St Kilda Wetlands Restoration Workshop Report

SOUTH AUSTRALIA

Government of South Australia
Department for Environment and Water

Scope

The scope of this Workshop Report includes consideration of recovery actions achievable within land managed by Salisbury Council and the Department for Environment and Water (DEW) including the Adelaide International Bird Sanctuary National Park (Winaityinaityi Pangkara), and Crown lands. Recovery actions on Freehold land or land currently under Mining Production Lease are not the focus of this document but were considered in the workshop with a view to informing long-term integrated management of the area.

The recommended actions arising from the workshop included in this report will form the basis of an action plan/s for recovery of impacted areas.

Background

Following removal of the key threatening process (hypersaline groundwater mounding) the wetlands and surrounding vegetation will begin to recover to some degree. The ability for colonising plants to germinate and survive will be influenced by the speed at which salt can be flushed from the soil by tidal movement and rainfall. It is unknown how long this process will take, it is likely it could take years. Once salt has been sufficiently depleted from the system, passive regeneration will begin to occur in some species such as mangroves, through propagule migration from un-impacted areas, and some samphire/saltmarsh species, provided a seed source is nearby or some plants that can reproduce vegetatively have survived. Although species will regenerate, the structure of the vegetation is likely to be significantly altered with loss of different age classes. There is also uncertainty around mangrove regeneration where biomass of dead and decaying mangrove forest may act as a barrier for landward mangrove propagule migration.

It is important to note that there will be large spatial and temporal heterogeneity in species recovery. Some samphire species may not recover without intervention, however it is unknown which species will require assistance and where. Ongoing monitoring will be required to inform revegetation decisions around intervention. Some species are incredibly slow growing, an example is the shrubby samphire (Tecticornia arbuscula). Die-off has occurred in individual plants that are up to 200 years old (Peri Coleman personal communication). This species dominates the more tidally wet areas landward of the mangroves, where it provides habitat for the Samphire Thornbill (Acanthiza iredalei rosinae) a species with State and Federal conservation rating of Vulnerable.

It is important that monitoring and research evaluation are conducted concurrently to actual restoration works. Research and monitoring outlined in this report should be a key component of any action plan, however the longer the area of impact is left unrestored, the more difficult it will likely become to manage the flow-on impacts (erosion, invasion with exotic species etc.) Recovery actions will likely focus on flora species, with some physical restoration required (e.g. re-levelling of borrow pits) in some areas to address salt accumulation.

Many workshop participants raised that the future long-term use and management of the saltfields, is critical for the development of long term outcomes for conservation along this section of coastline. This was acknowledged, however is not the focus of this report.

Broad Parameters for vegetation regeneration

- The formation of blue green algal mats in the saltmarsh is important for the reestablishment of vegetation. Algal mats gather fresh sediment, sequester carbon and contribute to nitrogen cycling. They will also capture a thin layer of soil on top of the hypersaline soil into which plants can colonise. These algal mats are not currently able to establish due to the height of the ground water mound which has been pushing them off the surface of the soil.
- With the depletion of the hypersaline groundwater mound, soil salinity will likely stay high for a long period, depending on flushes to the system through rain and tidal inundation. Low points at Little Para Estuary are collecting salt and need to be actively managed through earthworks to re-profile the land.

- It is expected that mangroves will regenerate through establishment of propagules once hypersaline water is no longer leaching into the system, and soil salt levels are appropriate for growth. Mangroves of all ages have been lost and large biomass from dead and decaying wood may impede propagule migration throughout the system. This is a concern in areas that are not inundated at high tide or lack connecting creeks for propagule migration.
- The extent of samphire species recovery is dependent on availability of seed, as well as vegetative spreading from colonising species such as Sarcocornia quinqueflora. The speed of recolonisation will depend on how many small nuclei patches ("designated survivors") are still viable when the soil conditions around them improve. The survival of these important small patches depends on how soon the impact ceases and how soon the cooler weather, rains and big tides return to ameliorate soil conditions (Peri Coleman, personal communication).
  Some species may not recover without intervention, and timeframes for recovery will differ for individual species.
- The extent of any impacts to seagrass are unknown and need to be monitored and captured as part of the management of this section of coastline.

