these vital lines to destroy the sanctity of the common waters of the land and to upset the great balancing medium of earthly life--the seas.

In the design for the environment submitted in following chapters, the water which finally moves off the land surface flows first through the strip forests of the farm and grazing lands; and from the towns and cities, through the City Forests--where the water is cleansed and reconstituted.

When the nations of the world agree--as they must do--to protect the vital line of land's contact with water the battle of pollution will be quickly won and there will soon emerge landscapes of unparallel efficiency and beauty.

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CHAPTER SIX

Design for Environment

If there had been no primary valleys there would be no primary ridges and the main ridge would be the only shape in the landscape and stretch from creek to creek and the creeks would be its boundaries.

But the intrusion, so to speak, of primary valleys into this one massive main ridge shape, gave the land three shapes and assisted in making three land forms. The primary valleys provided higher gathering places for water and higher sites for storing it below the amphitheatre where the three shapes unite and where water continues its attack. This is the place where the landscape can be made stronger, the focal point for improvements to be carried forward--the Keypoint for landscape designs.

The objective of landscape design has been stated at the end of Chapter 4, (1) to control and to use for the benefit of the landscape the water which, in the natural landscapes and in the present landscapes of man, flows over the surface of the land to the water courses, and (2) to improve the pattern of behaviour of water which falls as rain on the ridge shapes of the land, for the benefit of the landscape. The second is accomplished by designs for techniques which operate within the new design for the landscape and is dealt with in Chapter 12, Water the Forest.

The first objective--the control and better use of water--is the basis of landscape design. It is simply the addition of two new water lines to the landscape design of Nature.

The first water line is for the better control of water, the second is for the improved use of water.

We start off on a farm: if the area of land to be designed has a boundary fence which encloses only a part of the main ridge and one primary valley and its adjacent primary ridges, the first new water line would be placed so as. to divert the run-off from rainfall on the higher land to a storage site at the Keyline of the primary valley. This is the highest site for water storage in the highest valley of the landscape.

The storage dam in the primary valley is equipped with an outlet pipe to release the water to the second new water line. It uses the stored water to irrigate the land. Added to this plan can be a lower storage from which water would be pumped up to the irrigation dam.

The first new water line is a diversion channel to control the run-off water from rainfall; the second new water line is an irrigation channel to water the land. The design is made to suit the improved use of water during heavy run-off periods which provide water beyond the absorption capacity of the (and and the limits of the storages, (Chapter 12, Water the Forest).

These two new water lines are different from the water lines of Nature's landscape design. Whereas the natural drainage lines and water-divide lines do not touch, the new water lines cross over the drainage line of the primary valley and the water-divide line of the primary ridge. They may go on to cross the land and join up several primary valley drainage lines and primary ridge divide lines. In the same manner they cross over the water-divide line of a main ridge and join up with the drainage line of a creek or stream. They may thus connect up two or many unit-regions.

Now a concept is introduced which years ago helped solve the author's problem of designs for the farmscape. Called THE KEYLINE SCALE OF PERMANENCE, it is an order for planning based on the

relative permanence of the various items which together make up the completed landscape. In the next chapter the concept will be applied to the design of the town and the Cityscape.

This is the scale:

1. Climate.
2. Land shape.
3. Water.
4. Roads.
5. Trees.
6. Buildings.
7. Subdivision.
8. Soil.

The first three of the eight factors of the scale of permanence--climate, land shape and water--are THE INSEPARABLE TRINITY OF LANDSCAPE DESIGN.

The first two factors, climate and land shape, are the more or less unalterable background of the landscape. Water, with its lines and its patterns of flow, is the first factor of the landscape design of Nature which we change.

The two new water lines added to the landscape have a fall down the land--the same way the creek falls--but their gradient is made less than that of the creek below. Therefore the further the two new lines are extended, the greater the height difference between them and the creek below, and progressively more land lies between the new water lines and the drainage line of the creek.

Water is thus retained at higher levels on the land. Before it may join the water courses to flow on to the sea, it must cross-over the surface or go through the soil of the landscape.

The new water lines for city as well as for farm, are permanent features of the designed landscape. All factors below them on the scale are made to fit in with these new but now permanent water lines.

The fourth factor, roads, fit in with the new water lines. A road follows alongside the diversion channel right through to the boundary. The diversion channel with its associated road, has now added a 'zone' to the land by dividing the main ridge and the higher parts of the primary ridges--the high catchment area--from the rest of the land. Another road follows along the crest line of the main ridge to service this zone. The sites for shelter trees (the fifth factor) and for buildings (the sixth factor) with their work areas are positioned in this first zone of the land.

A second zone is added by the line of the irrigation channel which likewise, with its service road, divides the region from end to end. The second zone is thus bounded by the diversion channel above, the irrigation channel below, and the boundary fence at opposite ends.

The land which contains the areas for irrigating thus lies in another zone--the third zone of the land. This zone has a lower boundary; a channel; which controls the final overflow of water when it is in excess of the capacity of the soil and the storages.

The land lying between the lower boundary of the irrigation land and the creek, is yet another zone, the fourth zone of the land.

The four zones, with their service roads are connected. The site for this road is along the divide-lines, or centre lines, of the one or two large primary ridges in each unit-region. A primary ridge usually has a more or less uniform slope from the main ridge through to the creek below.

The system of new water lines and their roads has not only added four zones to the regions of Nature's landscape design; it has divided those zones in either two or in three parts by the one or two roads which connect and go through them. This further division of the natural regions provides the basis for the complete subdivision of the farmscape, or the cityscape--the seventh factor of the scale.

The fifth factor on the scale of permanence is trees.

Trees are absolutely essential for the health, for the balance, for the efficiency and for the aggrandisement of all the special purpose landscapes of man. If, as is said, they are second only in place to the diatoms of the seas for the supply of atmospheric oxygen, then trees and millions more trees are essential for the total environment.

They must be planted or 'left' in the right places. A plant, or a tree in the wrong place is a weed.

In the farmscape some trees will be associated with the layout of the new water lines, the roads and the fencing of the new zones. They are planted--or left in the initial clearing of land--to shade the stock and to break the winds which dry out the land. They provide in their leaf fall the elements from deep-down for the balance of the soil. But in landscape design, trees have another and special province. The strip forests for the farm and the City Forest for town and city, protect the natural drainage lines and the seas from the waste products which may remain in the water that flows from the land.

The strip forests of the farmscape are located principally in the fourth zone of the land. All water which may flow overland from the three higher zones is directed automatically into them. The water is absorbed into the deep soil of the strip forests and is cleaned and reconstituted before it flows to the streams. (Chapter 11, "Soil and Trees").

All primary valleys or perhaps even most of them do not possess suitable sites for storing water at their Keylines; the shape of the valley must have economic and practical significance for the purpose. If three primary valleys of the series in the one main ridge system have good storage shapes, these three valleys govern the position of the diversion channel. Because main ridges have a general rise toward the top of the region, the primary valleys tend to have a progressively rising relationship. In the opposite direction--with the fall of the creek--it is a failing relationship. The heights of the Keylines of the selected primary valleys are determined so that the one diversion channel may fall to the first storage site and continue beyond it to connect up with the other two sites. In this way the overflow water from the highest storage dam follows the diversion channel to help fill the dams further on down. In like manner the second new water line--the irrigation channel--connects up from dam to dam. When there is more water to be stared and more sites needed for storing it, the diversion channel and the irrigation channel are repeated and connect up the new storages lower down in the primary valleys. Zones two and three are then repeated above zone four.

The countryside has not been divided along the natural water-divide lines or according to the unit-regions, the twin regions and the larger regions of Nature. Boundary lines of farms generally cut across natural unit-regions since so many have been determined with a straight-edge on paper. Landscape design is not simply a matter to be applied only within the boundaries of the regions of Nature's subdivisions of the land, but within boundary fences. For instance, the higher boundary of a farm may start on a main ridge and divide a unit-region by crossing over a creek and the main ridge on the other side, and may include the head and one half of the next unit-region. The property may already have a good boundary fence, many subdivision fences, a stock dam in each paddock, roads through the farm, a homestead, other buildings and work areas. Moreover it may have been over-cleared of timber with trees left only in the steep places or standing in the "back-paddock."

Of the development work which was put in over the course of many years, only the boundary fence may be correctly located. There is a good chance also that the homestead--the sixth factor of the scale--is well positioned since this is often decided by the womenfolk. Because they like to overlook the entrance to the farm and the work areas, the homestead--more often than not--is located on a main ridge or on the higher part of a primary ridge.

To redesign such a farm the same two new water lines dominate the plan but there are several considerations which may determined their location. For instance on this particular property the water to be controlled does not all fall as rain on the farm, since, as one boundary fence crosses a region, water from outside the farm flows in via a creek. This source of water may be greater than from rain failing on the farm itself.

Design starts with the control of the water of greatest landscape significance, This is invariably water of greatest quantity and lowest cost.

Firstly the entire property is examined to determine the water resources available, to pin-point the features of the landscape and to envisage and decide on the landscape design for the farm.

Secondly, the most advantageous place for a starting-off project is selected. The prime requirements are that it fit the landscape design and be of such significance that it will quickly enhance the overall production and value of the farm. It proceeds by progressively controlling all the water resources which have profitable significance.

While these principles of design are universal in their application, there will be only one way to design each landscape. Every special purpose landscape will be unique; there will be no other like it on the face of the earth.

The last of the eight factors of the scale of permanence is soil.

Natural soils were not always fertile but when soil was fertile it was the great storehouse of the renewing and renewable surpluses of Nature. In the fertile natural grasslands and nearby forests, all the life in the landscape lived on the surpluses of Nature which had been provided by time and the reactions of the air, the water, the rocks of the earth and the heat and the light of the sun. They have lived, bred and died for countless generations yet the surpluses of Nature remained intact. THIS IS THE BALANCE OF THE LANDSCAPE.

The history of mankind in his series of leaps and retreats type of conquest of the earth, is the story of his discovery and exploitations of the great surpluses of Nature held in the soil and in the earth.

A fertile natural soil may be deprived of its fertility surpluses in a few decades as the various races of man have ably demonstrated over thousands of years.

But there is another side to the story of soil, which will be dealt with in the Chapters "Soil Sense" and and "The Bastardisation of Agriculture". Impoverished soil can be made fertile again and soil which was originally low fertility, can be made deep and fertile--both in a short space of time.

The management of this design for the farmscape is concerned with the improvement of the fertility of the soil. Therefore it is concerned to see that all the wastes of the farm from plants and from the urine and the dung of animals is absorbed again into the soil where it rightfully belongs. It is concerned to see that water which leaves the farm does so by first being absorbed into the soil to improve it, so that, as a coincidental, nothing from the farm may pollute the common waters of the land and the seas. The management of the design for the cityscape and for all the special purpose landscapes of man is likewise concerned with these same matters.

CHAPTER SEVEN

Design A New City

The basis of design for any landscape is the control and use of the water which has greatest significance for the efficiency and aggrandisement of the landscape. On the farm there are two general water resource avenues; one is the water which flows from rain on the farm, the other is water which flows to the farm from outside it. On some occasions the most significant source may be water from underground.

The provision of household and stock water at the several points where it is needed and where it must always be available even in the longest drought, is a subject for good design. But it is a flexible feature within the landscape and not of particular significance to landscape design.

The principal water for city design, in like manner, is not the water supply for houses and industry but the run-off from rainfall and the waste water of the effluents from the city. This water is to move by gravity flow.

The first three factors of the scale of permanence have been named, "the inseparable trinity of landscape design;" they are climate, land shape and water. These same factors are the special considerations for the selection of a site for a new city. Climate is eternally the most discussed aspect of anywhere--it is always of importance. It is the most permanent factor of the landscape.

Land shape will guide site selection by the influence of such matters as the size of the primary ridges and their lengths and slopes downwards and the size of the unit-regions and their association with regional unities. Land shape is second to climate in the order of permanencies.

Water for the city is a site consideration but it comes from outside and may be brought in from a considerable distance. City water must be reliable, pure and permanent.

A great influence for site selection may well be, in the first place, some geographical or geological feature of the wide landscape which offers particular advantages for city considerations.

The basis of design for the new city is the same as for the farmscape, it is designed from the Keylines or the primary valleys which have greatest landscape significance.

The city should have a definite size and a boundary which may be selected as an appropriately sized natural region. The boundary of the city may be principally the crest line of a large main ridge. The land for the city would first be surveyed and put on paper as a contour map. The natural drainage lines and the natural water-divide lines would clearly display the natural unit-regions within ever larger regions within the boundary of the design.

The flow of water of greatest landscape and design significance is the run-off from rainfall. While these flows in aggregate may be little more than that from city waste water, their peak flows will greatly exceed the flows of waste water. The average percentage of rainfall which becomes run-off from the natural landscape may be under 30 or even less than 12 per cent. But from the roofed and sealed areas of a city, rainfall run-off is very high. It is necessary to design for 100 per cent run-off from the biggest storm rains.

New water lines would be added to the map in similar fashion to the diversion channel lines for the farmscape; but there is a difference in slope consideration: On the farmscape the gradient of the channels

are governed by two factors, firstly, being made flatter than the creek below and secondly by being flat enough so that the flowing water does not wash out the channels in the earth. In the city these slope matters are critical. They arise from the movements of water which carries and transports such materials as raw sewerage. They become the governing gradients and determine the lines of the design for the new city. These grades may vary in relation to rates and distances of flow which in turn determines the sizes of the underground conduits. The levels of population density for the designed city would be determined beforehand so the conduits and their special gradients and margins of safety, become a matter of routine for water and sewerage authorities.

The gradients for the lines of run-off control and for sewerage transport would be plotted in on the contour map but with this difference; they would be designed to flow at uniform depths below the surface of the land. These lines for water control would not result in straights but would be made up of curves related to the contours of the land. Conduits for the main lines of a particular size would always lie at a set depth below the surface of the land. Roads would follow along these lines. Sub-mains would be smaller and be at a uniform but lesser depth below the surface.

The notable visual effects of the roads would be the emphasis of the great beauty that resides in the natural shapes and forms of the land. The homesites would finally be arranged like seats in a great amphitheatre.

The layout of the new water lines and their roads would divide the land into its characteristic zones as was illustrated for the farmscape. The higher land of the first zone would have a lower boundary related to the particular features and shapes of the primary valleys at their Keylines. But there would be other water lines within this zone. For instance the first of such lines would be located along the main ridge just above the first steep heads of the significant primary valleys.

