INFRASTRUCTURE DEVELOPMENT
PRODUCT AND INFORMATION KIT

CONTENTS

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The kit has been compiled with the aim of providing pastoral managers with the latest product and technical information to assist in any proposed infrastructure development.
This information should aid pastoral managers in the design and construction of cost effective infrastructure using sound engineering principles and quality products.

The kits contain five sections: -

- **Conventional fencing**
  Non electric fencing utilising high tensile plain wire and fabricated wire products
- **Electric fencing**
  High tensile plain wire fencing for small and large grazing animals
- **Total Grazing Management (TGM) yard construction**
  Yard specifications and construction techniques
- **Water supply**
  Borehole equipment and stock water reticulation
  Surface water harvesting and storage (dams)
- **Solar options**
  Solar powered applications for homestead power generation and pastoral infrastructure

The kit is designed as a permanent reference containing "living" information. As new product and technical information becomes available it can be included, and superseded information can be discarded.
Sincere thanks goes to the businesses cited below for supporting the concept of this kit and supplying product and technical information. Without that support the production of this kit would not have proceeded.

• BHP Wire Products	Kim Jones	ph	(08) 9442 3132
• Gallagher Australia Pty Ltd	Kerry Grieves		(08) 9322 2662
• Hardi Iplex	Guy Hopkins		(08) 9340 4888
• Solar Pumping & Power	Larry		014 511 5891
• Solar Sales	John Hall		(08) 9362 2111
	Nathan Stone		
	Glen Ritikis		
• Southern Wire	Roger Sivewright		(08) 9827 1322
• Sunbeam Rural Division	Ken Stan – Bishop		(08) 9444 7788
• W. D. Moore & Co.	Geoff Moore		(08) 9337 4766
	Stephen Warner-Jones		
	Denis Brewer		
	(W. D. Moore; station visits by arrangement)		

Station infrastructure is in a highly competitive market – shop around for product, services and prices.

Jim Addison, Senior Tech. Officer, 1 June 1999

INFRASTRUCTURE DEVELOPMENT
PRODUCT AND INFORMATION KIT

Conventional non electric suspension fencing

Suspension fencing is designed to control targeted grazing animals by creating a physical barrier to movement.

Advantages of modern suspension fencing are:

1. Less weight of materials per kilometre of fence

2. Lower cost and simple construction

3. Designed to withstand high impact loads

The characteristics of modern suspension fencing are:

- Strainer assemblies designed and constructed to sound engineering principles

  Strainer assemblies are the most important component of a fence
  Assemblies must be capable of withstanding total ambient wire strain plus any additional impact load. This capability must take account of prevailing soil conditions.
  Strainer assemblies need only be employed at the beginning and end of a fence and at points where the fence changes direction.

- High tensile galvanised plain wire

  High tensile wire, (usually of 2.5mm diameter), is commonly used. This type of wire has a high breaking strain and has good elasticity characteristics.

- Long strains

  The longer the strain the greater the elasticity of the fence. This results in negligible wire breakage when the fence receives high impact loads.
  Note: the types of knots used to join lengths of in-line wire will influence the strength of that wire component; use the “figure 8” knot or the “Orange” knot.

- In-line wire strained to appropriate working load

  A wire tension gauge fitted to a standard set of wire strainers is all that is required. Using the gauge all in-line wires may be equally strained to the wire manufacturer’s specification.

- Wide post spacings

  It is the in-line wire in a fence which provides the barrier to a grazing animal, not the posts. The role of the post is to maintain the location of the in-line wire, and to assist in maintaining the desired wire spacings.
  Terrain largely determines the distance between in-line posts. Use anti-sink devices on crests and anti lifts in dips to maintain fence design specification over time.

- In-line wire "side-lined" onto in-line posts

  "Side-lining" the wire increases construction speed, minimises damage to galvanising on the wire, and prevents corrosion taking place as a result of electrolysis between the in-line wire and steel in-line posts. In "side-lining" the electrolysis takes place between the steel posts and the tie wire. Tie wire is much cheaper and easier to replace than in-line wire.
  The in-line wire should be attached to the posts so that the wire may move laterally in relation to the post. This allows the elasticity characteristics of the fence wire to be maintained.
  Side-lining also allows longer strains to be constructed and easier replacement of posts if required.

- Suspended droppers

  Droppers are designed to maintain wire spacings between posts and to transfer impact loads to all in-line wires in the fence. The base of a dropper should not rest on the ground.
  Where multiple droppers are used between posts alternate droppers should be attached to the opposite side of the fence to give balance.

INFRASTRUCTURE DEVELOPMENT
PRODUCT AND INFORMATION KIT

Electric fencing

Electric fencing is designed to control targeted grazing animals by creating both a psychological and physical barrier to movement. Electric fencing employs many of the characteristics of suspension fencing in physical design, but incorporates an electrical component. This electrical component gives both improved animal control and reduces construction costs.

In the rangelands "fence return" systems are used. These require two or more wires, and include both pulsed and earth wires. An electrical circuit may be created in one of two ways;

via the ground, provided soil conditions, (especially moisture), allow,

by touching both a pulsed and earth wire simultaneously.

Touching an earth wire alone will not result in a shock being received. Therefore electric fences are designed so that an animal cannot push through a fence without making good contact with both a pulsed and earth wire. Sheep, cattle and goats invariably push through or under fences, and rarely jump over.

