AUSTRALIAN RAIL TRACK CORPORATION LTD

August 2013

ENVIRONMENTAL IMPACT AUDIT REPORT – CONSTRUCTION

for the

SOUTHERN SYDNEY FREIGHT LINE

Prepared by:

ARTC

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ABBREVIATIONS

ASS	Acid Sulphate Soils
ASSMSP	Acid Sulphate Soils Management Sub Plan
BHMSP	Built Heritage Management Sub Plan
CBR	California Bearing Ratio
CEMP	Construction Environment Management Plan
CNVMSP	Construction Noise and Vibration Management Sub Plan
CoA	Conditions of Approval
dB(A)	Decibel
DEWHA	Department of Environment, Water, Heritage and the Arts (now DSEWPC)
DoP	Department of Planning (now DoPI)
DoPI	Department of Planning and Infrastructure (formerly DoP)
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities (formerly DEWHA)
EPA	Environment Protection Authority (formerly OEH)
EPL	Environment Protection Licence
ESCSP	Erosion and Sediment Control Sub Plan
LGA	Local Government Area
MFN	Metropolitan Freight Network
OEH	Office of Environment and Heritage (now EPA)
POEO Act	Protection of the Environment Operations Act 1997
SFMSP	Spoil and Fill Management Sub Plan
SoC	Statement of Commitments
SFL	Southern Freight Link (an alliance between ARTC and Leighton Contractors)
SSFL	Southern Sydney Freight Line
SWMSP	Soil and Water Management Sub Plan
TCA	Transport Construction Authority (formerly TIDC)
TCP	Traffic Control Plan
TfNSW	Transport for New South Wales (formerly TCA)
TMP	Traffic Management Plan
TMR	Traffic Management Report

TMSP Traffic Management Sub Plan

1 INTRODUCTION

1.1 PROJECT OVERVIEW

The Australian Rail Track Corporation (ARTC) is undertaking a program of works to improve the efficiency and cost-effectiveness of rail freight services along the North-South Rail Corridor between Melbourne, Sydney and Brisbane. A major bottleneck in the rail freight network has existed in southern Sydney, where freight trains shared existing rail lines with the Sydney metropolitan passenger services operated by RailCorp. During morning and afternoon peak periods, freight services are not permitted to run due to passenger priority. As a result, freight services cannot arrive or depart Sydney at the optimum times.

To alleviate this bottleneck, the ARTC constructed the Southern Sydney Freight Line (SSFL), which has involved building a 36 kilometre bi-directional, non-electrified, dedicated freight line from Macarthur to Sefton in south-western Sydney (**Figure 1**). The new SSFL track is located on the western side of RailCorp's Main South Line corridor extending from south of Macarthur through to Ingleburn Railway Station where it connects into an existing six kilometre freight passing loop (constructed in 1995) and continues north to Glenfield Railway Station. The new construction starts again north of Glenfield Railway Station. The SSFL crosses from the western to the eastern side of the corridor on an overpass (or flyover) just north of RailCorp's Glenfield Junction where the East Hills Line joins the Main South Line.

The SSFL continues on the eastern side of the rail corridor through Cabramatta and then on the southern side through to Sefton Park Junction. At the Sefton Park Junction the SSFL crosses in an underpass (or deep cutting) to enable connection with the existing Metropolitan Goods Line. The SSFL is located wholly within the RailCorp corridor adjacent to their passenger tracks.

To accommodate the SSFL, retaining walls and earthworks were constructed for a new formation. New rail bridges and road bridge extensions were constructed, as were upgrades at six railway stations and their surrounding precincts — Leumeah, Minto, Casula, Warwick Farm, Cabramatta and Sefton — as well as modifications to a number of pedestrian bridges and other supplementary works, such as erection of noise barriers.

The SSFL Project was subject to extensive environmental examination under the NSW Government's *Environmental Planning and Assessment Act 1979* (EP&A Act) and received Approval from the Minister for Planning to proceed on 21 December 2006, subject to 76 Conditions of Approval (CoA) and 104 Statement of Commitments (SoC) relating to its design, construction and operation.

The Director-General's approval for the Construction Environmental Management Plan (CEMP) was received on 27 November 2008, and construction commenced on 29 November 2008.

The 5 km section of SSFL track between the existing Metropolitan Goods Line and Leightonfield, referred to as the Sefton Park Junction to Leightonfield SSFL, became Operational on 24 June 2012, following final agreement between ARTC and RailCorp. A separate Pre-Operation Compliance Report, addressing the requirements of CoA 9, was approved by the Department of Planning and Infrastructure (DoPI) on 19 August 2011 as described in **Section 1.3.3**.

The SSFL Pre-Operation Compliance Report, addressing the operation of the entire 36km of the SSFL Project which became operational on 23 December 2012, was approved by DoPI on 9 January 2013: 20130109 Approval for OEMP, OAQMP and OHRMP.pdf

Construction of the SSFL was officially completed on 2 August 2013 (20130726 Letter SSFL end of construction.pdf).