The underground conduits for the two classes of water--from rain run-off and from sewerage--could be placed near each other and lie under a common road, or be some distance apart and have their own separate roads.

The principal road of the first zone would follow, as in farmscape design, along the crest line of the main ridges.

The new city, like all landscapes, is designed from the main ridges downwards, and not as in the past, upwards from the shore lines and the river lines.

The second zone would lie between the lines of control and lines for use of the rain run-off water. The run-off from the two higher zones would be directed to City Forest areas located in the third zone--the zone on the farmscape which contains the blocks of irrigation land.

The sewage treatment works, which remove the clutter of the larger solids and grease, and partly clean the effluents, would be located at selected places along the lower boundary of the third zone. They would discharge their final effluents to irrigate the City Forests located in the fourth zone. The various water lines would then be connected by pipe lines with valve control up and down selected primary ridges. Their roads would lie above them.

Reverting to the scale of permanence: the first two factors of the scale, climate and land shape, have aided the selection of the site for the new city. The third factor, water--and the control and the use of the water of greatest landscape significance--has laid in the broad and basic water-line design of the city. The other water--for city homes and industries--is brought in from outside via PUMP, pipeline and/or gravity flow, to be delivered to water towers located on the hills of the main ridges. The present manner and considerations for its supply are fully adequate.

The fourth factor of the scale, roads, have followed along the uniquely located water lines to provide their service access. They have connected up the main ridges and the new zones of the landscape. They have added the final lines to the anatomy of the cityscape.

The fifth factor of the scale, trees, have been located to use for the benefit of the landscape, the rain run-

off and the waste water of the city.

The sixth factor of the scale is buildings. On the farms they are the homesteads which are the centres for control, administration and management.

The sixth factor for city design is the location of centres; for control, administration and management. The locations of these centres fit into the overall pattern of the water lines, the roads and the City Forests, so that they all serve their particular purposes.

The seventh factor of the scale of permanence is subdivision.

The design thus far is skeletal and on the surface is illustrated by the interconnected system of roads, run-off water holding areas at the Keylines of the selected primary valleys and the layout for the City Forests. Each of these separated areas are subdivided by appropriate further water lines, roads and streets. The rain run-off from every road and street and from the roofed and paved areas, and the waste water of the sewer lines from homes and buildings, are guided to their special underground mains to flow by gravity to their proper places. Such designs in detail within the design of the cityscape are the province of the municipal councils, the planners and the architects.

Soil is the eighth and last factor on the scale of permanence. Just how important this factor is, will be made clear in Chapter 10, Soil Sense.

CHAPTER EIGHT

Review The New City

What has this design achieved? What if any, are the benefits for the cityscape and for the people who will live there?

Firstly it has ensured a logical and forward planned sequence of developments, natural region by natural region, which can be studied on paper and fully understood by the many divergent professional peoples from sociologists to engineers and from biologists to architects who must play their parts in the countless, final and detailed designs within the framework of the city design. Each can appreciate the special province of the other and reach agreements and decisions more readily. A wide unity of purpose would be an expected result.

Construction and engineering aspects of the design, ensure that the major water lines with their roads, precede other developments as they should rightfully do. The locating of underground mains at uniform depths below the surface is efficient and economical, particularly by comparison with present city practices where the placement and servicing of these mains turn many cities into vast underground mining operations where excavations are often very deep and pumping stations innumerable. Moreover, other service mains which are not dependent on gravity alone--city water supply, electricity, gas and telephone--would be associated in a practical manner with the water design lines. Each would have its appropriate and regular place in relation to all others, to be tapped and serviced with simplicity and expedition at low cost.

The major new divisions of the land into zones by the gravity flowing water lines and their overhead and interconnecting roads, offers opportunities for rational subdivisions into suburban areas and for subdivisions within the suburbs. The excellence of many facets of design within the present cities, but which exist now only as disconnected and disordered mosaics, would produce in the new city, an overall harmony of efficiency and beauty.

The first zone of the main ridges with its principal roads along the crest lines is the place for many of the centres of administration and management, the sites for the cultural and commercial centres.

The fourth zone along and above the shoreline and the drainage lines of the streams, is a critical zone for the balance and health of the wide landscape.

This is the zone for the principal sport and playgrounds, of the larger parks and gardens as well as sewerage treatments and City Forests. Treatment works will be as compatible with sports-grounds as toilets are with gymnasiums; everything is clean. This is a CLEAN city, where waste water treatment works have trees in mass surrounds. The water which moves to the rivers and harbours from the soil of the City Forests will probably be better than the water stored today in the great supply dams on the rivers.

Indeed, the natural regions which collect the water for these dams, should be designed on the same new water lines, so that all the water goes into special cleansing forests before it can reach the streams and rivers to flow to the storages.

Sewerage treatment works will discharge their effluents to irrigate what must become the fastest growing forests. The growth stimulating products which remain even in effluents which appear crystal clear, such as the various phosphate and nitrogen factors, now bid fair by their effects on the common waters of the

land and the seas, to eventually destroy the oxygen balance of the world's atmosphere--and all life. But in the soil of the City Forest they would produce an opposite effect where the millions of rapidly growing trees would work to maintain the oxygen balance.

Of all landscapes, the greatest bulk of luxuriantly growing living matter will be in the City Forest. Therefore the City Forest must be also an important biological research centre. Because there may be certain trees in the world which would concentrate one or other of the harmful substances now in the environment; every kind of tree should be grown so that their wood could be analysed and such special properties discovered.

The fourth zone of the land protects the common waters and the atmosphere. There are to be no unnecessary intrusions into it but there will be public enterprises which are essential for the living and the workings of the city. Even these special facilities, where possible, must stand back from the water's edge and the shore lines, so that the water they shed and the waste water they release can be collected and pumped back to the mains along the upper boundary of the fourth zone, to be processed and reconstituted in the City Forest.

Many of the larger industrial complexes now intrude into the land of the fourth zone because of the ease and low cost convenience of getting rid of their obnoxious wastes in water by dumping them directly into the streams and the sea. They would be excluded and positioned in the second zone, where they would, if necessary, carry out the first processing of their wastes before it flows with the more normal city waste waters. Since the contents of waste water are valuable, designs for profitable extraction will continuously emerge. Where the size of such undertakings and their effluent discharge warrants, their individual design would provide for their own treatment works and forest. These businesses would soon learn ways to make both profitable.

What of the high cost of city land which would be used for growing forests? The cost of the land for a new city would be low. Only when people live there and other people want to live there does such land become valuable. It is more valuable when the facilities for homes and for industries have been completed at low cost efficiency in the roads and the service line beneath the roads. So why shouldn't a new city compete with older cities by offering clean air, good water and fertile soil and far better living, social and working conditions, as well as cheaper and better land for homes and for industries?

The land of the several City Forests will receive all the rain run-off and waste water from the city to use and reconstitute it and must continue to function even when it rains for a fortnight. To ensure its capacity in this direction and for economic reasons, dams for holding run-off rain water temporarily, would be located at the Keylines of the selected primary valleys, as in the farmscape. Concrete lined, they could be kept empty. The first rain run-off after a dry period carries with it greatly increased amounts of oil and other matter. The empty dams could be used to store temporarily this first flow, so that it could be cleaned when necessary. Even so, because the water goes in at the top and comes out at the bottom, the oil wastes which float and others which sink could be trapped and retained in the holding dams for treatment, sale or disposal after the rain has ceased. The dams would have controls which either turn the water into the dam or divert it around or below them. The bugbear of local floodings, which now occurs with each heavy rain storm, would be avoided.

The City Forest is a multi-forest. Firstly the various species of the trees would be selected for their ameliorating effects on the air, the waters and soil. Secondly the selection of tree species could be based on economic considerations. The City Forest is designed to be a working, perpetual forest for the profitable production of fertile soil and valuable timber (Chapter 11, "Soil and Trees".)

CHAPTER NINE

To Clean A City

The application of landscape design to the established farm and grazing properties is simple and direct. Although the designs are never repetitive but are of wide and fascinating variety, the principles of design are constant and essentially uncomplicated. The potential of each farm may be fully disclosed and design decisions reached in a matter of an hour or two's inspection with the owner. Only rarely would it take longer than two days. The marking-in of the design on the land with hundreds of pegs, may occupy only two or three days, and the practical constructions thereafter, be completed by the owner in a matter of weeks.

Because the landscape designer works with only those who have an adequate appreciation of the concepts and the principles involved, all decisions are the owner's; it is his farm; the design is his and he knows there is no other like *his* farm. Now he will live and work with the landscape design, knowing that everything he does on the land adds to the enrichment of the soil and to the glorious maturity of the farmscape.

Nature is the Master Designer. She is not slow and may be fast in Her appreciative reactions to good design, which is deeply satisfying and very flattering to the prideful owner.

But the application of the same landscape design to a large city is something entirely different. There is no enthusiastically co-operative owner who knows well the entire landscape, but instead a multitude of city officials, who are interested and knowledgeable each in his particular segment of a vast and complicated undertaking. On the farm the boundary fence, at least, is correctly located and the homestead--the centre of administration and management--usually so. But the city doesn't even have a boundary and the centres of administration and management are either scattered with apparent abandon or, with less sense of practical reality, clustered together in overcrowded city canyons. They possess no related or designed location but simply occupy land which happened to be available at the time, or was cheaper, or occupied only by poorer, small and out-of-date structures.

On the farm, only fences need be altered but in the city, great capital structures stand everywhere in the way. Even without any further considerations the thing appears impossible! What is there to do? Just what has always been done; give priority to the work which if not done is most likely to bring the city closer to a grinding halt or do the thing which public clamour demands should be done. And the clamour now is a command--clean up the bloody mess!

The response of the establishment is predictable with certainty. It will do what it always does; create highly inefficient bureaucratic structures whose immediate interest will be their own elevation to power and permanence. They will have the one efficient department of Public Relations to convince the people of their necessity and efficiency. Since some aspects of pollution are nicely photogenic, the Public Relations department will soon have good 'before-and-after pictures' of success to add to the mess of words they will issue. Their attack will be on the dirty, the untidy and the smelly. The attack on pollution of the air will be against smoke, the most obvious but the least dangerous area. The attack on pollution of the water will be against the scums and the floating rubbish, again the most obvious but the least harmful. The smothering and dehumanising consequences of the lack of balanced unity in the landscapes and the approaching destruction of the whole environment will be ignored. The wide pollution of the soil which now ill feeds us, won't be thought of. How can such creations of the Establishment, attack the greatest source of pollution, the Establishment itself? So what is the answer?

The major effort must be the design of City Forests on areas of land immediately outside the city, and the delivery to them, via pump and pipeline, of the effluents of the city.

The effect of this measure would stop water pollution. It also would reverse the process of oxygen depletion caused by effluents which, wherever they go, destroy the balance of waterlife by over-stimulating the slimes, the scums and the algae. Over-stimulated to death--in their decay they use up the oxygen of the water to cause the death of myriads of small animals and great numbers of fish which likewise in their decay, further reduce the water's oxygen. These effluents effect the production of oxygen by the seas. They have already caused the death of great fresh water lakes.

The indivisable pollutions of air and water can thus be attacked at the principal source.

The next great influence for the benefit of city people may be what happens on the farms and in the redesign of country towns, both of which are simple and straightforward. The large populations of the cities can have great influence on the country whenever they choose to use it. This is the time for choosing, because the effect of the countryside in polluting the total environment is almost overwhelming. Since primitive pollution arises directly from population, the human equivalent of the stock numbers add up to a high population in the country. But as well there are the more insidious materials used on farms which, together with their counterparts in industry, are the most dangerous destroyers of the balance of the environment.

The pollution problems of city and country cannot be separated, they are merely different aspects on the one great threatening catastrophe.

Present large cities cannot be redesigned or altered quickly to substantially improve the efficiency and economy of city functions. It is too late for that. They are more likely to become less efficient and more costly until, if and when, they cease to grow. But growth could be stopped and a new city designed nearby, but divorced from the function of the present city, except for the joining of the two by roads, public transport and communications. Who. could doubt that this would be the best for the larger cities and for the great majority of their citizens? The provision of those facilities which now lag behind population demands could catch up. Progressively rain run-off water control could be applied in the more critical areas and the water added to effluent movements to the City Forests. Although the efficiency of the city operations are not improved immediately great environmental amelioration would be achieved. The city would cease to be a major contributor to environment destruction.

CHAPTER TEN

Soil Sense

The foundation trio of a healthy environment is clean air, good water and fertile soils. These are the inseparables and the essentials.

Soil is a science of its own and a part of a lot of other sciences; so it is fortunate that it is not necessary to know all about soil in order to develop it and to use it. Few good gardeners have degrees in soil science, but they know how to make soil deeper and more fertile.

Soil may be considered as the conversion of rock by two processes. One is a process of ageing, the other is a process of living.

The ageing process is the disintegration of rock to dust and the mixings, the combinings, and the transformings through so many aeons of time. Eventually the surface of the land was little bits of everything from everywhere.

For a long time the earth remained in this state; then there was a great change. The living process started and covered and steadied the restless dust: the living soil was created. But there were ripples and wave motions, and great thunders from below to disturb the steadied dust; the soil was covered up and new soil was recreated many times. The evidence of past rain forests and wet lands is there in the coal seams which are mined now.

The result today is a thin covering of soil which, together with the sea, supports the life of the earth. This top-soil is underlaid by the great reserves of rock debris and soft rock--the dead subsoil. together they are from a few times to a hundred times or more thicker than the soil itself. This sub-soil, or soil material, is of great importance. It is the foundation of life now and for the future. Firstly, it can be turned into real soil quickly, and secondly, there are these immense quantities of it almost everywhere beneath the surface of agricultural land. This is the type of land on which cities are built.

This is how soil is formed. The ageing process of soil formation has taken unknown millions of years. But the point is, IT HAS ALREADY HAPPENED! THE LIVING PROCESS IS RAPID. These are the simple facts which the propagandists of anti-landscape artificial agriculture want all mankind to forget. The living process is *very* rapid. It merely has to convert the sub-soil into fertile soil. The length of time that this takes is related to the life cycles of the life in the soil. This includes even the most minute forms. There are many books dealing with this one aspect in the study of the microbiology of the soil. There are millions of organisms in an ounce of fertile soil and they breed, die and breed again in a matter of days or even hours. There are other larger forms of life in the soil which are part of the process. The animal life in the soil runs to many hundreds of species. Of these the giant is the earthworm, which is not only the great animal friend of man but is also a completely reliable soil informant. If a spadeful or two of soil discloses several sizes of earthworms ranging to seven inches long, then the soil is fertile.

