



## 2019 ASIC EXCELLENCE IN IRRIGATION

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### Category VII

Macadamia Orchard  
Micro Irrigation

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## 1 PROJECT OVERVIEW

The property at Gates Road, Canina Queensland was bought by our client as an established macadamia orchard, approximately 25 years old and having an installed irrigation system. Upon inspection, it was found that the installed irrigation system was inoperable and, had it been operable, would have had significant pressure and flow variations.

The property is steeply undulating with contours ranging from 100 metres to 160 metres. The macadamia rows run down the slopes at 90 degrees to the contour lines.

The soil tends toward red volcanic with a tendency to erode if left without ground cover or mulch. Water supply for the orchard is a 30 megalitre dam situated centrally on the property and approximately in the middle contour range.

The challenge in this design was to accurately size sub-mains and lateral lines in the steep topography so that the operating pressures stayed within the pressure limits of both the Low-Density Polyethylene tube and the optimum operating range of the pressure regulating micro sprinklers.

Harvesting of macadamias in Australia requires that the area below the macadamia trees be swept to gather up the naturally fallen nuts so all lateral lines are suspended 1 to 1.2 metres above the ground. At this height, the lateral lines are also within the eyeline of kangaroos, so the animals generally manage to avoid colliding with them.

In this design the macadamia tree spacing was approximately 4.5 metres (there were slight variations to this) with 9 metre row spacings. 2 sprinklers were installed between the trees, overlapping to maintain a high CU, DU and SC. Sprinkler radius threw out to the drip line of the trees.

## 2 PROJECT NARRATIVE

From the start this was going to be a challenging project, the steep country, the limited availability of water and financial concerns.

The nature of harvesting the macadamia nuts by sweeping the fallen nuts from under the trees means that, for the 3 month long harvesting period, the ground below the tree out to the drip line is swept bare.

On this steep topography the irrigation application rate must be high enough to meet the PIR cyclical window but not too high to cause run-off and erosion.

The original pump shed was basically a corrugated iron lean to, open on one side.

Filtration was an old, manually cleansed Amiad screen filter which was undersized originally for the job it had to perform.

Initially, consideration was given to utilizing the originally installed DN80 PVC main. In the event, this main was found to be DN65 PVC with new fittings either not available or very expensive.

They also wished to utilise the installed Regent pump, a 25-year-old veteran of which we were eventually able to source a performance curve for. A pump test confirmed that, despite its age, the pump was still capable of meeting the initial duties called for in our design.

The installed sub-mains and laterals were not adequately telescoped leading to significant pressure variations across irrigation zones. This manifested itself in overly high pressures and excessive flow rates at the lower end of the laterals and sprinklers barely turning at the upper end of the laterals.

Initially centralised fertigation was considered but, given the length of the mains and the wide range of pump duty heads, it was decided that fertigation would be carried out at the zone head-

works. This was carried out by a fertilizer tank mounted on a ATV and the provision of injection points just prior to the zone control valve.

Within the scope of the commissioned design works were the following:

- Calculation of the Peak Irrigation Requirement
- Definition of this system as a supplementary irrigation system due to limited water supply
- Lateral pipe sizing to distribute pressure evenly along the lateral length (remaining within the pressure tolerances of the LDPE pipe and sprinkler pressure compensating range)
- Mainline sizing with PN rating diminishing with the changing of the mainline elevation
- Selection of a suitable automatic suction scanner filter unit suitable for future expansion of the pump installation
- Local zone fertigation
- Matching the Regent pump to the new irrigation duties and the recommendation of a Variable Frequency Drive to optimise pump operation
- New suction line

Our client opted to install the new system using their own staff with staged site visits by JP WATER. The installation had to be carried out around normal farm operations and with at times inclement weather.

It is noteworthy that in this design, sub-main sizing telescoped down from DN80 PVC to DN25 PVC and lateral tubing from 25mm LDPE down to 10mm LDPE. These were very steep slopes. (see attached contour plan)

### 3 ROLE OF JP WATER P/L

Our role in this project spanned a period of nearly 12 months with many meetings and discussions as the extent of the limitations of the originally installed irrigation system became evermore apparent. As the limitations were confirmed so the cost of the system and the design needs grew.

Our scope of services eventually encapsulated the following:

- Calculation of the Peak Irrigation Requirement
- Sprinkler flow rate and spacing recommendations based on the outcome of the PIR calculations and soil considerations
- Hydraulic design works. In this the use of the 10mm LDPE pipe was calculated and discussed on site with the client. This is a difficult LDPE pipe size to source and the decision to utilise it was not taken lightly
- Recommendations as to fertigation and the location of Zone fertigation point as distinct from centralised fertigation. Given the high heads involved and the travel time for fertilizer from the central pump site, it was decided that the local zone system was the best
- Advice on installed zone headworks, mainline thrust blocking, filter installation and pump shed dimensions
- Detailed Bill of Materials and suitable suppliers
- Vetting of tenders for supply and responding to Requests for Information from suppliers. Here the supply of the 10mm LDPE again proved contentious
- Site visits as the project developed and was commissioned

### 4 SUMMARY

This was a challenging project in many aspects. If one aspect had to be named as critical to the successful operation of the design, it would have to be the use of the 10mm LDPE. No other aspect

of the design caused as much heartache and discussion as the inclusion of this pipe. It has proven to be the decision that, along with the rest of the hydraulic design, has made this system operate within the limitations of the pipe pressure rating and the sprinkler operating pressure range.