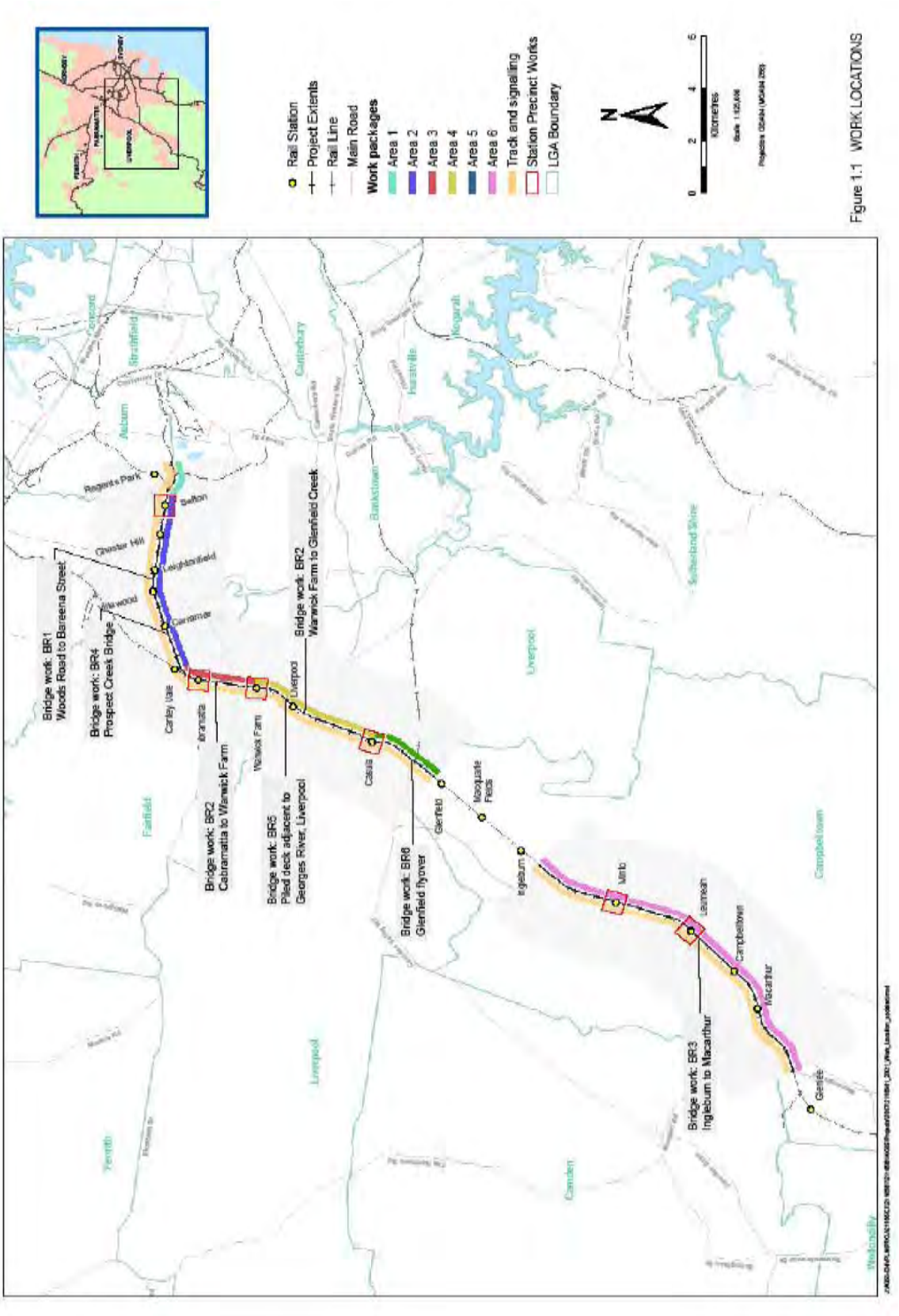

Figure 1 Location of Southern Sydney Freight Line

1.2 PURPOSE AND CONTENT OF THIS REPORT

This report addresses Condition 11 of the Minister's CoAs for the SSFL Project. CoA 11 states:

"*An Environmental Impact Audit Report - Construction must be prepared and submitted to the Director-General a maximum three months after Construction is complete (or at any other time interval agreed to by the Director-General). The Environmental Impact Audit Report – Construction must also be submitted to Relevant Government Departments upon the request of the Director-General. The Environmental Impact Audit Report – Construction must:*

(a) identify the major environmental controls used during Construction and assess their effectiveness (the assessment of effectiveness should be based on a comparison of actual impacts against performance criteria identified in the CEMP);

(b) identify any innovations in Construction methodology used to improve environmental management; and

(c) discuss the lessons learnt during Construction, including recommendations for future Projects.

The Environmental Impact Audit Report – Construction must be made Publicly Available."

In accordance with CoA 11, this report identifies the major environmental controls used during construction and assesses their effectiveness, identifies innovations used to improve environmental management, discusses lessons learnt during construction and makes recommendations for future projects.

This report draws on the extensive information documented in the *Environmental Controls and Monitoring* chapters in the eight construction compliance reports compiled for the SSFL Project and uses hyperlinks to reference documents.

The draft Environmental Impact Audit Report – Construction was provided to the EMR on 7 August 2013 for his review. The EMR provided his comments to ARTC on 13 August 2013, requesting a small number of improvements to the report. ARTC amended the report and submitted it to DoPI on 29 August 2013.

