Reviewing and updating Revegetation Works in Winton Wetlands and its Catchment

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Background

The WWCoM have undertaken a suite of revegetation measures to improve the biodiversity of the vegetation including revegetation trials and works, university studies to understand ecological processes around vegetation, revegetation success and restoration, and commissioning surveys on site to assess recovery of vegetation communities. In addition, several groups (Regent Honey Eater Project, Swamps Rivers Ranges and Goulburn broken CMA) have conducted revegetation works with their own objectives either onsite or adjacent to the reserve.

After several years of operation, all these projects need to be reviewed of programs to identify opportunities for integration, co-ordination or synergies, identify gaps and new programs required and discuss next steps and funding.

Objectives

The primary aims of wetland and woodland revegetation works (as outlined in the Restoration and Monitoring Strategy; Barlow 2011) at the reserve are to increase the connection, quality, extent and diversity of vegetation available on the reserve.

Brief Review of WWCoM Revegetation Works

We are attempting to achieve the aims of the Restoration and Monitoring Strategy (Barlow 2011) using a variety of revegetation techniques including aerial and direct seeding, tubestock planting and promoting conditions for natural regeneration. Over the past 6 years of revegetation activities, it is becoming clear that some programs have been more successful at achieving their objectives than others. This is a brief review of our various revegetation activities from 2011 to now.

1. *Aquatic (wetland) vegetation*

Southern Cane Grass

As the Restoration and Monitoring Strategy (Barlow, 2011) anticipated, since the Lake was decommissioned in 2010, Southern Cane Grass has rapidly become a dominant feature of the wetlands vegetation through entirely natural regeneration processes. The species was also successfully translocated (in clumps and from cuttings) from the main swamp to the Duck Pond (where it was absent) by Friends of Winton Wetlands volunteers in June 2014. It has since established there quite successfully (Figure 1) and is a feasible and repeatable technique to use in other areas where it is absent. It may be of benefit to track the changes in the distribution of

cane grass over time using drone footage (or the like) as we have recently established a connection with a local who is happy to use his technology to collect such information.

Figure 1. Photo of Duck Pond, Winton Wetlands (taken January 2017). Yellow circles highlight well established Southern Cane Grass. This was established after translocation of clumps and cuttings (rhizomes) from the main swamp in June 2014.

River Red Gums

Due to the scarcity of live, seed-bearing River Red Gum trees throughout the wetlands seed availability was augmented using tubestock planting, aerial seeding and hand seeding along swamp margins and at other strategic locations (Figure 2).

