Information Sheet

5.14 Irrigation System Maintenance

An irrigation system is a costly investment. Therefore, it is essential to maintain the irrigation system so that it continues to operate at the design specification. The benefit of investing in high capital irrigation systems is dependent on ensuring longevity of the irrigation system. Equipment will inevitably degrade over time due to damage from contaminants in the water, normal wear and tear and reaching the end of the design life of components. The impact of this can be reduced using proactive maintenance and being alert to key signs of potential failure. An irrigation system that is well-maintained performs well in terms of efficiency and consistency, requires few emergency repairs and helps to optimise the crop production system, thereby optimising profits.

Routine scheduled maintenance is thus a critical aspect of ensuring good system performance. In addition to maintenance, day-to-day monitoring helps identify abnormalities in the system's performance. Monitoring can be seen as an early warning to impending problems that could occur between the regular maintenance intervals. Another means of assessing irrigation systems is through periodic system evaluations. Evaluations are used to check that all aspects of the system are performing as per the original design. The system's performance can then be compared to the SABI (South African Irrigation Institute) irrigation norms to highlight inefficiencies, potential for hardware upgrades, and the effectiveness of current maintenance schedules.

It is vital that scheduled maintenance and system evaluation, along with regular monitoring are used cohesively to ensure that the system performs at an optimal level. As with all assets, the longer one waits before adopting a maintenance, monitoring and evaluation strategy the higher the likelihood of expensive, production-hampering issues. An unforeseen breakdown during critical periods, such as during a hot or dry period, or during water restrictions, can be disastrous for that crop.

Corrective maintenance

Corrective maintenance is any action required to return a system's performance to a desired level. Corrective maintenance is typically reactive in nature, i.e. repair it when it breaks. As can be expected, budgeting for corrective maintenance, which arises from unforeseen circumstance, can be difficult. It can also result in unwanted down time and yield loss. While some degree of corrective maintenance will always be required, it is preferred to keep this to a minimum.

Preventative maintenance

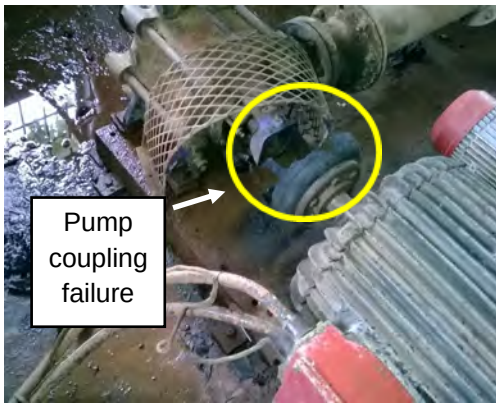
Preventative maintenance is any action required to keep a system's performance at a desired level. Preventative maintenance is a periodic, proactive and recurring activity, which can be pre-planned i.e. maintenance to minimise breakage/failure. Diligent preventative maintenance can substantially reduce the need for corrective maintenance.

An effective preventative maintenance programme for irrigation systems includes the use of:

- servicing schedules (including an inventory and spares to be kept in stock), and
- replacement schedules for the different components.

Preventative maintenance servicing schedules

Some general guidelines on maintenance of the pump and in-field irrigation systems are provided below. Most manufacturers also provide specific maintenance schedules for their products.



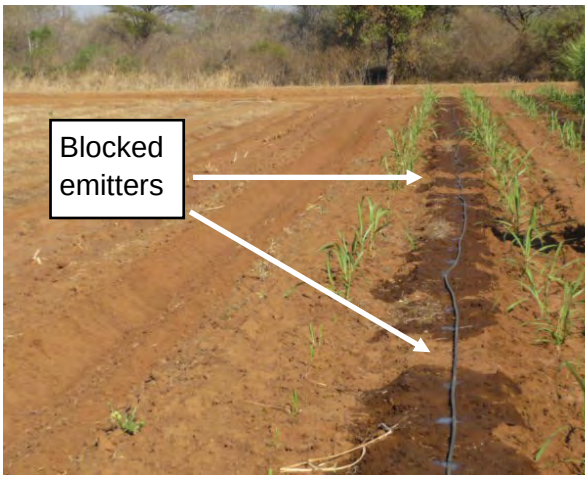
Pump Maintenance

The pump manufacturer usually provides a maintenance schedule. The pump must always run smoothly without any vibrations. The water depth on the suction side as well as the power consumption must also be regularly monitored. Over and above the manufacturer's schedule, the following table can serve as directives for the maintenance of centrifugal pumps.