1.3 PROJECT STATUS

On 2 November 2009, ARTC announced that the program for delivery of the SSFL was being re-evaluated with a view to determining the most cost effective way forward (Media Release - SSFL 021109.pdf).

On 14 September 2010, ARTC announced that the SSFL Project was "back on track" (20100914 Southern Sydney Freight Line back on track.pdf).

The opportunity to re-evaluate the program for delivery came about due to three key issues that directly impacted on the original delivery program as described in **Section 1.3.1** below. The resulting changes to the program for delivery are outlined in **Section 1.3.2**. This has had an effect on ARTC's timetable for implementation of the compliance action improvements identified in the first Construction Compliance Report, as described in **Section 1.3.4**.

On 1 August 2011, ARTC announced that Leighton Contractors had been selected to deliver the final stage of the SSFL in an alliance agreement, titled the Southern Freight Link (SFL) (20110801 Media Release.pdf). This stage of the works is described in **Section 1.3.3**. The SFL commenced construction in December 2011.

1.3.1 Re-evaluating the Program for Delivery

There were three key issues that directly impacted on the original delivery program:

- It became apparent that the windows available to complete the signalling design and modifications to RailCorp's ATRICS signalling system did not match the SSFL project delivery schedule. This meant that signal changes could not be made until November 2010 or early 2011, with a resulting overall slowing of the SSFL project;

- It became necessary to redesign part of the route to minimise the environmental impacts associated with constructing the SSFL in the vicinity of the Glenfield Waste Disposal Facility;
- The requirement for more extensive relocation of services such as water, gas, electricity, etc along the rail corridor impacted on the estimates of the quantities of materials required for the project. The significant size of this major infrastructure project and the adjustments to its delivery required the recalibration of quantities for the final construction of the line.

1.3.2 Changes to the Program for Delivery

In re-evaluating the program for delivery of the SSFL, ARTC decided to proceed on the following basis. This approach was taken throughout the period November 2009 to September 2010:

- Complete all design work and obtain all approvals;
- Complete the design and construction of all services relocations;
- Complete without delay the delivery of "easy access" railway station upgrades at Minto and Cabramatta;
- Complete without delay the construction of Auburn Road Bridge, Chester Hill Road Bridge and Bareena Street Bridge;
- Continue with selected long lead item works or other works that impact on RailCorp or TCA, including Glenfield Flyover and Glenfield Junction;
- Complete other road upgrades and modifications to a point where they were "made safe" to alleviate any third party inconvenience. This would enable safe use and access of public areas, and address potential environmental impacts;
- Suspend construction on all other works until 2010.

Some work sites were decommissioned and placed on stand-by during this period, and were reactivated when work recommenced. Environmental controls remained in place and were regularly monitored and reported on throughout the SSFL Project area, including at all the decommissioned sites.

From September 2010 to end 2011:

- Complete remaining design work and obtain related approvals;
- Complete the design and construction of all services relocations;
- Complete the delivery of "easy access" railway station upgrades at Sefton, Cabramatta, Warwick Farm, Casula, Minto and Leumeah;
- Complete the first section of track between Leightonfield and Sefton, including the Sefton Dive underneath the Bankstown Line;
- Complete signalling to connect the SSFL to the existing network north and south of the project, and at Leightonfield;
- Continue with selected long lead item works or other works that impact on RailCorp or TCA, including Glenfield Flyover and Glenfield Junction;
- Complete other road upgrades and modifications, and commence construction of the Casula Access Road between Shepherd Street and the Casula Powerhouse Cultural Centre to a point where they were "made safe" to alleviate any third party inconvenience.

The works from September 2010 to end 2011 resulted in a clean and clear construction site, to enable completion of the remainder of the line between Leightonfield and Macarthur from December 2011 onwards as the Final Stage of works (**Section 1.3.3**).

Local communities, local Councils and government agencies were extensively consulted over the changed project timeframe and the changes to the program.

ARTC continued to work under its current approvals and licences. No changes or extensions were required.

1.3.3 Staged Delivery of the SSFL

On 23 May 2011, DoPI emailed ARTC that "Consistent with the advice the Department provided in its meeting with ARTC on 25 January 2011, and taking into account that the project is now being completed in stages, you are advised that in accordance with condition 6, a Staging Report for the operational requirements of the project is required to be approved by the Director-General".

The SSFL Project was made Operational in two stages:

- First Stage: The 5km section of SSFL track from Sefton Park Junction to Leightonfield, within the Bankstown City Council Local Government Area became Operational on 24 June 2012, accommodating down freight traffic. Up freight traffic continued to use RailCorp's suburban line. There was no increase in freight traffic during this First Stage of Operations.
- Final Stage: The bi-directional 36 km SSFL track from Sefton Park Junction to Macarthur became Operational on 23 December 2012.

ARTC prepared a Staging Report to address the requirements of CoA 6 of the Minister's CoAs for the SSFL Project: 20110606 Letter SSFL CoA6 Staging Report.pdf. ARTC submitted an amended Staging Report on 9 September 2011 to address issues raised by DoPI in its review of the initial report: SSFL Staging Report 3 June 2011 - FINAL.pdf. DoPI approved the final Staging Report on 17 October 2011: 20111017 Approval for Staging Report.pdf.

The Staging Report describes how the CoAs and SoCs were to be addressed on a Stage specific basis. Where a condition was not applicable or partly applicable, this was clearly justified.

