GAP Information leaflet 13

Watering stock on sites

NB: Information provided is accurate at time of going to press but will vary over time. There are a large number of pumps available, and the leaflet is not intended to cover all models

1. Water requirements

Water is the main constituent of the animal's body, constituting 50 to 80 percent of the liveweight, depending on age and degree of fatness. An animal can lose almost all of its fat and about 50 per cent of its body protein and survive. However, the loss of 10 per cent of its body water can be fatal. Therefore, a successful livestock enterprise requires a good water supply. A good water supply is defined both in terms of quantity and quality of the water. A good water supply is important to the livestock manager because total water intakes are positively related to feed dry matter (DM) intakes.

Animals fulfil their needs for water from three major sources:

- Free drinking water or snow
- Water contained in feed
- Metabolic water produced by metabolic activities

Water consumption requirements depend on factors such as:

- Animal factors:
    - Age and condition of stock - Young animals, heavily pregnant or lactating females, and aged or weakened stock are less tolerant of saline water and need more water. In weaner sheep, high salinity depresses growth rate and wool production, and causes scouring
    - Breed differences – In Australia, British breed sheep need about 20 per cent more water than do Merino sheep in hot weather and cattle of the Bos indicus or Bos indicus-infused breeds drink less water under hot conditions than do Bos taurus breeds (British or European breeds)
    - Water use follows a predictable pattern in a day's operation. A herd of cattle often drinks as a unit and may consume three-quarters of the daily total consumption in one period of activity – provide as much drinking space as possible!
    - When the source of water is more than 900 feet from the grazing area, the grazing animals will come to drink as a group instead of as individuals
- Rate and composition of liveweight gain
- Type of diet and its water content - The diet of stock has a large influence on their water requirement. Good green pasture can supply all of an animal's water needs. Sheep under these conditions may not need to drink for many weeks (NB: caution – always provide water). Good pasture allows stock to use water which would normally be unsuitable at higher levels of consumption. Stock on dry pasture need increased water consumption to utilise the less digestible fodder. In some areas, for example coastal areas, stock grazing plants with high salt content require large quantities of relatively low-salinity water. This is because of the high level of salt in the diet and the need for a high water turnover to maintain the salt balance in the body.
- Level of dry matter intake
- Level of activity

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- Quality of water
- Temperature of the water offered
- Surrounding air temperature and relative humidity - In hot weather, animals use more water for evaporative cooling. For example, shearing increases the heat load on sheep in summer because the insulation formerly provided by the fleece is lost. The sheep adjust to this heat load by increasing evaporative cooling through panting. Water consumption can increase by 78 per cent under extreme conditions. The provision of shade will largely relieve this situation. In normal conditions with good quality water, consumption in summer will be about 40 per cent higher than in winter. Marginal quality water may become unsatisfactory during summer because animals drink more due to the high temperatures and drier pasture. The salinity of some water may also increase because of evaporation from troughs, bore drains and shallow tanks
- Drought - during drought, stock require more water as they are forced to select more fibrous and less digestible feed. This extra water is used to maintain the movement of the coarse feed in the gut. As drought worsens and stock become weaker, marginal waters may become unsuitable as the animals' tolerance of the salt decreases
- Feeding salt or salt-based licks or blocks during dry periods increases water intake. If water quality is marginal, this added salt intake may depress appetite and cause digestive upsets — the opposite of the supplement's purpose
- Watering points:
    - The consumption of water can be affected by the cleanliness of the watering point. Where the water level in an earth tank is low, animals may be forced to wade through mud to get to the water. Due to the boggy surroundings, the water becomes heavily contaminated with suspended soil and faeces, which can make stock reject the water. Also, animals in weak condition may become bogged and die
    - Wild Boar can create the same effect by wallowing along the water's edge
    - Such dams should be fenced off and the water pumped or gravitated to temporary troughing. This will ensure maximum use of the available water by avoiding fouling, and will remove the risk of stock losses from bogging
    - Troughs used in watering systems should be drained and cleaned regularly. Algae grow in troughs, producing unpleasant odours in the water which can repel stock. Salinity can also build up due to evaporation if troughs are not drained
    - The frequency of cleaning depends mainly on the temperature, which affects intake, and the rates of evaporation and algae growth. The type of stock will also have some influence on the frequency of cleaning, as tolerance of contamination varies according to the requirements of the particular class of stock
    - Contamination of trough water need only be very slight to cause problems with some stock. Instances have been recorded of weaned sheep refusing water because of a thin layer of dust on the surface of an otherwise clean trough
    - Care should be taken when introducing stock to extensive paddocks or unfamiliar watering systems. When introducing stock to a new paddock, make sure they are familiar with the location of the watering point and are drinking the water, particularly in pastoral areas. If water quality is marginal or unknown, check newly introduced stock during the first couple of days to ensure that there is no problem
- Watering radius
    - In pastoral areas, sheep normally graze within a radius of about 2.5 km of a watering point, and cattle within a radius of about 5 km. Animals will continue to graze the section of a pasture close to the water supply rather than walk farther to more lush growth. Therefore, if you move the water, you will change where the animals spend their time grazing and where they deposit their manure and urine. More watering locations mean manure and urine is more uniformly spread across the pasture.If stock require more water due to lactation, salinity or dry feed, they may need to drink more than once a day. This will reduce their foraging radius and the area of the paddock being used

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- ***Horses -*** The standard design rate is 40 to 55 litres per day
- ***Cattle -*** IFAW: "The Management and Welfare of Farm Animals" gives a range of 50-150g water per kg body weight per day. Adult cow roughly 600 kg body weight = 30 – 90 litres a day

Table 1 shows estimates of good quality water requirements of various classes of beef cattle in different physiological states and in different thermal requirements. Water intake from feeds plus that consumed ad libitum as free water is approximately equivalent to the water requirements of cattle.

Table 1. Approximate total daily water intake of beef cattle (litres)						
Animal description	Intakes in liters for temperatures in Celsius (C)					
	4.4°C	10°C	14.4°C	21.1°C	26.6°C	32.2°C
Feeders and replacements 2 - 6 months	20.1	22	25	29.5	33.7	48.1
Feeders and replacements 7 - 11 months	23	25.7	29.9	34.8	40.1	56.8
Feeders and replacements12 months and older	32.9	35.6	40.9	47.7	54.9	78
Bred heifers and dry cows	22.7	24.6	28	32.9	–	–
Lactating cows	43.1	47.7	54.9	64	67.8	61.3
Herd bulls	32.9	35.6	40.9	47.7	54.9	78

Table 2. Water requirements according to the type of stock and the type of grazing	
Stock type	**Consumption per head per day (L)**
Sheep	
Weaners	2–4
Adult dry sheep	
—grassland	2–6
—saltbush	4–12
Ewes with lambs	4–10
Cattle	
Lactating cows	
—grassland	40–100
—saltbush	70–140
Young stock	25–50
Dry stock (400 kg)	35–80
Horses	40–50

Table 2 gives the water requirements for stock. The figures quoted for consumption have a wide range — this variation in requirements is explained in the previous text.

