Practical Restoration Handbook

Dewatering

by
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1. DEWATERING

1.1 Introduction

This chapter intends to provide guidance for anyone struggling with too much water. The bulk of the chapter concerns pumps and pumping techniques as this is where experience shows the most information is needed. However, it is equally true to say that a successful dewatering is dependant not only on getting rid of the existing water but also stopping any more getting in. Because of this, preparation and clear thinking pay great dividends when attempting a dewatering.

1.2 General Considerations

There are three ways to get rid of water in the channel. One is to operate a sluice specifically built for the purpose, the second is to pull the plug out (assuming there is one in the section you wish to dewater) and the third is to pump it out. The golden rule for a successful dewatering is to have as much control as possible (this usually means doing it slowly!).

It is well worth appointing someone just to monitor levels and flows and ensure that the rest of the group can not only work in safety but also without worrying about whether their work is about to be washed away. Any tools required to operate the equipment (windlass, pump starting handle, etc.) should always be kept in a place known to all volunteers. It is also worth setting level marks to monitor levels as this may well prevent arguments later, particularly with third parties (it is recommended to set them on the offside to prevent tampering). However, when checking levels remember that given a strong enough flow a 'slope' on the canal is possible (up to 25mm over 500m).

If you are intending to use a sluice check first that it can take the flows you intend to send down it. Many sluices have not been used for a long time and not only is their mechanism often suspect but also the frames and even the culvert itself. Beware also of large items (branches, etc) sticking in the slide and preventing the paddle from going back down. Very embarrassing! So before operating in anger, clear the floating debris from an area of at least 5m from the sluice and keep a rake handy, you may even wish to fabricate a guard to stop the debris going down. Obviously be very wary if you go into the water to clear a blockage. However, at least a sluice can be dropped and the outfall stopped if it is all going wrong. This can not be said for the second technique - pulling the plug. Once that has started it is very difficult to stop so you had better be quite sure that you have got it right. The third technique of pumping is extensively dealt with later.

Timing is important as you need to consider the age old conflict as to dewatering in high summer (less water to get rid of), or to dewater in winter (lots of water to rewater with). You also need to consider the ecological impacts of dewatering at certain times of the season.

And finally remember that while you wish to remove all the water from your section others may find it necessary to maintain flow on either side of the section. Unless water supplies can be diverted from elsewhere it may be necessary to bypass the section with pumping. If the dewatering is over many days, or in particularly hot weather, it is important that the puddle clay lining doesn't dry out and crack otherwise potentially catastrophic leaks will occur. Therefore you should only dewater the minimum length necessary and it may even be prudent to partially rewater the section during the works to stop these cracks occurring.

1.3 Ecological Considerations

This is not just a case of removing any stranded fish (especially eels as they love to burrow through your dams and make them leak). You must also consider any effects of lowering the levels on vegetation; some marginal plants may well actually benefit from the level going up and down a little but others won't. Oxygen levels in whatever water is left will fall with potential problems. Timing throughout the year is a critical factor and expert guidance should be sought if the dewatering is long term (greater than a day or two). Of course if the work is necessary to prevent an imminent breach then ecological thoughts can be a little irrelevant.

One important consideration that must not be ignored is the potential impact of operating sluices or pumps into adjacent watercourses. Although the waters are often of a similar make up, you should still carry out an environmental impact study. This is obviously much more important where levels of pollution are high or where the ecology is very different. An example of this would be the Droitwich Junction Canal which is non saline in the section that runs through the highly saline marshlands by the M5 motorway. The Environmental Pollution Act is the relevant legislation.

1.4 Isolating the section to be worked on

There are five options: stop planks, sandbag dam, piling dam, specialist dams and earth bund. It should be said that dam design is a skill in itself and if you are unsure about the technique then it is best to get an expert to advise you. Because of this only a few golden rules are given here, for further advice on dam design please consult the IWAs Honorary Consultant Engineers who will be able to offer guidance (contact via IWA Head Office). You're probably going to get wet no matter which dam option you pick!