The living process has been going on for a long time. Some soils are thousands or even millions of years old. Soil is a process which has been maintained by countless generations of organisms which have only brief individual life spans. Even the earthworm, our friendly giant of the life in the soil, breeds in two to three months after hatching from egg capsules which may produce 20 live worms. Hereafter this hermaphrodite breeds almost weekly in good soil. An acre of fertile soil will contain a ton or more of

earthworms. Each will excrete everyday more than its own weight of humus-laden casts.

The soil is a complete universe. It has varying inhabitants which occupy specific atmospheres. There is the world of the aerobes which breathe air, and the world of the anaerobes which do not breathe air--they extract their oxygen from matter in the earth. The soil has climates (soil climates) of great diversity. The size of the populations of the soil (soil life) is fantastic. To try to assess the numbers of all these multitudes would be like trying to express light years in inches.

All forms of life require two things for optimum development; good living conditions, which embrace air (oxygen), moisture, warmth and space, and a plentiful supply of suitable food. Then they breed like hell--what else is there to do? This a soil climax. Multiple soil climaxes can be promoted to make soil quickly.

It has been found that the best and cheapest food of all for soil making on the grand scale is the dead roots of good pasture. It it is known how to promote this special organic matter in abundance, successions of climaxes can be promoted. We can promote these breeding orgies in the soil and improve and deepen the soil rapidly.

What is being said now is that if the living soil were stripped from a paddock, the sub-soil material below could be turned into a soil which would rival the original in only a few years.

One of the most controversial aspects of my farm experience has been the subject of soil. Briefly, the claim was that soil could be made deeper and more fertile--quickly. We had done it originally on poor top-soil, on sub-soil clay, on yellow shale, on the harder blue shales and on thin sandstone soil.

This is the simple technique that succeeded where orthodox methods had failed to produce even a poor pasture: we broke the soil material to three inches deep with a chisel plow--the modern equivalent of the ancient stick-plow. Into this we sowed a mixture of clovers (with the appropriate innoculants) and grasses with one hundred-weight of a 50-50 lime-superphosphate mixture to each acre. The pasture that resulted was cultivated likewise with a chisel plow in the autumn of each of the next three years only. (The particular attributes of the chisel plow are that it does not turn the soil under and secondly, it is a tough go-anywhere affair. It has two-inch wide chisel-like tynes attached to heavier spring-loaded steel shanks mounted on a steel frame. Its proper use on pasture land aerates the soil. The effect on soil improvement and pasture can be dramatic. There is a chisel plow which bears the name Yeomans, in which our financial interest ceased years ago. Our first version of the chisel plow was made in 1945.) The chisels were allowed to penetrate deeper into the earth in these three consecutive years, reaching a depth of six or seven inches in the final working. We were thus letting a great deal more air into the soil and making better use of the rainfall by taking more of it into the soil. During these three years, stock were managed in a way which encouraged the production of excessive quantities of pasture roots.

The super-phosphates--a chemical fertiliser--was used to artificially stimulate the grasses and clovers to grow the initial crop of roots. It was not used again or for any other purpose.

Generally by the time pasture plants have grown to near flowering stage, their roots will have penetrated as deeply into the soil as they will go. Supposing at this stage the grass is mown down or eaten off by stock, the grass suffers a severe shock. It is as if grass hated mowers and the sheep and cattle which tear-off and eat its leaves. The shock to the grass is very real. So firstly, the grass must recover from the shock. It does this by not growing at all for a time and by drawing for its recovery on the nutrients stored in its roots. These nutrients were made ready for the great reproductive event in the cycle-of-life of the grass--the flowering and the setting of seed. These deeper roots then die and become in various ways the food for the whole universe of life in the soil.

After recovery from the shock, completely new roots start downwards again. If a sod of grass is dug up at the right time and washed in water--gently--the base of the clump of grass seems to be infested with maggots. But they are not maggots; they are new roots starting on their way down again. If the grass is now left to grow undisturbed, by the exclusion of all stock from the paddock, these new roots will continue downwards to the maximum depth of the aerated top-soil. If the sub-soil has been aerated

previously by a suitable cultivation with the chisel plow the roots would continue deeper into the newly aerated and moist sub-soil. On the other hand, if the grass is eaten before the roots have penetrated to the new optimum depth, the roots will immediately die back because the grass will have suffered another severe shock. The system of the constant nibble, where stock remain on pasture for long periods, is the system of the constant shock. It will progressively reduce the depth of the aerated and alive soil to two inches or even less.

The farmer can thus ensure, by moving his stock on and off his pastures at appropriate times, that bigger and better crops of roots are produced from deeper root systems. Soil-life climaxes are heightened; and in the better living conditions--air, moisture, warmth and space--and a plentiful supply of suitable food, a frequency of climaxes is produced. In this manner shallow soil in which grass roots penetrate less than two inches, can be converted in three years into a very fertile soil five or ten times deeper. We have brought this about many times and so have many farmers. On the other hand, stock can be allowed to cause a withdrawal of the depth of grass root systems and their soil life communities, to shallower horizons: then the soil loses air and loses depth. The life in the soil is suppressed. The fertility of the soil is then in decline.

There are species of plants, lucerne is one of them, which send some of their roots deep down searching for moisture. Lucerne is the alfalfa of the Americas. The soil must have some aeration, such as is found naturally on the loamy and gravelly banks of a water course. Once any roots have penetrated deeply they improve the aeration of the deep soil. These pioneering roots provide the conditions for the roots of other plants to penetrate deeper and to follow the pattern of growth and decay in building a deeper and a better soil.

This is the Keyline soil making technique which authority has rejected for two decades. They have said soil cannot be made that way, it can only be improved by the constant use of chemicals.

The most recent happening which illustrates the speed with which soil can be transformed occured in May this year (1971). A T.V. camera unit, comprising a rural adviser, a cameraman and assistant, were taking movie sequences of projects we had designed in north-eastern Victoria. On one farm, the untreated soil above an irrigation channel was dug up with a spade and dicovered to be three inches deep. The soil peeled off the sub-soil below in a three-inch thick block carrying the light-brown earth of the root zone, and not a single root had penetrated into the yellow sub-soil. Soil nearby but below the new channel had been "pattern cultivated" once nine weeks earlier with a chisel plow and irrigated immediately afterwards. (Chapter 12, Water the Forest). But here the soil, wherever it was dug up, was nearly black to six inches deep and carried a heavy root growth with earthworms in evidence. Even the owner of the farm was surprised at this proof of how quickly soil can be made deeper and more fertile.

Last year (1970) in the Kiewa Region of north-eastern Victoria (south-eastern State of Australia), two high ranking officers of the Bureau of Agricultural Economics from Canberra, the seat of the Federal Government, inspected many samples of soil which were dug up with a spade. They were there at the request of a Minister of the Federal Government to inspect several properties on which these techniques of landscape design had been implemented.

The party which accompanied the officers were farmers and graziers of the Kiewa, my youngest son Ken and myself.

After the officers had been shown several properties, it would be true to say they had become convinced by the inspections and the demonstrations of the efficacy of the water control layouts and other aspects of the development but perhaps not yet of soil making; they were finding it too incredible to believe. Then came the final inspection of their visit.

On this property the owners had doubled their profit by following only one aspect of Keyline--soil development. Here that most scientific implement of soil examination--the spade--finally satisfied the officers. They saw many samples of pasture soil dug up. Some areas of the farm had only one year of soil development, others had two consecutive years and others the full three years. The officers looked at the soil, and felt it, they pulled it apart, they smelt it and compared it with untreated soil nearby. They became

acquainted with the earthworms, which seem to appear from nowhere when soil is on the improve.

Formerly these pastures were cared for according to the recommended orthodox procedures. But over the past three years no money had been spent on artificial fertilisers and no poison sprays had been used on the pastures. There were no pests to be seen.

The money saved added considerably to nett profits. So did the greater quantities of better feed which were produced. There were other bonuses: the former worry of bloat has now been removed; there is no sickness in the herd and there are no veterinary bills and a considerable number of man hours has been saved.

Finally, last year they were third highest in butterfat production for the dairy factory. The two other producers ahead of them were members of the Kiewa Keyline Club who had started their development work one year before them.

They still have their so-called pasture pests, but now the pests are hard to find instead of being in uncounted millions. I think they appreciate these pests now. They get the message, which is: when the pests breed to plague proportions they are saying: "This is wonderful pests' food." When it is a struggle for a few specimens to stay alive, the few pests are screaming in despair: "Keep your lousy pasture, it's only fit for cattle." A cow--if she is given a choice--and the pests, are good judges of pasture, but few men are.

Nature produced Her most fertile soil on only limited areas of the Earth where the climate was moderate. Always legumes and grasses grew together. The herds of grazing animals ate Nature's pastures. By learning from Nature's methods and applying techniques which improve the relationship of both air and water in the soil and by good stock control, the fertile soil belts of Nature can be extended to cover both higher and lower rainfall influences in hotter and colder climates.

In Nature's grasslands the carnivores ate the old, the sick and the excessive young of the grazing herds and maintained the Balance of the Landscape.

Now mankind dominates all. He must maintain the Balance of the Landscape--or perish.

CHAPTER ELEVEN

Soil And Trees

The natural rain-forests were one of the great surpluses of Nature but they are now alarmingly depleted and the trees are being used up at ever increasing speed. And this is the time when their restoration and expansion has become most critical for the safety and preservation of the total environment.

The deepest soil on the face of the earth was in the natural rain forests. The forest soils were not always the most fertile when judged on their capacity to produce in abundance the feeds of the high quality complete proteins. But they were tremendously absorbent.

Rain forests once grew wherever the conditions for their development had been suitable. They needed an adequate and regular water supply, mild to hot conditions with no long dry periods. The trees did not usually intrude into the great fertile grasslands because these were subject to drought.

Trees and the deep soil of the forest are critical in landscape design for the city and for the countryside--in the City Forest and the strip forests for the farm and grazing lands.

In nature the deep soil and the trees created each other because the climatic conditions were right--and no doubt they took their time about it! There is no such deep absorbent soil where it is needed for City Forests but there is need for hurry! However the responses of the inhabitants of the soil to good conditions and abundant food, are very rapid. These things can be promoted and controlled. As was said, fertile soil has been developed from poor soil and subsoil many times, in a space of only three years. For the development of the soil for the City Forest there is this difference; the objective is not eight or even sixteen inches of soil but the rapid development of four feet, five feet or more, of fertile and absorbent soil.

The preparation of the land for water flow and for the planting and irrigating of the soil and the trees are soil making procedures. There will be no waiting around for these things to happen. The natural responses will again be rapid.

Some experiments of the author in growing trees and experiences to do with rain forests are recounted in order to confirm the validity of the City Forest and the strip forests for their role in landscape design.

A hundred or more trees were planted a year after the purchase of the farm, (1943). The ground was opened up with a post hole digger; the young trees were watered for a time. The planting was a failure.

Immersed in the problems of water, no further attempts were made to grow trees for a few years. But becoming interested later in the treated round post type of fencing, it was decided to grow a perpetual forest of fence posts. This planting was so successful that in three years there were more trees ready for posts than could be used. When some of the trees were cut, a selected sucker was left to grow from each stump. They were large enough for posts in only two more years. The trees were spotted gums, (Eucalyptus maculata).

Of course this planting had been done differently, because in the meantime something had been learned from our soil experiments.

The poor shale derived soil, the exposed subsoil and the yellow shale was torn-up with an early version of chisel plow and sown as for a pasture and soil development programme and managed as such for a year.

There was one significant change; the area was chiselled when dry enough after every fall of rain for the one year. In the successive cultivations the chisels penetrated a little deeper. The lines for the rows of trees were deeply ripped--16 inches. By the end of the year the clovers and grasses had become healthy looking and vigorous, the poor soil material now looked like soil for seven inches down and there were some earthworms to be seen. In this moist soil the young six leaf seedling trees were planted after having been watered the evening before in the tubes in which they were grown by the New South Wales Forestry Commission. They received no water at planting time and only rain thereafter. The soil between the tree-rows was chiselled twice during the year after planting, by which time the roots of the young trees had gone down over 20 inches. Two years after tree planting the soil was found to be loaded with various grain and thread-like fungi, the character of the earthworms had changed to big and fat and clover plants persisted among the trees. I had not seen such forest soil since digging in the rain forest of Queensland's Atherton Tableland before the Second World War.

But this notable instance of soil making, which was repeated with other tree plantings, could be considerably accelerated. For instance, it was done on poor soil-material--sub-soil and shale--without irrigation and with less than an abundant rainfall. The ripping for the rows of trees was 16 inches deep; it is quite practical nowadays to rip to 50 inches and more. The depth of chiselling between tree rows did not exceed eight inches; it could likewise be ripped to 50 inches deep. Special plants would keep the earth aerated; many plants will go down to wherever the moisture is. No fungi spores were added; perhaps the best could be introduced. The earthworms arrived on their own accord; maybe the world's largest earthworms from the Gippsland rain forest of Victoria could be introduced and would grow longer than their recorded 11 feet. Very fortunately, earthworms are not over-sensitive to the chemicals of industry and agriculture. To multiply these factors there is the effect of irrigating the soil and the trees with the wonder-water from the city.

A great surplus of fertility would rapidly develop in the soil of the City Forests. It would also physically increase by the addition of dusts from the atmosphere filtered by the leaves and washed to the surface by the rain. Other matter would be extracted from the effluents by the soil processes and by the trees themselves, to return to the soil in the leaf-fall. Although indeterminate at the moment, the surplus of top fertility soil which would be available for sale to home gardeners, and for parks, gardens and plant nurseries, would be big business. It would require 20,000 acres or even up to 40,000 acres to use for optimum profits, the waste water from a city of 2,000,000 people. A large area? Perhaps, but certainly no giant in rain forests--or in grazing properties.