Table 3. Water Consumption of pigs	
Weight (kg)	L/day
25	3.8
45	5.7
70	7.5
90	9.5
115	11.0
Std Rate	9.0

Table 3: water consumption of pigs

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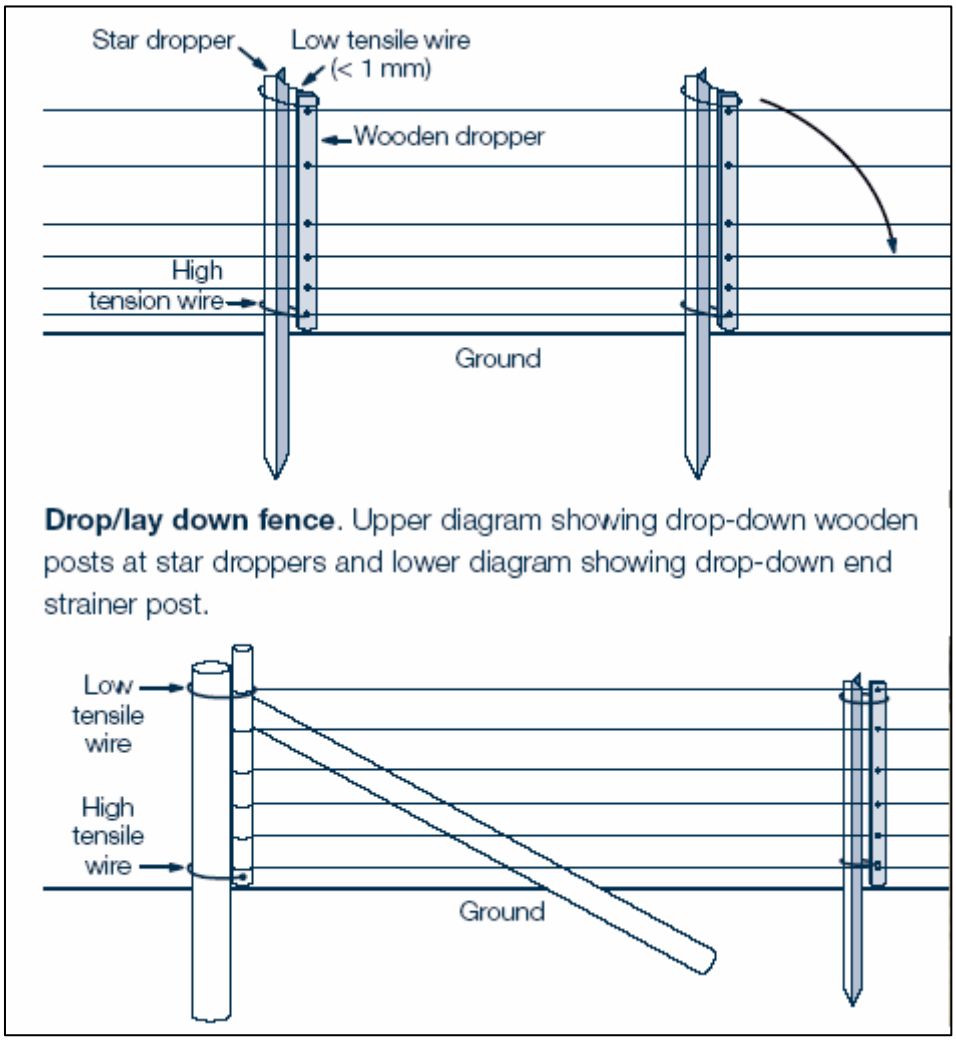
2. Options for watering

2.1. Natural water - streams, rivers, springs, ponds, wetlands

All year water can be provided by any natural water supply. You may need to fence (whether permanent or electric) sections of the watercourse to prevent excessive poaching and erosion and retain watering points at accessible points. NB: place the fence as far from the bank as possible to create riparian buffer and / or wildlife zone and to avoid frequent flood damage. You could use a 'drop down' fence that is lowered when floods are anticipated and then re-erected afterwards (see below).



Drop/lay down fence. Upper diagram showing drop-down wooden posts at star droppers and lower diagram showing drop-down end strainer post.

DROP DOWN FENCING

(http://cotton.pi.csiro.au/assets/pdffiles/enviro/ripguide/RG1.pdf)

Drop fences are designed to be either manually operated (dropped) before a flood, or to drop from their anchor points under the pressure of floodwater and debris. Once the floodwaters have receded, these fences are quick and simple to pull back up and reattach to their anchor points. They can also be dropped to allow stock or vehicle movement from one paddock to another without the need for expensive gateways.

Electronic fencing has been developed overseas as an alternative to fixed fencing, particularly for cattle. The stock wear a receiver initially developed in the form of an ear-tag, and transmitter boxes are located to form a boundary between the riparian area and the rest of the paddock. The transmitters emit a continuous signal which defines the boundary. The ear-tags respond by producing firstly an audio signal, followed by an electric stimulus to the animal's ear if it attempts to enter the exclusion land. Tests have shown that cattle quickly get used to this form of fencing, which is cheaper than conventional fixed fences and can be moved quickly in the event of a flood peak. This type of fencing is under active development in Australia and the USA, but is not commercially available as yet.

i.) Stock and other considerations of natural water supplies

- A variety of micro-organisms, such as bacteria, viruses, protozoa and parasite eggs can be water borne, and if you are unlucky your stock could be exposed to them when using natural water. If you want to maintain stock access to supply water there is no way to prevent this accidental exposure if it is going to happen. Do ensure that you maintain high health and welfare standards in your own stock, for example by preparing an animal health plan with your vet:
    - Johnes disease
    - Leptospirosis
    - Salmonellosis
    - Cryptosporidium

- Remember some of the negative environmental effects of overgrazing by stock (NB: some poaching and disturbance creates important bare ground habitat for annual plants and invertebrates):
    - Eutrophication from dunging and urination in the water
    - Poaching and erosion leading to sedimentation of spawning gravels for key species such as Salmon and Trout