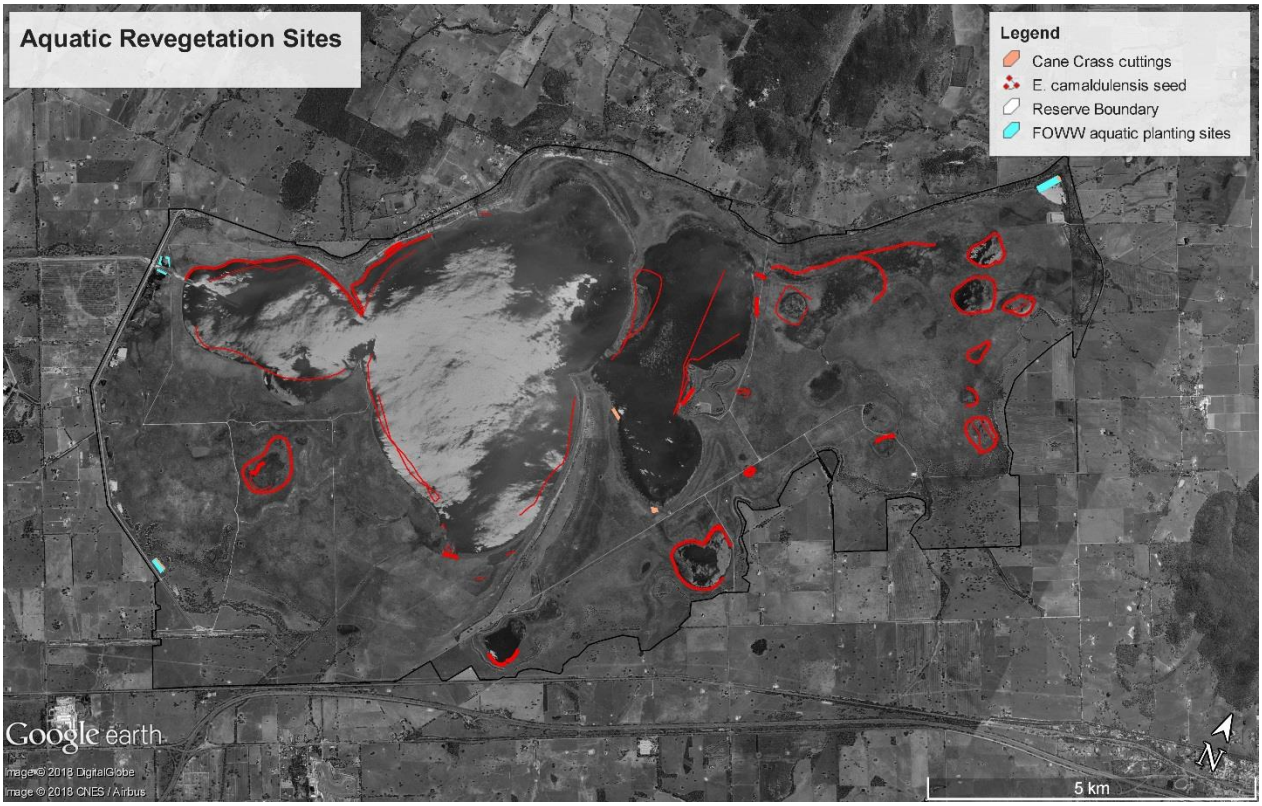

Figure 2. Map of aquatic revegetation sites (2010-2017) including planting sites (blue), aerial seeding and hand seeding locations (red lines) and cane grass translocations (pink blobs)

Tubestock

River red gum tubestock has been planted within a number of locations throughout the wetlands (Figure 2). Key locations included the west side of Ashmead's Swamp Road, east of Humphries Swamp, along Boggy Bridge Road, 11 Mile Creek and alongside Winton North School.

The goal of these plantings was to 1) establish River Red Gums for future seed sources and 2) aesthetic plantings for visually enhancing visitor areas.

Generally speaking, every River Red Gum planting location has had *some* longer term success, however there is notably less mortality in areas that are more densely planted over a large area in contrast to the lineal plantings along roadsides.

Aerial seeding programs 2013, 2014

Aerial seeding (via helicopter) was conducted along major swamp margins in November 2013 and then again in August 2014 in an effort to encourage germination of River Red Gums in areas that were harder to access on foot and lacked an existing seed source (see Figure 2 for seeding flight paths). Neither of these seeding programs had any detectable success, despite regular monitoring of seeding sites for 12 months post the August 2014 program.

Hand seeding program December 2016 (and research following by Chris Armstrong)

As a consequence of the lack of aerial seeding success, the remaining 16kgs of River Red Gum seed available was distributed by hand broadcasting in December 2016, during which conditions were highly suitable for RRG germination and establishment (water was drawing down, warm weather, good follow up rain). The seed was spread by hand at 9 sites (along swamp margins; 9 sites around the wetlands, each site with 3 x100m transects) along 2700m of swamp margin (Figure 2). There was evidence of germination and growth at all nine sites one month after seeding was conducted. However regular follow-up monitoring has revealed high seedling mortality, primarily due to herbivory. Only two sites- Boggy Bridge Road and Bill Friday Swamp have remaining healthy populations of RRG seedlings (Figure 3). A researcher from Deakin University is looking closely at why these sites have remained successful where others have not- one theory is that their soil characteristics may be contributing to the success. He is also gathering interesting data on the impact of guarding versus not guarding the seedlings and the seedlings growth rates.

Figure 3. River Red Gum seedlings (Boggy Bridge Road) established via hand seeding conducted in December 2016.

Augmentation of other impoverished/absent species

The diversity of wetland vegetation was enhanced at some locations on the reserve by planting of rarer or absent species (that were previously thought to be present). These species included sedges, rushes, Moira Grass, Southern Cane Grass, *Myriophyllum*, *Triglochin*, *Alisma*. Planting locations included the Duck Pond, the Mokoan Ponds and Dam Wall Campground Pond (Figure 2). Establishment of these species at these locations has been problematic due to the unpredictability of rainfall/water levels. Planting activity undertaken at Mokoan Ponds in July 2016 was very quickly inundated, whereas planting undertaken at the Dam Wall Campground in September 2017 was very rapidly dried (Figure 5). Careful consideration regarding the timing and location of future wetland revegetation days is necessary. Other novel methods of wetland vegetation establishment need to be trialled, such floating seed islands which Helen Repacholi (FoWW) is planning to trial as part of a study project.

