

Perth Plant Propagation Pty. Ltd.
Bauer Nimr constructed wetland
nursery project
Sultanate of Oman



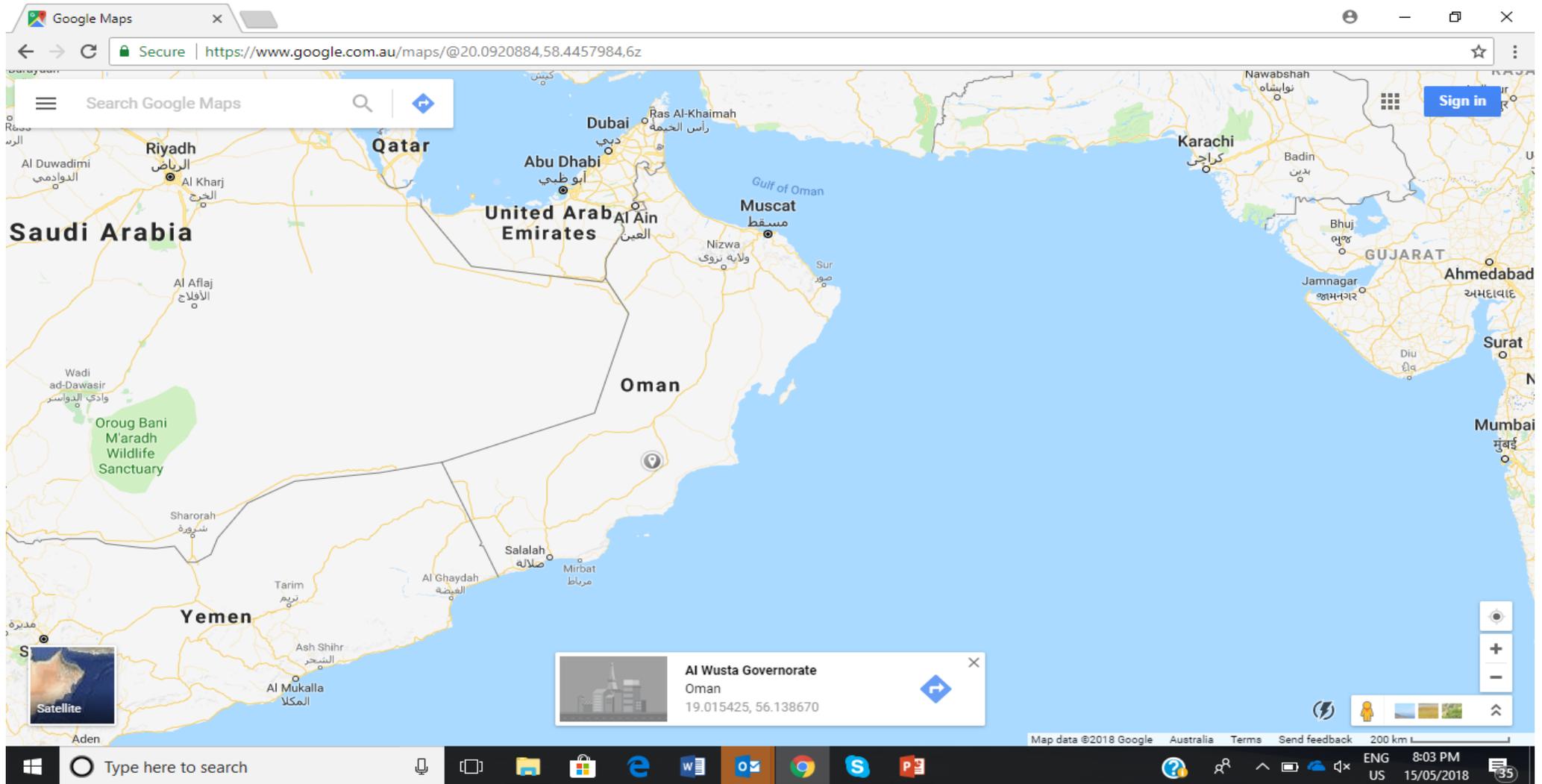
TAKING A WALK ON THE WILD SIDE

- No seed
- No nursery
- No nursery manager
- Omani desert is totally dry, temperatures reach over 50 degrees C.
- Limited horticultural equipment available

The requirement in April 2018

800,000 plants from scratch in 12 months

Nimr Oilfield 700 KM from Muscat



The Nimr oilfield in the Omani Desert



BACKGROUND

- Oil and gas production in Oman is the principal and essential income earning source for the Sultanate
- The oil fields in Oman produce large amounts of water as oil is extracted
- The oil is separated as can best be done but this leaves large volumes of water which is contaminated with oil residues
- Past practice has been to return this contaminated water by pumping up to 1.5 km underground
- The return of water underground requires massive pumps and power to drive them
- Petroleum Development Oman sought and developed with Bauer Resources of Germany a technique to use plants to purify the oil laden water within a constructed wetland.

The Australian & IPPS Connections

- The project manager for Bauer Resources / Bauer Nimr LLC is an Australian, Dr Tom Headley, a wetland water scientist with extensive experience in the use of wetlands for environmental remediation.
- His vast experience did not extend adequately to nursery construction and propagation.
- Through IPPS connections, my company Perth Plant Propagation Pty. Ltd. was approached to tender.
- The PPP tender was made with Dermot Molloy from Royal Victoria Botanic Gardens as a sub consultant.

