

20th July 2018

Port Augusta Ash Storage Area – Contingency Assessment for Improved Dust Control

Executive Summary

Flinders Power has developed a long-term rehabilitation strategy for the Ash Storage Area (ASA). The strategy approved by all relevant stakeholders consisted of the application of a topsoil capping and revegetation which would provide the best opportunity to achieve the rehabilitation aim of a safe, stable, self-sustaining landform. This strategy has been implemented over the past 18 months given the limited accessibility of selected areas due to existing sub-surface saturation. A dry 2017 has resulted in the revegetation of the site at a lower rate than would have been expected with average rainfall. As a result, the potential for topsoil dust lift-off of selected areas of the dam remains. To date these areas have been managed in accordance with existing Dust Management Plans and a Fugitive Dust Trigger Action and Response Plan.

In March 2018, Flinders engaged Tonkin Consulting to conduct a desktop review of alternate dust control options for the Port Augusta Ash Storage Area. A draft report was received and discussed with the EPA and DEWNR at a risk review workshop on 10 April 2018. A number of actions were raised at this meeting prompting Flinders to expand the scope of the Tonkin review.

A project team was formed to collaboratively progress the dust management Contingency Options Assessment, comprising expert independent consultants, specialist advisors and Flinders personnel.

A copy of the report Ash Storage Area Rehabilitation – Options Assessment (Tonkin Consulting, June 2018) was provided to the EPA on 29 June 2018.

The Options Assessment has been conducted in a staged approach:

- Stage 1: Engagement of independent expert advisors to facilitate an investigation of contingency options, identify data gaps and formulate and initiate a series of trials.
- Stage 2: Selection and application of contingency options for improved dust control.
- Stage 3: Continued monitoring and application of adaptive management strategies.

The Options analysis process has been undertaken through the period March 2018 – July 2018 and culminated in the submission of this summary document, the supporting Options Assessment (Appendix A) and all supporting documentation to the EPA in July 2018.

The immediate strategies listed below will be implemented in a staged approach, or in combination (where appropriate), as determined by the outcomes of the relevant trial plans and weather conditions.

- Flinders will, and are currently in the process of, acquiring the recommended seed for a Barley/Rye corn planting regime across the ASA site following a suitable rain event. If there is not a suitable rain event prior to the end of August 2018, dry seeding will take place in areas accessible for truck watering of which these areas will be irrigated to promote growth. This will provide some plant growth in strips across the ASA to reduce wind velocity and provide some root stability and mulching. Another planting regime may be required in April 2019.
- Flinders is currently evaluating surface roughening across the ASA which can be conducted during the seeding process if the appropriate rain event occurs.
- Flinders will decide on a suitable dust suppressant – which will be ascertained out of the current suppressant trials by the end of August 2018 – and the application of the selected suppressant will commence before end of September 2018 across areas of high risk that are to be identified and agreed. There will be a contingency plan for reapplication of the approved suppressant and extra areas if and when identified during the occurrence of future wind events.
- The irrigation options – both SA Water effluent outfall and potable water options – will continue to be pursued and assessed for appropriateness to the required outcomes for the site by the end of September 2018.

The dust management contingency options in this paper reflect the optimal approach at this point in time. Outcomes and learnings from ongoing options assessments, trials and specialist advice will continue to be incorporated into this document thereby making this an evolving document reflecting adaptive management strategies and actions.

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Background

Following the cessation of power generation in May 2016, a variety of methods were used in order to control dust generation at the Port Augusta Ash Storage Area ('ASA'). A polymer seal was applied in August 2016 in a trial area. Following a successful application, the whole 273 ha ASA was covered with the seal in November 2016. A severe storm event in late December 2016 compromised the polymer seal which was subsequently re-applied in January 2017.

Planning for the long-term rehabilitation of the ASA commenced in 2015 when the original ASA rehabilitation plan (developed at the time of privatisation in 2000) was re-assessed. In 2016 it was agreed by all parties that a topsoil capping and revegetation strategy would provide the best opportunity to achieve the rehabilitation aim of a safe, stable, self-sustaining landform. Following approval from the Department of Environment, Water and Natural Heritage to clear land for the purposes of creating an on-site soil borrow pit, and the EPA's acceptance of the approval for the rehabilitation plans, carting of topsoil commenced in early January 2017.

Flinders Power (Flinders), in consultation with its Alliance partner McMahon Services, developed detailed rehabilitation plans which include a Dust Management Plan and Fugitive Dust Trigger Action and Response Plan. These documents are periodically updated to cater for new or emerging conditions.

Throughout 2017 the polymer seal managed the risk of fugitive ash dust lift-off while the soil was being applied. The soil itself, being a sandy clay with inherent moisture, proved to be suitable working medium and crusting characteristics meant that the risk of dust generation after spreading was low. Seeding utilising a mix of 40 native species was commenced in June 2017 (103ha) and August 2017 (78ha). Due to low winter and spring rainfall in 2017, germination was limited and patchy in extent.

In mid-2017 earthworks were suspended due to risks associated with the soft, saturated conditions at the northern extent of the ASA. The dry conditions facilitated the improvement in conditions, and earthworks were recommenced in November 2017, with the outer banks and roadways being capped. As summer progressed, earthworks recommenced at the northern extent of the ASA with significant progress being made at the northern end of the ASA, the Former ASA, the Polishing Pond and Bird Lake. Seeding of a further 67ha was conducted in late May 2018. At the time of preparing this document, around 12ha of soiling and seeding in the Polishing Pond remains, pending safe access.

A risk workshop was held between Flinders and the EPA on 19 December 2017, whereby the project risk assessment was reviewed and updated, with a particular focus on summer risk controls.

A long, hot, dry summer combined with periodic gale-force winds caused the soil seal to desiccate and become a risk of dust generation. Several topsoil dust events occurred during unfavourable conditions in late December 2017 to April 2018 whereby fugitive dust was generated. At these times, Flinders deployed the Fugitive Dust TARP, including the use of 4 watercarts.

