Nursery & Garden Industry Queensland

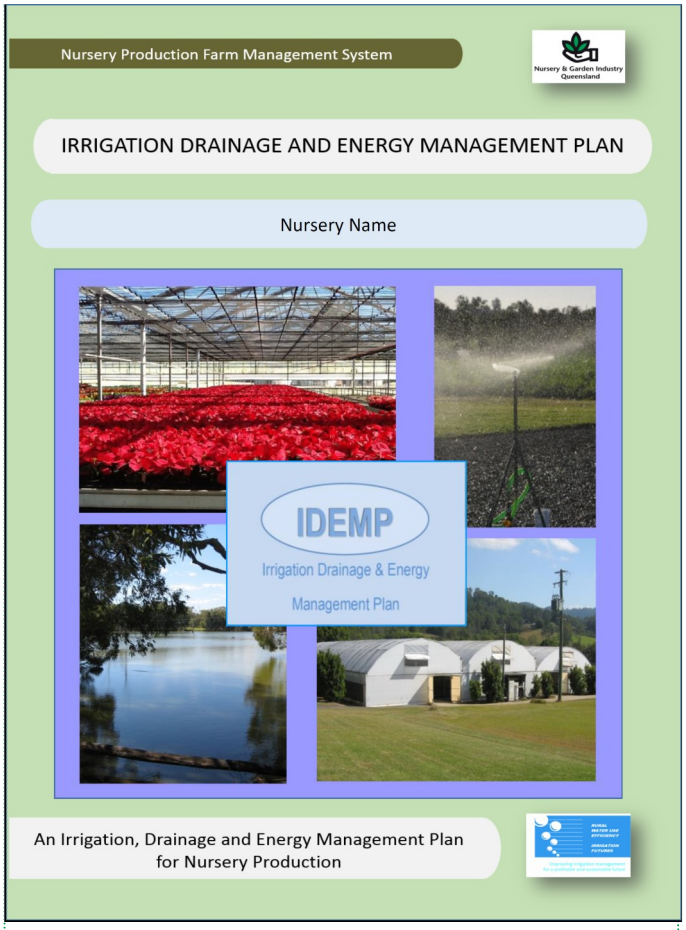
Conducting an Irrigation and Drainage System Audit

Technology advancements and deterioration of components mean that an irrigation system can't be installed and expected to operate to industry best practice for the next 20 years. What can be done is to constantly monitor all facets of the system, and apply maintenance programmes to ensure it remains at the cutting edge.

Irrigation and drainage system auditing highlights the limitations and opportunities that are available for optimising water use efficiency. These improvements can be realised through management, maintenance and technological improvements, thus reducing downtime and improving productivity and profitability. Auditing enables a prioritised action plan to be drawn up, and this in turn allows improvements to be costed and planned for. Conducting a system analysis also demonstrates to regulatory authorities that a responsible approach is being taken to water management, and impacts to the environment are being minimised. As an industry, it's imperative that information gained from irrigation system audits is readily available, so that nurseries have continued access to water.

The information contained in an Irrigation Drainage and Energy Management Plan (IDEMP) allows an irrigation and drainage audit to be conducted in a structured way, and develops an action plan to prioritise the changes that need to be made to improve overall system efficiency. The IDEMP template is free, and can be accessed by contacting the Nursery & Garden Industry Queensland. A full evaluation of an irrigation system may require the assistance of qualified irrigation specialists, but much of the data on system performance can be collected in-house e.g. catch can tests.

Assessing the following will highlight weaknesses in the system that may cause minor or significant crop losses, particularly when components are added to an existing system without full consideration of their impact on overall system performance.



- **Water supply**
  - ◊ How much is water worth to the business in dollars/Megalitre?
  - ◊ Which plants require the most and least water to produce?
  - ◊ How much water do each of these plant types require for a full production run?
  - ◊ What are the estimated nursery irrigation water volume requirements?
  - ◊ Is there a water meter on the irrigation supply to measure water use?
  - ◊ Is the water quality suitable for the complete range of crops, system components and disinfestation systems e.g. ultra-violet transmissibility of a water source needs to be assessed if ultra-violet disinfestation is used. Full nutrient tests will determine if there is a clogging hazard, and highlight the limitations imposed on disinfestation systems.

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- ◊ What regular testing is performed to monitor changes in water quality.
- ◊ Research should continue throughout the growing season to identify water quality variations e.g. after summer rain events, at periods of high seasonal planting and as levels in bores and/or surface water storages vary.
- ◊ Are all permits and licence requirements being met?
- ◊ Is the water source sustainable and environmentally sound?
- ◊ What is the calculated water storage available? Calculations should show the duration a water storage must stretch without replenishment, as this may be the limiting factor to production capacity.
- ◊ If bores are used, information on the sustainable long-term pumping rate, seasonal variability in standing water level, depth of aquifers, casing size and screens can be used to calculate available water and pumping efficiency.
- ◊ What is the calculated catchment or recharge capacity of the water source? Weather data will provide background on rainfall history and weather events for these calculations.
- ◊ What are the backup, reserve or emergency water sources, e.g. town supply?
- ◊ What are the contingency plans for emergency pumping, e.g. power failure?
- ◊ What systems are in place for recovering irrigation wastewater and water from rain events? Up to 60% of the irrigation applied through overhead systems may be available for collection and possible reuse?
- ◊ How often is the irrigation schedule changed to match changing plant water use?
- ◊ How are irrigation practices under water restrictions or low water availability changed?
- ◊ What waste and environmental issues are present?
- ◊ What water storage aeration systems are used?