- Stock can also spread Zoonotic infections via dunging and urination in to water courses. NB: maintain high health and welfare standards in your own stock, for example by preparing an animal health plan with your vet:
    - Salmonellosis
    - Cryptosporidium
    - E.coli

ii.) Blue green algae

- Occasionally, heavy algae growth occurs in stagnant or slow flowing bodies of water. Some species of algae, mainly the blue-green algae, can under certain circumstances be toxic to livestock
- These single cell or chain-like groups of cells are free floating and green, blue-green or brown in colour. They commonly appear as small specks or "grass clippings" in the water. The blue-green algae are single cell cyanobacteria that produce a microcystin toxin. The algae thrive in warm, stagnant water that is high in nitrogen and phosphorus. The largest release of toxin occurs when the algae dies. Cooler, rainy or windy weather can cause an algae kill. Early symptoms of poisoning are muscle twitches, scouring, photosensitivity and loss of co-ordination. If sufficient quantities of the toxin are consumed, paralysis and respiratory failure occurs rapidly. Animals are not able to breathe and suffocate to death within minutes. Thus, animals are usually found close to the suspect water source
- Removing animals from affected areas is the only sure method of preventing poisoning. Care should be taken to limit the growth of algae in water for livestock consumption

iii.) Toxic Elements

- On rare occasions natural water may contain or become contaminated with certain toxic elements such as arsenic, mercury, strontium, cadmium or radioactive substances. While these may harm animals, the major concern is that they do not accumulate in animal products used for human consumption. Analyses for these elements are only done when there are good reasons to suspect their presence

2.2. 'Dew' ponds

- For a full resume of dew pond construction see: Bowler, P, Le Bas, B and Wood, M, (summer 2004): 'Puddling the peaks ponds', CLM Volume 2, Number 2, British Wildlife Publishing, Hook
- **http://handbooks.btcv.org.uk/handbooks/content/section/2439**

✓ Long life
✓ Provide wildlife habitat
✓ No power supply needed

✗ Relatively high cost and labour required to construct
✗ Need sufficient rain

CREATED POND ON PLANKEN WAMBUIS, NATUURMONUMENTEN RESERVE NEAR EDE IN HOLLAND – HOLDS WATER FOR 30 – 40 PONIES AND 12 HIGHLAND CATTLE ALL YEAR ROUND

COST: approx. £4,785

2.3. Rain catchers, i.e. man made structures to collect rainfall

You can erect structures to collect rainfall to feed a trough or other watering area

To calculate volume of rainfall (m^3) from a given area:

Area of catcher.....m^2 x *average annual rainfall*.....mm divided by 10,000 = ...m^3 approximate monthly rainfall volume

- 1 m^3 of water = 1,000 litres

✓ Can be effective
✓ Simple design
✓ Cost savings
✓ Suitable for a range of watering purposes
✓ No power supply needed
✓ Suitable for remote sites

✗ Feasibility needs to be carefully assessed

FORESTRY COMMISSION DUAL PURPOSE RAIN CATCHER / CATTLE SHED ON FARRERS ALLOTMENT IN CUMBRIA

2.4. Dew and plant water

- Sheep that do not have ready access to water and are carefully shepherded **throughout** the day (as happens in parts of Holland) can often find enough water from dew on the vegetation and water in natural hollows.

NB: THIS IS NOT RECOMMENDED – ALWAYS PROVIDE ADEQUATE WATER

2.5. Water Bowsers

- Do not underestimate the amount of water that stock will require especially in hot weather and the time that will thus be required to keep up with demand!
- Put water bowser in to Google to find suppliers

2.6. Mains water and troughs

- Many options available

i.) Vandal proof troughs

- A trough full of water is difficult to steal - it's too heavy. The vandalism problems encountered with galvanised troughs are:
- The cover plate for the float valve (like a toilet cistern). Most designs have a place for putting a padlock on, but vandals have no need to tamper with the lock as they can peel open the plate sufficiently to get at the insides. The float valve is then bent to ensure the tap doesn't switch off. Possible solutions include: get a metalworker to change the plate for a more substantial grade, and perhaps design one which can't be bent back. Use a float arm that won't bend (may require metalworker again for bespoke job -order replacements at same time, and careful plumbing), and finally consider surfacing area of trough (or improving drainage) so that when our vandals do succeed, cattle don't have to visit a quagmire.
- Pipe supply – Occasional problem. Vandals will go for the connectors but could damage the pipe directly. The only solution would be to box the pipe in to ground level.
- There is often a stopcock or meter near some troughs. These should be sited at least 20 feet away and be unobtrusive or better buried below the ground surface. This one is of particular importance as vandals can switch the supply off (= thirsty cattle).
- Never use a bowser. If it is kept on site a whole range of vandalism / theft options open up. If the grazier uses it to just top up a trough the trough will get low enough to knock over / nick etc.
- If the site is a real problem, consider not grazing during the school holidays (and certainly don't put stock on during or just before the holidays) - that way you will have time to make repairs. Likewise install out of holiday time.
- Finally get the local high school involved in the site's maintenance. You may not get the vandals helping you, but you could well get their mate or their little sister.

Contact David Hodd: **david.hodd@nationaltrust.org.uk**

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Case study Epsom Common SSSI: An urban fringe SSSI with high public access and experience of vandalism to troughs. The Lower Mole Countryside Project use standard steel farm troughs on concrete "H" bases. Let into the ground next to the bases and set into concrete are four ground anchors made of painted concrete reinforcing rods. These hook over the rim of the trough and stop it being moved. The ballcock box lid has a hasp and staple welded to it so it can be padlocked and there is galvanised weldmesh welded into it to form a bottom, to stop anyone reaching up to the ballcock from underneath. The supply pipe is conventional alkathene armoured with 4" roadsign pole with a lump of roadsign ground anchor welded across the top to meet the ballcock box. This protects the pipe and the coupling. The bottom of the 4" pipe is concreted into the ground.

Painted silver, the trough looks like a standard farm trough from a distance, something thought important as a structure that looks commonplace has less of a visual impact and might be less tampered with. The other factor was budget. Use of scrap steel and staff labour for fabrication and welding kept cost minimal, but needed someone trained to use mig and stick welders.

So far this has kept the troughs safe for several years, after an initial spate of vandalism (damage included smashed connections, destroyed ballcocks and boxes, smashed stopcock housings, troughs overturned and broken "H" bases).

Stopcock housings are concrete with cast iron lids. Make sure the installing contractor sets these flush to the ground. They seem more vulnerable if this is not done. Even better, if you can get hold of the big cast-iron housings for use in the highway, these are more robust and difficult to open without a special tool. More expensive though.

Contact Nick Owen: **nick.owen@surreycc.gov.uk**

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ii.) Solar powered troughs

The trough can also be developed to utilise wind power in stead of solar.