It is undoubtedly best to spend time getting your dam right from the start, even if only dewatering for a quick inspection. Not only is a properly sealed dam safer (even tiny leaks have a habit of getting very big, very quickly) but by getting the whole area dry so that you can see what you are doing you will not miss anything in your inspection. If the dewatering is to enable actual works then a well sealed dam is essential. This is not only on grounds of safety, but also because everyone will work a lot better if they are not having to argue every 30 minutes about whose turn it is to go up top and start that noisy pump again. Nobody likes wading around 4" of water and you'll lose far less pointing trowels if you can see where they have been dropped.

The legislation that refers to dams is the Construction (Health, Safety and Welfare) Regulations 1996. Regulations 12 and 13 state that "it is a requirement to ensure cofferdams and caissons are properly designed, constructed and maintained". The WRG implementation of this is as follows:

Dams must be inspected before work starts each day or whenever there has been a significant change in the level that the dam is holding back. Each inspection must be recorded in a register. Where this is not the official HSE form (F91(part1)B) it can be a page in the site log. Note that minor problems (seepage etc.) can be noted as "requiring monitoring" in the record. The question of who is competent to inspect is largely dependent on how the site is run. If the site is run properly then there will be a register of who is competent to inspect. If not then the decision will be made by the site leader based on the volunteers experience of other similar works, not just of installing the dams but of working with them. If the inspector was not involved in the installation of the dam then the installation specification should be made available to them and any significant points (e.g. "offside edge of dam braced against tree") should be highlighted. See PRH "Health & Safety Section 1" for further details.

1.4.1 **Stop planks**: This is, of course, the easy option and you should be installing stop plank grooves where you can as you restore your canal (assuming no heritage conflicts). For them to work it is essential that the grooves and particularly the base are in good condition and clear of debris. The planks themselves should be good quality and made for the installation concerned. (Note that some sets of planks are of differing lengths, this is to cope with the batter (i.e. vertical slope) of the wall that the groove is set in). The wood will swell in the water and so it is best if the planks are soaked in the canal for a day before installing.

Just because BW blokes manage to install stop planks without getting wet doesn't mean you will manage it, they spend their lives installing them and it is a skill. There is every chance you are going to have to don the waders/wetsuit/underpants/whatever and walk along the sill clearing it. If the base and the surrounding area is not clear then you are on a hiding to nothing.

Sealing the planks is an art in itself; firstly lower them into place (don't worry that they float, the weight of the next one on top will cause them to sink down) and then tap firmly along the top plank to seat them properly. The top plank should then be wedged into place with wooden wedges driven between the wetside of the wood and the groove. Dewatering should then commence. Don't be too surprised if the gaps between the planks have considerable leaks - these will 'take up' as the wood swells. The final leaks can be sorted by 'racking' the planks with wood ash. The ash is gently drizzled along the wet side of the planks; as it sinks it is sucked into the gaps between the planks and then expands to fill the void. The effect is truly magical. If you don't have any wood ash then try sand or soil but it won't be anything like as good. The modern equivalent of 'racking' is to cover the wetside of the planks with plastic sheeting but even this is not as effective.

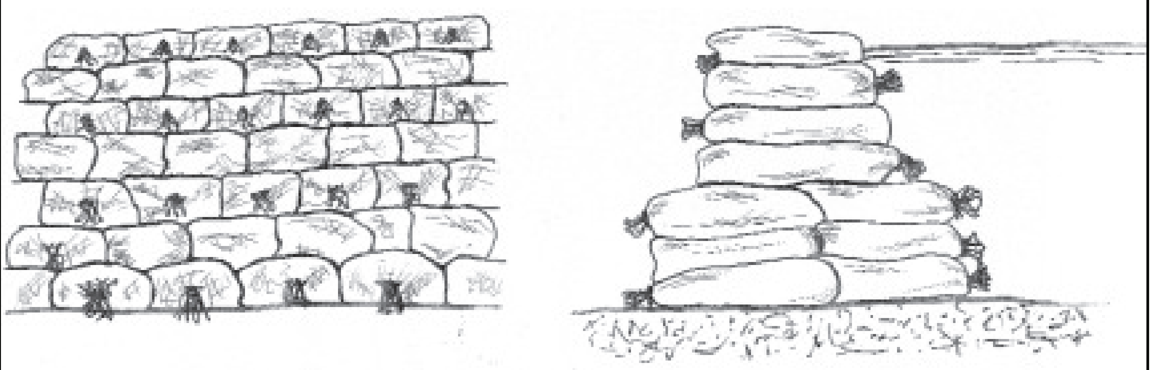
On wide waterways it is often the case that the planks will be additionally braced either by props from the gate recess or from upright beams placed into sockets behind the plank groove. The planks may also be very heavy and may require cranes to lift them.