Even Sydney, a city of high priced land, has much larger areas in reserves and so-called parklands which are little seen and rarely used. True, much of it is apparently worthless sandstone shelf country. Its 'water shape' is also poor. But the requirements of the rain forest are principally a place for the trees to stand up and adequate water. Sandstone country can be cultivated, if not by rippers then certainly by explosives. We had experience of this kind of 'cultivation' in 1951. A particular contract called the removal of 20,000 tons of sandstone daily which we lifted and dumped to the side with a dragline excavator--after "cultivation" with explosives. When each 'shot' of a ton of explosives was fired, a near-by observer would hear only a dull whoosh and see the section of land lift en masse and settle back again . The surface was so little disturbed that motor vehicles continued to travel it. But no matter how heavy the deluge, no water ran off and none formed pools on the explosive-cultivated land . Incidentally this contract was planned in 1950, and designed to operate on these same principles of 'complete water control' even if the rainfall was extremely high. 1951 turned out to be the year of the "widespread big wet." The nearly incessant rain eventually closed every coal mine, both underground and open-cut, in New South Wales, while our job did not lose a day.

There are other experiences relevant to the 'impossible' nature of sandstone shelf country. Firstly, years ago the author designed a machine to pulverise scrub, the smaller timber and the surface boulders of rock strewn rural land and coined a new word to name it, the 'tritter'. Drawn by the ordinary farm tractor, it turns at a low cost such things as lumps of sandstone into sand and dust to leave plenty of fine material to grow grass and trees. Tracks through rough country have nowadays been called "tritter trails". The tritter is marketed world wide by new owners. Secondly; sandstone country is frequently of 'poor water shape' which means that the three shapes of land--main ridge, primary valley and primary ridge--are not smoothed over and rounded off. They can be smoothed over and made suitable for rapid irrigation with the

minimum of rock-moving. A cheaper and better method for constituting natural water shapes would be to use the garbage which is in plentiful supply. Indeed the garbage disposal problem could be solved for centuries to come by using it to turn the rocky gorges of the sandstone shelf country into luxuriantly forested valleys.

This 'worthless' sandstone shelf country can be converted to deep soiled rain forests with little delay and produce as well as timber, plenty of surplus fertile soil for sale.

In 1948 the reserved remnant of a Kauri rain forest was seen in New Zealand immediately after heavy rain had ceased. The soil appeared merely moist. The forest remnant is a tourist attraction; the forest soil appeared to be deep. It was evident that the surface of the man-made grassland which surrounded it was much lower. A notice stated also that the grassland was once forest land. The height was lost through erosion by water, compaction and shrinkage. Such a forest would take-in dozens of inches of flood-type rains and discharge it gently from springs of clear water to the streams and the river.

Camped in the rain forests of New Guinea before the Second World War, one of the bugbears was getting wood to burn in the cooking fire. One of the most used expressions around the camps was "Wind 'im fire" which is pidgeon English for 'blow-up the fire' (to stop the stinking acrid smoke). But higher up there grew one special tree, an Australian eucalypt. When first seen I hurried to 'wash' my face in its leaves. After months in the smelly forest below, the urge was irresistible.

The vanishing rain forests of Australia do not have the unpleasant smell of many tropical forests. For the City Forest even the perfume could be chosen by planting a few special trees.

These natural rain-forests and others visited around Australia, the two islands of New Zealand, the Pacific Islands, Europe and America; wherever they remain, have in common the great water absorbtion capacity to stop any amount of rain-fall in its tracks; to take in water very quickly and to release it slowly in springs of clear water. A region which is covered with good grassland soil does not produce heavy floods, but covered with deep forest soil floods are not possible. Flood control is merely one coincidental of landscape design. There is another that would belong to the City Forests and is even more significant; they would be fire proof.

CHAPTER TWELVE

Water The Forest

Pattern and Flood-flo are the names which were bestowed on the two original Keyline irrigation procedures. They suit forest and farm.

In the first attempts to use for irrigating the water which was in such a hurry to get off our farm, costs, in time and money, won easily. Not looking to irrigate a potato patch or a few acres of grass, it had to pay for growing beef; so all the water available was needed and it had to be stored in dams first. There were no difficulties building them; that was already an experience in mining work.

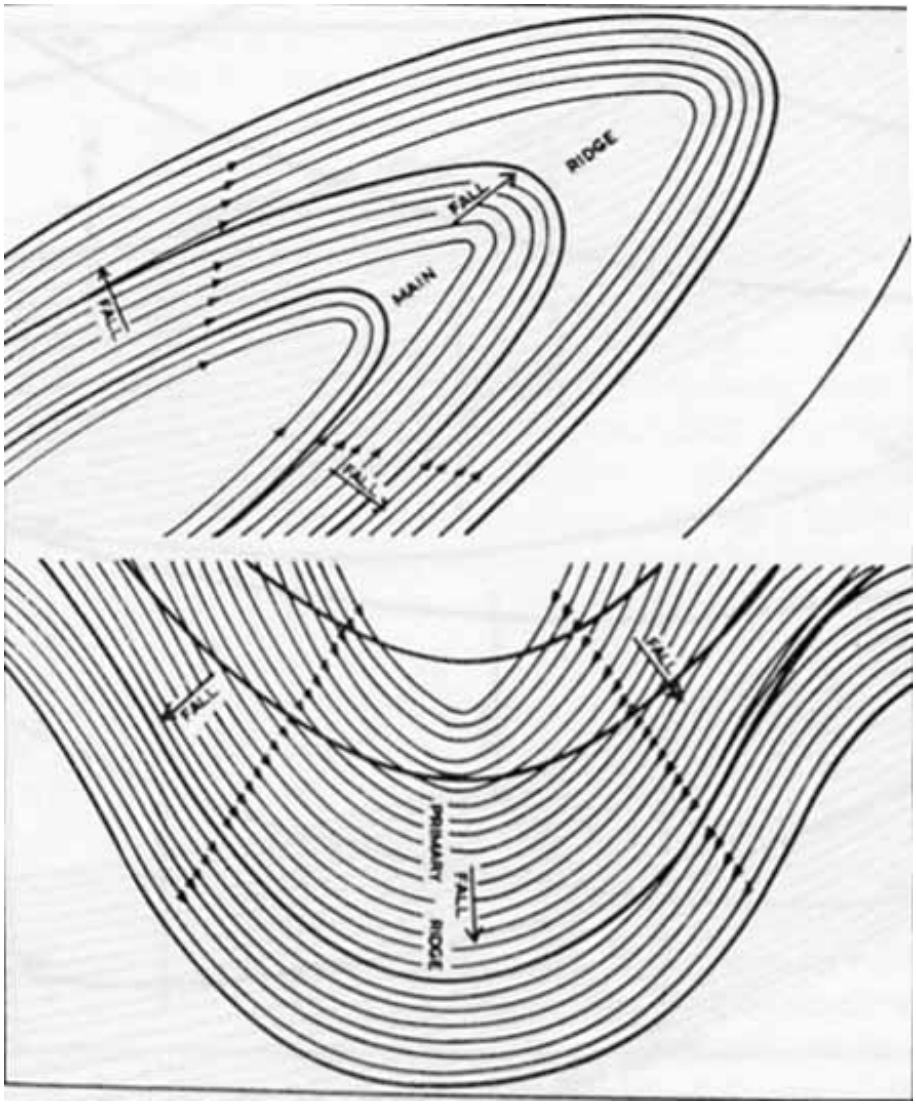
At that time government departments showed little interest in farm dams for irrigation. Critics described our dams as huge and useless. They said our soil was no good for anything but why cover with water the little good soil we had in the (primary) valleys in order to irrigate worthless shale ridges? Only creek and river flats were worth irrigating!

Such opinions were universal then, but passengers flying southwards of Sydney today will see evidence of the reversal of this view in the concentration of these dams so close to the metropolis. All were constructed years after we established their practicability and they are for irrigating land formerly believed unsuitable for the purpose.

We used both flood and spray systems of irrigation. The rate of water flow was doubled from 25,000 to 50,000 gallons an hour which was more than double spray rates at the time. Still the money flowed the wrong way.

While new ideas for irrigating were constantly being tried other experiments to improve soil were going forward. In theory and on paper a way had been devised for cultivating the land to slow down the run-off rainfall from the primary ridges and drift it toward the centre of the ridge, and to make the water drift outwards from the centres of the primary valleys. It was called Keyline 'pattern' cultivation, and now we would try it out.

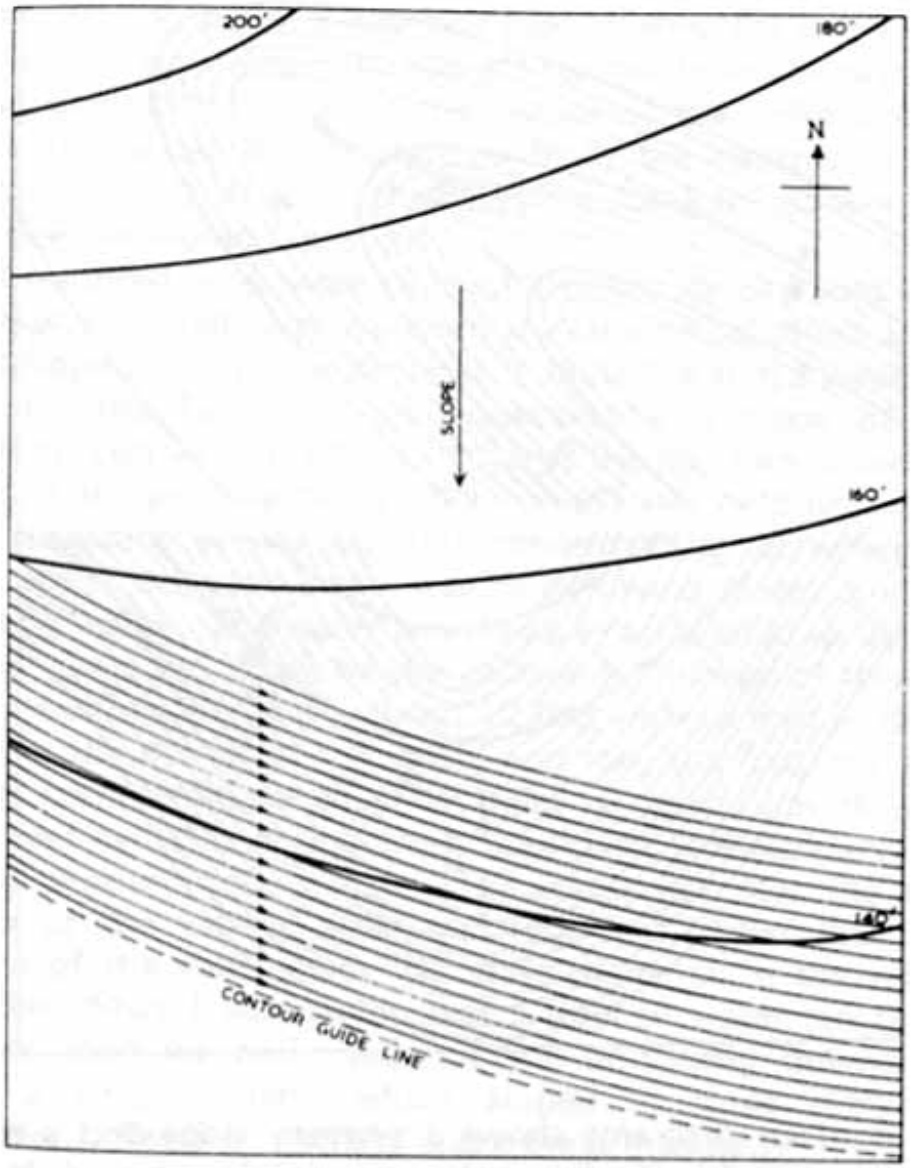
A hundred acres were plowed 'pattern' on dry land with an impliment half way between the later chisel plows and a road ripper. Some months later it rained during a weekend stay on the farm and an inspection was made of the 'pattern' cultivation. Where I entered the paddock it looked good. The rain was heavy, the run-off was held up nicely and spreading evenly and not concentrating anywhere. A dam some distance away was overflowing down a small primary valley. The water was doing exactly what in theory it had to do but it was hardly believable. Instead of flowing as it would normally do, about 12 feet wide, a foot or more deep in the centre of the valley and fast, the 'pattern' had taken complete control. The sheet of water was flowing 180 feet wide, covering from boundary to boundary the entire primary valley shape. The water out near the side limits of the valley, three and four feet higher than the centre of the valley, was the same depth as in the valley bottom. What I was seeing was a flow of water ten times greater than we had used, moving uniformly downward over a strip of land which sloped in three different directions. Keyline 'pattern' was a breakthrough!



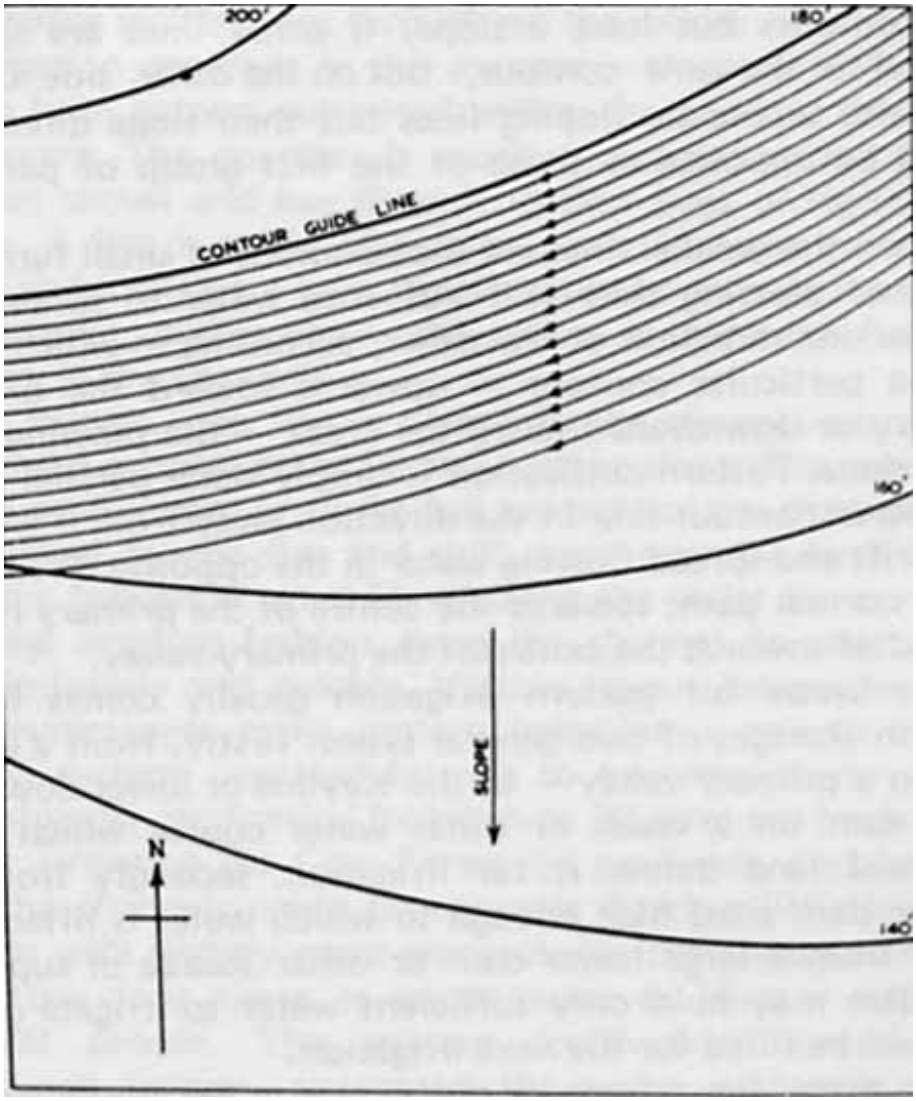
The contour diagrams shows a primary ridge and a main ridge shape with Keyline cultivation designed to drift the first flow of rainfall run-off towards the centre of each ridge.