Suppliers:

Nathan Marland of Winsund International Ltd - wind & solar energy UK & EUROPE, Priory Farm, Muggleswick, Co. Durham DH8 9DW. Tel: 01207 255365; E-mail: **info@winsund.com** ; Web: **www.winsund.com**

System A

- 1x Solar Panel - KC80 - rated at 80Wp
- 1x Inverter unit with 400W output at 230VAC "mains equivalent"
- Pump: 230VAC single phase pump with running load of 180W
- Capacity 550 litres per hour
- Dirty water compatible and self priming to 8m height
- 1x Solar Panel mounting frame or pole
- 1x Deep Cycle Battery 220Ah
- 1x Set of cabling
- 1x Pump float switch and fittings etc @ £ 1758 + VAT

System B

- 1x Solar Panel - KC60 - rated at 60Wp
- Pump: 12VDC pump - so no inverter required.
- Capacity 550litres per hour
- Dirty water compatible and self priming to 3m head height
- 1x Solar Panel mounting frame or pole
- 1x Deep Cycle Battery 220Ah
- 1x Set of cabling
- 1x Pump float switch and fittings etc @ £ 1490 + VAT
- GRP Cabinet for above @ £495+VAT
- Vandal Cover for Solar Panel @ £78+VAT

Optional Item:

- 1x Air wind generator:
- Rated 400W with 4m mounting pole to fix to cabinet or solar mounting post @ £ 624+ VAT

Not included:

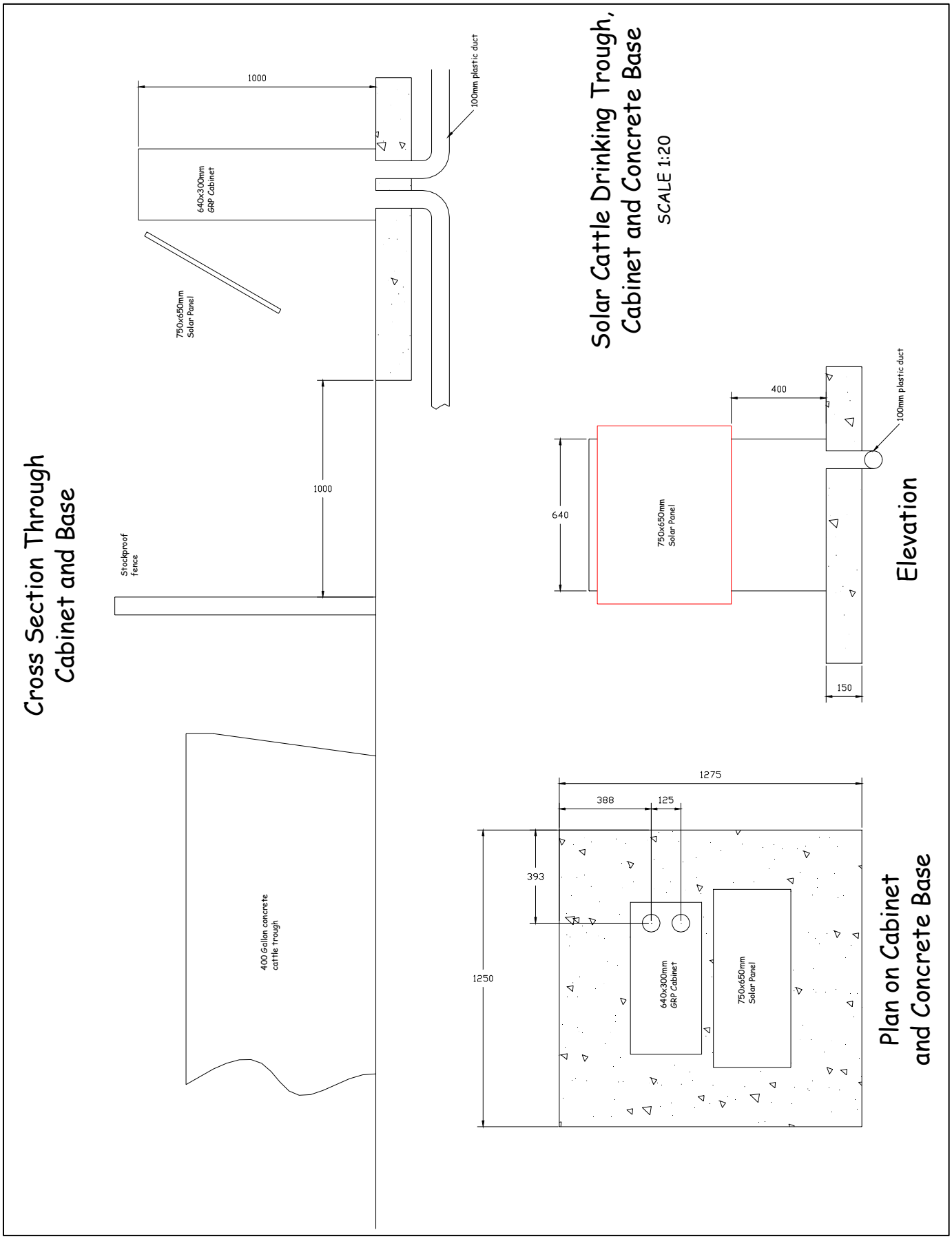
- Cattle Trough - 400 gallon rectangular concrete
- Alkathene Pipe - 1" from Water course to pump, 3/4" from Pump to trough
- Concrete Base/Plinth for cabinet
- Delivery
- Installation

Note:

- System A should operate throughout most of southern England at full capacity of at least 1000 litres per day from April through September and at a reduced capacity at other times.
- System B should operate at full capacity of at least 1000 litres per day from February through October, but please note that System B has a priming head of only 3m maximum.

Delivery Time:

1 unit - 2-6 weeks
5-10 units - 3-6 weeks



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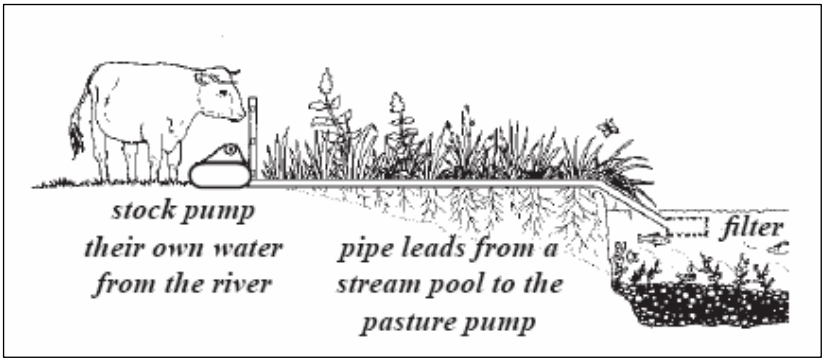
2.7. Pumps

i.) Pasture pumps

This pump type is a nose pump operated by cattle. As the animals drink from the pump bowl, they push against a lever, which in turn operates a piston and diaphragm and pumps more water from the stream. Tests show that livestock are quick to understand the mechanism. The pasture pump is positioned in the field and joined to a secure base, such as railway sleepers.