When checking stop plank installations one particular thing to keep an eye on is 'boiling under' the base or 'spurters' around the groove itself. This indicates that the water has found a route through and is eroding it's way through. When a set of stop planks does blow out it is very impressive, unless you're in the hole!

Rewatering when stop planks are in place involves removing the wedges from the top plank and then gently prizing the top plank up from the next one by inserting a mattock or similar into the gap. Always do this from the bank, not by standing behind the planks. The planks are holding back a huge pressure and they will be held very tightly against the groove. Let the pressure equalise and the planks will free themselves and float upwards. Resist the temptation to just remove everything, the flow will be massive and will wash tons of silt over your stop plank base making it very difficult to use again. Always check you have removed all the stop planks you installed - it is not unknown for the bottom one to stay stuck, you'll have to go in and free it!

One final warning: stop planks are very heavy and many a volunteer has crushed a finger installing them. They do however float and a few volunteers have been shocked by the bottom plank finally working itself free and shooting up from the bottom - especially when they were standing astride it!

1.4.2 **Sandbag dams:** are 'easy' to install in that the job is relatively unskilled but they are hard work, in particular the work involved in supplying them is very tiring. The process of filling the bags, tying them off and then placing them is very hard going. To work properly they must be filled with a dense, homogeneous substance without solids. Strangely enough this usually means sand. As stated before design is a black art but for narrow dams (i.e. across a bridge hole) and for a low head (up to 450mm) it is acceptable to use a single bag laid perpendicular to the line of the dam. For any head greater then it is necessary to use double depth as shown below.



Installation is basically a case of carefully positioning them and building them up in layers. Once a layer is completed then walk along the layer to firmly knit it into the previous layer. The dam will tend to 'take up' a little especially if silt is drizzled down over the wetside where any seepages appear (the sandbag equivalent of 'racking'), however, if this doesn't work then it will require significant rebuilding. Installation is easy compared to removal which involves stopping down in the rapidly rising water to find every single one of them (and they all have to be removed to prevent a navigation hazard!) It is very cold work and hot drinks and suitable welfare and dry clothing should be available. Beware of swallowing the water and remind all workers of the dangers of Weils disease (see PRH "Health and Safety Section 2).

Most farmers/builders merchants can supply sandbags, they come in 'ordinary' and 'rotproof' grades. It is usually better to go for rotproof, though there is, of course, a cost premium. Unless kept very dry (unlikely don't you think?) ordinary sandbags will rot within a few months.

1.4.3 **Piling dams**: The same considerations concerning design and inspections apply to piling dams also. The good news is that many piling companies (who have an interest in selling you the piles of course) will provide free design advice. See PRH "Bank Protection" for further details on piling suppliers.

Piling dams are much more suited to real long term dewaterings, they consist of a line of interlocked piles with silt and dredgings piled behind them to stop the leaks through the clutches (the curvy bits that link each pile). It is essential that the piles are driven far enough into the bed to prevent not only the head pushing the piles over but also the weight of the water boiling under the piles and blowing them out. If there is significant head to hold back then it is common to use a double line of piles tied together. This has the advantage that the gap between them can be filled with dredgings, this has two benefits; it will seal the leaks through the piles and it will provide a walkway across the canal. However it is essential that you give the dredgings time to settle if you intend to use it as a bridge and ensure the public can't get on it. Beware dredging too close to the dam as this will reduce the effective penetration of the piles (and then your dam will fall over).

1.4.4 **Specialist dams:** by this the author means such exotic items as canvas/scaffolding dams and inflatable dams. These are, quite simply, specialist and really in the hands of real companies who use the system full time. Certainly the author cannot think of any time volunteers have used these systems (no doubt someone will write in and correct him). They are very expensive. There is a rumour that British Waterways developed the inflatable dam system and then sold the patent as they didn't think it would amount to anything. It now costs them a fortune every time they use the technique. Only a rumour mind you. One technique being tried out just as this document was going to print was the use of sealed tanks filled with water to isolate a bridge hole on the Montgomery Canal. Contact the author to see how it turned out.