Pattern irrigation is based on pattern cultivation which in turn is based on the pattern of the contours of the various shapes of the land, (Chapter 4). Contours, which by nature are a uniform vertical distance apart, are parallel to each other on the vertical plane only. Marked in on the land with its varying slope planes, contours are not parallel to each other.

Therefore if lines are made parallel to a contour on one side of it--on paper or on the land surface--the lines are not contours but have a slope. if other lines are made parallel to the same contour, but on the other side of it, they also would be sloping lines but their slope direction would be opposite to those of the first group of parallel lines.



The contour diagram shows a selection of the contour guide line for the Keyline pattern of cultivation which will drift water toward the flatter eastern side of this area.



The contour diagram shows the selection of the contour guide line--the 180 foot contour--for the pattern of cultivation which will drift water toward the steeper Western side of this area.

When the parallel lines are the hundreds of small furrows of chisel plowing they will influence water to spread or drift in one direction or the other, according to which side of the particular contour--upwards toward the higher country or downward toward the creek--the plowing has been done. Pattern cultivation is simply done parallel to a marked-in contour line in the direction away from it which will drift and spread flowing water in the opposite direction to its normal path; towards the centre of the primary ridge instead of towards the centre of the primary valley.

The water for pattern irrigation usually comes from on-farm storages of two general types: firstly, from a large dam in a primary valley--at the Keyline or lower down--or a dam on a creek or other water course which has sufficient land below it for irrigation; secondly from a smaller dam sited high enough to which water is lifted by pump from a large lower dam or other source of supply. This dam may hold only sufficient water to irrigate once and then be filled for the next irrigation.

The water flows from an outlet pipe in the dam directly into an irrigation channel which is wholly within the ground like a shallow trench. The channel is about 50 inches wide and 25 inches deep, and usually has a gradient of one in 300.

Present outlets beneath the walls of dams, consist of two pipelines, one small inside a larger pipeline. The small line is one and a half inch bore to supply filtered drinking water from near the surface of the storage. It operates independently of the large steel pipeline--12 inches or 25 inches diameter--through which the irrigation water is released. This is in part of description of our Lockpipe System which is protected by various patent applications and designs registrations throughout the world.

Irrigation proceeds in this manner--the area of course having been pattern cultivated within the previous

three or four years: The operator is usually equipped with a long handled shovel and has three irrigation flags of registered design. A flag is made of a large piece of water resistant cloth, and includes a light weight pipe-bar to hold it across the channel, and a chain and spikes to hold the flag in position in the channel.

To irrigate, one flag is placed in the channel near the dam and a second, 60 to 90 feet further along. The water is turned on full bore or to the full capacity of the channel, to be blocked by the flag and spill down over the land. The operator follows a set drill, releasing the water by moving the flags leapfrog fashion along the channel, to water the land uniformly and quickly. Various layout designs to suit all circumstances make pattern irrigation a one to three channel system, operated by one to two men to vary the rates of water application from ten to 30 acres per hour.

For irrigating the City Forest on positively undulating land the channels could be concrete lined, a little larger, perhaps with slightly more gradient, for the same two men to control four times as much water as from a city of 200,000 people. The pattern 'cultivation' would be maintained forever, to spread. the water uniformly, by planting the trees in rows laid out on the appropriate pattern.

Pattern irrigation spreads water in large flows, uniformly, quickly, economically and it is a soil making process.

Flood-flo irrigation does the same things on gently undulating and flatter lands but it is much faster and even more economical. For instance a normal rate of irrigation on pasture land for one man is 33 acres per hour, but it is almost as effortless to irrigate 50 acres each hour.

Flood-flo irrigation operates on these same principles of the natural movement of water flow over various shapes of lands, only the emphasis given by landscape design is different. For instance, on the more positively undulating land the natural movements of water are too fast and it concentrates too quickly. Pattern irrigation slows it down and causes it to spread in the right direction. But on land which has very little slope, water travels too slowly, spreads too widely and loses its togetherness and its power to move down the gentle slopes fast enough; too much water soaks into the land. Landscape design controls it but in a different fashion.

The source of the water for flood-flo irrigation is similar to pattern irrigation. Because the landscape is flatter the dams are shallower and of much greater surface area and water holding capacity. The lockpipe system is always the larger size, 25 inch and they may be laid in duplicate. When the water is released it flows directly into an irrigation channel but the shape is different and there is no gradient; it is a contour channel.

This is the design; the irrigation channel is constructed as a two feet or larger earth bank on a contour across the land, a mile or more long. The water flows on the land above the bank where it may be from 50 to 300 or more feet wide according to the slope of the land it traverses. From the irrigation channel the water is released on to the land below through sheet metal water gates six feet wide. The irrigation land 800 to 1,000 metres wide is divided into 'water fields' of ten or more acres each by "water-steering banks" which join up with the irrigation channel and fall directly down the land.

The steering banks may be only a few inches high. They are placed on the surveyed lines of the maximum fall of the land.

The full flow of water is released via the water gates to each water field in turn. The steering banks hold the water together to flow gently but faster than normal for flat country. Between irrigations, all water gates are left open.

Should flood rains occur, the heavy rain run-off from higher land is automatically controlled by the irrigation channel to be spread into all the water fields through the open water gates.

Flood-flo would be also the system of irrigation chosen for much medium undulating country, when the slopes are not too short.

The land for City Forests would more generally be suited by Flood-flo irrigation. The amount of water which one man could control in irrigation would be three times greater than for pattern irrigation and 10 times greater than for any orthodox irrigation system.

The design of both water systems--pattern and flood-flo irrigation--automatically design their own road systems for efficient forest management and, why not, for tourists. For instance a sizeable City Forest on some of Sydney's unattractive and not used nearby sandstone reserves, could be laid out on flood-flo water design. Roads with wide parking strips would cross the slope of the land at say 600 metre intervals alongside the line of the irrigation channels. Other roads would follow the layout of some of the steering banks up and down the slope.

The roads would divide the City Forest into separate areas as did the farmscape and the cityscape design. These 'suburbs' of the City Forest could be adopted by schools or societies involved in landscape betterment--guardians of the environment. Children may like to 'people with trees' their own forest suburbs and watch the trees grow as they themselves grew up. My youngest son helped plant the six leaf seedlings for a strip forest and saw them grow to 60 feet high before he grew to manhood. The trees grew well and we did not have to wait years to see something. In 12 months they were ten feet high and in two years the strip forests transformed the landscape. But the City Forests, with the wonder-water of the city to irrigate the trees, would grow much faster.

CHAPTER THIRTEEN

The Desert Rainforest

If the design for the environment which has been submitted is the right way for the landscape then it must be the right way for all the special purpose landscapes of man, including the lands which are seriously drought prone and which have been the most difficult for man to hold with any great degree of permanence.

We have been encouraged to believe that droughts are getting worse in Australia because the climate is providing less rainfall and the number of consecutive years of far below average rainfall, is increasing. The opposite is the truth. If indeed there was less rain the cause would be the devastation of land and not the other way round. And this change of climate caused by the deterioration of the balance of the landscape over large areas, has occurred many times on the continents of the world during the last 3,000 years. Natural landscape of trees and grass have been turned into desert and given a desert climate by the action and the innocence of man of the way to work with the soil.

A particular grazing property had suffered six years of drought when I arrived in 1966. The average annual rainfall was reputed to be 14 inches but less than half this average had fallen in the six years. The homestead sat on a clay-pan a square mile or so in area. (Claypan aptly describes land from which the soil has been blown away and nothing now grows on it.) The size of the property was nearly 100 square miles. Of 6,000 sheep which the grazier had managed to hold through the drought, 5,000 had died recently.

The property was afflicted by the terrible twins of despair--drought and lack of finance.

We followed the usual routine; firstly, with the owner an inspection was made of the entire property within the 40 miles of boundary fence: secondly, we pin-pointed the principal features of the landscape and envisaged the design for all the land, and thirdly, we selected the most advantageous place for a starting-off project within this design. The last item was critical since the improvement of the property had to be of unusually high significance and it had to cost so very little.

Like most properties that cover many tens of square miles in these dry regions, this one had 'hard' areas which shed almost every drop of rain. The run-off from storms normally disappears in a bed of sand or a dry creek.

The plan was to intercept the rain run-off from some of the hard country with a diversion channel and lead the water to a large shallow storage dam for which we selected a site.

Apart from the land shape, we designed for the climate. Firstly, it was known that the drought could continue for years; secondly, there would be some rain every year. It could be as low as three inches but no previous drought year had been without rain. Therefore the design provided that the drought would be broken before the drought broke and with as little as three inches of rain.

So far a day and a half had been spent on the examination during which time the grazier had made his decision on the project. Another day and a half completed the more critical levelling and pegging. I returned a few weeks later for one day to supervise the start of the construction which was completed by the owner and his very helpful neighbours shortly afterwards.

What had been completed was a Keyline flood-flo irrigation project. It was made up of a diversion channel well over a mile long; a dam eight feet deep of only 6,000 cubic yards of earth moving which would cover with water somewhat less than 100 acres of land. The dam was equipped with a 25 inch outlet pipe. From the outlet a long irrigation channel was constructed on a contour and from this channel, steering banks extended down the maximum fall of the very gently sloping land.

Except for the addition of the diversion channel the project was as described in the last chapter for the layout of a City Forest for the city of Sydney. The principles are the same, the view would be vastly different.

During the year following construction, less than three and a half inches of rain fell. However, within a few weeks the first fall of 60 points nearly filled the dam and irrigation commenced a week later. Twice again in this first year of exceptionally low rainfall--low even for a period of long drought--the dam received water from the 'hard' area to fill and overflow. Each time the dam filled, the water was used to irrigate, when the soil required it, until none was left. The response of the soil and the fodder growth was nearly immediate and from the pictures received by the author this section of the property was quickly transformed. (See colour plates 6, 7 and 8)

The drought continued for five more years to break in April this year (1971).

The project and the property flourished through the drought. A second and much grander stage of the landscape design is now in train. The rain which broke the drought also filled for the first time a storage dam several times larger which had just been completed.

The above description contains the brief facts of a particular property; photographs are included in this book. What follows is not fact! Suppose that on this same property the condition had been even worse, climatically: Also that there were no good neighbours to help and no money to hire equipment to help. The grazier owns only a chisel plow and a 'ditcher', of both items there are tens of thousands on farms and grazing areas in Australia. (A ditcher is a grader type blade attached to the three point linkage system on the rear of the usual farm tractor. Not very effective for digging undisturbed earth, it moves earth which has been previously been ripped-up with a chisel plow.

What has landscape design to offer in these conditions which will cost less than the extremely economical project just described?

The basis of the design is the same as before but in this case there is a change of emphasis. Instead of holding the run-off rainfall from the 'hard' or shedding area in a storage dam now the design is based on doing the best with the little rainfall as it falls where it falls and particularly "during its run-off period"--but without a storage dam.

We have named this particular aspect of Keyline, "Focalising Rain Water." In essence it is a land preparation technique the same as for flood-flo irrigation. The water from the hard area is controlled and focussed onto a selected area one tenth the size of the shedding area.

For instance, an examination of the property may disclose 5,000 acres of hard country: a line is then located for a diversion channel which will collect the rain run-off and lead it to a selected area of only 500 acres. The diversion channel may have a slight fall to the start of the focus area where it becomes a contour and continues along and above it to serve as a water distributor--an irrigation channel.

From the channel small water-steering banks extend for half a mile directly down the gentle fall of the land dividing the focus area into water fields of ten to 20 acres each. Openings are made in the irrigation channel into each field with the 'sills' of the water opening exactly the same heights. They remain open so that instant and automatic irrigation results from every shower of rain which produces run-off from the shedding area.

A half inch of rain run-off would therefore provide the water equivalent of five inches of rain on the focus area. Thus in a drought year the rainfall equivalent may be 30 inches and in an average year, up to 100 inches.

The best use of the focus area for the prevention of drought losses and for profit will depend on the circumstances pertaining on each property. Under the worst climatic condition, growing edible trees and shrubs for stock fodder may be the objective. Even so, for the reasons discussed in Chapters 10 and 11, legumes and grasses would be grown for a year before planting the trees for fodder. Moreover pasture plants will more quickly provide the stock feed which may be so desperately needed in a drought.

A focus area of 500 acres could carry 300,000 or more trees especially selected for the purpose, all planted in rows to suit the manner decided for harvesting the fodder. The trees would continue to increase their capacity to grow more fodder and to grow it in the years when it may not be needed and store the leafy fodder in top condition "above the ground" ready for when it is needed. They would also grow again in a drought after their fodder had been harvested.

The selection of trees would not be confined to the few nutritious types which now grow in these dry lands but could include any desirable species which were suited to the climate and to the plentiful supply of water. Such trees as the cotton-wood poplar and the mulberry, which now appear rarely and only separately in their ones and two's in moist places in these surrounds, may shortly be seen in their ones and two hundreds of thousands.