Hints for the would-be constructor;

1. Start on a relatively small scale, eg 10 km
2. Keep the design simple
3. Use only top quality components
4. Attention to detail is vital; do it once, do it well
5. Adequately energise the fence as annual growth flushes will reduce performance through electrical leakage
6. Use cold galvanising on all knots to minimise corrosion and enhance electrical contact
7. Adequately earth the energiser and the fence as dry conditions in the rangelands can lead to poor earthing conditions, and hence reduced fence performance
8. Do not energise the top wire in an electric fence as this significantly raises the risk of lightening strike damage to the energiser

Experience with electric fencing in the rangelands indicates that once grazing animals are "trained" to electric fencing they tend to have greater respect for all other fence types they encounter.

SOME TERMS AND DEFINITIONS OFTEN USED IN DESCRIPTIONS OF ELECTRIC FENCE SYSTEMS

ENERGISER

The energiser, (usually solar powered in rangeland situations), provides regular pulses of electricity to the pulsed wire(s) in the fence

AMPS, (AMPERES)

This is the measure of the amount of current flowing in an electric circuit. This current determines the severity of shock received by an animal.

VOLTS

In order for current (AMPS) to flow, a source of electrical pressure is required. This pressure is known as VOLTAGE. In any given circuit, an increase in voltage will result in an increase in current (AMPS).

RESISTANCE

This is a measure of opposition to current flow in a circuit. For any given voltage, a decrease in resistance will result in an increase in current. Resistance is measured in OHMS.
(The smaller the diameter of the pulsed wire the higher the resistance per unit length)

PULSED WIRE

An in-line wire, insulated from "earth", which carries an intermittent high voltage potential appropriate to electric fencing, sometimes known as "live" or "hot" wire.

EARTH WIRE

An earth wire is a non pulsed in-line wire, which when contacted by an animal, simultaneously with a pulsed wire, completes the electrical circuit.

SHORT-CIRCUIT, (SHORT)

A term used in electric fencing when the pulsed output of the energiser is connected to earth through broken wires, faulty insulators, or any other way other than through an animal.

LEAKAGE

In any circuit, small amounts of current are lost from the pulsed wire to earth by way of green grass or shrubs touching the wire, or through faulty insulators. These losses are known as leakage. With long fences these losses may become significant.

JOULES

Joules are a unit of energy. Electric fence energisers have energy ratings quoted in Joules.

INFRASTRUCTURE DEVELOPMENT
PRODUCT AND INFORMATION KIT

Total Grazing Management (TGM)

TGM is the term used to identify a pastoral management strategy incorporating self-mustering infrastructure. It provides the pastoral manager with the means to manage total grazing pressure on range vegetation through low cost, low stress mustering. This management is based on the control of water availability to domestic and non-domestic grazing animals.

INFRASTRUCTURE DEVELOPMENT
PRODUCT AND INFORMATION KIT

Solar options

Photovoltaics technology has come a long way over the last twenty years. Increasingly photovoltaics (PV) is being employed in remote area power generation.

Solar power options for water pumping and electric fence energiser power may be found in this kit under the Electric Fencing and Water Supplies sections.

Homestead solar power generation literature may be found in this section.

Remote Area Power Systems information and a copy of the rebate scheme application form may also be found.

INFRASTRUCTURE DEVELOPMENT
PRODUCT AND INFORMATION KIT

Water Supplies

Major consideration in water point development include:

- ***Water quantity***

Having calculated the likely upper stocking level that the water point will have to service it is possible to work out the required daily production.

Factors influencing grazing animal water consumption rates include:

Lactation status

Body weight of the animal

Animal species

Daily temperatures

Pasture salinity

Forage moisture content

Water quality

The following two tables indicate likely consumption rates for various classes of stock at different southern rangeland locations.

1. Average daily consumption, per Dry Sheep Equivalent (DSE)

Location	Average daily consumption, (litres)
Carnarvon	2.3
Kalgoorlie	1.9
Meekatharra	2.7
Mt. Newman	2.9

n.b. Peak daily demand may be considerably higher than these average figures

2. Relative consumption rates for various classes of grazing animal

Species	Class	No. of DSE
Sheep	Non-lactating adult	1
	Lactating adult	2
Cattle	Non-lactating adult	10
	Lactating adult	15
Horses		10
Goats	Non-lactating adult	1
	Lactating adult	2
Kangaroos	Adult	0.3

Domestic requirements

Expected household consumption rates, based on bathroom, laundry and toilet needs are:

With septic system	180 litres/person/day
Without septic system	135 litres/person/day

Watered garden requirement ranges from 4 litres/m²/day in summer to 2 litres/m²/day in winter.

- ***Water quality***

  As salinity levels rise in stock water animal production tends to decline, especially in young or breeding animals.

Upper salinity limits for domestic and animal use

Use	MilliSiemens per metre	Total Soluble Salts (milligrams/litre)	Total Soluble Salts (grains/gallon)
Hot water systems	180	990	69.3
Human consumption	250	1375	96.3
Poultry	470	2585	181.0
Horses	1000	5500	385.0
Lambs, weaners, breeder ewes	1100	6050	423.5
Septic tanks	1550	8525	596.8
Beef cattle	1550	8525	596.8
Adult sheep	1650-2200	9075-12100	635.3-847.0

- ***Capital cost***

  The greater the depth from which water has to be pumped, and the greater the volume of water needed, the greater the amount of energy used to satisfy daily water requirements. Greater depth and volume also results in higher capital costs.

- ***Maintenance costs***

  Maintenance costs are significantly related to pumping depth, daily water volume required, and water quality.

- ***Risk assessment***

  Risks such as flood and storm damage should be assessed in water infrastructure planning.