1.4.5 **Bunds:** these are, of course, the easy way to sort the problem out. It may seem strange to fill in the canal but with a large excavator and the right material it is probably only a couple of hours to install a bund and only an hour to remove it. This is much quicker than any other technique. The material has to be impermeable and have significant mass - this either means clay or a waterproof liner and soil, clay is much the preferred option as it is easier to repair. They don't need inspection, but obviously it is a sensible idea to keep an eye on it.

1.5 Rewatering

This is the reverse of dewatering and should still be done slowly and with considerable control. It is essential that a careful check is kept of banks, towpaths and over hedges to ensure that leaks are not occurring as the water level is brought back up. Ideally the level should be monitored for several days to ensure no leaks occur before the dams are actually removed. One option rather than just breaking out the dam is to pump or siphon over the dam, alternatively you may have been clever and designed your bund with a fill pipe through it.

1.6 Wellpointing, Wellpoint De-watering

The name given to surrounding the site with special 2" suction tubes set down to below the level of the workings. The spacing between points, and the distance out from the dig depend on local conditions, soil and water table (distance down you need to dig before your hole fills with water) among others.

All the small 2" pipes feed into a single 6" pipe and then to the pump. The 2" pipes, which are not uncommonly 12 feet long are drilled into the ground by forcing water at about 100 PSIG down them. A very good way of working since none of the pump bits are in the way at the bottom of the hole. Unfortunately not a lot of good to us!

2. PUMPS

2.1 Introduction

Put simply, a pump is a machine for moving something from one place to another. In our case the something is usually water(-ish) which has to be moved from where it is to somewhere permanently out of the way. Pumps can be divided into two classes, centrifugal and positive displacement, and are classified by the size of the internal hose diameter.

It is important to stress the need for good planning whenever setting up a pumping system. You should fully consider access requirements, inconvenience to the public, etc. You should also ensure that you have adequate fuel supplies to ensure that the pump is not stopped unnecessarily. A final important consideration is that of noise pollution, this is obviously a major concern with continuous through-the-night pumping but it is also worth considering if starting a pump early in the morning. There are a number of simple precautions that can be taken to prevent this being a problem (prosecutions for Noise pollution are becoming increasingly common). By careful placement of the pump and erection of screen, straw bales, etc the nuisance to the public can be minimised.

2.2 Pump Components

2.2.1 The Pump Itself

Any pump can be powered by an internal combustion engine (diesel, petrol or two stroke), hydraulics, compressed air, electricity, or even hand on some of the small reciprocating pumps. A discussion of the relative merits of each power source is available in the PRH "Plant".

Centrifugal or induced flow pumps have a high throughput and are meant for use with cleanish water. They rely on external help for priming (priming, in pump terms, concerns getting rid of the air in the system). Methods of priming vary, the smaller 2" and 3" pumps are often filled with water manually before starting and then rely on some clever internal design to remove the air from the suction side of the system, often by operating internal valves by an external lever. Others use a completely external priming system with either a vacuum pump to clear the air out or the exact opposite, an air compressor working into an ejector on the main pump body.

Positive Displacement pumps usually have a lower throughput than centrifugal types, but are capable of handling either clean water or slurry (a liquid with a high content of undissolved solids, e.g. mud). There are several types; gear, piston, peristaltic (irrelevant - you'll have to look it up), though all those I've seen in use on restoration projects are of the diaphragm type. Not a fast or impressive pump to watch, but try leaving one on overnight and see how much it shifts. Sometimes this type of pump is referred to as a Nodding Donkey, from the rocking bar which is a feature of many machines of this type. This type of pump is often left on snore - a very apt description of the sound of a pump which has reduced the level to a point where it is pulling air and water, and just dealing with seepage.

A pump on its own is merely the heart of a system and isn't much good without some other bits.