Contingency Options Assessment

In March 2018 Flinders engaged Principal Scientist Dr Melissa Salt from Tonkin Consulting to conduct a literature review of alternate dust control options. A draft report was received and discussed with the EPA and DEWNR at a risk review workshop on 10 April 2018. A number of actions arising at this meeting prompted Flinders to expand the scope of the Tonkin review.

A project team was formed to collaboratively progress the Contingency Options Assessment, comprising:

- Dr Mellissa Salt (Tonkin Consulting)
- Dr Briony Horner (Succession Ecology)
- Glenn Christie (Succession Ecology)
- Kym Maule (Flinders Power)
- Brad Williams (Flinders Power)
- Terry Manning (Flinders Power)
- Ross Fitzgerald (McMahon Services)
- Dr Leong Mar (Red Planet Innovations)

Other parties, including Hydroplan (irrigation consultants), Soil Management Systems (agronomists), Beneterra (land rehabilitation advisors) and multiple dust suppressant companies have been engaged for advice.

Details regarding the skills and experience of Dr Salt and Dr Mar, being the two lead technical consultants for the review, are included within Appendix A – Ash Storage Area Rehabilitation – Options Assessment (Tonkin Consulting, July 2018).

A site inspection and project workshop was held in Port Augusta on 23 and 24 May 2018 to facilitate the Contingency Options Assessment. The workshop enabled the collation of options, preliminary ranking, and the identification of further studies required to inform the assessment.

A copy of the report *Ash Storage Area Rehabilitation – Options Assessment* (Tonkin Consulting, June 2018) was provided to the EPA on 29 June 2018. As the majority of issues relating to dust generation relate to the Ash Storage Area, the focus of the Options Assessment is necessarily the Ash Storage Area. However, the outcomes are equally applicable across all areas of the site that are a risk of dust generation, including the Ash Storage Area (comprising the ASA, Former ASA and Polishing Pond), the borrow pit, the Flinders-owned portion of Bird Lake and the rehabilitated coal stockpile.

The Options Assessment has been conducted in a staged approach:

- **Stage 1:** Engagement of independent expert advisors to facilitate an investigation of contingency options, identify data gaps and formulate and initiate a series of trials. This process has been undertaken through the period March 2018 – July 2018 and culminated in the submission of this summary document, the supporting Options Assessment (Appendix A) and all supporting documentation to the EPA in July 2018.

- **Stage 2:** Selection and application of contingency options for improved dust control. This process will be undertaken in August 2018 and will be informed by the trial outcomes, further investigations (e.g. irrigation), revegetation progress on the ASA and weather conditions.
 - o Post selection of the preferred contingency options Flinders will engage with the community and stakeholders delivering the outcomes from the “Options Assessment Review” advising of the contingency options, rationale for selection and triggers for application.

- **Stage 3:** Continued monitoring and application of adaptive management strategies.

Outcomes and learnings from ongoing trials and specialist advice will continue to be incorporated into this document thereby making this an evolving document reflecting adaptive management strategies

This summary document is intended to address EPA feedback to the initial independent Options Assessment report as received 6 July 2018.

Licence Conditions

The expansion of the Tonkin Consulting scope was formalised in a subsequent revision of EPA Licence 13006, voluntarily agreed by Flinders, being:

ASSESSMENT OF OPTIONS (U - 855)

The Licensee must:

1. appoint a suitably qualified expert(s) to undertake a detailed assessment of options ("Options Assessment") to prevent or minimise particulate emissions from the Premises;
2. ensure that the Options Assessment includes a comprehensive investigation and assessment of best-practice options to prevent or minimise particulate emissions from dust sources at the Premises, including, without limitation:
 - a. comprehensive details of each option investigated and assessed including the technical aspects; resources involved for implementation, timelines to achieve effective dust control, known examples of the options investigated having been successfully applied elsewhere and limitations associated with each option;
 - b. the feasibility of each option, such feasibility to also consider the risks and recommendations for dealing with such risks;
 - c. the methodology applied and considerations involved in selecting recommended options; and
 - d. the recommended option(s) to be taken to prevent or minimise particulate emissions and a plan for implementation of such option(s) including specific actions and timelines.
3. submit the Options Assessment to the EPA by the date listed below.

Compliance Date: 30-Jun-2018

VARIATION OF CONDITIONS OF LICENCE (pursuant to section 45(3) of the Environment Protection Act, 1993) (U - 863)

The EPA may:

1. Impose conditions or vary conditions of this licence at any time by notice in writing to the Licensee in the following circumstances:
 - a. in relation to particulate emissions from fugitive sources, including a condition requiring revision of the Dust Management Plan, or Closure and post-Closure Plan (the Plans), based on:
 - i. the progress of the implementation of the Plans;
 - ii. the reporting required under the Plans;
 - iii. the ambient monitoring data and information;
 - iv. Dust Management Plan reports; and
 - v. the Options Assessment.

Suppressant Investigations

Flinders identified early into the Options Assessment that a greater level of knowledge regarding the large range of commercially available dust suppressants was required. Dr Leong Mar (Red Planet Innovations), a chemist formerly with Dupont responsible for the development of industrial dust suppressants, was engaged to undertake a review of the shortlisted products. The seven products are:

- Dustac (Total Dust Control)
- ISB9000 (PMB Technologies)
- Envirobond (GrowGrass)
- Vital Strike and Stonewall Plus (Vital Chemicals)
- Dustex (Dustex Australia)
- Gluon 500 (Rainstorm)
- Hyrdobond (Spraygrass)

Flinders also met with Engineered Environmental Solutions, however discounted their product due to their non-Australian presence and lack of credible examples. Contact was made with Bio-Central Laboratories following an initial enquiry however they did not return our calls.

GrowGrass, Dustex, Rainstorm and Spraygrass all attended site to allow for the submission of detailed proposals. Vital Chemicals staff have attended site previously.