- ✓ Low cost
- ✓ Small number of moving parts
- ✓ Fairly simple system and in most cases works very well
- ✓ It is possible to buy & install them for less than the quoted estimate
- ✓ No power supply needed
- ✓ Suitable for remote sites

- ✗ Basic pump is unsuitable for very young calves or for sheep
- ✗ Liable to freeze up in winter
- ✗ 1 pump serves only about 20-30 cattle
- ✗ Maximum lift is about 24 feet

Cost of Pump	£295
Extra installation costs	£125
Installation time	1 hour
Volume of water delivered	5 litres / lever operation
Most appropriate farming system	Small farm with few stock

Suppliers

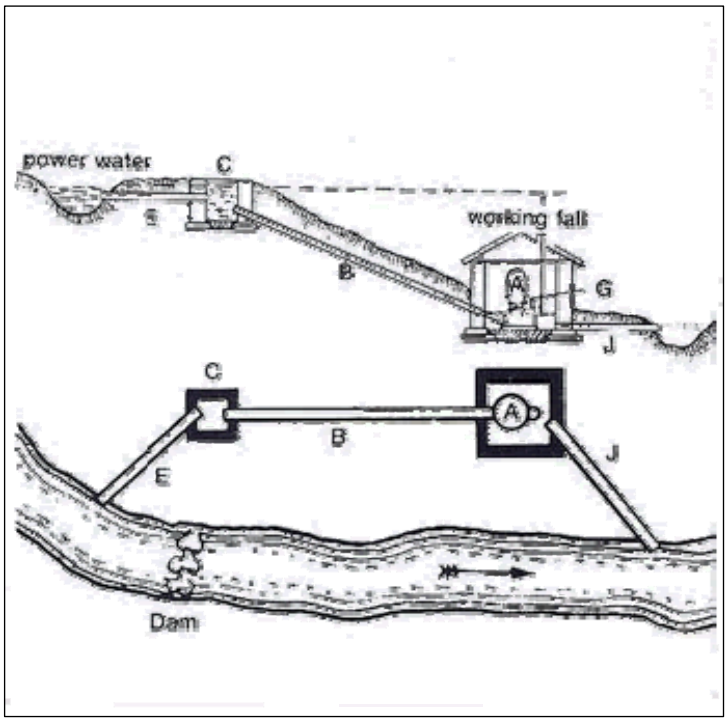
- The main manufacturers are Aquamat (Aquamat II) based in France (UK distributor Kramp Ashurst Ltd Tel 01767 602600; Web: **www.kramp.com**) and Lister, based in Germany
- Contact your local farm services or pump system supplier to find out if / where they can be purchased
- Filpump, Meadows Industrial Estate, Oldmeldrum, AB51 0EZ. Tel: 01651 873333; Fax: 01651 873344 Web: **www.filpumps.co.uk.** Costs for a pasture pump (complete with connections and pipe) from Filpumps is around £180
- Dureble, Spout House, Bay Horse, Lancaster, LA2 9DE. Tel: 01524 791162

ii.) Hydraulic RAM – (except where indicated otherwise, all images www.allspeeds.co.uk)

2 inch Vulcan Simple Type RAM – Tanzania
(Image - www.greenandcarter.com)

Hydraulic RAMs are ideal for remote situations, and having no moving metal parts they require only minimal maintenance and can usually cope with some degree of sediment and debris in the water. They do not require constant filter changing and can operate with very low falls or with extremely high falls, pumping to heads of more than 300 metres (1000 feet). The Vulcan RAM is manufactured in over 60 varying types and sizes.

How does it work?

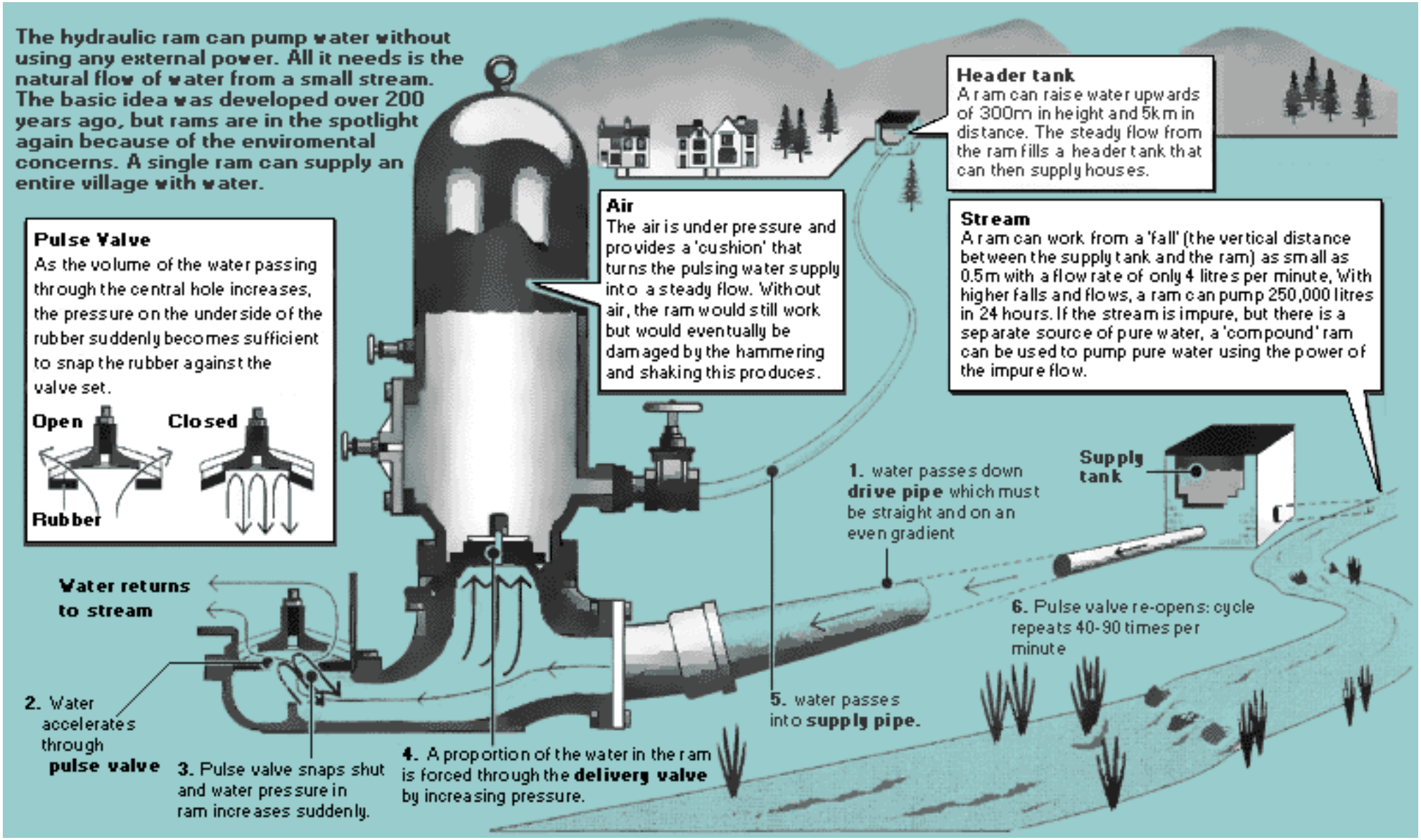


Water, entering the steel drive pipe flows through it by gravitation until it reaches the RAM, passes through the RAM and out through the pulse valve into the waste drain. As the water flows, its velocity increases until the pulse valve is no longer able to pass the volume of water flowing: at this point the pulse value is suddenly closed. The outlet thus being closed, the flow of water suddenly stops. This produces a concussion of more or less severity in the body of RAM according to the height and distance from which the water is flowing. The result of this concussion is that a portion of the water in the body of the RAM is forced upwards through the delivery valve into the air cylinder. At the same time the recoil allows the pulse valve to return to its original position. The outlet being thus reopened, the water which was brought to rest by the closing of the pulse valve recommences to flow through the RAM until it acquires the necessary velocity to raise the pulse valve a second time, closing the outlet, producing a concussion and forcing more water into chamber through the delivery valve. The water, which is forced into the air chamber, finds its way through a pipe, known as the 'rising main', to the place where it is required for use with a continuous flow being maintained so long as the RAM remains working.