Typical maintenance schedule for pumps

Monitor	Interval			
	Monthly	1 000 Operating hrs	Bi-annually	Annually
Check alignment / settings			X	
Replace oil			X	
Inspect and clean bearings		X		
Inspect all parts for wear and do hydraulic test [a]	X			
Inspect the gland packing leakage (it must leak slightly, because it is lubricated by water)	X			
Replace the gland packing				X
Inspect cables and electric equipment			X	

[a] Hydraulic test: Close stop valve and take a pressure reading at the pump outlet. A drop in pressure in comparison to when the pump was installed indicates pump wear.



Drip irrigation systems

Drip irrigation systems are extremely sensitive to blockage of filters and emitters. At the planning and design stage, the suitability of drip irrigation should be assessed against the quality of irrigation water available. See *SASRI Information Sheet 5.13 Water quality considerations for optimal performance of irrigation equipment* for more details. Thereafter, a **preventative maintenance programme, based on the prevailing water quality, is essential to avoid blockages**. It is extremely difficult and expensive to correct blocked emitters on a drip irrigation system. It is therefore essential to start with the preventative maintenance programme immediately after installation.

Maintenance actions for drip irrigation systems should be carried out according to the intervals shown in the table below. The intervals depend on the quality of the water and can be more frequent if the water quality is poor. The threshold values for blockage hazards from poor water quality, along with preventative and corrective solutions to treat blockages are presented in Information Sheet 5.13 *Water quality considerations for optimal performance of irrigation equipment*. It is good policy to err on the safe side by doing preventative maintenance more frequently, especially through flushing and chemically cleaning of the dripper lines, as well as flushing and cleaning of filters.

Inhibiting Root Penetration in Subsurface Drip irrigation

Subsurface drip irrigation in sugarcane cropping systems is prone to emitter blockages from root intrusion. This is especially the case when irrigation is withheld to dry-off before harvest. Even though irrigation is withheld during this period, the crop continues to grow and the roots often go in search of water, invariably penetrating into drip emitters.

Copper Ionisation (for inhibiting root penetration): Copper (Cu) is used to reduce root intrusion as well as kill bacteria and algae. Cu ions are toxic to most pathogens and plants, but the levels used to treat water are well below phytotoxicity thresholds. Cu can be introduced by ionisation (release of Cu ions into water by an electrolysis process) or as Cu salts such as copper sulphate. More recently, copper oxide has been incorporated into the drip emitter cover in a new series of drip irrigation products.

Root growth inhibitor: The herbicide Trifluralin can also be used to prevent root penetration. For sandy soils, more regular, but smaller doses are recommended, e.g. 0.1 ml/dripper, six to seven times per year. Ensure that all drippers (especially the furthest drippers) are filled with Trifluralin before the system is switched off. Rinse the application equipment with clean water after application of Trifluralin, especially if the same equipment is used for the application of fertiliser. Wait for at least 4 to 8 hours after Trifluralin application before continuing irrigation. Excessive application, or the leaching of Trifluralin out of drip lines and into the soil root zone can harm the root system and adversely affect crop yields. Profile holes must be dug regularly to monitor root penetration.

Maintenance and monitoring programme for drip irrigation (manual control[a])

	Interval			
	Weekly	Monthly	6-monthly	Yearly
Detect and fix leakages	X			
Monitor system flow (main flow meter)	X			
Flush laterals[b] Minimum flow velocity: 0.4 m/s (good quality water) : 0.5 m/s (avg quality water) : 0.6 m/s (poor quality water)	X	X		
Monitor pressure at lateral outlets. Adjust pressure reducing valves if necessary.		X		
Water sampling at lateral ends, evaluate changes in quality[b]		X		X
Service air valves and pressure control valves				X
Treatment with root growth inhibitor			X (or more frequent)	
Chlorine treatment (depending on water quality and application method)				X

Maintenance and monitoring programme for drip irrigation (manual control[a]) continued...

Activity	Interval			
	Weekly	Monthly	6-monthly	Yearly
Filters				
Backwash filters (as needed)[b]	X	X		
Monitor filter backwash cycle (adjust if necessary)		X		
Service air and pressure control valves				X
Monitor hydraulic and electrical connections				X
Check functioning of hydraulic valves on filter and inspect moving parts				X
Clean filter thoroughly		X		
Service screen filters: Replace screen element if necessary[c]		X		
Inspect sand level (± 360 mm) and shape[d] of sand particles in sand filters. Add sand or replace if necesary.			X	
Service disc filters. Replace discs if necessary[c].				X

[a] The maintenance schedule can be adjusted accordingly for automated systems.

[b] Use the more frequent interval when water quality is poor.