Flinders sent the following email to all suppliers in order to obtain detailed information to inform the Options Assessment:

Dear XYZ,

Thankyou for providing information regarding XYZ product. We are currently assessing a range of different products. To assist our decision-making, could you please provide the following (if available):

- *Chemical specifications for the product*
- *SDS*
- *Ecotoxicity studies, including biodegradation products*
- *Research papers regarding wind tunnel testing and germination/vegetation growth testing*
- *Case studies*
- *Referees*
- *Warranty period*
- *Trials*
- *Durability (predicted lifespan at differing application rates and information regarding what conditions impact the seal – rain, hail, wind, UV, ambient temperature etc)*
- *Application requirements (ie whether or not the surface needs to be pre-wet?)*
- *Application method*

To be clear, the 270ha Ash Storage Area and 20ha borrow pit has been covered with soil and seeded with 40+species of native vegetation. Germination is currently patchy, due to the lack of rainfall since seeding. The purpose of the suppressant is to hold the sandy clay soil in situ (preventing dust events during 40km/hr + winds) while enabling water and air penetration for germination and growth of vegetation. Our main concerns regarding applying a suppressant at this stage of our project is:

- will the suppressant inhibit germination?; and
- will the suppressant damage/kill existing vegetation growth?

To provide some assurance regarding this, we would like to conduct greenhouse trials over the next month via our ecological advisors Succession Ecology. Would your company be willing to provide (XXX)L of product to assist with these trials? Data regarding the success or otherwise of the trial would be provided to you.

The information above, and a successful greenhouse trial would enable Flinders to make a decision on the suitability of the dust suppressant that you recommend.

Kind regards,

XXX

Each company provided supporting data that met the Flinders request to varying degrees. For example, Vital Chemicals were able to provide a comprehensive set of chemical data and ecotoxicity studies, whereas PMB Technologies could not provide the same degree of scientific data. All information supplied to Flinders Power was forwarded to Tonkin Consulting and Red Planet Innovations to inform the Options Assessment. The full range of supporting data is available on request.

As noted in the Flinders email above, the key risk in the application of a dust suppressant over the site is whether or not it would impair germination or cause mortality of existing vegetation (for example, through suffocation on the leaf surface). None of the companies contacted had conducted significant scientific trials to address this risk. Hence the need for a specific trial to be conducted as outlined below.

The application rate of the product is also critical. It needs to be applied at a rate that will provide a durable cover and provide sufficient longevity, however it must also be permeable to water, air and germinants. The trial being conducted is at the application rate recommended by the supplier, who understand the long-term objective of a vegetative cover for the site. The trials will assist to determine the ideal application rate on the borrow pit soil, should a suppressant be selected as an option.

Further information regarding the suppressants, as provided by Dr Leong Mar, is outlined in Appendix A Options Assessment.

Irrigation

Watering could be utilised on the ASA as:

- A dust suppressant technique; and/or
- A technique to promote germination; and/or
- A technique to sustain vegetation growth.

A number of different options exist – from the use of water in strategic locations, to broadacre irrigation. There are a number of technical challenges (e.g. size of the site, supply infrastructure, evaporation rates), risks (e.g. rising salinity, vegetation becoming dependent on irrigation, the suitability of River Murray water for native vegetation germination and growth) and ethical issues (e.g. using potable water for non-commercial native veg establishment) that need to be considered. A more complete assessment of irrigation options is provided in Appendix A – Options Assessment.

To inform irrigation options Flinders Power has conducted / is conducting the following investigations:

SA Water – Port Augusta East Waste Water Treatment Plan

Flinders Power engaged with SA Water previously in late 2016 to determine if the effluent outfall could be utilised for dust suppression during the rehabilitation works. At the time McMahon Services were concerned of the biohazard risk to employees and stated that tertiary treatment would be required. Capital costs for the plant were significant and it was somewhat difficult to secure SA Water engagement.

In early 2018 Flinders again re-engaged with SA Water to determine the possibility of using outfall water to trigger germination, to suppress dust or as an irrigation source. Several meetings have occurred with SA Water representatives, with a concept plan being finalised at the time of writing this document. There are a number of risks to using the water, including:

- A moderate salt content (~8,000 – 13,000 μ S/cm) which may inhibit germination or growth and adds to the salt loading in the soil profile. Ref papers
- Varying levels of metals and nutrients.
- E.Coli at levels between 3,000 – 11,000 (org/100mL).
- Vegetation dependence on outfall water.

In relation to salt content or irrigation water, Mahmood and Malik (1986) conducted trials regarding seed germination and growth at varying levels of salinity using *Atriplex rhagodioides*. This is a species in the seed blend on the ASA. The results of the study determined a progressive decline in germination outcomes with increasing salinity, with 70% germination at an EC of 3,000 μ S/cm, 50%

germination at 15,000 μ S/cm and circa 8% at 30,000 μ S/cm. Seedling yield (following irrigation with increased levels of salinity) was 75% at 15,000 μ S/cm as compared to 3,000 μ S/cm. The study concluded that while *Atriplex rhagodioides* is salt tolerant and may be a suitable candidate for irrigation with saline water, that vegetative outcomes are reduced.

A similar study was undertaken by de Araujo et al. (2006) with *Atriplex nummularia* (again, a species in the seed mix on the ASA). The study found that seedlings displayed improved growth with low levels of salinity, up to around 13,500 μ S/cm and reduced performance with salinity beyond this point.

Should the water be acceptable for use, there would be approximately 1ML/day available, and would largely eliminate the outfall from the plant to Spencer Gulf. It is also a potential significant community benefit. The option to dilute the effluent outfall with mains water is also being discussed with SA Water; however, issues with separation of potable water and wastewater need to be carefully considered.