2.2.2 The Suction

The suction pipe, providing it is airtight, can be as long as you like as long as no part is more than about 20ft above the final level of the filter. The theoretical limit is about 27ft but this is asking a lot of the pump seals. It's a swings and roundabouts question as to whether a short high lift is easier than a longer (135ft was used not so long ago) lower length of lift. A longer pipe takes more time to prime, which means more water in the workings before it is removed. A longer suction may well allow the machine to be placed away from the working area and therefore appear quieter and less in the way. Suction pressure (or vacuum as it is negative), is often measured in inches of mercury ("Hg) and in reasonable site working 1" Hg can be taken as 1ft (300mm) lift of water. If the pump is below water level, e.g. the other side of stop planks, once primed the suction acts as a siphon and the pump works at maximum efficiency. It is worth noting that the throughput of a pump falls dramatically as the suction height, not length, rises.

2.2.3 Filters

Filters are fitted to a pump suction to block up! It is easier to clear a blocked filter than to strip and clear a pump. Where several filters are available, give a thought to which is best for the job in hand. If doing a bulk pump down into a sediment based bed try suspending the filter with a rope and lowering it as the level falls. Generally avoid disturbing the area around a pump inlet until you have finished with it. The less you stir up the less chance of it blocking. One type of pump which does not have priming problems is the submersible. These do, however, still have trouble with blocked filters. And unless the filter is fairly fine you must be very careful that a jammed pump is switched off before clearing it, since a sudden restart could very well show one reason for painting plant blood red!

2.2.4 The Discharge

If everything else is working correctly this only has to direct the output out of the way. Air leaks, water leaks and general construction are of absolutely no consequence from the pump's point of view; indeed many small pumps are run without any outlet at all. However if it is feasible a suction quality length with its end under water can clear many pump blockages without intervention, especially when run on snore. If the suction and discharge are under water and the non-return valve jammed open the pump will often prime from the higher level and once primed will start pumping, taking the blockage with it. Discharge pressure is measured in pounds per square inch (or psi) and if needed for site work, with a free flowing end, it is reasonable to assume that for each pound of discharge pressure the pump is pushing the water to a height of 2 ft.

2.2.5 Couplings

Many types of couplings are in use, but I will only deal with those that I have seen around the movement.

BSP - British Standard Pipe. A very good thread but not really suitable for site use. The thread is very fine and clogs up, then wears very quickly and can be damaged when dropped.

URT - Urban Round Thread. A coarse thread more suitable for site work than BSP. Quite a lot of wrg hoses use this coupling.

FLANGED - Separate nuts and bolts, plus a gasket or seal; an awkward type of beast, very rarely seen.

INSTANTANEOUS - Most often seen on fire hoses and used on small bore discharges. Very easily connected and disconnected when not under pressure, and minor coupling leaks seal up under pressure. Will not work on suctions. Quite a lot of wrg blue 2” lay-flat hose uses these.

BAUER - A ball and socket coupling with an over-centre toggle clamp ring that should not need tools. It is designed to work up to 30 degrees out of line. Wherever possible these are the couplings fitted to WRG pumps. The lever often has a maker’s name stamped in it.

All the above couplings rely on a seal, usually rubber or plastic but sometimes exotic materials like leather are seen. Seals cost very little and can make all the difference to the speed of pumping, since every bit of air that leaks in is just more non-productive work for the pump to do, if indeed it ever actually gets primed.

If several different types of coupling are in use then various adaptors may need making up. You may be interested to know that the yellow plastic pipes in use by most gas utilities are just the right diameter for most couplings to push into and seal.

2.2.6 Hoses

These come in several grades and types. Suction quality hose is very heavy and usually made of ribbed, wire reinforced plastic or rubber and is relatively flexible when laying out. The black rigid plastic hose is claimed to be for discharge only, but is often employed on the suction without any problem. Lay-flat is discharge only and is completely different from the other two because, as its name suggests, it lays flat when not under pressure. Compared to rigid it is light and easy to move around but, except on straight runs or used under pressure, as in fire brigade use, only has to get a kink in it to stop all pumping. If straightening out this type of hose with the pump running please be very careful because the pressure inside the fold of a kink is painful! Occasionally, you may find a length of ex fire-brigade lay-flat which becomes wet on the outside, this is called percolating hose and is designed so that the damp outer face reduces damage over hot surfaces.

When setting up both the pump and the hose run think carefully about possible access needed during the job. It is bad practice to drive over hoses with dumpers, etc – a rigid suction will probably be destroyed and whilst a section of lay-flat may well survive it will be damaged by the weight of a dumper pushing it onto sharp stones beneath it. So think carefully; if you have to stop and disconnect halfway through the job and then restart and reprime will it affect the chances of success? Better to get the hoses to follow a route so they are out of the way in the first place.