It may sound incredible that severe drought losses could be wiped out and species of trees could grow which never grew there before. But the fact which is more incredible is that great damage has been suffered by Australia's landscapes when there has always been such potential for tremendous landscape enhancement.

However, one point was the matter of cost. All the construction for the project could be done by a lone grazier with the chisel plow to loosen the earth and the ditcher to sidecast it into position. The first outlay would be for fuel and oil. Progressively the water fields would be fenced for stock control.

Focalising rain water would be fully effective whether the scheme was only one fifth the size on this proposal or five times larger. And such a low costing start would quickly lead to a near drought proof property after less than an inch of rain.

This summary is the outline of a way to get a landscape design started off in severe drought and under conditions of financial hardship. The second stage could be the construction of a dam as little as six feet higher to collect and store water for even more effective use on the focus area, which then would become fully controlled irrigation land.

These techniques have wide application on the drought prone lands as well as in the more bountiful regions. They do not have universal application yet because not all properties have reliable run-off areas. Water shedding areas can be created artificially; some are even roofed over with corrugated galvanised iron to provide drinking water. There are much cheaper methods for creating these special areas and no doubt new techniques will further reduce costs. But because a focus area of less than one per cent of a property may double its production and value, a great deal of money could be economically spent on artificial shedding areas.

However on the thousands of properties which are now deteriorating and where these techniques of landscape design apply immediately, the focalising of rainfall will multiply the rainfall equivalent on the focus areas by five or more times year in and year out.

RAIN FORESTS IN THE LAND OF DROUGHT on focus areas, are the strip forests of this dry landscape. They are as logical as City Forests and as practical as strip forests anywhere else.

CHAPTER FOURTEEN

The Barstardisation of Agriculture

The concern for the non-renewing resources of Nature which lie below the earth has not been how they can be used more rationally and be made to last longer, but principally a matter of finding better and faster ways of getting them out and using them up. The highly efficient and scientific application of the same exploitive principles to the renewing and renewable resources of the soil has opened wide the road to global catastrophe.

There is a critical need that a firm line be drawn between the legitimate use of the surpluses of Nature and their straight-out destructure exploitation. But who is to draw the line and who could maintain the line? Authority? Not likely! Youth then? Perhaps they had better, because they and their children are the people who will be worst affected.

Mankind generally has never come to terms with the soil. All through history the fertility of the soil had been squandered and great areas have eroded away and were abandoned. But there were also some notable and oft-times accidental successes in reversing the process of soil destruction and recreating soil of the highest fertility. However on the slow road to advancing knowledge of soil, one scientific observation of considerable moment was misunderstood and applied wrongly. An avenue of great profit was disclosed in the misapplication of the scientific discovery. The pushing aside of the farmers' practical knowledge and love of the soil, started the bastardisation of agriculture. In the years since, the process has been one of almost constant acceleration.

The scientific event was Leibig's "Chemistry in It's Application to Agriculture" in 1840. By analysing the ash of burnt plants he disclosed that they contained chemical ingredients. This was a great scientific advance in knowledge of the soil at a time when science had not started its intrusion and its compartmentalisation of agriculture. Knowledge of scientific law was somewhat confused in those days but the previous discovery of oxygen and something of its provinces in soil and in plant growth had at least established a foundation for the advancement of knowledge about the soil and its various processes.

At a time of such little knowledge Liebig's teachings appeared wide and illuminating. Soil and humus were now regarded as dead things. There was little appreciation that soil was a community of living things or that bacteria and fungi peopled the humus of the soil and played a critical role in the production of plant life.

The function of chemicals in the soil dominated this intrusion of science into farming where formerly it had been the sole province of the experience and the instincts of the farmers themselves. Now farming could be taken by 'scientists' into the laboratory and in pots of sand, plants could be grown by adding to the sand a little of this and a pinch of that, dissolved in water, and then show how they should be grown on the farm. Even today, when it should be apparent to everybody that the great bulk of farming research and experiments should have been done on working farms under the watchful and critical eye or practical farmers, the researcher mostly avoids the wind and the rain for his pots and tubes in the laboratory.

The analysis of the ash of burnt plants to disclose their chemical constituents was a good story and there were those who did not wait on the farmers' demands but went out and made much profit in telling the story. They sold artificial 'fertilisers', (in reality plant stimulants) nitrogen, N, phosphorous, P, and potassium, K (Kalium). The N.P.K. mentality came to dominate agriculture.

It all worked very well. The skills from the land had founded the industries. There was a new demand on the farmers to satisfy the machines, the workers and the rapidly rising population, and the regular farm worker had left the land to work in a factory. Artificials have little effect on the production from fertile soil, but because soils were depleted or were poor, the farmer, with a few bags of the plant stimulants, was able to increase production with less labour. But the use of artificials started a great change. The eco-systems in the soil, which depend on plant roots for their source of energy, became starved because the roots stay nearer the surface where the drugs are. The plants become hooked and eventually can not grow without them. Progressively more artificial fertilisers become necessary as the eco-systems collapse and fail in their task to feed the plant. Thus the cycle of fertility in the soil is destroyed by a process of artificial defertilisation.

The dominance of artificials did not prevent further discoveries of the natural truths of soil and its functions. Darwin's "The Formation of Vegetable Mould Through the Action of (earth) Worms with Observations on Their Habits" (1882) established the interlocking nature of life. But it did not affect the 'Chemicals on the March.' Nor did Pasteur's discovery of the part played by the microbes, which was so profoundly to effect great new fields of science, have any greater influence against the abuse of the chemical fragment of knowledge of the soil.

So-called scientists with superb arrogance said they had only to put the ashes of burnt plants in a test tube, analyse them, and scatter the equivalent quantities of chemicals over the soil to produce successful crops.

After the First World War ended, every authority--education, science and government--advocated artificial fertilisers. The factories set up for 'fixing' nitrogen from the atmosphere for the manufacture of explosives, turned to the production of sulphate of ammonia which flooded the market and the farmlands. It greatly stimulated plant growth, depleted the remaining humus in the soil and started the process of poisoning the water run-off and eventually all food with nitrates.

Departments of Agriculture were installed in the universities and agricultural experiment stations were established over the world. All deliberately or unconsciously laid emphasis on the N.P.K. mentality and forced the farmer to believe them. Another great mischief was being added--the fear of the parasite, the pest and the weed.

This was a time of high-speed in the bastardisation of agriculture.

It was not long before the Strangest Depression in history engulfed and sickened mankind. But most people today won't know about that, they are too young and the historical record is none too clear. It was the era of POVERTY IN THE MIDST OF PLENTY. Traditional finance collapsed on the stockpile of abundance. It appeared that over-production threatened sales. The ensuing loss of profits endangered the loans, so the banks called-up their loan money. When the money came into the banks it balanced off the overdraft ledgers and ceased to exist. Financiers and investors tried to sell out; hence the panic and the stock market crashes. On a national level there was insufficient money left in circulation to run the economy.

Economists and financial 'experts' advising governments, were so naive they forecast that Germany could not fight a war because she had no money and Japan could never challenge anybody because she had no money. They thought money was the thing when it was only the token for real things. It was the time when confidence was lost in the great confidence trick of traditional finance.

The United States was ever famous for its booms and busts type of economy. But for three years before 1932 Uncle Sam had his hands full with the greatest bust in history. In that year one name became heard above all the rest--Franklin Delano Roosevelt. The name of his game was "New Deal" and after a year of campaigning, Roosevelt swept to the Presidency of the United States in 1933. This was the birth of the Democrats.

"The New Deal was an undisclosed plan of change in the structure and political procedure in the United States of America" (Webster's University Dictionary), but Roosevelt's plan gradually became clear. It was

to get the minds of people off the poverty and despair of the Great Depression by giving them something else to worry about--the Menace of Soil Erosion: and with this as the focus, issue the government credit to bring back confidence and beat the depression.

The publicity which then arose on the pollution of soil erosion was greater than the hullabaloo of the space programme and the noisy present day stink about pollution combined. And the pictures of land devastation were dramatic and horrifying.

Roosevelt's plans were well laid. In one year, 1933, there emerged firstly the New Deal which was sock-it-to-everyone'; billions of government dollars for the unemployed millions, for the impoverished farmers, and in loans to desperate businessmen; secondly Dr. Hugh Hammond Bennett and the Soil Erosion Campaign--half a million men were soon employed in the Civil Conservation Corp alone, and thirdly, David Lilienthal and T.V.A. (Tennessee Valley Authority). The cost was unbelievable although cheaper than the Second World War poised only a few years ahead. Then in May 1934 the weather joined up with Roosevelt's Public Relations campaign: Out of the west, where South West Kansas, South East Colarado, the panhandles of Texas and Oklahoma and North East New Mexico all meet on the great plans, the earth lifted and moved eastward across the Northern American Continent to be "sifted through the windows of New York Skyscrappers". (H. H. Bennett -"Soil Conservation"). DUST BOWL! What a name for their Public Relations machine to play with.

Roosevelt succeeded in restoring confidence, getting the economy functioning and people back to work, and remained President to die in office near the end of the Second World War.

But what had happened to agriculture which had caused soil erosion--still the greatest soil remover of all time? What happened to the soil? It should have been the greatest programme for enlightenment on soil, its processes and its functions; instead it became just the opposite. H. H. Bennett, who was called the father of American Soil Conservation, invented a concept--THE IRREPLACEABLE NATURE OF SOIL. It was expressed in innumerable ways in every class of media throughout the great campaign and on into the years to the present day. It is still accepted widely, including here in Australia. Bennett wrote: "Once this valuable asset (soil) leaves a field, it is as irretrievably lost as if consumed by fire . . . . ." "Soil is produced from the parent material so slowly that we may as well accept as a fact, that, once the surface layer is washed off, land so affected is, from the practical standpoint, generally in a condition of permanent improverishment." And . . . "it takes Nature under the most favourable conditions, including a good cover of grass, trees or other protective vegetation, anywhere from 300 to 1,000 years or more to build a single inch of topsoil. . . . The time involved may be much longer; the building of the second inch may require many more years than the building of the first inch at the surface, and so on downward."

So the great cry of the soil erosion campaign was "Save the soil that is left."

This false and utterly pessimistic teaching on soil may have suited Roosevelt's campaign, the chemical fertiliser manufacturers and the financial institutions but it produced the least good for the colossal expenditure, and did nothing for todays world except add to its troubles.

There was little that was realistic in the whole razzmataz. Even the choice of the term 'soil conservation' was absurd since CONSERVATION IS NEVER ENOUGH.

Soil conservation first taught that clearing the timber caused erosion; plowing up the grassland caused soil erosion, as if the answer was that man should live only on nuts, fruit and meat. Other statements nearer the truth, said soil erosion was firstly the loss of the fertility of the soil. Even this is not so since the soil on more than three quarters of the land surface of the earth never was fertile, but it did not erode until it was occupied by man. In the semi-arid regions the soil had balance. The loss of the natural balance of the soil, caused by man's occupation of the land and his innocence of the soil, is the cause of soil erosion.

In 1933 the United States established the Soil Erosion Service. In 1935 Congress passed the basic Soil Conservation Act (Pulic Law 46, 74th Congress), which authorised the Secretary of Agriculture to establish the "Soil Conservation Service" who renamed the Soil Erosion Service, the United States Soil Conservation Service, within the Department of Agriculture.

The nation which was the greatest despoiler of soil in history--natural soils as fertile as any on the face of the earth had been so damaged in only ten to 15 years as to be washing away--set out to teach other nations--how to 'conserve' their soil. Soil conservation was even elevated in America to a new "science" with its own graduates in 1948.

The essential fundamentals of American Soil Conservation are (1) to use the land in keeping with its capabilities and (2) to protect the land in keeping with its needs. The scheme of the Soil Conservation Service for "farm planning" is based entirely upon capability as to land use. This "capability" classification places all land in one of eight soil classes ranging from Class (1) "Very good land that can be cultivated safely with ordinary good farming methods. It is nearly level and easily worked" to Class (8) It suited only for wildlife or for recreation. This land usually is rough, stony, sandy, wet or highly erodible." All classes are based on the soil as it exists at the time of planning.

Superficially this may seem fair enough but it is completely unrealistic. Firstly, no provision is made for the fact that soil can be quickly changed for the better and secondly, their planning of each farm is based on the classification of soil when soil is the least permanent of the principal factors of the farming landscape. (See Chapter 6, Design for Environment).

Soil conservation is so well oriented to the chemical mentality that the whole scheme could well have had its basis in big business. Certainly, the decreasing number of organically and biologically inclined farmers were being brain-washed to believe they were wrong.

And again Australia devotedly followed America.

The Great National Expenditure on Soil Conservation did some good. It even appeared to do a great deal of good in places but it was a crime against people and a crime against the landscape. Because of its wide miseducation on soil, it added greatly to the bastardisation of agriculture.

When the submarine menaced Great Britain in the Second World War the farmers were urged to grow more and more food. It was the co-ordinated Defence and Financial policy to force farmers to buy the chemical stimulants. The finance given to farmers was in fact a subsidy for the chemical industry. The government itself became the partner of the producers of artificials to ensure their greatly increased use.

No one seems to have been concerned with what the final result would be on the soil, the crops, the livestock and the people, and who even mentioned the environment itself? Or who said there was a better way? Plenty of people knew a better way, the natural and rational way, but they had only dollar voices, against the million dollar voices of big business. There are no huge profits for business in health but plenty in disease and in controlling its symptoms.

During the Second World War a new array of chemicals were being readied for their onslaught on the farmlands and to be extended to a devastating attack on the whole environment. Some of those which have come into use had been banned in warfare because of fear of the frightful consequences! While artificial plant stimulants continued their advance and the further farming departed from the natural and rational way, the greater has been the rise of the pests and the parasite. Now the new and efficiently business oriented chemical sciences are those of the pesticides, insecticides, weedicides and the defoliants. These are the big exploitive businesses of the billions of dollars. Their great crime against Nature, the farmer and the normal life of man has been their introduction into the world environment of chemical substances--particularly those of the chlorinated hydrocarbons and organic phosphates--which are not compatible with any form of life on earth.