The documentation required by the SSFL Planning Approval for Operation of the **First Stage** was submitted to DoPI in mid 2011. The Pre-Operation Compliance Report was submitted to DoPI on 10 June 2011 in accordance with CoA9, amended and resubmitted on 19 July 2011 and approved by DoPI on 19 August 2011.

The Operational Environmental Management Plan was submitted to DoPI on 10 June 2011 in accordance with CoA 14. The OEMP incorporated the Operation Noise and Vibration Management Plan (ONVMP), Operation Air Quality Management Plan (OAQMP) and the Operation Hazard and Risk Management Plan (OHRMP) for the First Stage.

DoPI approved the OHRMP on 8 July 2011, and the OEMP and OAQMP on 21 July 2011 subject to two requirements which were met.

The final ONVMP for the full 36 km SSFL was approved on 5 October 2011 pursuant to five requirements which were addressed by ARTC in the ONVMP at: (20111005 Condition 51_letter to ARTC re approval of ONVMP.pdf).

The documentation required by the SSFL Planning Approval for Operation of the **Final Stage** was submitted to DoPI in November 2012. The Operational Environmental Management Plan was submitted to DoPI on 20 November 2012 in accordance with CoA 14: 20121120 Letter SSFL CoA 14 OEMP.pdf . As required by CoA 14, the OEMP incorporated the Operational Air Quality Management Plan (OAQMP, CoA 76) and the Operational Hazards and Risk Management Plan (OHRMP, CoA 70) for the Final Stage. The Department responded on 17 December 2012 with comments on the OEMP, OAQMP and OHRMP: 20121217 DoPI Comments on OEMP.msg. ARTC addressed the Department's comments on 19 December 2012 (20121219 Ltr

to DoPI re OEMP.pdf) and submitted an updated OEMP and subplans: SSFL OEMP 2012 Main Report Final Ver2.pdf. The Department approved the OEMP, OAQMP and OHRMP on 9 January 2013: 20130109 Approval for OEMP, OAQMP and OHRMP.pdf.

The Pre-Operation Compliance Report was submitted to DoPI on 21 November 2012 in accordance with CoA9 (20121121 SSFL letter CoA 9 Pre-Operation Compliance Report.pdf). DoPI provided comments to ARTC on the Pre-Operation Compliance Report on 7 February 2013: SSFL: 20130207 SSFL (MP 05_0089) - CoA 9 - Pre-Operation Compliance Report - Department Comments.msg. ATRC amended the report and re-submitted it to DoPI on 28 March 2013: 20130328 SSFL letter CoA 9 Pre-Operation Compliance Report.pdf and SSFL Pre-Operation Compliance Report Dec 2012 Final _Update March 2013_.pdf

1.3.4 Environmental Compliance Improvements

ARTC's timetable for implementation of the compliance action improvements identified in the first Construction Compliance Report has been shaped by:

- The first Construction Compliance Report was submitted to the EMR on 23 September 2009, and reviewed by the EMR between 23 September and 20 November 2009. By mid-October ARTC had developed presentations for contractors on improvements required relating to collection and provision of information for the second Construction Compliance Report, ready for delivery following the EMR's review of the first Construction Compliance Report;

- Contractors were informed during October 2009 of the changes to program delivery, and partial suspension of work notices were issued on 21 October;

- Following the issuing of partial suspension of work notices, contractors were actively engaged in decommissioning sites and scaling back works. This continued until after the reporting period for the second Construction Compliance report which concluded on 29 November 2009. As a result, briefing sessions were not held with contractors during this compliance period, and not all the improvements to practices outlined in the first Construction Compliance report have been implemented;

- With the changes to the program for delivery commenced in September 2010, as described in **Section 1.3.2** above, ARTC developed a monthly environmental reporting checklist in collaboration with the contractor organisations: SSFL Monthly Enviro Reporting Checklist.PDF. The checklist provided a template against which each organisation could report each month. The reporting schedule:
    - Matched the existing ARTC and EPL reporting schedules;
    - Included additional information required for SSFL compliance reporting to DoPI.

  All requested information was clearly labelled with the relevant EPL clause, condition of approval, statement of commitment, or CEMP Sub Plan through which it is required. The introduction of the checklist and a monthly reporting schedule streamlined the reporting and compliance process. The first use of the new reporting was in January 2011;

- With the changes to the program for delivery commenced in September 2010, as described in **Section 1.3.2** above, ARTC developed a contamination checklist in collaboration with the contractor organisations: Contamination Incident Checklist.pdf. The checklist provided a template against which each organisation could report and recorded contamination incidents as per the Contamination Management Plan. The first use of the new reporting was in January 2011;

- As part of the project's commitment to continuous improvement, the format of reporting noise monitoring results was refined in the October 2010 EPL Report to provide a more comprehensive and meaningful summary of the results. The monthly EPL report detailed the predicted and measured noise levels, as well as the background noise levels and noise level above background (CoA 45);

- As part of the project's commitment to continuous improvement, the format of the EMR report was refined in February 2011 to clearly classify actions as *non-conformances*, *corrective actions* or *improvement opportunities*. This clarification allowed actions to be suitable prioritised, addressed and reported;
- Following comments provided by DoPI on the fifth Construction Compliance Report and as part of the project's commitment to continuous improvement, ARTC reviewed the timing of implementing corrective actions issued by the EMR (20120502 DoPI re 29 May to 29 Nov 2011 compliance report.pdf, 20120514 letter to DoPI re May-Nov 11 compliance report.pdf). Improvements to the process were included in the sixth and seventh compliance reports; and
- Following comments provided by DoPI on the sixth Construction Compliance Report, and as part of the project's commitment to continuous improvement, ARTC provided additional information on construction noise management for subsequent compliance reporting periods.