[c] W.r.t screen and disc filters, any screen element or discs that show signs of mechanical/physical damage should be replaced. Remove and clean screen elements or discs with blockages (with chemicals, if necessary). If the screen element or disc cannot be cleaned effectively, it must also be replaced.

[d] The sand particles should have sharp edges to be effective. The effectiveness of sand filters is reduced if sand particles become round due to frictional wear.

Sprinkler irrigation systems

Lack of maintenance will result in a decrease in system performance. For example, an increase in losses due to leaks, or worn sprinkler nozzles, will result in higher flow rates, lower pressure, lower uniformity and higher energy requirements. Regular maintenance is important to ensure good application uniformity and efficiency. It is critical to replace worn components of sprinklers regularly.

Maintenance schedule for sprinkler irrigation systems (manual control[a])

Action	Interval	
	With each cycle	Annually
Inspect the system for leakages	X	
Check system pressure and system flow	X	
Service air valves and hydrants		X
Check sprinklers for wear and replace springs, washers and nozzles where necessary		X
Flush mainlines		X
Replace rubbers at quick coupling pipes where necessary		X

[a] The maintenance schedule can be adjusted accordingly for automated systems

After the irrigation season, and before the pipes are stored, the following must be done:

- Mark all the holes in quick coupling pipes with paint so that they can be repaired.
- Remove all gaskets from pipes if they are stored in the sun.
- Replace all damaged and hardened gaskets.
- Replace all worn male and female pipe fittings.
- Replace all dragline pipes that have more than three joints.
- Check standing pipes for corrosion and replace if necessary.
- Ensure that all standing pipes are the same length and straight.

Moving irrigation systems (Centre Pivots)

There are many parts in moving irrigations systems, which necessitate regular maintenance and replacement. The maintenance schedule for moving irrigation systems is shown in the table below.

Maintenance schedule of centre pivots

Action	Interval		
	After each revolution	After each 4th revolution	Seasonal
Electrical			
Switch on pivot and listen to each motor and starter. If any abnormal sound is heard, remove and service.			X
Replace end tower's electric bulb (if out) and remove dust, insects and water where necessary.			X
Check tower panel and main control cabinet. Clean panels, remove dust, insects e.g. wasps, etc.			X
Inspect condition of wiring of pivot			X
Inspect electrical motor cable condition, earth conductor and connections			X
Structure			
Tighten all bolts and nuts where necessary. Ensure that earth conductors are clean.			X
Grease pivot		X	
Grease pin that holds swing mechanism of towable pivots to prevent rusting		X	
Check system for leakages. Repair if necessary			X
Replace gearbox oil			X

Maintenance schedule of centre pivots (continued...)

Action	Interval		
	After each revolution	After each 4th revolution	Seasonal
Structure (continued)			
Drain and replace lubricants in motors			X
Grease moving parts and roller bearings	X		
Check U-couplings, grease if necessary			X
Check wheel bolts and adjust as prescribed	X		
Check wheel pressure and adjust as prescribed	X		
Check flange fittings for leakages, secure and replace if necessary	X		
Inspect framework for sturdiness – tighten bolts if necessary	X		
Check that all the safety switches work			X
Check that all the drainage valves work	X		
Clean sand trap if necessary	X		
Sprinklers			
Check nozzles for wear, replace if necessary			X
Check that the pressure gauge works correctly			X
Check the condition of the sprinklers			X
Check pivot pressure and pressure at beginning of towers			X
Check for blockages in nozzles	X		
Flush the system			X
Equipment			
Check functioning of end nozzles and check nozzle for wear			X
Inspect cut-off action of end nozzle – repair or replace if necessary			X
Check stop in slot micro switch, adjust if necessary	X		
Test the automatic reverse-action movement of pivots by switching the hand lever forward and back			X
Fill wheel tracks deeper than 150 mm with timber or stones		X	

With linear systems, the following additional measures must be kept in mind when maintenance is undertaken:

- **Drive:** All electrical cables must be checked regularly and replaced if necessary. Check bearings and belts and adjust if necessary.
- **Alignment:** Check alignment according to manufacturer's prescriptions. Where a system uses a supply line that must be towed, the road must be as even and dry as possible to make the towing of pipe easier.

Further reading

Comprehensive information on the maintenance, monitoring and evaluation of different irrigation system components is provided in the ARC's Irrigation User Manual published by the Water Research Commission (WRC report number TT 819/2/20, available by email from orders@wrc.org.za or as a download from www.wrc.co.za).

Acknowledgments

The maintenance schedules in this information sheet were mainly extracted from a report titled "Standards and guidelines for efficient use of water from dam wall release to root zone application" published by the Water Research Commission (report no TT 466/10) and subsequently used to update the ARC Irrigation User's Manual.

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February 2021