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Technical support for Mallee Farms with Seeps

Final Report for NR MDB NRM

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1 Project Summary

Five properties were visited in 2014/15 in investigate the issues of Mallee soaks. The project officer briefly assessed the soils and landscapes and discussed the soaks histories, possible management strategies and successes with each of the farmers involved.

Four of these properties involved soaks areas that appeared to be the direct result of localized catchments where excess moisture from rainfall had accumulated from surrounding or adjacent sandhills. Generally these involved fairly deep, often non-wetting sands of low fertility that over-layed a clay base. Many of these areas have become problematic after the wet year of 2010 which followed a decade highlighted by dryer than average seasons. These farmers have also moved to farming systems that consistently use chemical summer weed control to preserve summer moisture. It is unclear whether the high rainfall year of 2010 instigated many of these seep issues, or whether it was the just the year that brought an underlying problem to the surface.

The soaks generally appear in the lower parts to the catchments where there is heavier clay close to the surface. There were some instances where these soaks have begun to form in the midslopes, but always where the heavier soil types come to the surface.

In these instances it appears likely that the excess moisture that falls in these localized sandy catchment areas is not utilized due to summer weed control (in more conventional mixed grazing systems summer weeds were allowed to grow and were grazed by livestock, utilizing much of the summer rainfall) or only partially used during growing season due to poor crop and pasture growth. Rainfall can readily pass through these sands (often non-wetting in nature) to the tight clays beneath, flow laterally across them and accumulate towards the lower reaches of the catchments. The moisture will appear at the surface where these clays are shallow, and this can lead to water ponding at the base areas of these sandy rises.

While this water is generally low in salinity, it does pick up some salt from the soil as it passes through. Where soil has become bare due to excess moisture, there is evidence of salt crystals forming on the surface, as capillary rise causes the moisture to evaporate at the surface and gradually accumulating more residual salinity at the surface. This makes the ground less productive and harder to rehabilitate.

Some farmers have attempted to establish lucerne on the sand hills, with varying levels of success, as achieving good lucerne populations on poor soils is difficult, particularly in poor seasons. One farmer has use deep ripping to try and divert water flows and drain the excess water away, but it is too early to assess the success of this. At one site, successful rehabilitation of cropping land is occurring, through a combination of strategic tree planting and the use of salt and excessive moisture tolerant grasses (puccinellia and tall wheat grass) in the mid 1990's. Lucerne was also established well in the late 2000's after numerous attempts. Up to 7ha of previous bare unproductive ground has now been restored to cropping in recent years. This is a good example of what may be achieved by targeted utilization of higher water use strategies within a localized catchment area.

One property, however, has numerous soak sites developing that appear to be directly related to groundwater flows associated with the Noora basin, near the salt interception scheme. While there are many historic low lying salt areas within the general landscape, it is very concerning to see the recent and growing degradation of cropping land on this and neighbouring properties. Further investigation by the relevant authorities is encouraged.

Farmers were very appreciative of the interest being shown in issues involved with their soak sites and would be interested in any future assistance in overcoming these growing problems.

2 Project Brief

A suitably and qualified consultant will be engaged to contact and visit on farm farmers who are affected by seeps to investigate and advise farmers on current projects investigating the issue

The consultant will be required to;

- Contact farmers Peter Loller, Gary Frahn, David Thiele, Janet Flohr and Jock Krause (NB, after discussions with Jock Krause, and further discussion with project manager Bernie Lawson, it was decided appropriate to replace the Jock Krause visit with David Smith).
- Undertake farm visits and provide agronomic advice and information gained from current projects investigating mallee seeps

  Collect historical information on site including
  - long term and short term land use,
  - siting and spreading of the seepages
  - remedial actions undertaken by the owner
- Produce a report collating information collected from farm visits and incorporate into a general report with information from all mallee seep projects.

3 Site inspections

3.1 David Thiel, Wunkar

Figure 1. Thiel's soak areas inspected near Wunkar

3.1.1 Site history and current situation

David Thiel was visited in late 2014 to inspect the soak area at his Wunkar property. David has recently purchased the property which now has a bare soak area of approximately 1ha in size that has salt crystals forming at the surface. The previous owner, Warren May had told him that the soak had appeared after the wet season in 2010 which had followed a decade of many dry seasons.

There is a secondary area closer to the road which is of concern and showing high moisture levels but is still able to be cropped through at present.

While both farmers have livestock and use volunteer pastures in their farming systems, this particular paddock has been fairly intensively cropped with full summer weed control in recent years.

Having formed relatively quickly, the main soak appears to be fed from excess water collecting from the large sandy rise on the southern side and accumulating in the loamy clay soil at the base of the rise. There is concern the main soak area could increase in size and degrade more cropping land if high water use options are not utilised.

The main soak location is 34°27'07"S, 140°14'03"E. The secondary area of concern is at 34°27'17S, 140°13'36"E.

Figure 2: David Thiel's paddock with soak areas, Gibbs Rd, Wunkar.