This series of events, which takes time to describe clearly, occurs from 40 to 90 times per minute, according to the size of the hydraulic RAM, the fall of the water driving the RAM, etc. The RAM will continue working automatically, the pulse valve rubber and delivery valve rubber being the only moving parts.

The fall of water necessary to work a RAM may be as low as 500mm (20 inches) and with such a fall, water may be raised to 18m (60 feet). With higher falls, such as from 2m (6.7 feet) to 7m (23.3 feet) and over, water can be raised to upwards of 300m (1000 feet) or more in height and distance is more or less unlimited: several ram installations pump to over 5 km (3.13 miles).

Due to the action of the RAM, unless the conditions are unusually severe, and provided the RAM is kept working, it will be unaffected by changes in temperature especially low temperatures which might cause a conventional system to 'freeze up' unless some form of heat is provided.



(Image - www.cat.org.uk)

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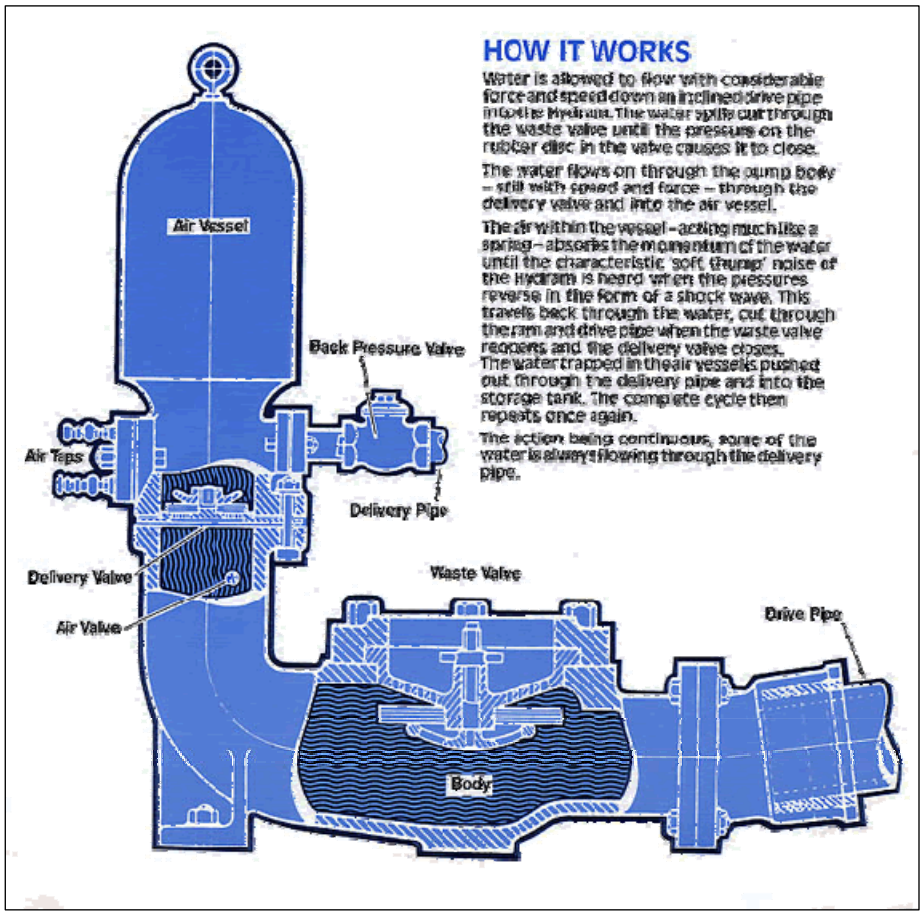