1.4 CONSTRUCTED WORKS

For the major works packages identified in the CEMP, **Table 1-1** outlines the final constructed works.

Table 1-1: Constructed Works

Activity	Works Package	Description
Sefton Dive	SD	Retaining walls completed Jan 10. Auburn Road Bridge Stage 2 completed Feb10. Sewer diversion ULX completed May 10. Aqueduct completed Jan 11. Underpinning at Cooper Rd Bridge completed Feb 11. Deflection wall completed Apr 11. Main excavation completed Jun 11. Track laying completed Jul 11. Auburn Road roundabout reinstatement completed Nov 11. Pump station commissioned Dec 11. Landscaping and road repairs in Bankstown Local Government Area completed Feb 12. Tie in pump station to Sydney Water sewer completed Jun 12. Restoration of Birrong school grounds. Final defect rectification works completed Jul 13.
Enabling Works	--	All service relocations including defect rectification works completed in Apr 13 – involving RailCorp signalling, RailCorp HV, Utility HV, Sydney Water and Gas relocations.
Earthworks and Retaining Walls	E&RW 1	Retaining walls between Woods Rd and Miller Rd completed May 11. Earthworks, shotcrete, rock nailing and drainage works completed during May 11. Track laying completed Jun 11. Landscaping undertaken in Oct and Nov 11. Minor defects between Enfield West and Leightonfield completed Apr 13. 4th Ave Footbridge completed Aug 12.

Activity	Works Package	Description
Earthworks and Retaining Walls	E&RW 2	Clearing works and earthworks/retaining walls completed. Cabramatta Road East Deflection Wallcompleted Jun 12. Liverpool civil embankment works around Liverpool Station commenced in Apr 11, and completed Mar 13. New stairs to Newbridge Rd commissioned Dec 11. Work to Casula Access Rd (North of Woodbrook Rd) Commenced May 11. Road opened to the public in Sep 12 to access the Powerhouse Museum. Final asphalt and line marking completed Dec 12. Landscaping and weed management works completed Mar 13.
	E&RW 3	Clearing works and earthworks/retaining walls completed. Casula Access Rd (South of Woodbrook Rd) opened to the public in Sep 12 to access the Powerhouse Museum. Final asphalt and line marking completed Dec 12. Glenfield Junction channel diversion and tie-in completed Feb 11. Retaining walls and fill to abutments to Glenfield Flyover completed mid 12. Work on the Northern, Southern and Glenfield Viaducts completed Nov 12. Landscaping and weed management works completed Mar 13.
	E&RW 4	Clearing works and earthworks/retaining walls completed. Minto Viaduct and Culverts completed Aug 12. Bow Bowing Ck diversion completed Jul 2012 Landscaping and weed management works completed Mar 13.
	Campbelltown Perway Siding	Bulk excavation completed Nov 11. Civil works completed May 12. Track and signalling works completed Jun/Jul 12. New Perway commissioned Jul 12.
Bridgeworks	BR 1	Hector Street Bridge completed Nov 09. Chester Hill Road Bridge completed Feb 10. Miller Road Bridge completed Sep 10. Bareena Street Bridge completed Jul 12. Woods Rd Bridge completed Jan 11. Hector Street intersection upgraded May 11.
	BR 2	All bridges substantially completed in 2009. Liverpool Yard Bridge replaced with a viaduct (see below).
	BR 3	Bunbury Curran Ck Bridge completed Nov 12. Minto Viaduct completed Nov 12. Bow Bowing Ck Bridge completed Apr 12.

Activity	Works Package	Description
Bridgeworks	BR 4	Prospect Creek bridge completed 09. Retaining walls and footpath approached completed Aug12. Additional screens were installed Mar 13 and additional lighting installed Aug 13.
	BR 5	BR5 bridge completed 09. Liverpool Hospital Bridges completed and handed over in 10.
	BR 6	Glenfield Flyover Bridge completed Nov 12.
	Liverpool Viaduct	Work to the Viaduct commenced in Aug 11. Piling completed Sep 11, main structural works completed Feb 12 and adjacent piled slab completed Jun 12.
Station Works	ST 1- Sefton, Carramar, Warwick Farm, Leightonfield, Casula	Sefton – new pedestrian bridge extension and lift shafts installed. Cladding and glazing to lift shafts completed. Family Accessible Toilet completed May 11. Throw screens completed Aug 11. Preliminary lift shafts commissioned Nov 11. Reinstate platform finishes around new lift shafts and surrounding areas completed Nov 11. All works completed Feb 12. Carramar – extension to pedestrian subway completed 09. Final works completed Mar 11. Warwick Farm – car park largely completed 09. Foundations for overbridge completed, footbridge and two lift structure lifted into position Aug 10. Third lift shaft installed Apr 11. New pedestrian bridge installed Jul 11. Preliminary commission of lift shafts Nov 11. All works completed Apr 12 and restoration to carpark completed Jun 13. Leightonfield – deflection wall completed 09. Casula – two pilecaps and lift shaft bases completed 09. Padmount substation installed in10. Third lift shaft piling completed and lift pit progressed following the completion of the temporary road works to the Casula Powerhouse Jun 11. Installation of third lift shaft and pedestrian bridge Oct 11. All works completed Mar 12.
	ST 2 - Cabramatta	Concourse with office, booking office and disabled amenities constructed with the lift and stairs completed in 2010 and commissioned Feb 11. Old ticket office demolished Mar 11. Decommissioned exiting platform access and supplied temporary access for public to platform Oct 11. Station and concourse works completed Feb 12.