Figure 5. Photos of seeding Water Plantain (left) and Carex clumps (right) at the Dam Wall Campground Pond (February 2018). This area was wet in September 2017.

2. ***Terrestrial vegetation***

WWCOM have followed a number of predominant principles to guide our terrestrial revegetation work on the reserve (Figure 6, principles outlined by Barlow, 2011). These guiding principles included:

1) Focus on improving quality, structural diversity, extent and connectivity of vegetation
2) Manage to enhance natural regeneration potential
3) Using the relevant EVC as a good reference for appropriate species selection
4) Establishing structurally important species in early stages of revegetation work (e.g. Box trees)
5) Retention of litter and fallen branches (as they are structurally important)

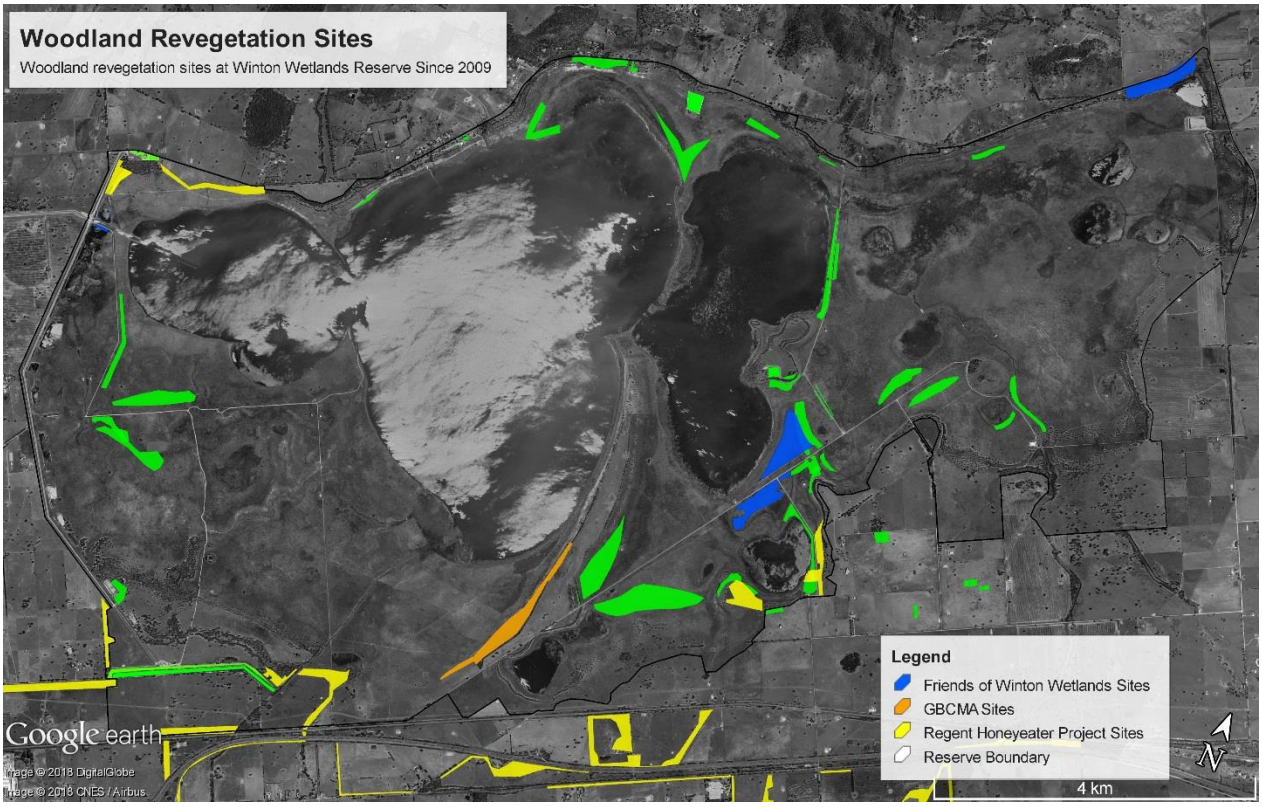

Figure 6. Map of woodland revegetation works undertaken by WWCOM (green), Friends of Winton Wetlands (blue), RHE Project (yellow) and GBCMA (orange).