Oil Field Produced Water



Oil & Water at Nimr

- 9 ltrs of water produced for every litre of oil
- The Nimr oilfield currently producing 110,000 cubic metres of water per day
- Previously dealt with by pumping water surplus 1.5 km underground at huge expense
- Petroleum Development Oman expanding – An additional 60,000 cubic metres per day will come on stream on May 1st 2019.

Existing Constructed Wetland



Aerial view of existing 680 hectare wetland and evaporation system



Purified water at the outflow



Existing Wetland

- Receiving 130,000 cubic metres of oil laden water per day
- Existing wetland 380 hectares with 300 hectares of evaporation pond
- The algae & bacteria that the plants support devour the oil residues
- Existing vegetation a monoculture of *Phragmites australis*
- Single species prone to pest attack and root mass clogging
- New wetland requires a revised plant selection solution

Expansion of constructed wetland

- A new area of 250 hectares is now being developed
- Completion required by April 2019.
- 4 species to be produced to total 800,000 plants. All 4 species found within Oman.

- *Typha domingensis*
- *Juncus rigidus*
- *Schoenoplectus littoralis*
- *Cyperus laevigatus*

- Existing nursery area set up for cuttings grown in ponds. No experience or facilities for seed prop or overhead watering.

Our consulting assignment – April 2018

- Seed collection, processing & storage
- Seed treatments to promote germination
- Soil mixes for propagation
- Devise infrastructure for new nursery, germination areas and open nursery
- Recommend irrigation requirements
- Nursery operating procedures
- Risk management

Key Deliverables of the assignment

1. Best practice to recommend materials, structures, irrigation, operating procedures to propagate from seed 800,000 wetland seedlings, including advice on collection, processing, storage and germination of seed and subsequent pricking out and growing on to ensure stock availability within 12 months.
2. Report required within 7 days of completion of visit

Seed collection in April 2018



Bog method for prop of *Typha domingensis*



Lots to consider in a new Omani desert nursery



Previous growing area with no irrigation



Nimr nursery potting shed



Nimr nursery staff potting with desert sand



Tom Headley & Dermot in Muscat, Oman



Muscat – Where the desert meets the ocean



Arabian food for the plant man



Challenges to be addressed

- Convincing management that it would work !!
- Staff having never done growing from seed before
- No nursery experience beyond division and pond growing
- No facilities for germination and overhead watering
- How to collect seed, process and store.
- How best to germinate and grow on
- Nursery design, germination areas & growing areas
- Assess water sources, tanks, pumps, supply lines and sprinklers
- Assess water needs with evaporation rates of up to 14 mm per day

More challenges

- Protecting the germination areas and growing area from desert conditions
- Sourcing growing media, plant trays and reticulation items that were not available locally
- Decide on direct sow to end containers or prick out
- Maintaining liaison and control from Australia
- Finding a nursery manager for a relatively short term project
- Writing SOPs for people with limited experience
- Product import restrictions to Oman.



Solutions – Working from both ends

Visualise the finished product and what is required at the end.

At the same time, start at the front end with seed and trials.

End point – Tray size determines space requirement, which determines reticulation layout, which according to peak conditions determines watering volumes and timings. The trays were 50 cell, 40 x 40 x 90 from China which told us we needed 122 benches of 12 metres x 1.5 metres for a growing areas of 4,000 m² watered via 18 stations with 180 Rotoframe sprinklers supplied by a Grundfos 4 HP demand pump powered by a 6 KVA diesel generator. Non stop watering, 10 hours.

Start Points

Seed

- >Best method for sowing and production.
- >Germination area enclosure
- >How to protect
- >Best watering system (R.O. water, overhead Netafin vibronets)

Construction

- Enclosures – draft spec
- Benches – draft spec
- Retic – Calculations on supply pressure, coverage and timings.

Seed collection, processing, storage & trials

Start point

- Assess available seed
- Review maturity
- Advise on collection
- How and where to process
- Protection in storage
- Assessing viability
- Sowing techniques
- Monitoring and reporting

Follow up back in Australia

- Monitoring project timelines
- Monitoring germination
- Recruitment of nursery manager
- Acquisition of tanks, pumps, controllers, solenoids, pipes and saddles risers and sprinklers
- Monitor fabrication, and connections for water supply and electrical services.

Germination Area



Germination Area



Nimr Nursery Stock February 2019



Nursery Stock Shot 2



Nursery shot 3



Nursery shot 4



Nursery stock shot 5



Presenter and Kashif, Nursery Manager



New Wetland Site



Oil and water entry point – New wetland



Planting preparation – Potti Putki



Project Update

- Detailed planting program documented (29 pages)
- The 800,000 plants ready to go with a minimum of 650,000 required. The balance available for backup
- Planting due to start on March 10th, being just 1 week behind schedule set early 2018. Delay due to site construction issues
- Planting to take six weeks max, with 2 wetland cells to be planted each week and with allowance for construction delays
- 32,500 plants to be installed per planting day
- Ten planting areas each 13 hectares with 65,000 plants to each
- Interim water to be introduced within a half day of planting commencement.

Muscat Roadside Landscape



Muscat Tour



Acknowledgements

- Dr Tom Headley, Scientific Lead, Bauer Resources.
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- Dermot Molloy, Horticulturist & Propagator, Royal Botanic Gardens, Victoria.
- Kashif, Rakesh and the team at Nimr nursery.

Seeking & sharing on the Wild Side



Thank you to all at IPPS South Africa for the fun times over the last 4 years