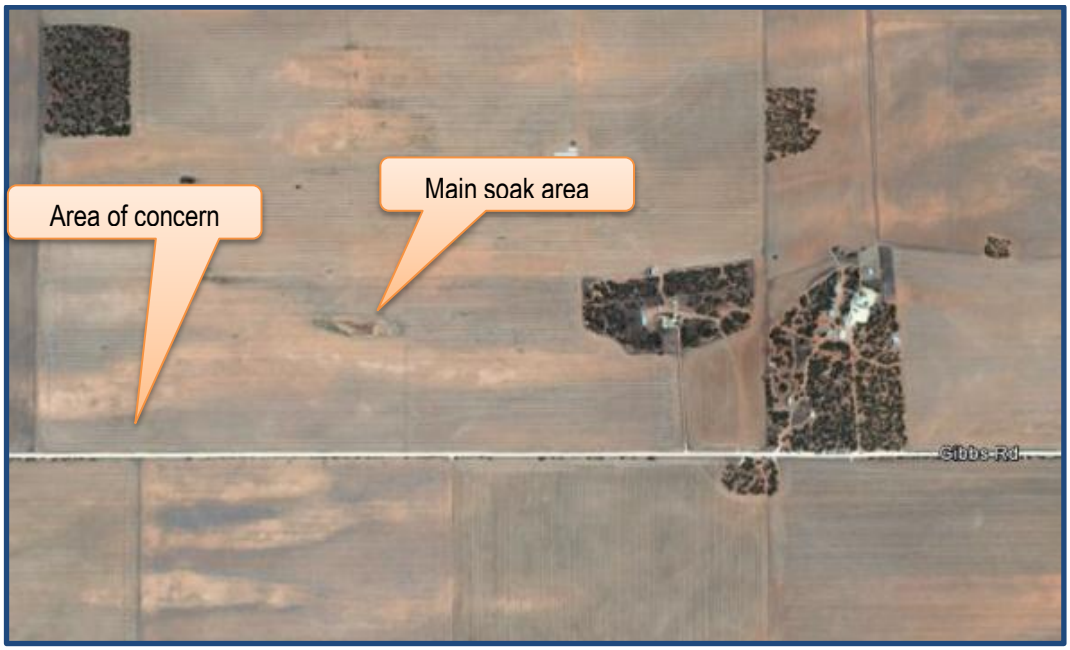


Figure 3: Close up of David Thiel's main soak area.

Figure 4: David Thiel's main soak area looking sown from sandy rise.

Figure 5: Extensive degraded soak area, with heavy soils and salt at surface.

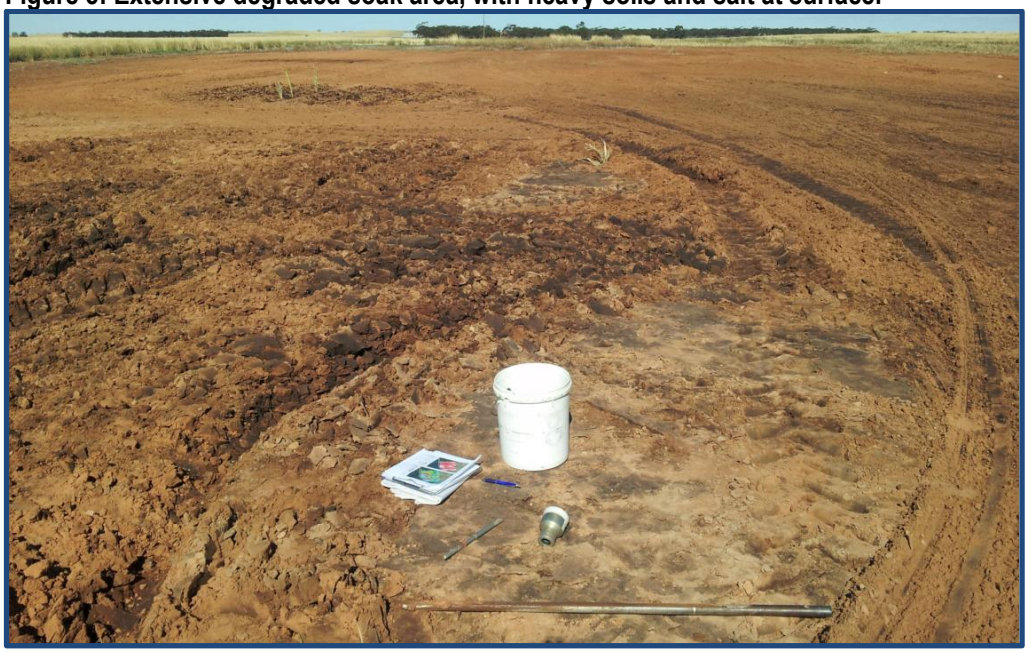


Figure 6: Localised perched water table at main soak site.

Figure 7: Soil profile of loamy soil over saturated clay at soak site.

Figure 8: Secondary area of concern showing excessive moisture build up.