SA Water provided a high-level plan to Flinders Power. On 19 July 2018, Flinders Power with Tonkin Consulting met with SA Water to discuss the objectives of utilising wastewater for irrigation and a pathway for moving forward. It is envisaged over the medium term that during winter, wastewater could be irrigated over a larger area to assist in promoting vegetative growth and during summer could be used on targeted areas to assist in dust suppression. From this meeting, it has been agreed that:

- SA Water, Flinders Power and Tonkin Consulting will prepare a Wastewater Irrigation Trial Plan to investigate the potential impacts (both beneficial and detrimental) to native vegetation germination and survival over approx. 5 ha;
- SA Water will discuss the Trial Plan with Department of Health to gain approval to conduct the trial;
- Flinders Power will discuss the trial with EPA and Community to present the trial and gauge interest for larger scale irrigation;
- Flinders Power and SA Water will work towards an acceptable commercial arrangement if the trial proves successful and is acceptable to the community and regulators (both Department of Health and EPA).

It is proposed for the trial to be located near the SA Water wastewater treatment plant and include areas currently being monitored for vegetation establishment. It is unlikely that dust generation from the trial area would be able to be separated from upwind impacts and hence dust generation may not be able to be quantified but visual observations may prove useful in qualitatively assessing impact on dust generation.

Progression beyond a trial remains subject to:

- Trial outcomes to demonstrate benefits and/or no detrimental impacts to stakeholders;

- Technical advice received regarding the pros/cons of the option, particularly in relation to water quality;
- A tenable commercial agreement between parties; and the
- Endorsement of Department of Health, EPA and the Community

Wet Earth Dust Control and Water Management Solutions

Advice from Wet Earth 6 March 2018 is: – The largest fog mister they have is F250 which is diesel powered and they have only made 2 of them which went to the middle east. They have a range of 250m and require 840L/min. of water. Their advice is that fog cannons do not work in high winds. NOTE: Flinders has trialled many fog cannon option for the coal stockpile with no suitable results for dust mitigation in high winds found.

40% coverage of the ASA = 10 lines of 10 sprinklers with 40m throw. 4 sprinklers at a time would require 148m³/hr at 650Kpa. Material only budget cost of \$650k plus installation, water and maintenance costs.

Halls Irrigation

Flinders made extensive contact with Halls Irrigation with no response.

Nelson Irrigation and Viss Water

On 8 May 2018 a site visit was conducted with an indication of a relevant proposal of a system and running parameters within a month. On 13 June 2018 Flinders made contact again with an indication from VISS to have the proposal finished within the week. Follow up attempts have been made since with no reply.

Hydroplan

Due to a lack of genuine interest from irrigation companies, Flinders engaged irrigation consultant James Sullivan from Hydroplan. Mr Sullivan has previous experience in designing irrigation systems for Lea Memorial Oval and other parks and gardens in Port Augusta and was deemed a suitable choice. Mr Sullivan undertook a site visit on 13/6/18 and indicated a proposal would be sent within a fortnight.

At the time of preparing this report Hydroplan have submitted a Fee proposal for Flinders' consideration on 13/7/18

MJ Binder Consulting - Irrigation design

Flinders has contacted MJ binder for an irrigation design due to tardy responses from other suppliers on 16/7/18. Flinders has supplied data on the site to the consultant. Flinders is expecting a proposal for consideration by 24/7/18.

In summary, the use of waste water or potable water remains an area requiring further investigation. Initial indications are that given the size of the ash dam from which dust is potentially generated and the significant resources involved that irrigation is unlikely to be a solution but may be useful in promoting or combining with other techniques

Additional Seeding Methods

Succession Ecology is constantly reviewing the germination progress across the ASA of which will allow Flinders to understand areas where there is insufficient growth as per the revegetation plan. There is a store of contingency seed available to apply in these areas if it is required.

Nurture Revegetation undertook a site visit in May 2018 and provided Flinders with a rehabilitation proposal. The Nurture solution was to re-seed the ASA utilising native seed pelletized within a clay matrix.

As outlined in the section below, seedbank testing of the viable seed within the ASA soil is currently underway. The Nurture revegetation approach may be viable once the results of the seedbank testing are better understood.

Agronomic Advice

Throughout the course of the options assessment process, Flinders has discussed cover crop options with multiple local farmers and agronomists. Flinders subsequently has been working closely with Mr Brenton Byerlee from Soil Management Systems (Orroroo). Mr Byerlee's advice has been critical in terms of crop selection, seed sourcing, equipment sourcing and fertiliser selection. Mr Byerlee has been closely involved in the cover crop trial and has proposed a seeding regime for the ASA.

Please refer to "appendix C" for details.

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Investigations and Trials

The following further investigations and trials are underway. The overarching purpose of these trials is to inform future updates to the Option Assessment and any plan for the implementation of the options, and to ensure to the extent possible that the selected option/s do not detract from the project objective of a revegetated safe, stable and self-sustaining landform for the ASA.

| Further Investigation / trial | Scope | Parties | Expected Timeline | Reference |
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| 1. SA Water – use of effluent outfall | <p>Please refer commentary above</p> <p>A trial irrigation area is proposed. Tonkin Consulting and SA Water are discussing the trial plan.</p> | <p>Flinders Power</p> <p>SA Water</p> <p>Tonkin Consulting</p> | <p>A trial plan is anticipated by early August. As a collaborative effort between Flinders, Tonkin and SA Water Assuming the trial is acceptable to regulators and the community, it is envisaged that the trial could commence in September/October 2018 pending commercial agreement and equipment availability</p> | N/A |
| 2. Surface roughening | <p>Flinders has noted that dust lift-off on the ASA occurs more readily on areas where the surface is smooth. While the whole surface was textured following seeding, subsequent rains have flattened and smoothed the profile.</p> | <p>Flinders Power</p> <p>McMahon Services</p> | <p>Works are complete. Monitoring is ongoing with expected completion by end-</p> | Appendix B |