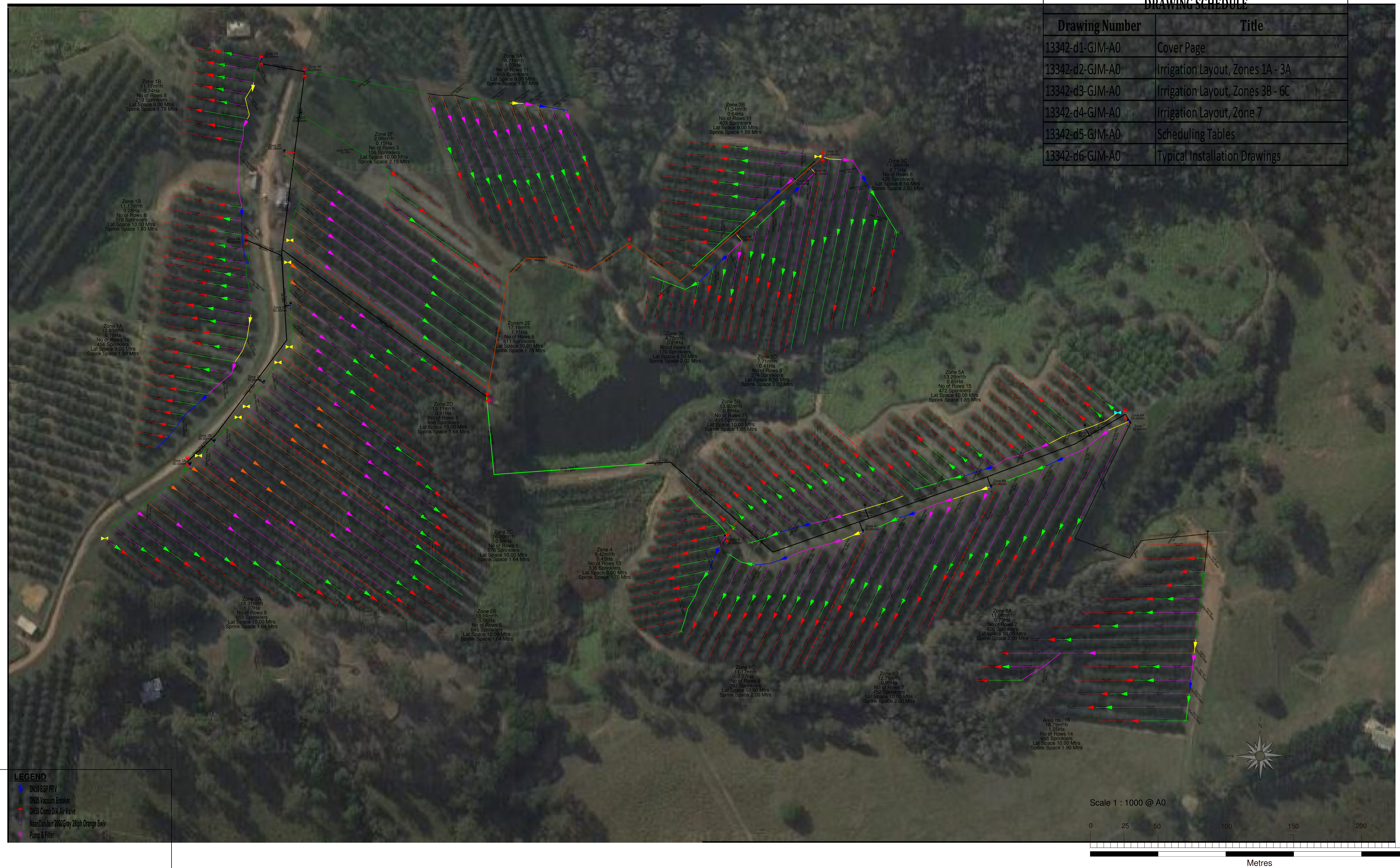


Jim Phillips CI Ag, Dip Irrig, QBCC1087585

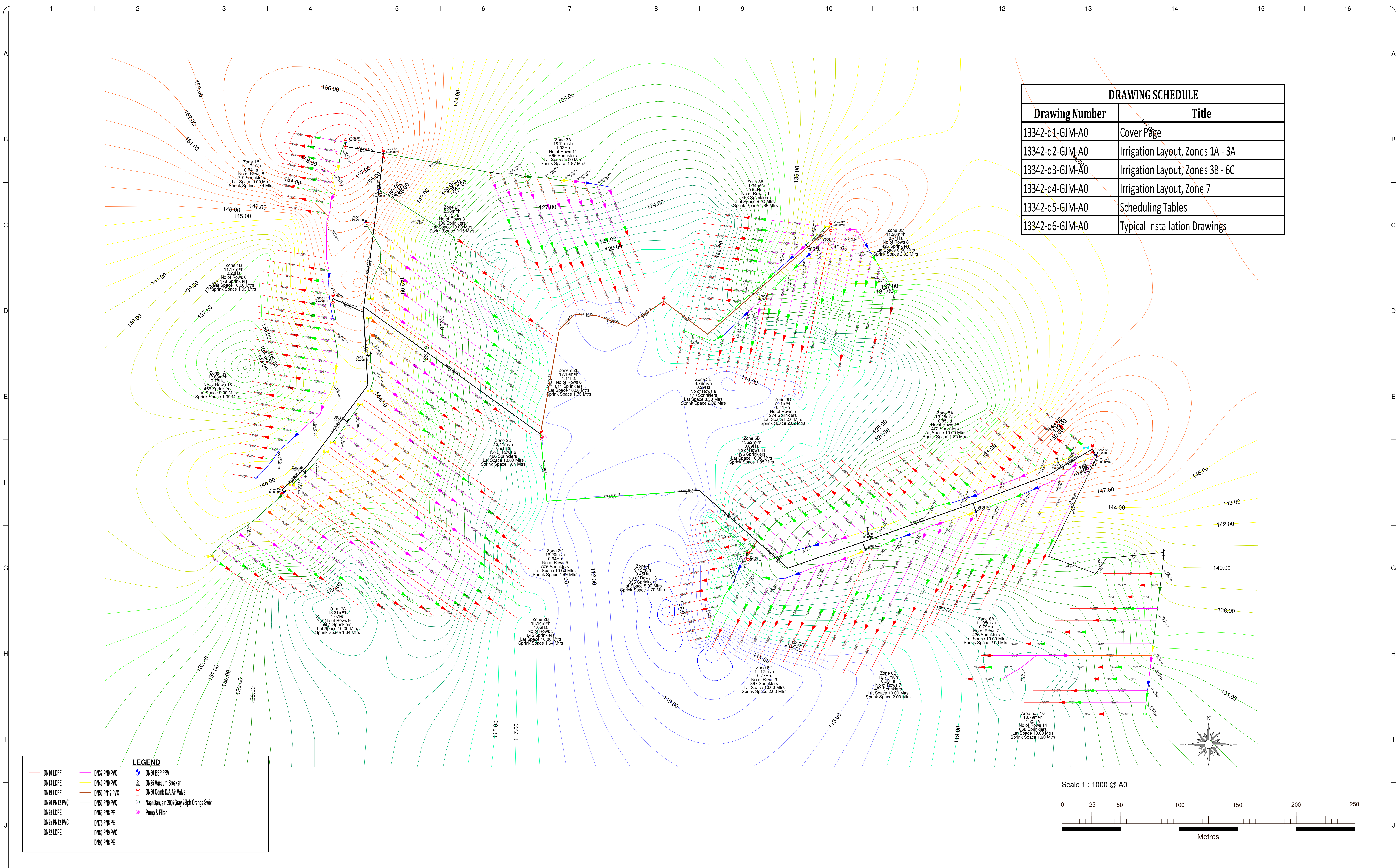




DRAWING SCHEDULE	
Drawing Number	Title
13342-d1-GJM-A0	Cover Page
13342-d2-GJM-A0	Irrigation Layout, Zones 1A - 3A
13342-d3-GJM-A0	Irrigation Layout, Zones 3B - 6C
13342-d4-GJM-A0	Irrigation Layout, Zone 7
13342-d5-GJM-A0	Scheduling Tables
13342-d6-GJM-A0	Typical Installation Drawings







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Peak Irrigation Requirement  
Definition

Peak Irrigation Requirement (PIR) is an estimate of the maximum amount of water that should be supplied to a mature plant growing under the most demanding environmental conditions.  
PIR in this design is between September and December in a "No Rain" situation.  
The column "Irrig Req mm/Day" reflects the PIR with historical averaged rainfall.

PEAK IRRIGATION REQUIREMENTS									
Locality		Canina QLD							
Crop		Macadamias							
UTM Zone		56j							
Latitude		-26.129399			Irrig Effic %	87.50%	PUF %	100.00%	Emitter Spacing Mtrs
Longitude		152.753704						2.5	Lateral Spacing Mtrs
Altitude Mtrs		117							9
Climate Data Source		FAO CROPWAT 8 & CLIMWAT2							
Crop Factor Source		Old Water Resources Commission							
Irrig Efficiency Source		Irrigation 6th Edition							