3.1.2 Brief recommendations

A number of high water use options were discussed with David that may still fit in with his mixed farming system. David has accepted that the main soak area, that is mostly bare and with salt crystals formed at the surface, is not likely to be able to be rehabilitated back to cropping. His main goal is to get cover over the area, and to introduce some practical solutions that will help him utilise more water and inhibit the spread of the area. These included lucerne, strategic tree planting, as well as the establishment of salt tolerant grasses such as puccinellia and tall wheat grass to maintain soil cover on bare areas to decrease evaporation and salt accumulation at the soak areas.

Since then has sown approximately 5ha of lucerne on the surrounding sandhill which, if successful, will be used for grazing and cut for hay. He sowed it with canola to assist with improving the fine seed distribution and help protect the soil from wind. However, this extra crop competition for moisture could reduce lucerne survival through the first Spring if the dry season continues. Unfortunately it appears that this cover crop won't be able to be sprayed out without damaging the lucerne. Good Spring rains will enhance lucerne establishment.

David has planted about 30-40 native trees in the area this year but reports that many have died, most likely due to the high salt levels. He may need to try more salt tolerant trees in future, or possibly saltbush, along with salt tolerant grasses. He intends to fence the main soak areas to protect the trees. Any assistance in achieving these goals will be much appreciated by the farmer.

3.2 Peter and Hannah Loller, Lowaldie

Figure 9. Loller soak areas inspected near Borrika

3.2.1 Site history and current situation

The Lollers have a mixed farming system of crops and pastures for livestock. They introduced no till in 2004 on part of their property but have been full no till with summer weed control since 2008. Before this summer weeds were controlled mainly through grazing and ploughing. Recent paddock history is Clearfield Wheat in 2013, pasture in 2014 and barley/wheat in 2015. The soak area to the north of the sand hill has appeared since the wet year in 2010. It has always been the most fertile hollow with the best yields. Now it is an area of less than 1 hectare that is bare and 2 hectares of crop area affected. This area is growing and has the potential to spread further into the paddock.

Area 2 on the southern side of the hill has been sown to barley this year and will likely be sown to veldt and lucerne next year into the barley stubble to use excess water. This area is localised between sandy rises and should be recoverable if high water use options are established.

Area 1 is located at 35°05’30”S, 140°04’59”, while Area 2 is at 35°05’32”, 140°05’07”.

Figure 10. Area baring out and quite moist at base of sandhill.

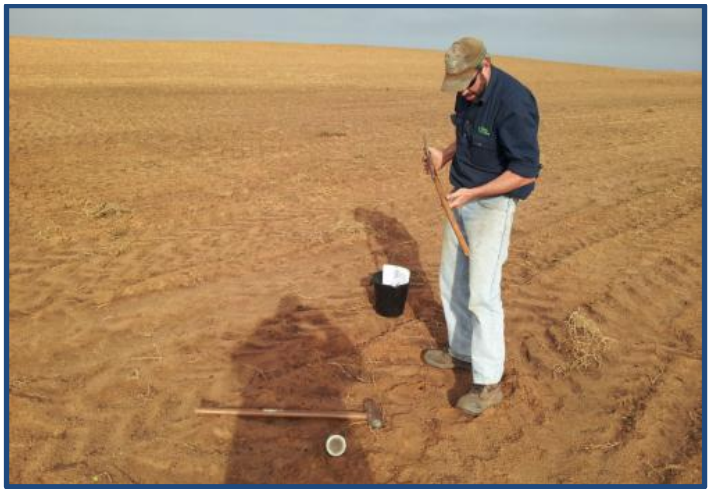


Figure 11. Growing bare area on southern side of sandhill

Figure 12. Growing Bare area on southern side of sandhill

Figure 13. Soil Probe profile showing saturated clay below 50cm.

Figure 14. Midslope area of clay near surface that is baring out

Figure 15. 2011 Google Earth image of soak areas and sand hill.

3.2.2 Brief recommendations

The Lollers realise that they must introduce some higher water use options on the sandhill above the soak areas if they want to prevent them spreading in the future. If lucerne and veldt grass can be established on this area it may well help achieve this while providing important livestock fodder at critical times of the year. Notill seeding veldt and lucerne into next years barley stubble should provide adequate soil cover for lucerne establishment, provided it is not overgrazed this summer.

The bare area on the southern side sandhill should be sown with puccinellia and tall wheat grass at the beginning of next season to help use up surface water and prevent the accumulation of salts at the surface through evaporation.

Figure 16. 2013 Google Earth image of soak areas

3.3 Gary and Janet Flohr, Lameroo

The farm belonging to Gary and Janet Flohr has numerous soak areas that have developed in recent years. Three of these sites were inspected by project officer, Chris McDonough on 12 June 2015. The Flohrs have been continuous cropping with no till and full chemical summer weed control since 1994.