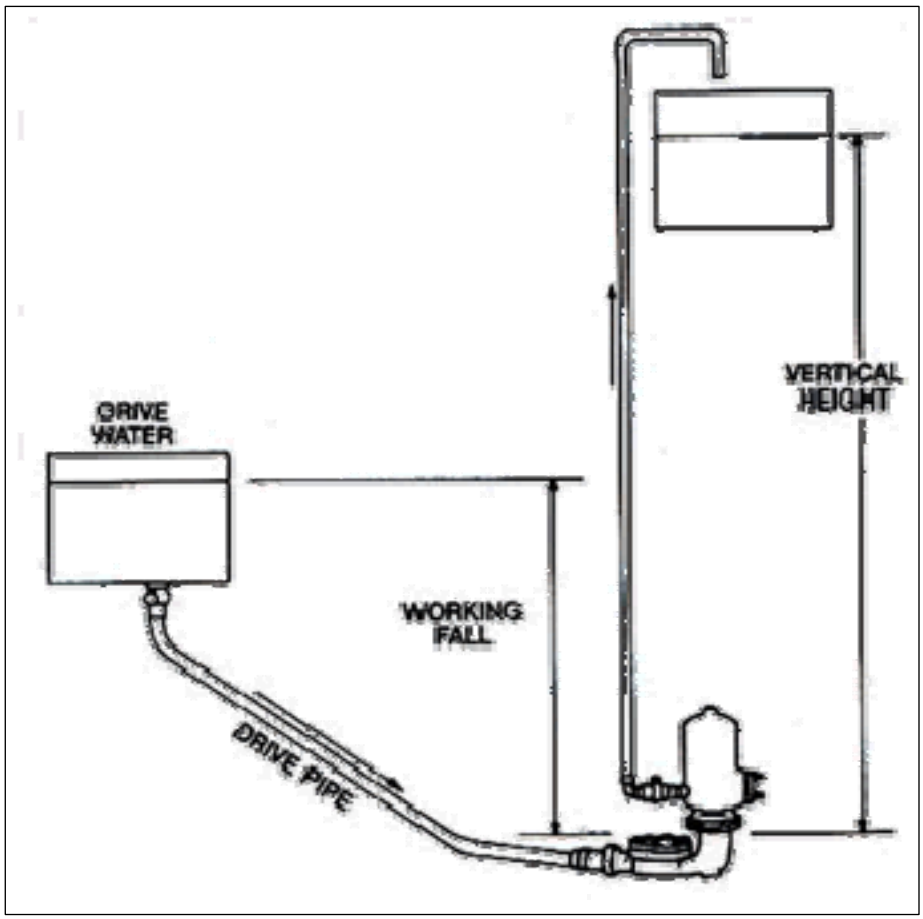

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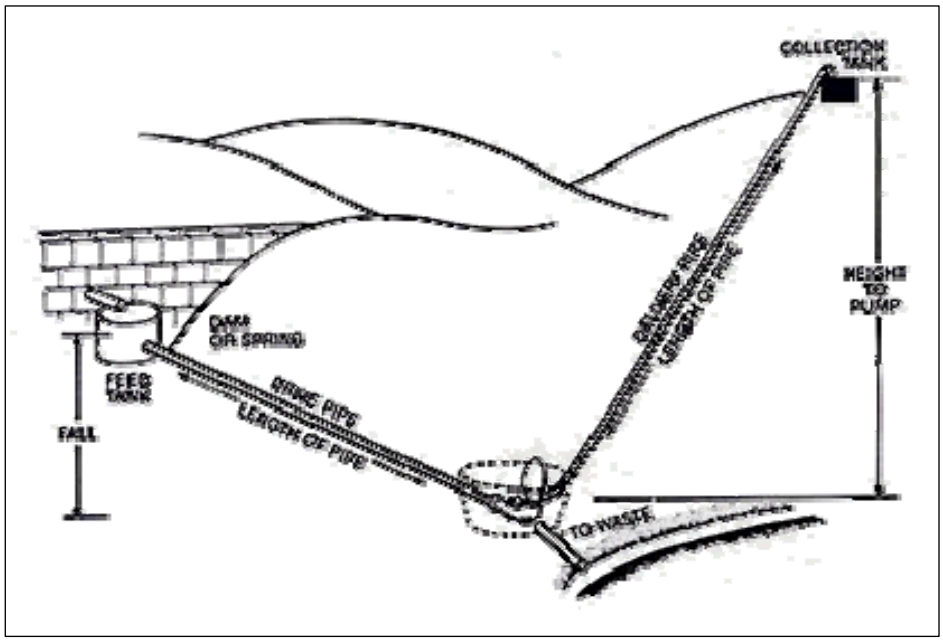
Case study, Richard Micklethwaite, Penhein Farm: I inherited a hydram from my father when I took over this farm. Since then I have almost rebuilt its lay out to make it more reliable and pump more water. The principle is that water rushes down a pipe and gets stopped dead by a valve, (once per second +/-). The water does not like this and so it surges up into an air pressure vessel through a non return valve. Each pulse squeezes the air in the pressure vessel which then expands again delivering a steady stream of water. Here we pump about 2000 gallons a day to about 150 feet (watering 100 head of cattle plus a couple of hundred sheep and three houses), then it is stopped by a ball valve and goes higher and pumps at a rate of about 1800 gallons a day (supplying another small farm which has pigs, sheep, cattle and about four people), then goes much higher to a total of about 230 feet I guess (supplying a reconstructed 17th century farm and buildings) and delivers about 800 gallons a day. There are just two valves, no engine, or motor. The amount of maintenance depends on how well you install the collecting tank from the stream. Be very careful who you take advice from as a contractor will want the quick and easy option. You must not have any leaks as you only receive a trickle. The amount of water you gets depends on the type of hydram, the length and fall of the drive pipe, the skin friction of that pipe, the size and length of the delivery pipe (the bigger the diameter of the plastic delivery pipe the lower the skin friction so the more water you get), and the vertical height it delivers to. When I replaced the original steel delivery with plastic (i.e. the pipe from the pump to the storage tanks) we got 25 % more water due to reduced skin friction. The pipe feeding the hydram must be steel and not plastic and be dead straight. In my case this lasted about 50 years and when I replaced it I fitted a yacht's sacrificial anode to prevent electrolytic corrosion, but that idea may get a visit from the men in white coats (magnesium type fitted under water so I have no idea if it is working! If it is disappearing then it is working). So what you do is put it in and see what happens. Think in terms of getting 10% of the water that you give it. Therefore you must be able to allow 90% to go to waste during October when the stream will be at its lowest. Last year due to a very dry time and a lot of extra stock we hitched a tractor driven pump along side it and pumped waste water to top up the storage tanks. The more storage you install of delivered water the more likely you can get through a peak demand when you use more than is pumped. Each pulse draws a small amount of air in as well so there are air bubbles in the delivery pipe which helps with the flow and to lift the water.



The only other details that occur to me off the top of my head is to remember to include a few gate valves at strategic points in the system to isolate various component parts of the system for maintenance and to not underestimate the considerable pressure build up of even a few metres head pressure and so the need for components to be able to withstand it. Also if you have any high points in a system that may drain empty and trap air, may be worth including “t" pieces in case of air locks.

As regards extraction, the funny thing about hydrams is that the slower they go the more water they pump (I think they get a bigger mouthful of water and so pump more - the longer between each pulse the faster the water moves down the pipe so the bigger the surge.) You are allowed to extract 20 cubic metres a day without needing an abstraction licence from the Environment Agency, so you pump the absolute minimum

you need to get below the threshold, i.e. you speed up the ram not slow it down. My Blake's Hydram does not pump enough to cross the maximum limit for free water any way.

The pump makes a clunking sound apparently like two rams fighting hence the name. You are saving £3K a year and so do not resent spending freely on the installation and renewing dodgy pipes when necessary.

Another sexy toy is a wind pump that pumps water downhill to the source of water through venturi and then back up the hill so you get more coming up than going down. This allows you to locate the pump high on a windy hill and not in some wood at the bottom of a windless valley. Here over looking the Severn at 550 feet we get at least five windless days on the trot so you would need serious water storage. No prizes for my views of wind turbines.

Reference: By Intermediate Technology and available through their bookshop called if I remember correctly "Gravity flow water systems".

Working demonstration: Richard Micklethwaite: **Richard@Penhein.co.uk**

- ✓ Very effective
- ✓ Simple design, no moving parts so minimal maintenance required
- ✓ Cost savings over time
- ✓ Long lasting
- ✓ Reliable
- ✓ Suitable for a range of watering purposes
- ✓ No power supply needed
- ✓ Suitable for remote sites
- ✓ They can operate with very low falls or with extremely high falls, pumping to heads of more than 300 metres (1000 feet).