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| | <p>In early May 2018 the borrow pit was ripped and re-seeded. A Pistenbully dozer was used to roughen the surface of a trial area of the ASA.</p> <p>A trial plan is presented as Appendix B</p> | | <p>July 2018 pending appropriate conditions i.e. suitably strong enough winds to allow an accurate assessment of the trial areas.</p> <p>A report will be generated on the outcomes of the trial once the various conditions are realised. The report will provide what was experienced visually or captured by photographic evidence if it can be captured accurately.</p> | |
| <p>3. Cover Crop</p> | <p>An option being explored is the potential use of a cover crop of sterile Munda Barley or Rye Corn to provide a windbreak, stabilise the soil, and provide a surface mat following summer die-back.</p> <p>Similar approaches have been used in revegetation projects previously, however the ability of a cover crop to germinate and grow to a sufficient level in the borrow pit soil, plus potential allelopathic impacts to native vegetation germination and growth is unknown. Hence a trial was recommended.</p> <p>A trial plan is presented as Appendix C</p> | <p>Flinders Power Succession Ecology McMahon Services Tonkin Consulting Soil Management Systems</p> | <p>Progressive monitoring is underway.</p> <p>A trial report is expected by 17/08/2018</p> | <p>Appendix C</p> |

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| <p>4. Seedbank viability testing and root/ash interface testing</p> | <p>Specific concerns raised during the risk workshop in April 2018 included:</p> <ol style="list-style-type: none"> 1. The potential for seedbank loss due to wind scour and the reduction in seedbank viability of those areas of the ASA seeded in 2017; and 2. The affects of the soil/ash interface on plant survival <p>A trial was initiated via Succession Ecology to take a number of random soil samples across the ASA and grow out the sample under greenhouse conditions to check seedbank status. The trial included excavating a number of mature plants on the ASA to determine root distribution and observations of plant health.</p> <p>A trial plan is presented in Appendix D.</p> | <p>Flinders Power Succession Ecology</p> | <p>Germination of samples has occurred.</p> <p>A trial report is expected by 3/08/2018</p> | <p>Appendix D</p> |
| <p>5. Routine ASA monitoring</p> | <p>In accordance with the ASA Post-Completion Monitoring and Maintenance Plan, routine vegetation surveys have been conducted by Succession Ecology to monitor revegetation outcomes.</p> <p>The monitoring report for May 2018 is attached as Appendix E.</p> <p>The June 2018 monitoring round has been undertaken, however the report is pending. The June report indicated a 70x increase in recruitment over the April results due to a 25mm rainfall event across 8-9th June 2018. The ASA now averages 7.1 plants/m², however distribution remains patchy. New areas seeded have shown signs of early germination, as has the ripped and re-seeded borrow pit.</p> | <p>Flinders Power Succession Ecology</p> | <p>Ongoing bi-monthly monitoring</p> <p>The June 2018 monitoring report summary is expected by 25/7/18 and the full report by 3/08/2018</p> <p>The August monitoring report is expected by 17/08/2018</p> | <p>Appendix E</p> |

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| <p>6. Soil Sampling</p> | <p>It is noted that there are spatial differences across the ASA in terms of soil chemical and physical properties that may correlate with germination outcomes and the potential for dust generation.</p> <p>A soil sampling program has been initiated to provide further information regarding soil characteristics. This information may provide a useful insight to potential treatment options.</p> <p>A trial plan is presented in Appendix F</p> | <p>Flinders Power</p> <p>Tonkin Consulting</p> | <p>Soil samples have been taken.</p> <p>A report is expected by 10/08/2018</p> | <p>Appendix F</p> |
| <p>7. Soil Surface Polymer Trial</p> | <p>There is scarce information currently regarding the impact of a dust suppressant seal on the ability of native vegetation to germinate and establish. Suppliers are unable to supply comprehensive data, and the little information that is available generally relates to a grass cover crop.</p> <p>In order to determine whether the use of a commercial dust suppressant will have a beneficial or detrimental effect on revegetation outcomes, it was agreed to conduct a trial.</p> <p>Of the dust suppressants reviewed by the project team, seven were selected for a greenhouse germination trial. The trial is also useful to make a subjective assessment of whether the product forms an effective seal.</p> <p>Another concern was the impact of spraying the suppressants on the existing vegetation on the ASA. The trial plan includes testing an application of suppressant on nominated existing plants on the ASA.</p> <p>All trial plan is provided in Appendix G</p> | <p>Flinders Power</p> <p>Succession Ecology</p> <p>Dust suppressant suppliers</p> | <p>The trial is underway</p> <p>A report is expected by 17/08/2018</p> | <p>Appendix G</p> |

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| <p>8. ASA sprinkler germination trial</p> | <p>Little is known of the differences in germination and growth of native vegetation in an arid environment between the use of mains water as compared to natural rainfall.</p> <p>Flinders Power initiated a trail at the southern end of the ASA to determine germination and growth outcomes when a known quantity of irrigation water is applied.</p> <p>A trial plan is provided in Appendix H.</p> | <p>Flinders Power</p> | <p>The trial is underway</p> <p>A report is expected by 20/7/18</p> | <p>Appendix H</p> |