WRG plant do have a source of 2” lay-flat, with instantaneous couplings. All lengths are damaged, but a box of jubilee clips works wonders, and for just the cost of transport, these could prove very reasonable. Contact the author for further details. Wherever hoses go over a solid edge care should be taken to ensure no damage can occur, both on principle and since a subsequent air leak could prove very difficult to find.

2.3 Maintenance

2.3.1 **Tools:** Both URT and BSP couplings are fitted with two or three small lugs for doing and undoing. Most of the time these are hammered together, eventually breaking off. There are proper spanners for this job and I am following up a possible supplier. A wire brush and spot of grease on all the threads can work wonders.

2.3.2 **Frost Precautions:** The name given to draining down a system to prevent ice forming, which at best will prevent you starting the pump or, more probably, will quite happily burst various expensive castings.

Most water-holding parts of the pump will have a valve or screwed plug/sealing washer, which is removed to drain down. Failure to replace tightly is another possible air leak during priming.

Frost precautions are invariably carried out at the end of the day, and involve cold machines, cold water and cold tools. They must, however, be carried out if there is the least chance of frost before you next expect anyone to use that pump again.

2.4 Failure to Prime

Several reasons are well known but try looking at the filter. If that is clear and the system has been working look for any joints that have recently cleared water level, either not tight or faulty seal, check the gland on the pump and - a problem I have only heard of once - the vacuum pump belt breaking. Even quite small twigs can stop a ball type valve from operating, if this happens then the pump will need to be stopped and stripped down and the debris removed. If on a diaphragm pump the water appears to be going in and out of the filter check the suction valve. If on a centrifugal pump a hissing rushing sound is heard from the discharge, the outlet valve is probably jammed open, which will probably need the pump stopping and a cover removing to clear. Having said that, lay-flat has been known to act as an additional NRV (non return valve). When the pump one gets jammed, you will notice it as it is sucked flat by the priming system. It would be quite reasonable to use a short length of lay-flat immediately after the pump then rigid to final discharge point. Another point to check is that all frost precaution drain points have been replaced or closed.

2.5 Odd Points (the hints and tips section)

If possible, give any pumps that have finished work a few minutes run in clean water. This clears them out and usually makes them easier to prime next time. This can be a viable idea if they get sluggish when pumping soup, just watch how long it is before clean water on the inlet comes out as clean water!

Two 3” pumps are not equal to one 6” pump! All other things being equal, the pumping capacity is proportional to the cross sectional area of the hose. A bit of schoolboy maths means that the capacity is increased by the square of the hose diameter. Thus you have:

Hose diameter	‘Hole’ available to pump through
2” pump	3 sq. ins.
3” pump	7 sq. ins.
4” pump	12 sq. ins.
6” pump	28 sq. ins.

So a move from a 3” to a 4” pump can produce a much improved flow (over 70% better).

Whilst a centrifugal pump will quite happily pump a certain amount of suspended solids these cause more wear than on a diaphragm pump.

If you dig a road sign out of the mine, observe that the support post makes quite a useful adapter/extension piece for 3” suction pipe.

Keep your eye on any oil pots, because running out of oil can introduce air leaks and increase wear quite considerably.

On those pumps with a removable plug for filling/priming, the plug is invariably on the outlet side and does not need to be more than finger tight. I have seen them hammered home when there is no pipe on the outlet, four interrupted inches away!

When rolling up lay-flat hose with instantaneous couplings, please note that the female end should be in the centre of the coil. It makes running out very quick and simple next time round.

When draining down pipework at the end of session please take care not to allow water to run onto a path where it could freeze and become a hazard to other users.

An increasing number of hire pumps are now appearing fitted with electric start. This makes life easier until the system fails: flat battery or jammed starter motor for instance. Don't lose the key!

Try and arrange for the correct starting handle to be supplied, it's easier than running around on Saturday afternoon when the hire place is shut. One of the most popular games with small hired-in pumps is "where's the jubilee clip gone?". This game can also be played with hose seals, special spanners, etc. Keep hold of all the bits and pieces and preferably keep a few spares in your tool kit as they will charge if you don't return them.