Identified barriers to restoration

- Governance structure inadequate to manage the area in an integrated way – workshop identified a need for a long term plan (50 years) for the section of coastline that takes into account land use now and into the future, including use of salt field ponds, sea level rise and saltmarsh migration. Potential for Jennifer McKay (Uni SA - Environmental Law) to work with DEW, relevant Councils and community groups investigating governance models.
- Significant knowledge gaps around timeframes necessary for natural soil remediation without which vegetation recovery will be hindered.
- Some flora species (particularly high marsh and terrestrial species) that should be used in revegetation works will need to be collected from nearby area and propagated, leading to a 1-2 year lag time for revegetation works.
- Funding will need to be sourced for recovery actions as well ongoing monitoring to inform adaptive management. Without data on what is working, we will not be able to adjust our strategies to maximise success.

Data collection and monitoring questions (Priority ranking)

1. **Determine the extent and location of hypersaline groundwater through monitoring of groundwater (+ soil salinity) and modeling.** Delineate the size, position, and movement of hypersaline groundwater and model ongoing movement. Integral to assess how the die-off occurred, and predict when impacts will cease or happen again (Huade Guan, personal communication). Confirm with EPA regarding the data they are collecting.

2. **Monitor plant physiological states to determine salinity threshold for mangroves and samphire to assist with predicting future dieback.** Using leaf stomatal conductance, canopy temperature (in comparison to air temperature), and or leaf fluorescence to estimate whether plant stress is increasing or decreasing (Huade Guan and Sabine Dittman, Flinders University). Any methods will need to account for temporal fluctuations in conductance under 'normal' conditions (Alice Jones, University of Adelaide).

   Ascertain the salinity of plant root zones using leaf water potential. Understanding thresholds (salinity, Na/Ca ratio) for mangrove and samphire diebacks is necessary to predict whether further areas are affected to the degree that they will dieback, in order to set management and restoration efforts (Sabine Dittman, personal communication). Understanding thresholds will also be important for future management of wetlands generally (Huade Guan, personal communication). There is existing literature on mangrove species Avicennia marina (mostly seedlings), but much less available on various saltmarsh species present. Thresholds will likely be variable depending on each species niche in the tidal zone and methodology should be designed to best capture that variability (Alice Jones, personal communication).

3. **Monitor recolonisation of mangroves propagules, samphire recovery and seagrass.** Determining which species are recovering and where they aren't will assist in planning of revegetation works.

4. **Develop remote sensing to calculate further dieback, predict future events and monitor recovery.** Developing real time monitoring pipelines/workflow for vegetation recovery across broader area based on

ground-truthed remote sensing data to allow for active and regular monitoring of condition of change and success of restoration attempts. Establish better detection of condition trends and trajectories (i.e. not just binary - alive/ dead, presence/ absence). Possible use of hyperspectral and thermal bands rather than NDVI (Normalized difference vegetation index) (Huade Guan, Flinders University).

University of Adelaide (Alice Jones and Ramesh Raja Segaran) are leading a collaborative grant proposal that focuses on the above (i.e. early detection of change in condition of coastal vegetation and making better use of remote-sensing tools for these applications), with applications due end of March looking for partners and letters of support.

Confirm any potential overlap / collaboration with DEW remote sensing and mapping work.

5. **Map health and status of seagrass adjacent to impact area.** Salinity impacts to adjacent seagrass are currently unknown and require investigation. Alice Jones (University of Adelaide) suggests this will be difficult using just RGB images due to the muddy sediment and turbid water in the seagrass (Zostera sp.) areas adjacent to the mangroves. Hyperspectral remote sensed data from Airborne Research Australia could potentially assist, as well as EPA and SAW for previous seagrass mapping. Kayak surveys suggested, with the potential to involve volunteers through Estuary Care Foundation. We need to establish some baseline data (i.e. what was there before and what condition was it in). Involve Jason Tanner (UoA) and Ken Clarke (UoA), SARDI.

