

Hunter Starting Smarter Irrigation Project

Irrigation System Decisions Developing a new site

Setting plans in motion

When planning to develop a new irrigation site, there is usually no definitive best option. The right way to proceed is to take time to execute a due diligence process and ensure you are aware of any permits or licences which need to be factored into planning. Collect information on the characteristics of the site you are seeking to develop, especially soil considerations, the water source (volume, quality), system options, supporting infrastructure and labour requirements. Importantly, make sure you work with trusted advisors- ask other irrigators- including experts in irrigation agronomy and irrigation systems (design *and* maintenance). A well-considered development plan will reflect a balanced compromise between all factors.

Most retailers of irrigation equipment provide a design service built-in to the purchase price of the system. In-house designs are often minimally adequate and usually aim to sell the particular brand they are associated with. Better results are often obtained by engaging an independent consultant who will work out your requirements and provide the performance specifications for your irrigation system. This independent report can then be given to retailers to provide quotes for specific systems. At commissioning, the system should be demonstrated to perform according to the performance specifications provided by the independent designer/consultant.

Independent design consultants

Irrigation Australia Ltd (IAL) maintains a list of *Certified Irrigation Designers* (CID). A CID has undertaken certification process and can therefore attest to meeting international standard competencies in:

- ✓ Designing efficient irrigation systems that improve water efficiency and reduce waste;
- ✓ Applying best practice to agriculture, commercial, or residential irrigation systems;
- ✓ Bringing a tested and vetted professionalism to irrigation projects;
- ✓ Managing commercial and residential spaces that will flourish in site specific climates; and
- ✓ Ensuring all federal, state and local regulatory standards are being met.

This list can be found on the IAL website:
www.irrigationaustralia.com.au

Useful Resources

Knowledge Management System for Irrigation (KMSI)

The KMSI provides a suite of tools for decisions associated with irrigation design and management. It is developed and maintained by the National Centre for Engineering in Agriculture (NCEA), University of Southern Queensland. One of these tools is outlined below.

EconCalc

An Economic Calculator for Irrigation Systems

EconCalc is a decision support tool used to economically evaluate the costs and benefits associated with a new irrigation system. It calculates a number of economic performance indicators such as Net Present Value (NPV), Annualised Costs/ Benefits (annuity), the International Rate of Return (IRR) and the Benefit Cost Ratio.

[EconCalc Link Here](#) [User Manual Here](#)

IPART

Irrigation Pump Evaluation Reporting Tool

(existing systems)

IPERT is designed to assist in the evaluation and collation of on-farm irrigation pumping systems performance data. It provides a range of functions including standardisation of on-farm data record acquisition, calculation and presentation of on-farm irrigation pumping system evaluation indices, automated generation grower recommendations and grower report generation.

Access requires KMSI registration which can be arranged through the website: www.kmsi.usq.edu.au

Irrigation New Zealand

Irrigation Decision Support Package

Developed to help:

- ✓ Irrigators gather the right information to prepare a design (specification brief);
- ✓ Irrigators better understand irrigation system performance indicators when comparing quotes;
- ✓ Irrigation designers develop a design brief based upon irrigator supplied information; and
- ✓ Irrigation designers prepare a quote using standardised system performance indicators.

[INZ Irrigation Development Website Here](#)

Irrigation System Development Checklist

Development Checklist

The following checklist of factors recommended for consideration when planning a development/ major upgrade of an irrigation site on-farm has been developed by NSW based irrigation system expert, Peter Smith of Sapphire Irrigation Consulting.

Site Characteristics

- ✓ **Soil survey** – soil type is the most significant factor for irrigation. Different soil types have widely varied characteristics which make a big difference to the design and management of irrigation. A comprehensive soil survey providing indications of soil texture, soil structure, infiltration rates, water holding capacity, problem soils and any subsoil constraints is essential. Proceeding without a soil survey means the design and management will be based on guess work. An electromagnetic induction (EM38) soil survey is a cost-effective method that provides good results for all but very sandy soils.
- ✓ **Topography** – all irrigation works best on fairly level, flat land. A topographic survey of the potential irrigation area is essential for good system design. Paddocks may appear to have little variation where they actually vary a lot. Not allowing for this often results in poor irrigation performance. A topographic survey also identifies infrastructure and permanent fixtures such as powerlines, roads, railway lines and fences.
- ✓ **Field size and shape** – how will irrigation be laid out in the new field? If centre pivot is an option, are you comfortable farming in circles? How will you manage unwatered areas such as corners of square fields?
- ✓ **Vegetation** – irrigation areas should be clear of vegetation in the line of planned areas for overhead or travelling irrigators. Investigate if any particular approvals from relevant authorities are needed for the removal of vegetation. Plans should also consider where/ how shade shelter and biodiversity areas may be incorporated into areas adjacent to the irrigated site.
- ✓ **Pasture/ Crop planning**- the types of pasture or crop you intend to grow and desired yield levels need to be considered as this will influence the design of the system and perhaps the type of system.
- ✓ **Climatic factors** – climate is the main driver of plant water use and this influences most aspects of design and management. Defining the peak and average evapotranspiration for your location for the pasture or crops you intend to grow is important.