It matters not how offensive the waste substances of life may become, which in its effect has been named primitive pollution, they are still foods for some other natural forms of life. Their disagreeable aspects arise from unnatural accumulations, or because they are out of their normal place in the landscape or because they have been prevented from returning to the soil where they belong. But with these foreign synthetic chemical substances, many of long life persistance, there is a complete departure from the natural and the normal. Until their recent introduction, their synthetic molecules did not exist during the whole course of the millions of years of the evolution of life. They are food for no life yet all life must eat

them. All forms of life have protective mechanisms in their bodies, as we do, yet no natural defensive organs have genetic experience for detoxifying them and no process of elimination will get rid of them. That is why I have called them THE ULTIMATE FILTH. They are the filthiest things on Earth. They have now entered every form of life on earth to rape and debase it. They supplied the greatest acceleration of all to the bastardisation of agriculture. Today--now--we are well into the era of the Utter bastardisation of agriculture.

In spite of the debasing effect on agriculture which attended Liebig's discoveries, they were and still are of great usefulness. Firstly, the application of chemical fertilisers (except nitrogen) is an excellent way to ascertain quickly if soil is fertile or infertile. If plant growth is markedly improved, then the soil is infertile. Secondly, they have their most important province in assisting the kick-off of a soil development and improvement programme. The best way to make soil fertile is to follow the way of Nature and hurry it up a little. The clovers and the grasses can be stimulated to grow where they are reluctant to grow, by using these plants stimulants--once. When a start has been made with a satisfactory crop of grass and roots, then aeration of the soil and improved use of rain with the correct management of livestock are the prime means for rapidly improving the soil. No more artificial stimulants should be used. If they are used again they become agents of defertility and pollution.

But the chemical manufacturers promoted the more theory--"if a little is good more is better" and instead of the plant stimulants assisting in the development of a healthy soil, the soil became a medium of holding the plant in place to receive the growth promoters. If there was still some natural fertility banked in the soil it was burnt up as ever more soluble salts are used to grow the artificial and unhealthy crop.

If plants nutrients were soluble in natural soil there would be none left for any growth--it would have been leached to deeper levels aeons ago. The concept is that these nutrients exist in the soil "insoluble yet available" to plants by the final action of the plant roots themselves working with mechanisms within the soil. The plants thus have the faculty of being able to select the nutrients they need in the proportions in which they need them; and this is the way it is for healthy plants growing on fertile soil.

But plants which grow from chemical additives are not able to exercise in full this natural selection of its nutrients because they are all mixed together as salts in water solutions and are taken in by the plant out of the normal proportions in which the various elements are needed. The plant is not a normal plant, it is therefore something less--a diseased plant. Nature's way is for insects to attack the unhealthy plants and for weeds to grow in the damaged soil. "Scientific" agriculture replies with insecticides, pesticides and weedicides of ever increasing potency and danger to the environment.

The simple and obvious way to measure the success of farming is that there is no disease in the soil, the plants are free from attack by insects and from fungus and virus diseases and the animals and the people who feed on the plants are healthy and vigorous.

Soil erosion and the creating of alkali lands are the final manifestation of diseased soil and show that the soil had been beaten to near death. The concept of soil conservation is to 'save the soil that is left' and pin the soil to the earth so they can continue to hammer hell out of it with all the techniques of modern agriculture.

There are many signs of soil deterioration before good soil reaches the stage of destructive erosion or salting--and practically all are associated with the reduction of air in the soil. Year-after-year fine cultivation of the soil reduces the intake of water and more of it runs off and air is not drawn in by water moving down deeply to keep the springs and streams flowing. But good crop rotation, which includes deep rooting legumes and grasses, maintains and improves the humus, the crumb structure, the absorbtion capacity and the aeration, and keeps the springs flowing. If stock are run and managed properly, the improvement of soil--the banking of surplus fertility--will be continuous.

The living wonder of the fertile soil is its completeness and its durability, when it is properly managed. A mm. or two of surface soil moves on each year to lower levels while a mm. or two of the subsoil below, with its store of minerals, becomes a part of the fertile top-soil. Year after year and century after century, good food can be produced and the fertility of the soil can remain intact.

Only through a fertile soil can the plants, the animals, ourselves and our children, and the whole environment, recover from the effects of the bastardisation of our agriculture.

CHAPTER FIFTEEN

Water, Life Or Death

The deterioration of the land which is caused by perennial irrigation is of special moment for the Human Environment Revolution.

The basis of landscape design is water in association with land; a principal factor for the improvement of the landscape is the better use of water, yet the destruction of land by irrigation has kept pace and very often exceeded that caused by other wrongful agricultural practices.

There are the two movements in the soil which come from outside it; the first is air, the second is water. The movement of air into and out of the soil and the movement of water into and through the soil cannot be separated.

It rains! Water goes down into the soil and pushes out the air. The rain stops! The free water drains from the soil and sucks air back in. Much water remains trapped in the "crumbs" of the soil structure and as a film covering the particles of the soil. The kind of association of air and water in the soil has been a principal factor in the fertility of the soil.

The most fertile natural soil for the production of good food for the welfare of man and his animals was in the natural grasslands where the rainfall was moderate. Where the rainfall was much below 16 inches annually the minerals necessary for the production of high quality complete protein were not so readily available. But where the rainfall exceeded 30 inches, the extra amount of water going down through the soil had not only speeded up the process for the release of the nutrients minerals, but had partially overcome the capacity of the organic matter in the soil to retain them. They were leached downwards to deeper levels in the earth or washed away. In the regions where the temperatures were higher, both of these reactions were more pronounced.

The health and constitution of animals from the over-dry and the over-wet natural regions is markedly inferior to those produced in the regions of moderate rainfall, (16 to 30 inches). For instance, the thigh bones of rabbits from both the wet and the dry regions are of almost tissue paper thinness compared with the normal thick and strong bones of rabbits from the moderate regions, (W. A. Albrecht, "Soil Fertility and Animal Health", and his concept "insoluble yet available").

These simple natural facts relating to air, water and soil, illuminate the problems of irrigating the land and the reasons why some irrigation schemes have been successful and many others have destroyed land.

Thousands of years ago a method for creating fertile soil and for irrigating, was developed in Egypt along the River Nile. This river overflowed each year with precise regularity carrying with it and spreading over the land, great quantities of silt of both mineral rock and organic origin. The early Egyptians diverted the richly laden water behind banks and in canals, to far beyond the limits of the natural flood plain. The water was finally led into embanked fields where the rich silts were deposited and the water soaked into the dry land. Countless millions of workers soon cultivated, mixed and aerated the soil: they were not people; they were Egyptian earthworms. Crops were sown and later harvested without any further water from the Nile or from rainfall.

This is the "basin" system of irrigation. It was permanent and successful and it did not deplete the

fertility of the soil, but improved it. It is a system of irrigation which, on its long record, may be classed as universally successful. It is based on one inundation, then a cultivation and sowing when the soil has drained sufficiently. One application of water grew the crop to maturity.

This was the system of irrigation used in ancient Egypt. But now things have been changed. The Nile has been dammed to create large reservoirs for perennial irrigation, so that the same land can be watered periodically to grow cotton and other crops. The silts are also impounded with the water and remain lost forever in the reservoirs. Now the Egyptians will need to develop real skills in the management of their soil otherwise their agriculture will follow the chemical way toward destruction. Artificial fertiliser will trigger off invasions of new pests to be poisoned with ever more potent insecticides. This is already happening and the polluted Nile waters are helping to turn the Mediterranean into another dead sea and causing a great loss of food from the sea for the people of the Mediterranean countries.

Bordering on China, Russia and India is the Hunza, the region of a stream where for over 2,000 years people lived on, and irrigated, the ridges. Almost completely isolated from the rest of the world, conjecture has it their ancestors were a few soldiers from the army of Alexander the Great and their Persian wives. These people in the first place were raiders of the caravans of traders on the nearby route between China and India. Here in their uncompromising fastness only 100 miles long and narrowing in places to a couple of miles wide they developed a healthy agriculture by taking water from melting glaciers along constructed channels to terraced fields and rock gardens. Soil for their irrigation land was carried up laboriously from lower levels and built up by composting all the wastes of plant and animal life. In this system of irrigation, good aeration of the soil was maintained by excellent drainage--always an absolute necessity. The compost spread on the soil maintained an excess fertility in the humus which added and retained the minerals. Sir Robert McCarrison, a medical officer, seems to have "discovered" the Hunzacuts for the western world about 50 years ago and referred to their outstanding health and vitality in his Mellon (1921) and Cantor (1936) lectures. In his book "Nutrition and Health" he reports that the Hunzacuts are unsurpassed in perfection of physique and in freedom from disease. Their food consists of wheat, barley and maize, vegetables and fruits, milk and butter, and meat on feast days. They grow an abundant crop of apricots and "among these people the span of life is extraordinary long."

In sharp contract to this successful system of irrigating the ridges, is the wide failure of perennial irrigation. Man loves to boast of his irrigation making the desert bloom. Of course the desert will bloom--for a time. The desert lands had too little rainfall to release the mineral elements of plant nutrition so they remained richly endowed with minerals. The irrigation water first aids their release causing plant life to luxuriate. And all would be well if the soil was managed rationally to create a store of humus and surplus fertility. Instead, because water made the desert bloom, the emphasis is too generally on water alone and not on soil aeration or on developing a humus laden soil which would both extend the value of the water and prevent the leaching of the minerals from the soil. When eventually the irrigated land does not bloom so well, the reduced production is often blamed on too little water so more is added to cause more leaching and less aeration. This hastens the destruction of the soil by either the formation of alkali land (salting) or by water-logging.

This process of soil destruction took many decades and in earlier times the cause was often seen and understood and remedied by spreading dressings of dung on the land, by green manuring and by hand cultivating to aerate the soil. Where water was in short supply the remedies were often found more quickly than in the presence of abundant water. However, with the general advance of the bastardisation of agriculture, soil destruction by perennial irrigation was speeded up to become a shorter term process.

For instance perennial irrigation in Australia is little more than an infant in age, but already is has succeeded in destroying much land and in placing in extreme jeopardy the greatest natural region on the continent--the Murray Region--which includes parts of Victoria, New South Wales and South Australia. But here the deterioration and impending destruction is not caused by agriculture alone; there are other causes and other culprits.

The real trap seems to have been the status deal of keeping up with the Joneses--in our case, the American Joneses. Australian politicians had seen the earlier irrigation schemes in America and been greatly impressed. They received the enthusiastic support of many people in this country, particularly of

the engineers, who, with politicians are not unaffectful by the urges of 'status'.

But things were quite different in the U.S.A. Firstly, they had vast waste storages in snow and ice, which started to melt in the spring to keep their great rivers flowing through the summer and autumn, (fall). It was only necessary to divert the water from the rivers on to the dry land. Secondly, America had a rapidly rising population many times greater than Australia has now, to buy the higher priced products of the irrigation land, such as the fruits and vegetables.

In Australia there were no frozen water assets to keep inland rivers flowing in the summer. They often cease flowing altogether. The enthusiastic partnership of politician and engineer disavowed the changed circumstances and brushed aside the views of their more rational opponents.

The construction of big dams at high cost started and has been kept going ever since by an extraordinary effort of successful public relations, not unassociated with national status symbols. Australians, like most other peoples, are suckers for status symbols, but unlike others, Australians have no idea what the symbols have cost them. Australia started to make the 'desert bloom'. With the aid of a national water wailing fixation about being the driest continent, we have been persuaded to overlook the fact that on a per capita basis, we are extremely water rich. The result now is that we have more unprofitable irrigation land to population numbers, than any nation on earth.

The expressed intention from the earliest irrigation projects until the present day, was that government irrigation would be paid for by the farmers, but despite the make-believe of cost/benefit studies, this prospect was discarded by governments long ago. They are seemingly satisfied if the actual cost of reticulating the water to the irrigation farmers is recovered. There is no possibility of recovering the cost of the high priced storages or the often more costly reticulation canals.

However the point of non-recoverable costs or even the inflationary effect of the squandering of large sums of public moneys, is not so much the issue here. Rather it is concern for the environment and the direct destruction of land.

The failure of irrigation from the point of view of the landscape is occasioned by the design of the system which was done by engineers. Recently the Murray Valley Commission, who control the Murray Waters, received the report of the Murray Valley Salinity Commission which it commissioned in 1967 to seek the causes and to find the cures for the destruction of irrigation land by salting--the 3,000 years old problem of irrigation land. This report on an important landscape matter and one which should have received wide comment, was not noticed in any news media of mass circulation. The following references are taken, therefore from a small Victorian monthly "Irrigation Farmer" November issue, 1970 and December-January issue 1970-71. Headlines include, "SALINITY REPORT PROPOSE HUGE REMEDIAL EXPENDITURE FOR MURRAY AREAS . . . . . "MORE THAN A MILLION TONS OF SALT ANNUALLY POLLUTES THE MURRAY RIVER." "BEAT THE SALT PROBLEM OR ABANDON THE AREA" and goes on to say "The facts of life will force all water users (farmers in government irrigation districts) to unite in common brotherhood for their own eventual survival" and "The clear warning in the Salinity Report of the inevitable consequences of accepting the continuing deterioration of the irrigated lands of the Murray-Goulburn River systems justifies a searching review of the priorities of reclamation of the existing irrigation areas--or of the construction of new reservoirs that encourage demands for the opening of new irrigation districts."

This last statement seems to be asking; should the polluted land be abandoned and new dams built and new canals constructed to supply water to new irrigation districts to ruin more land and to pollute the rivers? Yet of the public who pay for these highly photogenic government irrigation catastrophies, how many have even heard of the Salinity Report?

Government irrigation in Australia is an enormously high priced ecological and landscape disaster caused by irrational engineering design and agricultural practices which are anti-landscape in their methods of handling water.

Our agricultural water developments have started at the wrong water-line--the drainage line of the river

after the water had left the land, instead of at the water-divide line of the main ridges and retained the water on the land a little longer.

THE HUGE REMEDIAL EXPENDITURE mentioned by the magazine is $110,000,000. It is by no means 'huge' by comparison with the original costs or with the damage already done to the region. A particularly disquieting aspects of the "Salinity Report" is that it was produced by engineers and proposes an engineering solution for a calamity of engineering design. There was no report of any solutions, alternative to engineering, having been sought for the salt problem from the less financially involved sciences of the ecologist, the biologists and other more landscape orientated professions.