Early Outcomes

While awaiting formal trial outcome reports, the following are summarised outcomes of trails conducted to date:

| Trial | Early indications |
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| Cover Crop trial | <ul style="list-style-type: none"> - Successful germination, albeit patchy distribution. - Growth is moderate, despite a number of morning frosts. - Barley germinated faster than Rye but over time Rye has become more abundant. - Some evidence of germination that is unable to penetrate the clay crust. - Native seed germinant counts are exceeding Barley/Rye counts. This suggests that allelopathic inhibitors may not be a concern. - Germination following one rainfall event of 25mm. - The watered sections of the trial area are out-competing the non-watered sections. |
| Surface Roughening trial | <ul style="list-style-type: none"> - Both the ASA roughening by Pistenbully and borrow pit by dozer ripping was performed successfully and safely. - Visual observation during strong winds indicate that both areas out-perform smooth areas - Visual observation of seed capture in rills created by the roughening - Both areas have sealed following June rains - Evidence of increased germinant outcomes in some areas following June rainfall |
| Seedbank viability and root/ash interface | <ul style="list-style-type: none"> - Soil samples taken have germinated with an average of 21.9 germinants/m² - As anticipated, germination rates vary across the samples, ranging from 0 to 15 plants per tray (0 to 178.5 plants/m²) <p>Cross-sectional profiles of roots indicate healthy growth and distribution in the cover soil. At the soil/ash interface roots generally travel perpendicular along the interface. This is likely due to moisture that sits on top of the low-permeability ash layer. There is some evidence of plant roots penetrating the ash layer. It is likely that roots profiles will be concentrated in the soil as it offers higher nutrient availability. There is no evidence that the ash is toxic to plant growth as all plants selected have shown healthy roots and foliage.</p> |
| Soil surface polymer trial | <ul style="list-style-type: none"> - Germination through the suppressant treatments has commenced, however it remains early days. - Germination has only occurred in the sandy-loam soil not the borrow pit soil. This may be due to the salt content of the borrow pit soil inhibiting germination, and the need for rainfall to flush the salt content from the upper profile. - A 10ml rainfall event has been simulated on the soil samples to see if this will result in germination from the borrow pit soils. - All suppressants appear to form a strong, cohesive seal on the sandy loam. The sealant properties appear different on the sandy-loam as opposed to the sandy clay of the borrow pit, some form a cracking or |

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| | <p>thick coat on the surface of the borrow pit soil and do not appear to penetrate the soil well. This may be related to the clay in the soil.</p> <ul style="list-style-type: none"> - There is a marked difference in germination outcomes (in the sandy loam) based on the suppressant used. The germination outcomes for Gluon and Dustex were very poor. PMB and Vital Bon-Matt Stonewall Plus have an average germination rate higher than the Control. |
| <p>ASA sprinkler germination trial</p> | <ul style="list-style-type: none"> - In the simulated 15mm rainfall event – after 4 weeks there appears to be a significant mortality rate of the previous counted germinates i.e. half of the germinates have perished due to no follow up rainfall and or harsh conditions such as frosts. E.g. 2 week count average was 34.2 plants per plot to the 4 week average 11.2 plants per plot - In the 45mm simulated rainfall event there are similar results 2-week average. 57.2 plants per plot 4 week count 25.6 plants per plot. |

Way forward

Flinders Power is committed to implementing appropriate treatments to improve dust control at the site. The preferred approach selected is a variety of treatment options to be applied across different high-risk areas of the site (including, planting of a cover crop, surface roughening, irrigation and the use of appropriate dust suppressants).

Trial outcomes will influence the parameters of the selected strategy. However, as the windy seasons of Spring and Summer are rapidly approaching, the appropriate strategy for areas of dust risk will be determined soon (as informed by various trial outcomes) that will provide the best opportunity for dust control and long-term revegetation success.

The following table sets out the approach committed to by Flinders to prevent or minimise particulate emissions and provides a plan for implementation of these option(s), including specific actions and timelines.

Stage 1: Engagement of independent expert advisors to facilitate an investigation of contingency options, identify data gaps and formulate and initiate a series of trials.

| Actions | Who | Delivered by | Inter-dependencies | Milestones/Deliverables | Status |
|--|--|--------------|--------------------|--|----------|
| 1. Engage suitably qualified technical experts to undertake an Options Assessment | Flinders | 31/3/18 | nil | Commercial scope of work agreed Purchase order executed | Complete |
| 2. Form a project team | Flinders | 30/4/18 | nil | N/A | Complete |
| 3. Undertake a site visit and risk workshop | Flinders, Tonkin, Succession, McMahon | 30/5/18 | nil | Ranked options spreadsheet List of further trials required Actions arising list | Complete |
| 4. Undertake literature review | Tonkin | 23/6/18 | nil | Draft report submission | Complete |
| 5. Undertake options analysis group ranking | Flinders, Tonkin, Succession, McMahon | 23/6/18 | nil | Final options assessment matrix | Complete |
| 6. Prepare draft Options Assessment report | Tonkin, Red Planet | 23/6/18 | nil | Draft Options Assessment report | Complete |
| 7. Prepare final Options Assessment report for EPA submission | Tonkin, Flinders | 30/6/2018 | nil | Final Options Assessment report EPA report submission | Complete |
| 8. Develop trial plans | Flinders, Tonkin, Succession | 10/7/2018 | nil | Documented trial plans for: - ASA Surface Roughening Trial Plan (Flinders Power, July 2018) | Complete |

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|--|----------|-----------|-----|--|----------|
| | | | | <ul style="list-style-type: none"> - Barley/Rye Corn Cover Crop Trial (Tonkin Consulting, May 2018) - Soil Seedbank and Plant Root Growth Trial (Succession Ecology, April 2018) - Ash Storage Area Soil Sampling – Proposal (Tonkin Consulting, June 2018) - Soil Surface Polymer Trials (Succession Ecology, June 2018) - ASA Sprinkler Germination Trial (Flinders Power, June 2018) | |
| 9. Develop Flinders Options Assessment Overview (this document) | Flinders | 20/7/2018 | nil | EPA re-submission | Complete |

Stage 2: Selection and application of contingency options for improved dust control.