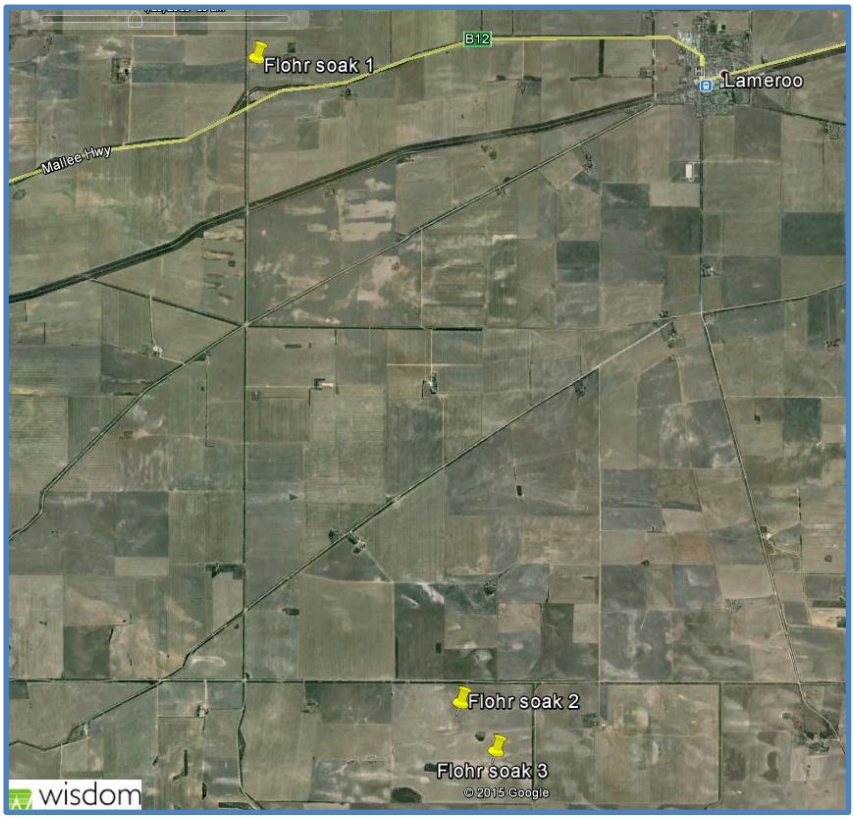
3.3.1 Site histories and current situations

Soak 1: this is a small soak area that has developed at the base of a sandy rise since the wet year of 2010 in an area which used to produce his best crop, (possibly due to the extra moisture). Prior to 1994 there was always lots of stinkwort and other summer weeds over this area. The rise is sand over clay and the soak area below is a heavy loam with particularly hard, white, blocky clay on the surface which appears to be contributing to the moisture appearing at the surface. The farmer has used deep ripping across the length of the sand hill in an attempt to both divert moisture to the roadside at the edge of the paddock, as well as allow for deep drainage of lateral flowing moisture in April 2014. Gary believes that this ripping has provided some benefit in reducing the soak affected area, but it is unclear whether this may have been due to increased crop growth and moisture use on the hill, or just natural seasonal variation. In 2015 Gary ripped directly down the slope to the wet spot.

Soaks 2 & 3: the Flohrs have farmed the southern area for the last ten years containing sites 2 and 3. They have controlled couch grass and skeleton weed on the hills since then (2005). In the wet year of 2010 these soaks formed at the base of sand hills reasonably quickly.

At Soak 2 approximately 3 hectares are affected in 2 areas along the fence line on the eastern side of the sandy rise, and the area is spreading. It appears that the excess rainwater is collecting on the sandy rises and flowing across the top of the clay to the lower flats where the clay is close to the surface and the soaks are appearing. The soak areas are not too salty yet but this could change if cover is not established as the clays below are known to be high in transient salinity. There is a small dam area in the middle of the paddock that has water in it, suggesting that water is perched above the tight sodic clays underneath (Fig 28).

Figure 17 Flohr Soak sites inspected near Lameroo.



Soak 3: is situated in the paddock directly south of Soak 2. Again this appears to be the result of excess moisture collecting on the deep sands above and accumulating in the clay soils at the lower part of the catchment. This area appears to be a part of a bigger catchment system and is becoming wetter and slightly larger each year. The main soak area had crop sown through it but is too moist and too salty for crop germination. There are lots of salt crystals on the surface. The farmer has ripped the hills around this area to try and drain the water but this appears to have had little impact. He has attempted to establish lucerne on the hills but this has not established well. Some clay spreading has been done in 2013 and has improved crop growth on the sands.

Site 1 is located at 35°19'43"S, 140°25'54"E, Site 2 is at 35°25'38"S, 140°28'16"E and 35°25'28"S, 140°28'11"E and Site 3 is at 35°26'01"S and 140°28'36"E.

Figure 18 Google Earth image of late 2013, showing soak and sandhill areas.