Recovery Actions

Entire Area

1. Develop soil salinity and vegetation recovery monitoring plan to inform revegetation/ recovery actions. Links to Urrbrae TAFE Project.
2. Develop community engagement plan - community can take part in monitoring and 'action days'. Needs coordination and funding. Citizen science can capture recovery process through static photo points that are already set up. Public to capture photos of recovery i.e. what flora and fauna species are returning? (See https://www.inaturalist.org/projects/st-kilda-mangroves-saltmarsh).
3. Assess which species will need to be propagated (not currently in nurseries) and engage seed collection from local sources (such as Provenance) to begin propagation (some species will take 1-2 years to be ready for planting).
4. Plan collection of mangrove propagules for use in mangrove 'Propagule Parties' December through March can assist in 'passive' recovery of mangroves. This could be run by Salisbury Council and Estuary Care Foundation hosting or holding community events.
5. Develop integrated management plan for coastal system, identify areas for coastal retreat of habitats under sea level rise, and blue carbon sequestration potential.

In addition to actions relevant for the whole area of impact the following points address actions specific to the Little Para Estuary and St Kilda and surrounds.

Little Para Estuary

Priority

1. Reshape topography to remove low points where salt is accumulating using machinery and associated engineering. This will help restore natural river flow and tidal flow to help flush salt. This is a priority to occur prior to any revegetation attempts. Will be most effective if put in place prior to increased flows from winter rainfall.
2. The ford at Little Para should be replaced with culverts to allow increased water flow and natural corridor movements, allowing salt flushing and fish passage. This work is a priority prior to any revegetation works - this area can be replanted with native rushlands, to replicate the plant associationthat have been killed by salinity.

Short term

1. Removal of weeds such as Juncus acutus on dredge mounds adjacent to Little Para and boxthorn (Lycium ferocissimum).
2. East of the Northern Connector in area that would have been saltmarsh retreat zone (before highway) - this can be revegetated with Gahnia filum to provide habitat for Yellowish sedge skipper butterflies (Hesperilla flavescens).

Without intervention this area cut off by the highway will become an exotic grassland. Planting can be assisted by community volunteers.

3. Revegetate high marsh areas and cheniers - (Action Plan for Little Para Estuary – Delta Environmental Consulting).

Longer term

1. Investigate eventual removal of dredge mounds on banks of Little Para currently colonised with red gums.
2. Develop a biodiversity master plan linking both sides of the Northern Connector including Dry Creek and Little Para.
3. Scope additional opportunities for visitor infrastructure and community engagement - see Action Plan for Little Para Estuary – Delta Environmental Consulting.

St Kilda and surrounds

Short term

1. Continue monitoring of trial restoration pond (XB8A), for ecological monitoring and blue carbon, with continued funding for Flinders and Adelaide Uni. Can provide template for future areas that may experience similar impacts.
2. Consider the feasibility of the restoration of the Mangrove boardwalk and/ or connectivity with other paths, including extension of walk using levee bank on eastern side of the samphire/ mangrove area.
3. Investigate use of shellfish to assist in restoration of system (particularly eutrophication). Can potentially be used to polish water near stormwater outlets at Bolivar. Oysters spawn from October. Can use OzFish robust oyster baskets or coir bags filled with oysters shell from SA oyster growers.
4. Develop ecological monitoring program for indicator species - shorebird surveys in the area have been funded by the Landscape board but will need to continue to be funded. Expansion of survey for other fauna species such as invertebrates. Data collected for fish and benthic invertebrates in Swan Alley, collected when dieback occurred (Sabine Dittman, personal communication).
5. Find out what impacts, if any, there have been on the adjacent Zostera (seagrass) meadows.

Longer term

1. Investigate future of salt fields with salt lakes and mud flat foraging habitat for migratory shorebirds. Needs to consider that lakes will need ongoing management for salinity levels due to high levels of evaporation and low rainfall.

Additional Stakeholders to engage

Kaurna Traditional Owners, Environmental Protection Agency (EPA), Department of Energy and Mining (DEM), PIRSA Fisheries, Nature Conservancy SA, South Australian Research and Development Institute (SARDI).