- ✗ Needs to be carefully installed to generate sufficient delivery
- ✗ Relatively expensive to install
- ✗ Susceptible to choking with debris
- ✗ Can be difficult to achieve optimum supply

Cost of Pump	£500
Extra installation costs	Approximately £1000
Installation time	3 days
Volume of water delivered	11,365 litres / day (2,500 gallons)
Most appropriate farming system	Large scale unit requiring a permanent reticulated water system

Suppliers

- Green and Carter Vulcan hydraulic rams - Tel: 01823 672365; Email: **general@greenandcarter.com** ; Web: **www.greenandcarter.com/** ; Data form: **www.greenandcarter.com/main/product/dataform.htm**
- Jim Winterbottom of All speeds. Tel: 01254 615100; Web: **www.allspeeds.co.uk**

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iii.) Papa

Similar to the hydraulic ram, this pump requires a siphon effect in its feed pipe in order to operate effectively. The pump is easily installed and cheaper than the hydraulic ram but produces a lesser volume of water. The moving column of water can be either in an open channel or river or it can be contained in a pipe. It is the energy contained in the moving column of water and the patented means of harnessing this energy to amplify the pressure many times over which creates the pumping power. There must be a positive flow for the pump to operate. The pump will lift a percentage of the flow rate in the moving column of water to a height dependant upon the energy available in the column of water

Case study: Gary Nixon (ex - Devon Wildlife Trust): I recently attended a 'Papa Pump' demonstration for water supply to livestock water troughs. It is a water powered pumping system that works without any mains supply. All you need is a moving column of water to operate, such as a river, stream or brook. The system at the demo was a straight forward, very simple system. The system also works with an added pressure vessel if there is not enough head to pump the water supply up to certain heights. The minimum flow rate required is 3 gallons / minute. There is a constant supply to the trough(s) with an overflow piped back to the water source. resulting in minimum extraction.

The purpose of the demo was to show how to prevent livestock erosion along a steep river bank to prevent disturbance of the gravelly salmon and Trout spawning beds. I have had a site visit with Phil Sewell, the Technical Director and inventor on some of my reserves where mains supply is unfeasible and costly. On one reserve, a pump is now supplying a trough 35-40 metres above the stream level as long as there is 3 gallons / minute minimum flow rate.

- ✓ Small number of moving parts
- ✓ Fairly simple system and in most cases works very well
- ✓ Easy to install and relatively cheap
- ✓ Suitable for all stock
- ✓ No power supply needed
- ✓ Suitable for remote sites

- ✗ Produces less water than the Ram pump
- ✗ Some may find it difficult to install
- ✗ Needs reasonable river flows – problems in drought conditions?

Cost of Pump	£295
Extra installation costs	Approximately £200
Installation time	4 hours
Volume of water delivered	2270 litres / day (500 gallons)
Most appropriate farming system	Smaller scale unit requiring a permanent reticulated water system

Suppliers:

- Phil Sewell, Ppump Limited, 14a Kingshill Industrial Estate, Bude, Cornwall EX23 8QN. Tel: 01288 354454; Email: **info@waterpoweredpumps.co.uk** ; Web site: **www.papapump.com** or **www.waterpoweredpumps.co.uk**

Working demonstration: Frances Cooper, Action for Wildlife Project: **fcooper@dartmoor-npa.gov.uk**

iv.) Wind pumps

Wind pumps can pump large amounts of water giving significant cost savings, though initial above ground components and installation costs are relatively high. These will be offset by long working life.

- For a full resume of wind pumps see: Burgess Graham, (winter 1998): '*Windpumps return to the wetlands',* ENACT Volume 6, Number 4, British Wildlife Publishing

✓ Long working life
✓ Very low maintenance and running costs
✓ High volumes can be pumped
✓ Suitable for all stock
✓ Renewable energy
✓ Suitable for remote sites

✗ Relatively difficult to install
✗ Relatively expensive to install

Suppliers:

- Graham Burgess Windpumps Ltd: Tel: 01297 631 672; Email: **sales@windpumps.co.uk** Web: **www.windpumps.co.uk**

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v.) Solar pumps

Solar pumps are ideally suited to watering stock where there are no alternative supplies. Some pumps stop working when the sun goes in so take specialist advice when choosing a system.

✓ Low maintenance and running costs
✓ Suitable for all stock
✓ Renewable energy
✓ Suitable for remote sites

✗ Pumps low volumes of water
✗ Some stop working when sun not shining!

NB: Various pumps are available with varying attributes – information below apply to the Aquasolar 1500 used for one grazing compartment on Shapwick Heath NNR – melvyn.yeandle@english-nature.org.uk	
Cost of Pump	http://www.unlimitedpower.co.uk/Solar_Pumps_Fountains.html
Extra installation costs	Low cost installation - £300 - £350
Installation time	2 hours
Volume of water delivered	Low rate of flow
Most appropriate farming system	Small watering requirements, e.g. non-breeding sheep and / or goats

Suppliers: **www.unlimited-power.co.uk/Site_Index.html** or **www.gosolar.u-net.com/solar_fountains.htm**

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3. EA extraction licences

- If you are extracting < 20 m^3 (4000 gallons) per day for riparian agricultural use then you do not need an extraction licence from the Environment Agency
- However, whether a licence is required for the power generation component of the installation will depend upon the configuration. Removal of water from the source of supply, e.g. via a drive pipe to feed a hydram is likely to constitute an abstraction. Installations that are situated entirely within the supplying river or stream are unlikely to constitute an abstraction, but consideration will need to be given to whether the device constitutes an impounding
- If in doubt, please seek advice from your local water resources licensing team at the nearest Environment Agency office regarding the requirement for licences – Tel: 08708 506506; Email: **enquiries@environment-agency.gov.uk** ; Web: **www.environment-agency.gov.uk**

Forms and guidance:

- A guide to getting your licence : **www.environment-agency.gov.uk/commondata/acrobat/guide_abstr_final_1142993.pdf**
- Application forms: **www.environment-agency.gov.uk/subjects/waterres/1341275/564321/566207/678323/?version=1&lang=_e**

4. References

- Burgess Graham, (winter 1998): 'Windpumps return to the wetlands', ENACT Volume 6, Number 4, British Wildlife Publishing
- Drop down fences **- http://cotton.pi.csiro.au/assets/pdffiles/enviro/ripguide/RG1.pdf**
- Bowler, P, Le Bas, B and Wood, M, (summer 2004): 'Puddling the peaks ponds', CLM Volume 2, Number 2, British Wildlife Publishing, Hook
- Dew ponds: **http://handbooks.btcv.org.uk/handbooks/content/section/2439**
- A guide to getting your licence : **www.environment-agency.gov.uk/commondata/acrobat/guide_abstr_final_1142993.pdf**
- Abstraction licence application forms: **www.environment-agency.gov.uk/subjects/waterres/1341275/564321/566207/678323/?version=1&lang=_e**

- Hydraulic Ram Pumps, Jeffrey et al (1992): Step-by-step instructions on designing, installing and operating water supply systems based on hydraulic ram pumps
- Manual on the Hydraulic Ram, Watt (1975): Details on how to make and maintain a small hydraulic ram on a suitable site

Both are available mail order from the Centre of Alternative Technology. Tel: 01654 705959; Email: **mail.order@cat.org.uk** ; Web: **www.cat.org.uk/index.tmpl?refer=index&init=1**

GAP especially wishes to acknowledge the work of Flora Grigor – Taylor of Grampian FWAG who compiled information on various off – stream watering options for livestock as part of a project funded by Scottish Natural Heritage

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