However, these matters illustrate that water can be life or death to the landscape. The wrong handling of water by state governments in Australia has turned the good water of costly irrigation storages, into a powerful instrument of pollution. This, along with other crimes against the landscape in the region, could make the Murray River become what is already has been called--Australia's largest sewer.

The two irrigation procedures which have been suggested for landscape design--Keyline pattern and flood-flo--are perfect drainage methods and maintain good aeration in the soil. They provide close control of water to supply enough but not to over-water and water-log the soil. That is why they are described as soil making procedures.

CHAPTER SIXTEEN

The Family Farm

The world is suffering a great global bellyache. The abused earth simply cannot digest the stuff that is dumped and spread over the land, sprayed and exhausted into the air and washed and spilled into the seas.

During nearly 40 years of the constant concern and efforts by conservationists, and the spending of huge sums of public and private money, the deterioration of the environment has continued to accelerate. CONSERVATION NEVER WILL BE ENOUGH!

Although general awareness of the out-of balance landscapes and the consequences of new pollutants is recent, many anti-landscape processes are of long standing. In the old world with small numbers of people the wide Balance of Nature was little disturbed. However, the world today seems small for a population so great: there are few landscapes or processes of Nature which remain undisturbed to balance the wide violations of man.

The nature of the species Homo sapiens led eventually to the winning of all the freedoms he demanded. But the freedoms of man left freedom itself open to be abused. Man finds himself again enslaved by the institutionalisation of his freedoms.

The freedom of organisation has given business the right to kill. It is obvious that murder shortens life, but many enterprises do not agree that shortening life is killing. So they continue their onslaught on human life by using the power of money to persuade us to buy things which as food or in use, shorten life. These selfish money interests are causing us all, particularly little children, to be less alive in life and quicker dead. Their deadly game has been the cause of an irrevocable split in society. An expanding group of people will not take part in any activity which will help the continuance of the established order which sanctions such activities. They have rejected and left the rat races of the business world and the workers life. They are not drop-outs, but they opt out of the machinery of the Establishment. In a large measure they think as great numbers of other people think but there is this difference; they are backing up their convictions by acting on them in their lives. They already constitute a head society since they include in their number so many with outstanding intelligence and sincerity. The Human Environment Revolution has need of their qualities and their dedication.

If my analysis of the landscape design of Nature; of soil and landscape processes, and of the bastardisation of agriculture, are correct; the only answer to the depravity and destruction of our environment and for the consequent inhumanity of society is a re-union of mankind with the natural landscape and the ways of Nature.

Firstly, it is proposed that the City Forest be the major step for the cities; secondly; all country towns should be redesigned to include their own City Forest in preparation for increased population, and thirdly, there is THE FAMILY FARM, and the redesign of the whole farming landscape. Fourthly is the need for the creation of new cities.

It was stated in Chapter 2, "the farm was and still remains the most critically important landscape of man." THE MOST IMPORTANT LAND ON EARTH FOR HUMAN SURVIVAL AND THE WELFARE OF MANKIND, COULD WELL BE THE FAMILY FARMS--THE PRIMARY COMMUNITY UNITS LIVING IN HARMONY WITH LANDSCAPE! The important people are the

rebel farmers who have not been bastardised and who have stuck to the healthy and meaningful way of working with their soil and of farming with Nature.

Great pressures have been exerted on the farmers to force them to follow the will of the Establishment. The degradation of agriculture substituted quantity for quality in food. The healthy balance of mixed farming enterprises were immediately at a disadvantage with the over speciallsed one-crop type of agriculture which was urged on the farmers. Eventually thousands of farmers were forced into line by financial circumstances alone.

The ghoulish impositions of probate have been sapping the substance of the family farms for a long time. Probate, which was originally imposed to break up the great estates of Britain, has remained to become a macabre joke on everyone. Its damaging effects were worst on the farming families. But probate did not affect the rising institutions. With their own "everlasting life" they have been able to acquire and to accumulate over the generations, enormous wealth and power, and wide control over the environment. They are now either a sector of the Establishment or they exercise a compelling measure of control over it.

The make-believe of subsidies and assistance to farmers invariably finished as cash in the hands of the institutions. But the real objective is clearly shown in the arrogant demand of the Establishment for farmers to "get big or get out". A further damage to the future of healthy farming is the restraints which the Establishment has placed on the children of farmers who want to go on the land.

The concern of institutions is not with human welfare. They should be humanised by being permitted to die regularly and pay probate. An institutional probate is just, but probate on private lives is not.

The family farm is now critically stressed. It is my contention that the young people must fight as for their own lives to save these farms and their people. The young people and the farming families have great need of each other. They are alike because, almost alone, both have continued to fight for real freedom and living space.

Healthy farms have much to offer the young people. Practically the only sources of good food are these farms. This does not decry the fact that fruit and vegetables of superlative flavour and goodness are grown in home gardens where the fertility of the soil is maintained and continuously improved by the addition of properly prepared compost. (See Sir Albert Howard's, "An Agricultural Testament" and "Farming and Gardening For Health or Disease.")

With the Industrial Revolution in England 'cheap food' was the cry of the industrialists. Their concern was to keep wages down and profits up. Cheap food for the working people became the popular aim of governments. The effect of the policy was to encourage mono-culture in the new lands--which eventually led to the loss of fertility of large areas of fertile soil--and cause the decline in farming and in the fertility of the soil in the older continental countries.

Status symbols also played a part in the loss of the wholesomeness of food. There was the status of "White." White bolted flour, white refined sugar, white bread, white rice were at first dearer than their wholesome counterparts. Only the more affluent could afford them, so everyone wanted them and later got them as they became staple items of diet. Now there are few items of food which escape the processors and profit seekers. Perhaps we need a Brown Australia policy.

The continuous decline in the fertility of the soil and the loss of the real goodness of food has led to the degenerative diseases and those formerly specific to old age, attacking ever more youthful sections of the population. Modern food is no longer cheap--except in quality.

However, there is a revolution in thinking taking place on the subject of food. It is no secret now-a-days that good fruit, vegetables, meat and grains grow only on fertile soil without the application of artificial fertilisers and poison sprays. It is being realised that the one feed for producing the finest taste and goodness in meat, is good pasture growing on fertile soil. The products of the pig are much tastier when it can get out onto grass and not live eternally on concrete. It is something to speak of when a chicken is eaten which grew up with soil and pasture beneath its feet. It does not look like the pale bloated corpses in

their celephane coffins of the battery produced article. The taste is something many have forgotten and some have never experienced. And what about an egg which does not have the pale insipid yolk or the watery white of the wire mesh caged hen fed on unnatural feed. Even fish, of which there is an increasing doubts of its freedom from contamination, can be grown pollution free in ponds on the healthy farms. We produced fish in farm dams in water which drained off good soil. They grew quickly and were all that could be desired.

A successful Human Environment Revolution will depend on youth and the 'rebel' farmer. A simple way to get the best for the environment from these farmers is to buy the good food which they produce. They must be made prosperous and given their rightful place in the community. There are too few of them now but their numbers would be swelled quickly with the demand for wholesome food.

If cities are to be given the landscape balance of health and good living a new agricultural revolution is necessary--and the rebel farmers are needed in the forefront.

A necessary first step is for the two groups of critically important people to get together and to get to know each other. The place of meeting should be on the good land of the farmers. Here again youth will lead! It would be presumptuous to suggest to the young people what they should do. It is only necessary to say to the farmers--if you want to develop real fertility in your soil--if you want to grow only food of complete wholesomeness and get the benefits of your labour--if you want to grow healthy fish--if you want your land to become a farmscape of outstanding health, balance and beauty; by-pass the Establishment and ask for assistance and the co-operation of youth! If you lack contacts write to Keyline, P.O. Box 165, Paddington, 2021, New South Wales, Australia.

Quite apart from the consideration of healthy landscapes and the production of food, there is a nostalgic longing for the country and for participation in farm life by thousands of city people. The principal tourist attraction for city folk could become their visits to farmer friends in the country.

Instead of the drift away from the land to the city, there is a need for more people on the land. There can be good business in the diversification of the farming enterprise and the successful background to this move is a fertile soil.

General reader; if you would like your surrounds in either the city or the country designed and developed on the lines we have discussed, your wishes can be expressed in local and community activities and the ballot boxes.

When you go out in the country, or outside your front door and are able to see the shape of the land through the structures of the city; look at a main ridge--the sky line. Look at the depression below it which is the primary valley with its primary ridges on either side. Look at the water lines of the natural landscape--the contours of shore lines and the drainage lines of water courses. Look also at the placing of trees--or their rarity in the cities; look at the green foliage and grass--or the dry bare soil and the concrete. Let the Landscape Design of Nature remind you that your survival depends on the Human Environment Revolution.

Afterword

Town planning and the polluted water of cities seems remote from farming. Perhaps this is one of our mistakes!

Present developments, for the treatment of sewerage and waste water, call for the expenditure by taxpayers of multi-millions of dollars on huge bio-chemical processing plants, not yet seen in this country. But it is all so unnecessary!

High volume irrigation and rapid soil building techniques can create for us City Forests which will solve our water Pollution problem in the most natural and obvious way, and, at the same time give us a whole series of environmental benefits.

The spin-off from these suggestions would include lower local and other government taxes, reduced sewerage charges and a valuable and continuous timber supply from unique and beautiful forest parklands.

The techniques which guarantee the success of the City Forest are not orthodox agricultural practices but those which my father has devised. They are firstly, the incredibly fast creation of deep fertile soil and secondly, the low-cost high-speed irrigation. I saw their development over many years on our own property and later their adoption by farmers round Australia.

Allan Yeomans.

Plate 1.

Aerial view of portion of our first farm near Richmond, New South Wales.

The road left, through the picture follows along the line of a main ridge. The dams in sight, except two, are in primary valleys which fall from the main ridge to the creek below. The dam on the creek supplies, via pump and pipe-line, the horse-shoe shaped dam on a primary ridge. Out of sight there is a smaller dam on the creek where it enters the property, which diverts creek flow to fill four interconnected dams. Keyline pattern is the system of irrigation used. (See Chapter 6, Design for Environment.)

Started in 1943, the Richmond farm was the principal site where the landscape design concepts originated. Many soil and irrigation experiments and the dam construction techniques--called double vibration--were developed on this area. The site of first successful forest plantings are out of the picture to the West,--right.

Plate 2.

Looking north-east from the main ridge of Vaucluse (Sydney eastern suburb); the skyline is the main ridge and water-divide line between the ocean and Sydney harbour. South Head lighthouse is on the left. Old South Head Road winds from right to left. The primary valleys and primary ridges are disguised by the buildings. The low grassed area is Rose Bay Golf Course. The higher land is sandstone shelf country.

Plate 3.

View from the main ridge of Bellevue Hill (Sydney eastern suburb) near a primary valley, right, which falls towards Bondi and the ocean. The Keypoint is near the lowest building on the right. The shapes of the land have been ignored and are now disguised.

Plate 4.

Son Ken, and tallow-woods (E.microcorys) planted 1955. The subsoil and yellow shale of this formerly eroded land was prepared and sown as for a pasture of clovers and grass and chisel plowed when dry enough after each fall of rain for one year. Then the trees were planted. Vide Chapter II, Soil and Trees.

Plate 5.

A spotted gum E. maculata in a strip of forest of tallow-woods (E.

microcorys) planted 1953. Pictures in "The Keyline Plan" and "The Challenge of Landscape" taken shortly after various tree plantings include Ken as a young boy.

These belts of trees are located along water lines well up on the landscape, whereas the strip forests referred to in the text are generally lower down and occupy a strip of land which has a fall directly down the slope.

Plate 6.

Picture taken from inside a water-field of a Keyline flood-flo irrigation project looking toward the irrigation channel with two water gates open. 60 points of rain supplied the water for the storage dam, (100 points equals one inch). The rate of flow is in excess of 70 cu-secs (1,600,000 gallons per hour). Vide Chapter 13, The Desert Rain Forest.

Plate 7.

Reverse aspect of Plate 6 photographed from the irrigation channel looking down the water field. The uniformity of the spread and the

movement of the flood-flo water is a result of placing the steering banks precisely on the line of the maximum fall of the flattish land.

The largest and lowest costing dams and the fastest rates of one-man irrigation, are features of such drought prone landscapes.

Plate 8.

After the irrigation is completed all the water gates are opened until closed again for the next watering. Gates are six feet wide and two feet deep.

Plate 9.

Looking westward over the primary valley above Parsley Bay to the main ridge of Vaucluse with Sydney skyline in the background. More frequently now the Vaucluse ridge is the skyline as the city disappears in smog.

Plate 10.

The ocean and sandstone cliffs at South Head Lighthouse: the land slopes from near the cliffs to Sydney harbour--(Port Jackson). The ridges terminate as points jutting into the harbour; the valleys fall to bays in the harbour.

The impression of planning in this suburban scene is more apparent than real.

Plate 11.

A three day Keyline school held for 80 members in pouring rain. Every item of the design for complete water control operated with the run-off water. The diversion channel flowing in the foreground connects up and fills four irrigation dams. Vide Chapter 6, Design for Environment.

Plate 12.

A dry weather scene. Between the dog on the irrigated primary ridge and the primary ridge in the background, a primary valley falls to a water course below and to the left. The dam which supplies the water via a lock-pipe system is filled with the water which usually flows without use to the rivers. Irrigation is by Keyline pattern.

Plate 13.

The group are walking across a primary ridge above new pattern irrigation land not yet fenced. The saddle on the right skyline shows where a primary valley starts. Across the land there are two primary valleys and three primary ridges. The hill is on a main ridge. The distant skyline is also a main ridge.

Plate 14.

Pattern irrigation on a primary ridge. The dam for water supply is in the primary valley above the trees and the car on the left. These trees, planted many years earlier in the primary valley, are in the wrong position. Many had to be removed from the dam site. New trees have been planted above the irrigation land.

Plate 15.

The steep primordial vista where the rocks below appear to have thrust through the landscape. Vide Chapter 5, The Fragment Between.

Plate 16.

The flatter lands, which appear to have little shape, have many excellent sites for water storage. Vide Chapter 13, The Desert Rain Forest.

Plate 17.

The steep heads of three primary valleys fall from the main ridge on the right to flatten near the fence which divides the dry from the green area. The dark background is forest country.

The land has deteriorated greatly, but remains richly endowed for landscape design which is to be applied shortly.