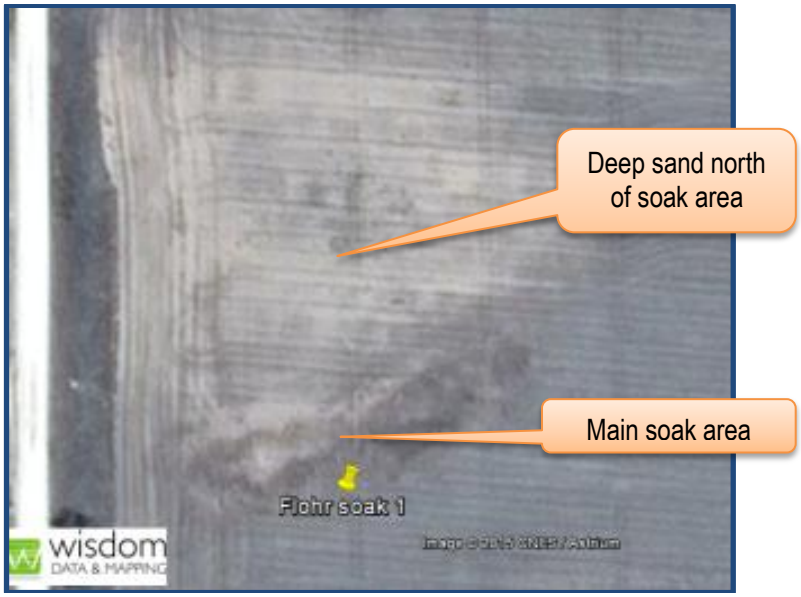


Figure19. 2011 Google Map of Site 1 area.

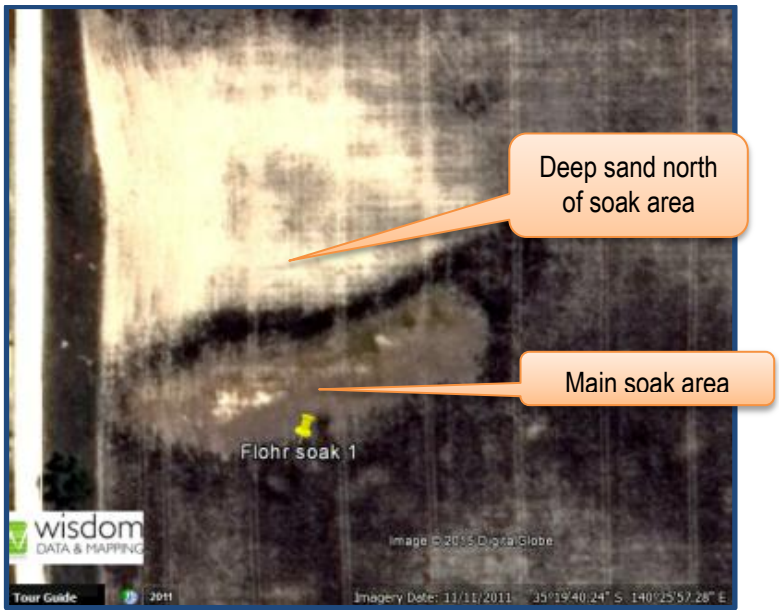


Figure 20. Clayed and ripped sandhill above Soak 1

Figure 21. Sand hill overlooking Soak 1

Figure 22. Clods of white hard clay at Soak 1 area

Figure 23. Solid hard clay clods at Soak 1 area

Figure 24. Google Map showing Saok areas 2 and 3 from late 2011

Figure 25. Soak areas 2 and 3 on farm south of Lameroo, 2014 Google Map

Figure 26. Soak area 2 along fence line at base of sandy rise

Figure 27. White clay from soil probe, under sandy loam topsoil at Soak 2

Figure 28. Nearby dam, with Soak 2 in background

Figure 29. Soak area 3, still attempting to crop but with little success

Figure 30. Attempted seeding through Soak 3 unsuccessful

Figure 31. Salt accumulation at surface

Figure 32. Degraded Soak 3 area at base of sandy rise

Figure 33. Attempted lucerne establishment from previous years

3.3.2 Brief recommendations

Site 1: it would appear that moisture is accumulating possibly from summer rainfalls on the small sandy rise and moving laterally south down the slope to the heavy clay area where it accumulates at the surface. It does not appear likely that this area will greatly increase given the local paddock landscape.

As the Flohrs are continuous cropping they are not likely to use perennial vegetation to intercept moisture flows at this site. Spreading some sand over the clayed area was discussed to reduce capillary rise and salt concentration at the surface. Establishing some form of soil cover such as spreading hay over the relatively small bare areas is considered essential to reduce moisture evaporation and salt accumulation at this site. The use of deep ripping was discussed and it was thought that this may have some effect of re-directing moisture flows and breaking up any soil compaction, leading to increased crop growth on the hills which may help reduce the soak area below. However, it is unlikely that the deep ripping would be draining moisture away through the subsoils, given the nature of the subsoil clays known to the area.

At the Soak 2 area there is a long fence line at the base of the sandy rise which could be used to plant rows of trees that will help utilise excess moisture to protect the loamy flat beneath. Establishing lucerne for hay on the sandhill would be beneficial for water use, but is not easily achieved on these deep sands with variable seasonal conditions.