Activity	Works Package	Description
Station Works	ST 3 – Minto, Leumeah, Campbelltown, Macarthur	Minto – Bus stop relocated, stair demolished 09, deflection wall completed, stairs and footbridge deck installed and bases for all lifts completed in 10. Third lift shaft lifted into position in 11. Commissioning of lift shafts Oct 11. All lifts, pedestrian walkways and stairs were completed May 12. Leumeah – Overbridge foundations and lift shaft progressed in 09. Works suspended until Aug 10. Car park works completed May 11. Precast lift shaft installed Aug 11. Car park extension completed Aug 11. Pedestrian bridge installed Nov 11. Lifts, pedestrian footbridge and stairs completed Mar 12. Overall completion Jun 12. Campbelltown – Staff footbridge completed in 2010 except for lighting, CCTV and handrail installation. These works are dependent on earthing and bonding (by others). Deflection wall for pedestrian footbridge commenced Jul 11. Final strengthening and column removal works to the pedestrian footbridge completed May 12. Macarthur – Deflection wall completed 09.
Track Construction	TC1	Installed 356 A&B crossover at Sefton Jul 09. Installed Turnout 198 and catchpoints at Sefton Junction Aug 09. Installed 65A&B points and 66A turnout at Glenlee Jan 10. Removed 48 points at Glenfield Jan 11. Installed Sefton Bi-Directional track Apr 11. Removed Metropolitan Down Goods Line between 21km and Sefton Junction Apr 11. Completed reconstruction of 450m of the Leightonfield Refuge Loop connecting into 223 pts Apr 11. Reconstructed 70m shunt neck into Leightonfield No1 siding onto new alignment Apr 11. Completed reconstruction of a further 720m of the Leightonfield refuge loop Oct 11. Completed maintenance works to Leightonfield No1 siding including the replacement of 220pts Oct 11. All SSFL track installed from 356 A&B crossover, Sefton to the connection into Leightonfield No.1 siding, including installation of 62a and b points near Miller Road, Villawood. Completed Aug 11. Removed crossover 62 A&B and turnout 61 A&B at Ingleburn Jul 12. Campbelltown Perway Siding commissioned Jul 12. Commissioned 65B catchpoints at Glenlee Aug 12. Casula Level Crossing decommissioned Oct 12. Removed crossover 223 A&B and turnout 223 A&B at Leightonfield Yard Oct 12.

Activity	Works Package	Description
Track Construction	TC1	All SSFL track from 223 A&B crossover at Leightonfield Yard to 65B points at Glenlee installed by 9 Nov 12, including: • Approximately 26km of plain line track; • New turnout southern side of Glenfield loop; • Loop across Glenfield flyover; • New turnout northern side of Glenfield loop. Highi-rail pads at 4th Avenue Carramar, and Atkinson St Liverpool installed Oct 12. Completed maintenance tamping on SSFL Stage 1 Oct 12 (Leightonfield Yard to Enfield West). Completed tamping to line and level and final adjustments on Villawood to Glenlee 30 Nov 12.
Signalling and Communication	SC 1	Commissioned Glenlee/Macarthur interlocking and transfer of Glenlee control to Junee Nov 10. Metropolitan Freight Network (MFN) take-up for Sefton Park Junction Jan 11. Completed construction works for Sefton/Sefton Park Junction bidirectional Apr 11. Decommissioning of Wellington Road Level Crossing, and associated commissioning of Sefton Triangle Bridge May 11. Commissioned Enfield West to Leightonfield Jul 11. Full operations commenced 24 Jun 12. Commissioning of Leightonfield yard including disconnection from RailCorp Oct 12. Construction and commissioning of Campbelltown Level Crossing for Line Speed Testing 2 Dec 12. Construction of signalling infrastructure for final stage Leightonfield to Glenlee Dec 12.
Other	Noise Walls - GW2	Noise walls in Bankstown City Council area completed during May 11. Painting completed during Aug 11. Noise walls in Fairfield, Liverpool and Campbelltown City Council areas commenced Apr 12 and completed Jan 13, Nov 12 and Dec 12 respectively. Noise attenuation in all buildings completed in Jul 13.
	Liverpool Section Hut	Building completed and commissioned early 10. Commissioning of new Liverpool Compressor Hut Jun 12.
	Cabramatta Station – Sewer Diversion	Sydney Water sewer diversion completed Aug 2011. Final cutover Jan 12.