2.6 Pressures

PSI	-	Pounds per square inch
PSIG	-	Pounds per square inch gauge
PSIA	-	Pounds per square inch absolute

The only difference in the above is the measurement starting point, in that 'gauge' states that it takes normal atmospheric pressure as zero, whereas 'absolute' uses a total vacuum as zero. PSI on its own can be taken as PSIG.

2.7 Other Possible Solutions

2.7.1 **Siphons:** one wonderful device to take note of is the siphon. Once primed these work quietly and at no cost, 24 hours a day, and can shift quite large, but still controlled amounts of water.

2.7.2 **Ejectors:** or Venturi pumps. A system of using one pumped medium to cause a vacuum which moves another i.e. a high pressure pump pumps clean(-ish) water, inserted into the outlet is an adapter that has a lower pressure hose attached, the fast flow of fluid past the adapter causes a vacuum to be formed in the low pressure pipe. This suction is used to extract the "target" water/silt/etc. The high pressure pump is often ex-fire brigade. This is a system I don't know anything like enough about, but one where all the moving parts can be run in a much more controlled environment, and is one of the most effective methods of drying out a work site I have seen. It does however require a large source of clean water to run the high pressure side. Any more information would be appreciated.

2.7.3 **Bucket Chain:** don't laugh. This can be the quickest if the quantity is difficult i.e. shallow pools, full of short twigs, leaves, etc. A good way of mopping up pools possibly feeding on to a pump. Another technique is to consider using an excavator to bail out small pools. This is not a pretty solution and a large slurry pool often forms but can be successful.

APPENDIX 1 - GLOSSARY

Air balance chamber A tall tube, sealed from the air, on the outlet side of a diaphragm pump. Required on longer discharge runs to cut down pulsing and to smooth the water flow.

Cavitation The name given to a centrifugal pump thrashing around in an air/water mixture. It dramatically reduces the efficiency of a pump.

Clack valve A hinged flap type of one-way valve, usually opened by water flow and shut by an attached weight, or the weight of water above it. See NRV.

Diaphragm The flexible, usually fabric reinforced rubber, piece that moves in and out of the pumping chamber.

Eye The centre of the impeller.

Foot valve Not really part of the pump but a non-return valve in the filter. Normally in addition to the one in the pump and its inclusion can only help matters.

Impeller The part of a centrifugal pump which rotates at high speed and imparts motion to the liquid.

Loose lug General name for a coupling where part of it is free to rotate so that it can be tightened up.

NRV Non-return valve. A device to stop things flowing the wrong way. Sometimes a rubber-covered wooden ball, others are hinged flaps. See clack valve.

Packing Looking like nasty greasy rope, it is used to form an airtight seal between a static pump body and the rotating shaft.

SWA Steel wire armour hose. A type of hose where the shape is formed round a spiral wire frame work.

Volute The casing around the impeller, the pump body itself.

Vortex A hole in the water, from the surface to the filter, caused by the suction point being too near the surface. Causes air to enter the pump (cavitation!) and surface rubbish to be drawn onto the filter, which reduces pumping. A shovel or sheet of wood over the filter can prevent a vortex forming whilst not reducing water flow. Looks like the bath water going down a plug hole.

APPENDIX 2 - THE WRG PUMP FLEET

Okay so what pumps do we actually have on the wrg plant list and equally important what state are they in? This list represents a snapshot in time of the WRG pump fleet and is only included to show the fact that at anyone time only about 75% are working and most of those are on long term loan. Also note that it is not a case of thinking about just the pump; hoses, filters and the method of moving it around the country also need to be considered. The list was undoubtedly out-of-date when it was printed so please contact the WRG Plant Manager for further details. All are invariably in need of a clean down and repaint, otherwise:

P1 Lister diesel engined 3” Sykes Univac centrifugal pump. Undergoing a complete engine rebuild with Andy Greenwell, and should soon be available for use, it now has 100 plus feet of hose thanks to the eagle-eyed Dave Carnell who spotted some in his works scrap bin, which leaves only the filter and pump couplings to buy.

P3 Briggs and Stratton petrol engined 2” Bauer-couplings centrifugal pump. Usually seen with North West on lock clearances. 50’ suction and a quantity of lay flat, as needed, for discharge.