| Actions | Who | Update Delivered By | Inter-dependencies | Milestones/Deliverables | Status |
|--|------------------------------|---------------------|---|--|-------------|
| 1. Continue the trial program | Flinders, Succession, Tonkin | various | Nil | Project team progress updates Fortnightly EPA progress update report | In progress |
| 2. Trial reports: | | | | | |
| ASA Surface Roughening | Flinders | 31/8/18 | appropriate weather conditions i.e. windy conditions from the SE. | Trial report complete | In progress |
| Barley/Rye Corn Cover Crop Trial | Succession | 17/08/2018 | Nil | Trial report complete | In progress |
| Soil Seedbank and Plant Root Growth Trial | Succession | 03/08/2018 | Nil | Trial report complete | In progress |
| Ash Storage Area Soil Sampling | Tonkin | 10/08/2018 | Nil | Trial report complete | In progress |
| Soil Surface Polymer Trials | Succession | 17/08/2018 | Nil | Trial report complete | In progress |
| ASA Sprinkler Germination Trial | Flinders | 13/7/18 | Nil | Trial report complete | In progress |
| 3. Continue discussions with SA Water – develop and implement a trial | Flinders, SA Water, Tonkin | 03/08/2018 | Commercial agreement Suitability of water for use Auditor endorsement | Trial Plan agreed by all parties Notification to Community Reference Group and stakeholders | In progress |

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| <p>4. Continue discussions with irrigation advisors</p> | <p>Flinders, Hydroplan, MJ Binder Consulting</p> | <p>31/07/2018</p> | <p>Engagement with co-party</p> | <p>Irrigation advice report</p> | <p>In progress – awaiting response from consultant</p> |
| <p>5. Conduct broad-scale seeding of a Barley and/or Rye Corn cover crop, targeting those areas of the ASA with limited vegetation cover.</p> <p>NOTE: Seeding method, rate, row spacing and whether or not a fertiliser should be included is yet to be determined. Row spacing is important in terms of providing an effective windbreak, and also not impacting the un-germinated native seed in the inter-rows</p> | <p>Flinders, Tonkin, Succession, MSA, Soil Management Systems</p> | <p>Seeding is likely to immediately follow the next rainfall event to reduce the risks associated with dust generation (mechanical movement is likely to break the soil crust which is then a risk during strong winds) and promote immediate germination prior to the crust re-forming.</p> <p>Aiming to have dry seeding complete before end of September if no effective rain is experienced to allow wet</p> | <p>This process will be informed by the trial outcomes, further investigations, revegetation progress on the ASA and weather conditions.</p> <p>EPA acceptance, DEWNR and Site Contamination Auditor approval</p> | <p>Cover crop implementation and monitoring plan</p> <p>Update to the Dust Management Plan</p> <p>Notification to Community Reference Group and Stakeholders</p> <p>Media release</p> | <p>Flinders is currently sourcing seed and equipment and is discussing the implementation plan with technical advisors (Soil Management Systems, Succession Ecology, Tonkin Consulting and McMahon Services).</p> <p>See seed proposal attached.</p> <p>Appendix C – sub appendix C</p> |

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| | | seeding prior to this date | | | |
| <p>6. Conduct surface roughening</p> <p>NOTE: This method will target those areas of the ASA with limited vegetation cover.</p> | Flinders, Tonkin, Succession, MSA, Soil Management Systems | <p>This may be completed concurrently with seeding and occur following rains to reduce the risk of impacting the surface crust causing dust generation during strong winds.</p> <p>Aiming to commence week starting 30 July</p> | <p>This process will be informed by the trial outcomes, further investigations, revegetation progress on the ASA and weather conditions.</p> <p>EPA, DEWNR and Site Contamination Auditor approval</p> | <p>Surface roughening implementation and monitoring plan</p> <p>Update to the Dust Management Plan</p> <p>Notification to Community Reference Group</p> <p>Media release</p> | <p>Flinders is currently sourcing equipment and is discussing the implementation plan with technical advisors (Soil Management Systems, Succession Ecology, Tonkin Consulting and McMahon Services).</p> |
| <p>7. Select the most suitable dust suppressant for widespread application.</p> <p>Identify areas for treatment with suppressant.</p> <p>Finalise commercial arrangement for supply and application</p> <p>Implement</p> | Flinders, Tonkins, Succession, MSA, Red Planet Innovations | <p>Consider application of the suppressant Application commencement by end of September. This process could either be a whole of ASA, a checkboard application or a targeted application in</p> | <p>This process will be informed by the trial outcomes, further investigations, revegetation progress on the ASA and weather conditions.</p> <p>Flinders would prefer to defer application of a suppressant until</p> | <p>Dust suppressant implementation and monitoring plan</p> <p>Update to the Dust Management Plan</p> <p>Notification to Community Reference Group</p> <p>Media release</p> | <p>The dust surface soil polymer trial is underway and Flinders is liaising with suppliers.</p> <p>ASA surface soil polymer trials are being closely monitored and we can have a more informed decision on the best</p> |

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| | | <p>identified areas of concern from previous witnessed dust events</p> <p>The counter issue is the impact on existing vegetation, with likely high mortality for small germinants</p> | <p>necessary to allow vegetation establishment through spring.</p> <p>EPA, DEWNR and Site Contamination Auditor approval</p> | | <p>suppressants by mid-August.</p> <p>Further consultation on how much and where will be decided with the options assessment team when the suppressant trial results are realised.</p> |
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Stage 3: Continued monitoring and application of adaptive management strategies.

| Actions | Who | Timeframes | Inter-dependencies | Milestones/Deliverables | Status |
|---|----------------------|--|--|---|-------------------------|
| 1. Monitoring in accordance with the ASA Post-Completion Monitoring and Maintenance Plan | Flinders, Succession | Bi-monthly vegetation surveys | Nil | Monitoring reports | In progress and ongoing |
| 2. Visual and real-time dust monitoring in accordance with the Dust Management Plan and Fugitive Dust TARP | Flinders | Continuous | Nil | Monthly TSP/PM10 reporting to EPA. Notification of events | In progress and ongoing |
| 3. Update contingency plans | Flinders | In conjunction with Stage 2 implementation | Stage 2 implementation outcomes | Revised Dust Management Plan and Fugitive Dust TARP | Not yet commenced |
| 4. Consider SA Water WWTP irrigation implementation | Flinders, SA Water | Dependant on trial outcomes | Trial outcomes Commercial agreement EPA, DH | <u>SA Water – Port Augusta East Waste Water Treatment Plan</u> Assuming the trial is acceptable to regulators and the community, it is envisaged that the trial could commence in September/October 2018 pending commercial agreement and equipment availability | In progress |
| 5. Consider implementation of other watering/irrigation solutions | Flinders | Dependant on irrigation consultant's recommendation for potable water irrigation | Trial outcomes Dependant on timing of receipt of independent advice | TBA | Not yet commenced |