To achieve higher water use around Soak 3, establishing lucerne for hay on the hills is recommended as this can provide a profitable landuse, while allowing the rest of the paddock to be continuously cropped. If this is successful the higher water usage should impede the spread of the soak areas and possibly lead to some land reclamation. There is real concern however, that the salt accumulation at the surface may make reclamation for cropping very difficult or a long term prospect. It is essential that soil cover be achieved as soon as possible on the bare soak site by using puccinellia or tall wheat grass on the most severe areas to minimise evaporation and resulting salt concentration.

3.4 Gary Frahn, Taldra

3.4.1 Site history and current situation

The farmer described how the Noora Salt Interception Scheme was established in 1982. Gary said that he remembers the low lying swales shown as Area 6 always had some level of samphire, but was still able to be cropped intermittently. Since the establishment of the Salt Interception Scheme the Frahns have fenced these areas off and planted trees around them. In the last 6 years Gary has been very concerned with the groundwater at these sites now rising to the surface permanently and the samphire is beginning to die back (as can be seen Fig 49). Gary said that the Noora Drainage Disposal Scheme assessment of the ground water impacts after 20 years of operation (in 2003) DWLBC report 2003/28 clearly says that the scheme has had an impact on the water table levels with a rising trend, yet he has had very little success in getting anyone to recognise that these issues are impacting on his farmland and ability to crop.

6 years ago Seep areas 1, 2 and 3 (Fig 35) were able to be cropped normally. Now where it is able to be sown it either does not germinate, or dies. Only seep area 2 can have machinery driven across it, the rest he has to now drive around. This is clearly depicted in Figures 39 and 43. Figures 37 and 38 clearly show the salt crystals that are accumulating at the soil surface due to capillary rise and evaporation, which appears to be the main reason for the crops not germinating, along with ground saturation in some areas. Figure 44 shows the crops struggling to germinate at the very edges of these affected areas.

Seeps areas 1 & 2 have approximately 8ha directly affected by saline soaks, with another 8ha endangered. Seep Area 3 has about 4ha bare and moist and going saline, with 12ha affected. Seep 4 is currently affecting about 1 ha of the Frahns farm, and an estimated 10ha of neighbour Peter Obst property.

The Frahns have utilised Notill cropping on their property with a mixture of cereal and canola grown, generally with summer weed control. Stubbles are generally lightly grazed. They now lease 75% of their land and sharefarm 25%. The Frahns are committed to conservation and Landcare, having fenced off 120ha around existing soak areas and shelterbelts, and planted in excess of 35000 trees and shrubs.

The new areas that now are too wet and saline to be cropped may now need to be fenced to established some form of perennial vegetation such as tall wheat grass, puccinellia or saltbush to try and maintain soil cover to reduce evaporation and the concentration of salts at the surface. It would be beneficial if grazing could be gained from these options.

Seep 1 is located at 34°22'11"S, 140°47'5496"E, Seep 2 is at 34°22'08"S, 140°47'01"E, Seep 3 at 34°21'16"S, 140°48'23"E and Site 4 is at 34°22'50"S and 140°47'15"E.