Box Woodland Vegetation

Regent Honeyeater Box woodland corridors (2010-2017)

The Regent Honeyeater Project (RHE Project) has been working alongside WWCOM for a number of years (Figure 6) creating vegetation links (corridors) within and outside the reserve boundary. These links are designed to aid fauna (including the RHE) to move through the

landscape. It is a highly successful and very thorough project with a comprehensive pre-planting weed control program and fencing construction works. To date visible and very useable (for fauna) corridors of box woodland vegetation can be observed along Ashmead's Swamp Road (2017), at Gould's Hill (2015) and along the north-west biolink (2015/2017: running along the northern edge sargents swamp starting from the dam wall). In 2018 the project aims to create further corridors along Lake Mokoan Road (Boggy Bridge) and at Humphries' Hill.

*WWCOM/*FOWW *Box Woodland plantings (2011-2017)*

WWCOM has undertaken a variety of box woodland plantings throughout the reserve with generally great success. The major objective of these plantings was to establish structurally important species (box species), with the view of adding structural and floristic diversity once the overstorey is established. Many of these plantings are now highly visible and are offering habitat connections between other woodland remnants within the reserve. The Grey and White Box trees planted in 2012 near the Ashmead's Swamp Road entrance are thriving (Figure 7), and the Grey Box trees within the 2014 plantation on Flynn's road are now >2m tall and are 'emergent' trees (Figure 8). This is important as this area of vegetation now has another vegetation 'layer' developing amongst the Cassinia mid-storey. Large scale box woodland plantings undertaken in 2015 (Figure 9) are also thriving, with visible linkages being created between Green's Hill and Winton North Road.

Figure 7. Photo of Grey Box and White Box trees planted in 2012 along Ashmead's Swamp Road, Winton Wetlands.

Figure 8. Photos of Grey Box trees along Flynn's Road Winton Wetlands (planted as tubestock in 2014) emerging (see yellow arrows) above mid-storey vegetation. Upper photograph illustrates that some trees are >2m (given that's an adult kangaroo underneath one).

Figure 9. Photo of the Joan Kirner Box Woodland plantation (2015) linking woodland between Green's Hill and Ashmead's Swamp Road.

Shallow Sands Woodland vegetation- GBCMA Sandhills Revegetation Project Plantings (Lunette) 2017

In autumn 2017, the Goulburn Broken CMA undertook tubestock planting and direct seeding activity within a 15ha area of Shallow Sands Woodland along the Lunette at Winton Wetlands (Figure 6). The objective of the Sandhill's project was to create connections and linkages across sand woodland country. Tubestock planted included Bulokes, Sheoks, Yellow Box, White Cypress Pine, Silver Banksia, Fringe Myrtle and Sweet Bursaria. Direct seeded plants included a mix of understorey species such as Acacia species, Hop bush and Lightwood.

Recent examination by GBCMA and WWCOM staff has revealed that the majority of the tubestock are thriving, with the direct seeded areas also beginning to become visible and establish itself (Figure 10). It is important to continue rabbit control works adjacent to the planting area as the Lunette is associated with a relatively high proportion of rabbit activity. Photopoints will be established in the coming months at the site to standardise the ongoing monitoring of the progress.

Figure 10. Progress photos of GBCMA tubestock planting and direct seeding conducted in autumn 2017 as part of the Sandhill's Revegetation Project. Yellow arrows indicate seedlings that are establishing as a result of direct seeding work.

Direct Seeding and understorey species establishment

Direct seeding of a mix of understorey species was undertaken at a variety of locations during 2014 (Figure 11). There is very low density, low diversity (just enough to be detectable) establishment of understorey species at Flynns Road (near North road, Figure 12), northern foreshore, Green's camp (Figure 14) and Boggy Bridge Road. There was very good germination and survivorship at Flynn's Road (Figure 13), the entrance to the Lunette (Figure 15) and >50% survivorship of tubestock (understorey species) planted near the Duck Pond.