- **What systems are in place for managing contaminates in irrigation water e.g. filtration?**
  - ◊ How are particles filtered from the irrigation water supply?
  - ◊ What degree of filtration is used, i.e. mesh or micron size?
  - ◊ What filter types are used, e.g. screen, disc, media?
  - ◊ Where are the filtration systems located? Single or multiple sites across the nursery, e.g. propagation, drip irrigation lines.
  - ◊ What backwashing occurs on filtration systems – manual or automated, and at what frequency?
  - ◊ Describe the filtration maintenance programme – regular and annual maintenance.

- **Disinfestation systems**
  - ◊ What types of disinfestation systems are used? Physical, biological, or oxidising agent?
  - ◊ Is the disinfestation system automated?
  - ◊ What systems are in place for monitoring disinfestation effectiveness?

- **Storage tanks for disinfestation and distribution/ application**
  - ◊ What is the total storage volume – number of tanks and volumes?
  - ◊ Where are the tanks located?
  - ◊ Specify the tank construction material. Identify accidental damage, flooding and corrosion issues.

- **Pumping**
  - ◊ Specifications of pumps, e.g. single/three phase, multi stage, centrifugal, variable frequency drive. Pump curves - from an irrigation specialist or on-line.
  - ◊ Compare pump performance to the duties required when running different irrigation zones.
  - ◊ Recording shut off pressures and comparing these to pump curves can indicates the degree of impellor wear and the efficiency of the pumping system.
  - ◊ Assess the system hydraulics to determine the adequacy of the performance of pumps, pipes and valves.
  - ◊ What are the transfer pump specifications, if used, e.g. to fill storage tanks?
  - ◊ What pumping velocity, flow and system pressure/s are required for efficient operation of the system?
  - ◊ What redundancy is built into the system e.g. backup pump or alternative power supply?
  - ◊ Pump suction specifications? Suction height lift (head), length of suction, volume and velocity, pipe size, material and pipe friction?

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- **Describe the irrigation distribution network**
  - ◊ Main and sub-main locations, e.g. above or below ground, routes, mapping.
  - ◊ Main, sub-main and lateral pipe sizes, classes and material.

- **Irrigation application**
  - ◊ What types of irrigation systems are used, e.g. overhead, drip, bottom up?
  - ◊ For each irrigation zone, what is the emitter being used, the operating pressure and Best Management Practice (BMP) parameters i.e. Mean Application Rate (MAR), Coefficient of Uniformity (Cu) and Scheduling Coefficient (Sc)?
  - ◊ How often are the block pressures, MAR, Cu and Sc tested on the irrigation system?

- **Irrigation scheduling**
  - ◊ How is scheduling managed to minimise wind effects, reduce excessively wet foliage, minimise interference with staff working schedules, and to take advantage of off-peak power or water periods. This information can help to reduce excessive water use and nutrient leaching, which will improve uneven and/or slow plant growth, decrease leaf drop, and address poor internode spacing and plant shape. This may also provide information on how to reduce excessive drainage, minimise the impact on elevating and/or contaminating water tables and reduce irrigation costs.
  - ◊ Record the current irrigation schedule for each block, the process used to determine irrigation run times, and any daily and seasonal variations in irrigation scheduling.

- **Irrigation controllers**
  - ◊ Does the irrigation controller have the flexibility to meet site requirements?
  - ◊ Is is multi-wire or a two-wire system?
  - ◊ How many irrigation stations/zones on each controller.
  - ◊ How many programs are available.
  - ◊ Is there the ability to pulse irrigate.
  - ◊ Can the run time percentage be adjusted i.e. seasonal adjust.
  - ◊ What inputs can be connected to the controller e.g. weather data.
  - ◊ Is internet connectivity required or available.

- **System monitoring and maintenance**
  - ◊ Is there regular monitoring and recording of performance parameters, e.g. operating pressures, MAR, Cu, Sc?
  - ◊ Is disinfestation and treatment efficacy monitored and recorded, e.g. chlorine residual level and contact time.
  - ◊ What in-house and external regular programmed maintenance is performed.

- **Drainage**
  - ◊ What types of drains are used and how well do they cope with water from heavy rainfall?
  - ◊ What components make up the drainage system, e.g. surface earth drains, surface concrete drains, surface sealed drains other than concrete, pipe drains, slotted drainage pipes, sediment traps, interception traps, water treatment, and collection sumps/storage?
  - ◊ How well does the drainage system match the slope, soils and rainfall intensity?
  - ◊ How is drainage managed to minimise downstream pollution?
  - ◊ How does the storage of water optimise water retention and minimise pollution in surface and groundwater systems?
  - ◊ Are losses through seepage minimised?
  - ◊ What volumes of drainage water are available?
  - ◊ What collection and recycling options are available and used?
  - ◊ What are the limiting factors for recycling or reusing water?
  - ◊ Is storm water runoff from roofs and production areas collected separately?
  - ◊ Is drainage water storage capacity sufficient to store the wettest month's runoff volume?
  - ◊ Does the current drainage system require maintenance?
  - ◊ Does the drainage system meet all necessary state and local regulations?
  - ◊ How often Is the quality of drainage water tested?

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- ◊ Calculation of catchment and rainfall history will provide guidance on drainage design requirements.

- **What nutrient reduction systems are in place?**
  - ◊ Is the water quality of drainage water tested regularly?
  - ◊ Are constructed wetlands installed?
  - ◊ Are collection drains and water storage areas planted to reduce nutrient loads?

Once the system has been audited, an assessment can then be made on how well integrated the system is from the water source to the end use application?

From the audit and overall assessment, a prioritised action plan can be drawn up to guide the upgrading of the system to improve its reliability and efficiency.

For further information on conducting an irrigation system audit refer to The Nursery Papers May 2006 Issue no. 4. “How efficient is your business water management?”.

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