Figure 34. Frahn farm soak sites inspected near Yamba

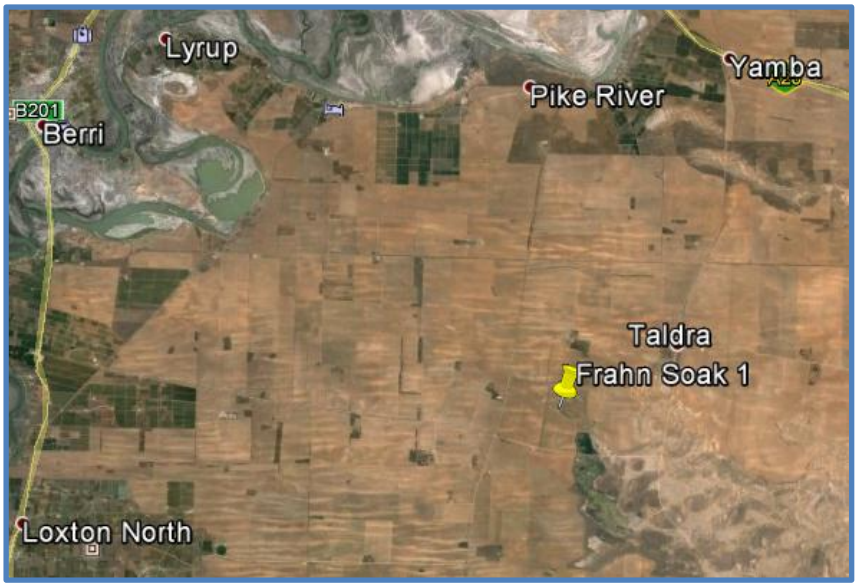


Figure 35. Map of Frahn farm showing seep areas

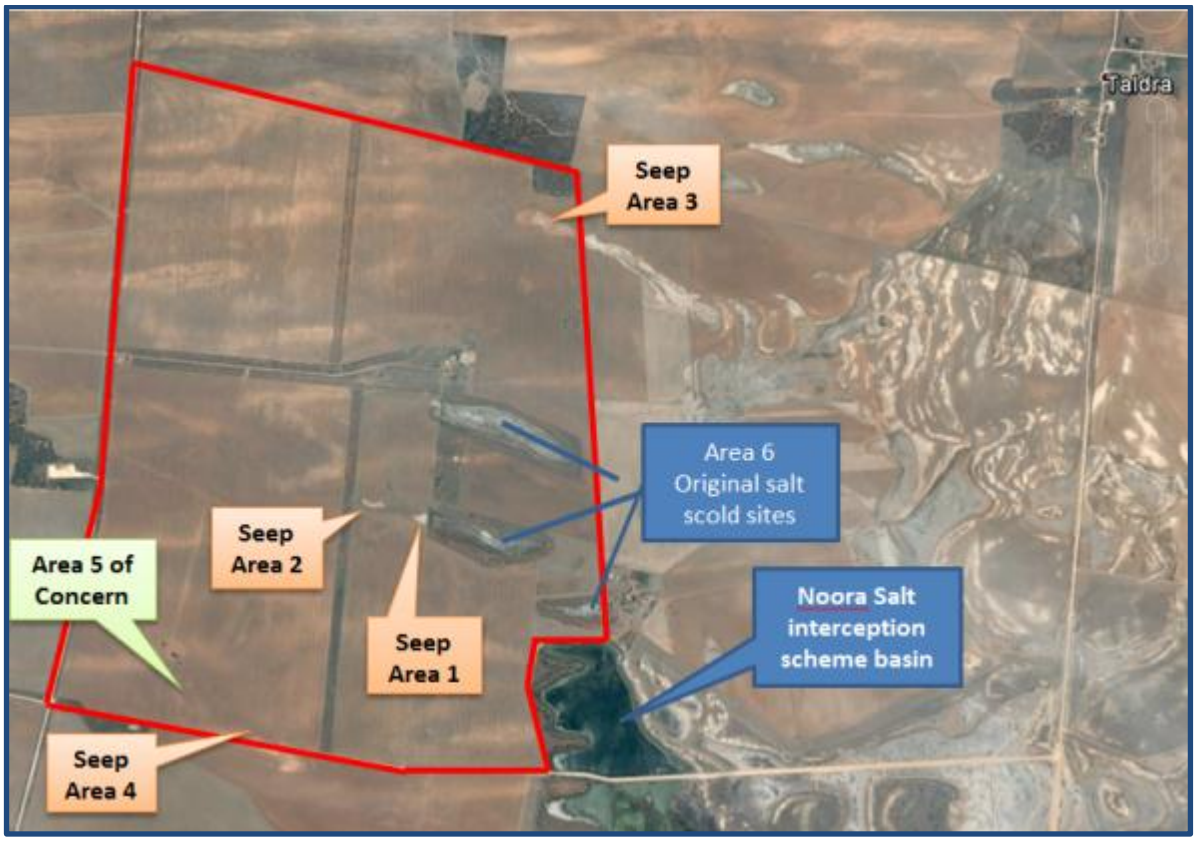


Figure 36. Seep Area 1 now mainly being cropped around

Figure 37. Seep 1 showing salt accumulation at surface

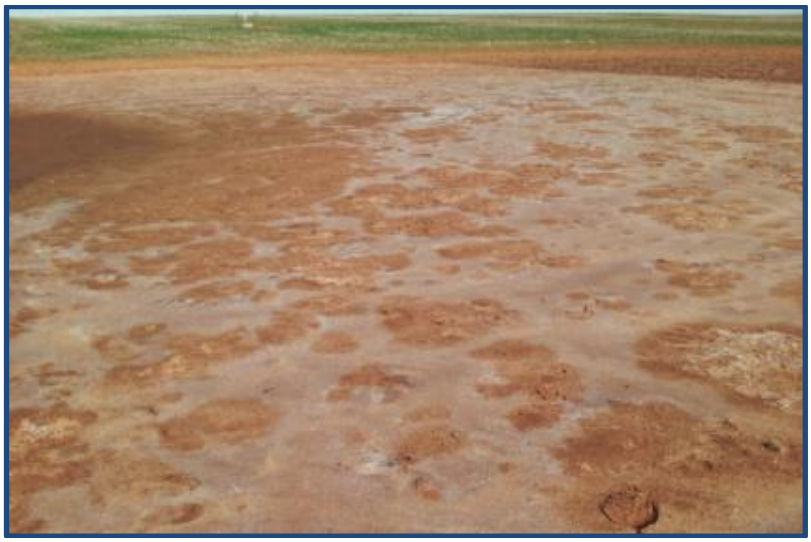


Figure 18. Surface salt accumulation Seep 1

Figure 39. Crop planting but no germination due to soil salinity at Seep 1

Figure 40. 2010 Google Map showing seep areas

Figure 41. 2014 Google Map showing seep areas

Figure 42. Seep 2 bared areas of no crop germination due to moisture and salt

Figure 43. Seep 3 gaining in size and moisture, showing lack of crop germination

Figure 44. Poor crop germination at edge of affected area

Figure 45. Soak 3 with large area now too salty for crop germination

Figure 46. Crop Area 5 of concern, and neighbours bare areas over the road.