Activity	Works Package	Description
	Campbelltown Yard	Campbelltown Yard, walkway, lighting, services works and car park works were completed Dec 12. Four new prefabricated personnel buildings were delivered to site in May 12, and fitout completed Jun12. Enabling works completed Jun 12.

1.5 DISTRIBUTION AND APPROVAL

As required by CoA11, this report is to be submitted to the Director-General, with copies also provided to the following relevant government agencies:

- Environment Protection Authority (formerly the Office of Environment and Heritage);
- Department of Primary Industries (formerly the Department of Industry and Investment – incorporating the Office of Water);
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPC).

After review and approval by DoPI, this report will be made available to the public via the project website: http://www.ssfl.artc.com.au/.

2 ENVIRONMENTAL CONTROLS, EFFECTIVENESS, INNOVATIONS AND LESSONS LEARNT

2.1 INTRODUCTION

Information in this chapter addresses the following parts from CoA 11 for each of the key areas of environmental compliance:

(a) identify the major environmental controls used during Construction and assess their effectiveness (the assessment of effectiveness should be based on a comparison of actual impacts against performance criteria identified in the CEMP);

(b) identify any innovations in Construction methodology used to improve environmental management; and

(c) discuss the lessons learnt during Construction, including recommendations for future Projects.

Information is presented in the order in which the area of environmental compliance occurs in the main sections of the Project Approval:

- Noise and Vibration
- Traffic
- Flora and Fauna
- Erosion and Sediment Control
- Spoil and Fill
- Acid Sulphate Soils
- Surface Water and Groundwater
- Air Quality
- Greenhouse Gases and Sustainable Energy
- Hazard and Risk
- Built and Indigenous Heritage
- Waste Management and Recycling.

For each area of environmental compliance, information is presented on:

- Environmental Controls;
- Effectiveness of Controls. This assessment of effectiveness is based on comparing construction impacts against performance criteria or predictions identified in the CEMP;
- Innovations to Improve Environmental Management;
- Lessons Learnt During Construction. The recommendations arising from the lessons learnt for future projects are also summarised in Chapter 3.

2.1.1 Summary of Environmental Monitoring

The requirements for regular monitoring and reporting to be undertaken as described in the CEMP and Sub Plans include:

- Noise and Vibration
    - Monthly noise and vibration reports to the EMR
    - Noise and vibration information in monthly EPL reports to the EPA
- Traffic
    - Inspections of damage to local roads and reporting to the EMR

    - Daily record of site entries and exits
- Flora and Fauna
    - Monthly report to the EMR on the health of *Acacia Pubescens*
    - Monitoring of flying foxes by an ecologist
- Erosion and Sediment Control
    - Regular (daily to weekly) checking of erosion and sediment controls. These results are to be reported in the compliance report
    - Monthly site audit/monitoring reports by an independent geotechnical engineer
- Spoil and Fill
    - Regular (daily to weekly) checking stockpiles/fill storage locations, dust management, complaints and responses, etc. These results are to be reported in the compliance report
    - Monthly site audit/monitoring reports by an independent geotechnical engineer
- Acid Sulphate Soils
    - Fortnightly monitoring reports by contractor(s) when working in a potential Acid Sulphate Soils area
- Surface Water and Groundwater
    - Quarterly groundwater reports to the EMR. If pollution is found, immediate reporting to EMR
- Air Quality
    - Monthly weather monitoring reports to the EMR
    - Monthly dust monitoring reports to the EMR
- Greenhouse Gases and Sustainable Energy
    - Six-monthly energy audits of the project
    - Reporting in the pre-construction and construction compliance reports
- Hazard & Risk
    - Atmosphere monitoring in excavations
- Built and Indigenous Heritage
    - Reporting historical relics and Aboriginal objects if discovered
- Waste Management and Recycling
    - Environment Manager to complete the waste register weekly
    - Monthly inspections of waste facilities and storage compounds
    - Quarterly audit of waste management procedures to ensure that the plan is being adhered to.

As described in the six-monthly Construction Compliance Reports, the EMR and an ARTC representative undertook weekly inspections of sections of the 36km length of the SSFL project. Following each inspection, the relevant Contractors were provided with a report from the EMR detailing required improvement actions; an example of this report is provided in: SFL Area 3 120822.pdf.

The required actions are classified as either a *non-conformance*, a *corrective action* or an *improvement opportunity*:

- A *non-conformance* was raised by the EMR in situations that did not conform to the CEMP and presented environmental risk. A non-conformance may also have been raised if previous corrective actions were not suitably addressed.
- A *corrective action* was issued by the EMR in situations where there was a failure or breakdown in controls associated with a moderate environmental risk. Corrective actions were also issued for minor items that had not been addressed in a suitable timeframe.

- An *improvement opportunity* was issued by the EMR in circumstances associated with a low environmental risk where controls were in place, but management practices could be improved.

ARTC is committed to ongoing environmental compliance improvement, and maintained a comprehensive schedule of site visits. The schedule tracked contractors timely responses to the EMR reports, to ensure all actions were addressed and closed out in an acceptable time frame and manner. The contractor responses were also used by ARTC to ensure the timely and appropriate close out of any non-conformances raised by the EMR.

ARTC also elected to issue contractual non-conformances to contractors. In these circumstances, the close out of the non-conformance was tracked by both the contractors' response to the EMR report and a Non-Conformance Investigation Report.