Water Considerations

- ✓ **Quantity of water available** – how many megalitres of water can you reliably access? There is no point having a large irrigable area but insufficient water to supply the plant water requirements.
- ✓ **Water quality** – have the water from all your sources tested for quality. Water quality has an effect on the type of plants that can be grown, the type of irrigation system you choose and may have detrimental effects on soil and irrigation infrastructure. It is better to discover this in advance rather than after you have installed an expensive system that does not work well.
- ✓ **Water availability** – can your water supply keep pace with the plants' water demand? If you have a limited supply rate eg. from a bore or water delivered from a scheme, the rate of supply may impose a limit on the area of pasture you can irrigate.
- ✓ **How far does the water have to be pumped?** – if the supply source is a long way from the irrigated field, there will be increased costs in both the pipework required and the annual running costs
- ✓ **Is on-farm storage needed?** – if your supply has to be ordered many days in advance or it is not reliable, an on-farm storage might be needed. A storage allows shorter supply paths to the irrigated field, greater flow rates and faster channel/pipe fill, and a collection point for return or storm water.

Infrastructure/ equipment

- ✓ **Pump selection and costs** – the pump should always be selected as one of the last steps to ensure that it can perform efficiently at the required duty. Pumps are relatively cheap and a small percentage of the overall cost of the irrigation system. If the pump is poorly selected, extra running costs over just a few seasons will almost certainly be more than any saving that might have been made on the purchase price.
- ✓ **Monitoring of water and energy efficiency should be planned from the start** – this means fitting appropriate meters and gauges. Having them with the capacity to be read remotely encourages collecting and using the data.
 - For electrically driven pumps, install a pressure gauge at the pump, a water meter, and use the power meter readings
 - For diesel driven pumps, install a pressure gauge at the pump, a water meter, and a diesel fuel flow meter

Irrigation System Development Checklist

Information from these can be used to monitor pump efficiency and cost per ML. Observations over time will indicate where there is a problem and when it is cost-effective to renovate the pump or other components.

- ✓ **Monitoring of soil moisture** – what soil moisture monitoring system will you install and how will you make your irrigation scheduling decisions? Refer the *Hunter Starting Smarter Soil Moisture Monitoring Checklist*.

Cost

- ✓ **Capital costs and operating costs** – the irrigation layout must be beneficial for your business so insist on detail of the running costs as well as the capital costs so you can determine what is optimal for you. There is often a trade-off between these where a small increase in capital cost results in a large reduction to operating costs.
- ✓ **Labour availability** – some systems (eg. surface systems, hand-shift, traveller) require high labour input; other systems (eg. centre pivot, drip) require more skilled labour. Labour and training costs need to be considered.
- ✓ **Installation**- the type of system and layout will require different labour, equipment and timeframes to install. Also consider flow-on effects and disruption to infrastructure availability and daily routines around the farm during installation
- ✓ **Pump selection and costs** – as this is very important... this point is highlighted again- the pump should always be selected as one of the last steps to ensure that it can perform efficiently at the required duty. Pumps are relatively cheap and a small percentage of the overall cost of the irrigation system. If the pump is poorly selected, extra running costs over just a few seasons will almost certainly be more than any saving that might have been made on the purchase price.
- ✓ **Water efficiency and productivity** can be monitored by recording yield from the irrigated area, the water meter readings and rainfall. Refer to the *Hunter Starting Smarter Soil Moisture Monitoring Checklist* for ways to best record this type of information.
- ✓ Indicators such as Irrigation Water Use Index (IWUI) and Gross Production Water Use Index (GPWUI) can be easily calculated at the end of each season to evaluate the annual water and economic efficiencies of the system.

Commissioning

- ✓ This is the final phase of the irrigation works and you should insist that it is included in the contract. Commissioning includes demonstrating that the system, including all components and supporting infrastructure, performs to specifications.
- ✓ A formal hand-over should be conducted between supplier/installer and the owner with comprehensive instructions on how to operate and maintain the system. Consider training of staff into the process of formal hand-over.
- ✓ A commissioning report should be received.
- ✓ It is suggested that the final 20% of the value be withheld until satisfactory commissioning can be proven.

Ongoing support & advice

- ✓ Ensure you include post-commissioning support into the contract with your irrigation system and components suppliers. Include:
 - Retesting of the system and all components after the first irrigation season.
 - Regular maintenance services for at least one to two irrigation seasons.
 - Control panel calibration checks and recalibration services.
 - Distribution Uniformity and Coefficient of Uniformity checks.

For further information refer to the *Irrigation Australia Ltd System Design Guidelines (April 2017) for piped agricultural irrigation systems.*

[Click Here](#)

The Hunter Starting Smarter Irrigation Project wishes to acknowledge that this information sheet has been prepared by Marguerite White of ICD Project Services & Peter Smith of Sapphire Irrigation Consulting.