Figure 47. Near Area 4 of concern with poor crop growth

Figure 48. Sandy loam over clay soils at areas of concern

Figure 49. Concern over water more permanently in areas that is killing samphire and bluebush.

3.4.2 Brief recommendations

The increased water movement leading to the spread of saline soaks in this area appear to be associated with larger catchment issues. These soak areas are very different to other mallee sites as they are not adjacent to deep non-wetting sandy rises, but are generally surrounded by productive loamy soils.

While management strategies targeting specific soak areas may have some impact, these may be of little consequence if the main driving influence is due to rising ground water associated with the Noora Salt Interception Scheme. Further investigation by relevant authorities is encouraged in this area, as the impact on farming land is becoming very significant.

The farmer has been encouraged to establish salt tolerant cover (such as puccinellia, tall wheat grass or saltbush) at the start of next season, on all bare areas as soon to try and minimise evaporation and salt accumulation at the surface. There appears to be little point in trying to crop through areas that are now too saline and wet for cereal crops, and an increasingly high risk of getting machinery stuck.

The farmer is considering a major tree planting venture around the fast growing Seep Area 3, which may assist in using more water, but will be at the cost of taking cropping land out of production to hopefully protect other areas in the catchment. There are no guarantees as to whether this will be successful. This could include a woodlot of salt tolerant trees. Saltbush could be of some grazing value. The possibility of growing some lucerne hay for their horses was also discussed, however, this may be limited to areas away from the saline wet areas, so may be difficult to establish, and have limited production potential in such a low rainfall environment.

3.5 David and Phillip Smith, Geranium

This soak catchment area is a good example of how high water use perennials such as lucerne and native trees can be used to intercept excess moisture flows and reclaim soak areas for cropping.

Figure 46 shows the catchment area with established lucerne on the deep non-wetting sand above tree line around the edge of a 3 hectare soak-affected area. This area appears to be reducing with more hectares being reclaimed for cropping in recent years.

Figure 54. Lucerne in foreground, planted trees and reclaimed soak area below.

Figure 54. Smith farm soak area inspected south of Geranium

3.5.1 Site history and current situation

The Smith family purchased the land in 1990. There was a bare area of approximately 10 hectares affected, much of which was very slimy with crab holes and oozed moisture and would fill up after every rain. Some salinity was evident. This area could not be cropped but became infested with sea barley grass.

In 1992 trees were planted along the base of the rise above the soak area and tall wheat grass and puccinellia were established in the soak area. The trees were a mixture of seedling plantings and direct seeding. This was done through the Garralands Landcare Group and Trees for Life. The trees were fenced off but the area was grazed once the trees were established. In 2010 lucerne was sown on the deep non-wetting sand over clay above the tree line.

These high water use perennial plantings have resulted in the drying out of the area and the reclamation approximately 7 hectares back to cropping. Once an area is growing rye grass well it has been deemed suitable for cropping. The trees have stopped the water forming more crab holes. In the last 3 years the immediate paddock has been sown to canola 2012, oaten hay 2013 and barley in 2014. As the paddock is presently being share farmed, any yield data or comparisons of the reclaimed area was not obtained.

The soak site is located at 35^{o}30'01"S, 140^{o}09'29"E.

3.5.2 Brief recommendations

Few recommendations were required for this site as it essentially is heading in the right direction for rehabilitation. It will be important not to overgraze the lucerne at critical times and make sure it is adequately fertilized to maintain its health and density well into the future.

It will be important to monitor the growth on the cropping ground that has been reclaimed, and to assess whether the underlying accumulation of salts is still problematic, or reducing due to improved surface cover. If this is the case then the crop growth could be benefitted by the slightly moisture soil associated with the soak area. There is still the potential for more cropping land to be reclaimed at this site.

Figure 46. Smith rehabilitated soak site (Google Maps 2013)

Figure 27. Tall wheat grass established above soak area.

Figure 48. White sand over clay near old soak area

Figure 49. Reclaimed cropping area on left

Figure 50. Reclaimed cropping area at the base of the tree line.

Figure 51. Crab holes in lower tree planted areas

Figure 52. Lucerne establishment on sandhill

Figure 53. Lucerne establishment on sandhill

Figure 55. Deep white sand where lucerne established

4 Acknowledgements

The project officer would like to thank the contributions of all the farmers involved in giving their time, expertise and information about each site. Rural Solution SA also thank Bernie Lawson of NR SAMDB for supporting this project with information, contacts and funding, as well as Scott Gillett of Wisdom Data and Mapping for assistance in mapping soak site locations.