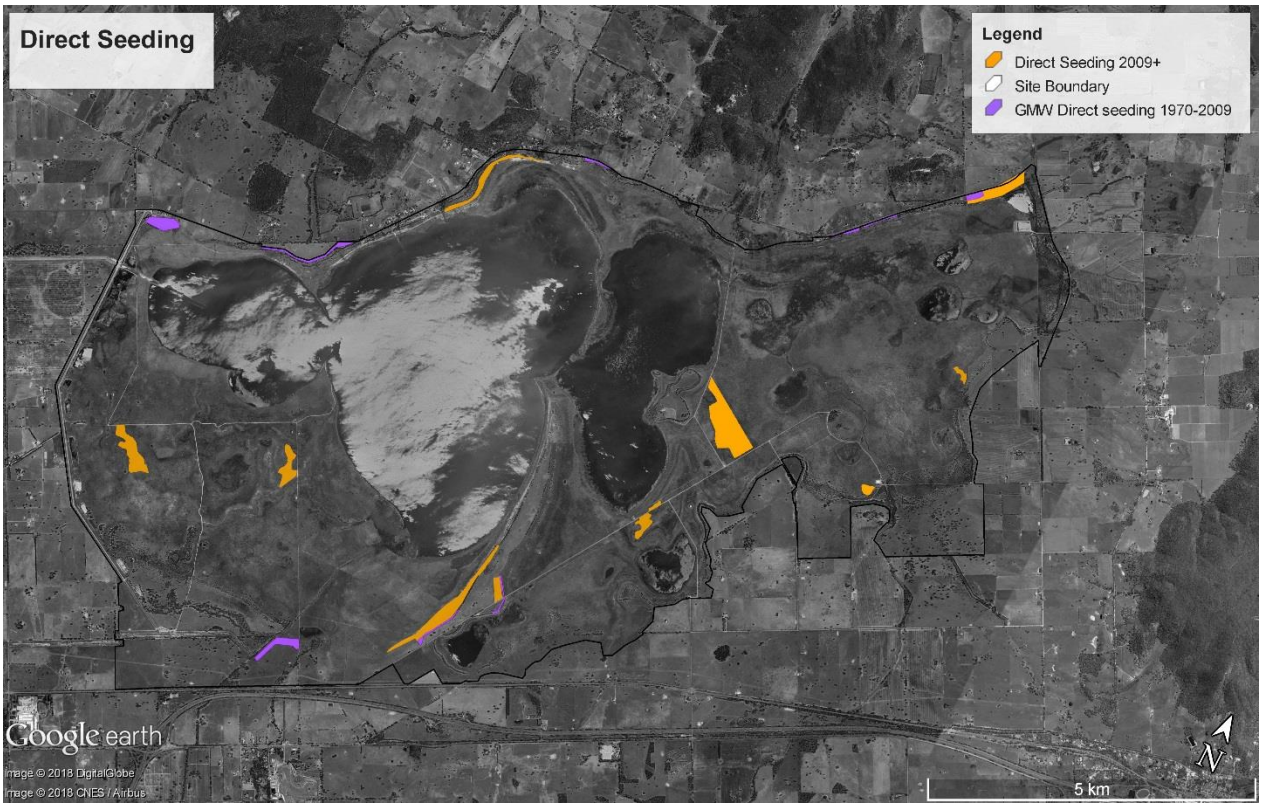

Figure 11. Map of all direct seeding locations at Winton Wetlands Reserve (1970-2017)

Figure 12. Photos of vegetation occurring as a result of direct seeding activity along Flynn's Road in 2014. Box trees are >1m tall, understorey species are >600mm high.

Figure 13. Photos of regeneration of understorey species as a result of direct seeding activity conducted in 2014 in the SW of Winton Wetlands. Note the obvious furrow lines of regeneration. A great diversity of species were present.

Figure 14. Photo of regeneration of understorey species as a result of direct seeding activity conducted in 2014 near Green's Camp (eastern edge of wetlands).

Figure 15. Regeneration as a result of direct seeding undertaken in 2014 at the entrance to the Lunette walk on Winton North Road. Note most of this regeneration is Golden Wattle.

Overall Recommendations/Conclusion

- Monitoring of cane grass distribution may be helpful in order to document changes over time (perhaps using drone technology?)
- Tubestock planting for RRG and Box woodland/understorey species has been largely successful- however care should be paid to planting density of RRG as they don't appear to be very resilient to lineal plantings.
- Direct seeding for understorey species is a cost effective revegetation method for broadscale areas on the reserve
- Hand seeding of RRG- great germination and site specificity, but poor long term success rate
- New methods (and timing) of wetland revegetation need to be trialled
- New methods of RRG establishment could be trialled- namely clay balling, seed orchards (Jane Robert's idea) and perhaps planting highly developed trees (large or older seedlings)
- Surveys of what fauna are using the RHE/other woodland corridors???- infrared cams, targeted bird survey work, nest box work in some areas????
- Increase structural and floristic diversity in woodland plantations- low density planting of understorey/grass species