P4 Briggs and Stratton petrol engined Johnson Mk 18, 3” Bauer - couplings centrifugal pump. 100’ of rigid hose. Recently taken to Aston locks on the Mont. This beast has an external lever to select pump or prime. Unless on a good quantity pump out, this lever can be left on prime when the machine will pump 70% of its maximum capacity, but will deal with any air entering the system. Otherwise, any air entering when on pump will stop the pumping and cause the machine to thrash around with the water already in it, i.e. cavitate.

P5 Lister diesel engined, Johnson Mk 4, 3”, BSP-couplings, diaphragm pump. Both the pump and engine of the unit need looking at. It will then need new couplings plus hose and a filter.

P6 Lister diesel engined, Johnson Mk 4, 3”, Bauer-couplinged, diaphragm pump. 100’ of hose and a filter. Moved to Wilts and Berks Seven Locks project during April 89. The air balance chamber has recently been rebuilt, so that the valve seat is properly held down, and a new pin stops the support leg flapping around. Still burning oil but snores nicely.

P7 Villiers petrol engined, Simplite diaphragm pump. Has 2” suction and 3” discharge both push on and are then held with a screw clip, both now have a Bauer adapter permanently fitted. It has had a carb. rebuild (Alan Jervis no less!) and a new cover on the starter pulley so that it runs safely. At the first of the recent St. Helens weekend digs it was tested and proved capable of a 14’ lift and indeed was used in anger for the first time.

P8 Weda manufactured Bauer-couplinged 110 volt electrosubmersible pump. 2” Bauer couplings. Normally used by North West on it’s lock clearances. In full working order though we are looking at putting an automatic level controller on.

P9 3-phase 6” electric bore hole pump (a version of submersible, where the pump and motor are separated by several feet of shaft, so that the pump is submerged but the motor is in free air) apparently our most useless pump, but it came for just the cost of transport, having been spotted in an educational establishment’s waste bin. Before any of the limited number of sites with electricity can use it we will need to obtain some cable and some piping, with luck and a following wind some recently donated control gear will provide auto or manual operation. The words “apparently useless” are used above since the first enquiry about this type of pump was two weeks after we obtained it, and from someone who knew nothing about it.

P10 Lister diesel engined Bauer-couplings, fast tow 4” Sykes Univac. A recent successful tender by North West. Needs checking over, certainly needs fitting with road lighting and the wheel bearings have been replaced. So that with some hoses a very useful extremely mobile machine should result. A spare wheel will also be needed at some time, 5-60 15 five study 4 7/8” PCD (pitch circle diameter). Hint!

P11 Lister diesel engined 6” Sykes Univac, Bauer couplings machine. A recent donation from David Hutchings on the Upper Avon, where it was not in use enough to warrant keeping it on site. Has 100’ plus of hoses, needs a filter and routine check over then should make mincemeat of some of our long term pumping problems.

P12 Lister diesel engined 4” Sykes Univac, Bauer-couplings machine. A routine check and this complete machine should be another useful addition from David Hutchings.

P99 Coventry Climax petrol LPP (lightweight portable pump). Obtained via a man from the T&MCS. Believed working except that the plug caps have been removed and we do not have a suitable suction coupling.

Other Pumps

Also known to be in the restoration movement are pumps from the following stables:

Godwin DPC.6 dri-prime centrifugal
Honda 3” centrifugal. Search diaphragm pump
Search diaphragm pump
Selwood Spate 75C
Wickem diaphragm pump

APPENDIX 3 - THE WRG LITERATURE FLEET

The author has, or knows the whereabouts of, varying amounts of information on:

Coventry Climax Godiva pump (the LPP)

Godwin DPC.6

Honda WA20/WASO 3" pumps

Johnson Mk 4, 5, 9A, 148, 18

Selwood Simplite 50E Spate 75C

Sykes UVS

Weda SL164

Wickem 8" x 4" diaphragm pump

John Palmer
WRG Plant Manager
53 Southwood Road
Great Moor
Stockport
SK2 7DJ

In addition SLD pumps produce an excellent small booklet full of hints, tips, technical advice, for use when selecting pumps – it is highly recommended:

> Pumps, Hose, Jetting and Traffic Lights
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