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Risk Assessment

A risk assessment for program delivery (addressing health, safety, environmental and social risks) at the site has previously been completed and was updated following the April 2018 risk workshop. Dependant on the final strategy chosen, the risk assessment will be updated and re-submitted to the EPA. The risk assessment will be significantly informed by the outcomes of the trials and the Tonkin Consulting Options Assessment.

Contingency Planning

Should the control plan not be successful in managing dust, the Options Assessment process has provided a range of potential additional control measures. Selected contingency measures will be considered and adopted where appropriate and in collaboration with the EPA. Monitoring of performance using visual observation, video observation and dust monitoring will be key to identifying those areas of site that require an additional or alternative approach (out of the options assessment process) compared to what has been adopted for that particular area.

Dust Management Plan

Should this proposal be accepted by the SA EPA, a variation will be made to the Dust Management Plan and Fugitive Dust Trigger Action and Response Plan, and the document re-issued for approval.

Community Engagement

Flinders Power acknowledges the strong community interest in the closure program and has been proactively engaging with the local community since the closure announcement in June 2015. Flinders management regularly meets with the Port Augusta City Council and provides a progress update report to stakeholders on a weekly basis. Project newsletters and factsheets are also circulated periodically and posted on the Flinders Power website.

Flinders has formed a Community Reference Group, consisting of interested residents, Port Augusta City Council, the local Member of Parliament, CentreCare, the EPA and others. The group meets every 6-8 weeks, allowing Flinders an opportunity provide project updates, and for the community members an opportunity to ask questions.

This contingency options assessment has been communicated transparently within the weekly progress reports, during site visits and at the Community Reference Group meetings throughout 2018.

- Flinders Power will discuss the existing community engagement methods with the EPA communication and engagement staff and consider the merits of any additional strategies to be adopted. . Flinders undertakes to implement additional beneficial engagement strategies as they are developed. An update to this section with be provided as community engagement strategies are completed.

Conclusion

Flinders Power is recommending the following options be implemented on the Ash Storage Area site as dust management contingency measures. There will be a range of options applied across the site as no one option will provide the desired outcomes of dust suppression and still provide a sustainable outcome for the long term, and there are varying degrees of dust lift-off risk across various parts of the site.

The strategies below will be delivered in a staged approach, or in combination with each other (where appropriate) which will be determined by the outcomes of the relevant trial plans and weather conditions. The contingency options analysis processes will be continually assessed and adapted as the strategies are implemented and the success of the outcomes understood to ensure the optimal outcome is achieved.

- Flinders will, and are currently in the process of, acquiring the recommended seed for a Barley/Rye corn planting regime across the ASA site following a suitable rain event. If there is not a suitable rain event prior to the end of August 2018, dry seeding will take place in areas accessible for truck watering of which these areas will be irrigated to promote growth. This will provide some plant growth in strips across the ASA to reduce wind velocity and provide some root stability and mulching. Another planting regime may be required in April 2019.
- Flinders is currently evaluating surface roughening across the ASA which can be conducted during the seeding process if the appropriate rain event occurs.
- Flinders will decide on a suitable dust suppressant – which will be ascertained out of the current suppressant trials by the end of August 2018 – and the application of the selected suppressant will commence before end of September 2018 across areas of high risk that are to be identified and agreed. There will be a contingency plan for reapplication of the approved suppressant and extra areas if and when identified during the occurrence of future wind events.
- The irrigation options – both SA Water effluent outfall and potable water options – will continue to be pursued and assessed for appropriateness to the required outcomes for the site by the end of September 2018.

The dust management contingency options in this paper reflect the optimal approach at this point in time. The management strategies and plans will continue to evolve as the success of adopted strategies is determined and the outcomes of trials and further investigations become available.

Reference List

De Araujo, A., Silveira, J., Almeida, T., Rocha, I., Morais, D. and Viegas, R. (2006) Salinity tolerance of halophyte *Atriplex nummularia* L. grown under increasing NaCl levels. *Revista Brasileira de Engenharia Agrícola e Ambiental*, v10, n4, p848-854

Mahmood, K. and Malik, K (1987) Salt tolerance studies on *Atriplex Rhagodioides* F. Muell. *Environmental and Experimental Botany*, V27, 1, pp119 – 125.

Appendix A Ash Storage Area Rehabilitation – Options Assessment (Tonkin Consulting, July 2018)

Appendix B ASA Surface Roughening Trial Plan (Flinders Power, July 2018)

Appendix C Barley/Rye Corn Cover Crop Trial (Tonkin Consulting, May 2018)

Sub-Appendix A: Barley AgFact (L.J.Cook (1987) Barley Growing. Department of Agriculture New South Wales AGFACTS)

Sub-Appendix B: Cereal Rye Grownote (GRDC (2018) Cereal Rye – Grow Notes. Grains Research & Development Corporation.

Sub- Appendix C Cover Crop Seeding Plan July 2018

Appendix D Soil Seedbank and Plant Root Growth Trial (Succession Ecology, April 2018)

Appendix E Post-Seeding Monitoring: April 2018 Assessment (Succession Ecology, May 2018)

Appendix F Ash Storage Area Soil Sampling – Proposal (Tonkin Consulting, June 2018)

Appendix G Soil Surface Polymer Trials (Succession Ecology, July 2018)

Appendix H ASA Sprinkler Germination Trial (Flinders Power, June 2018)