2.1.2 Innovations to Improve Environmental Management

As well as innovations to improve the management of specific areas of environmental compliance as described in Sections 2.2.3 to 2.13.3, an over-arching innovation was to elevate environmental management to the status similar to that of safety in the Project culture. This meant that everyone on the Project, from Project Director to labourer, was responsible for environmental management, not just the Environment Team. The inclusion of environmental management as part of Project culture was achieved by implementing measures including:

- Senior management promoting the importance of environmental management and the individual accountability of staff and contractors;
- An extensive induction program for all the Project workforce on environmental management and individual's responsibility;
- A properly resourced Environment Team, tasked with education and awareness raising, as well as regulatory monitoring and reporting;
- Regular meetings between the Project Environment Team, contractors' Environmental Managers and the EMR to review progress and reinforce a Project-wide approach to environmental management;
- Environmental management KPIs for the Project, its alliances and contractors;
- Reporting of environmental management issues at the Project's weekly Leadership Team meeting, in monthly reports to ARTC and the EPA, six monthly Construction Compliance reports to DoPI and annual reports to the EPA;
- Development and implementation of a monthly environmental reporting checklist in collaboration with the contractor organisations, as described in **Section 1.3.4**. All requested information was clearly labelled with the relevant EPL clause, condition of approval, statement of commitment, or CEMP Sub Plan through which it is required. The checklist provided a template against which each organisation could report each month. The introduction of the checklist and a monthly reporting schedule streamlined the reporting and compliance process. The reporting schedule matched the existing ARTC and EPL reporting schedules, and included additional information required for SSFL compliance reporting to DoPI;
- The format of the EMR report was refined to clearly classify actions as *non-conformances*, *corrective actions* or *improvement opportunities*. This clarification allowed actions to be suitable prioritised, addressed and reported;
- The timing for implementing corrective actions issued by the EMR was tightened, with follow up reporting generally within one week.

2.1.3 Lessons Learnt During Construction

The elevation of environmental management to the status similar to that of safety in the Project culture, making everyone responsible for environmental management, contributed to the relatively small number of environmental complaints for a project of this scale in a highly urbanised area of Sydney.

Development and implementation of a streamlined monthly environmental reporting checklist and schedule meant that information was collected once by contractor organisations and the Project, and used for multiple reports in a timely manner. This resulted in a streamlined reporting and compliance process for this large Project.

Clarifying the format of the EMR report to clearly classify actions as *non-conformances*, *corrective actions* or *improvement opportunities* resulted in actions being suitably prioritised, addressed and reported in a timely manner.

As noted for a number of specific areas of environmental compliance described in Sections 1.3.4 and 2.2.4 to 2.13.4, it is essential for effective compliance management to maintain up-to-date registers of environmental-related documentation, including monitoring data for noise, spoil and fill, etc, and EMR reports and close outs.

2.2 NOISE AND VIBRATION

2.2.1 Environmental Controls

During the project, noise and vibration controls and monitoring were conducted as required by CoA 41. The monitoring program included conducting environmental noise and vibration monitoring within one week after commencement of each new stage of the construction works and monthly thereafter.

Noise and vibration mitigation measures adopted on the project are described in the Construction Noise and Vibration Management Sub Plan (CNVMSP, SSFL Construction Noise & Vibration 20090115.pdf), and are summarised below in **Table 2-1**.

Training and establishment of strict working hours were used to control noise impacts of construction activities (**Figure 2**). Site personnel were toolboxed on the importance of noise reduction during works (**Figure 3**).

Table 2-1: Noise and Vibration Mitigation Measures

Item	Description
Construction Hours	Works were carried out within standard Construction Hours (as defined in CoA 43), unless the works were covered by CoA 43 and 44.
Public Address Systems	Systems were designed and installed with their pointing axis directed away from residential buildings and sensitive receptors. Use was not permitted outside Construction Hours.
Deliveries	Deliveries were carried out generally within standard Construction Hours. Loading and unloading were carried out as far as possible away from sensitive receivers.
Equipment Noise	All equipment was adequately maintained and kept in good working order. All equipment was operated in an appropriate and efficient manner.
Truck Noise (off site)	Trucks were not allowed to queue up outside residential areas prior to 7.00 am start time. Trucking routes used main roads where feasible in accordance with the project TMP.
Clustering	Clustering of equipment within fleets was minimised wherever practical.
Site layout and Site Access	Where possible, plant was located / orientated to direct noise away from sensitive receivers.
Reversing Alarms	Mobile plant and trucks operating on site for a significant portion of the project had reversing alarm noise emissions minimised in-so-far-as possible, recognising the need to maintain occupational safety. A program of converting reversing *beepers* to *quackers,* reducing the impact of reversing alarms was completed. Where possible, drive-on / drive-off arrangements for trucks were provided, eliminating the need for reversing alarms to be used.
Noise Monitoring	Noise monitoring was carried out during critical stages of construction at nearest affected residences, in accordance with the CNVMSP.
Vibration Monitoring	Vibration monitoring was carried out where vibration intensive activities were being undertaken to ensure works were conducted in accordance with CoA 46.
Community Liaison	A program of community liaison and complaint response was implemented, to ensure complaints were addressed and responded to in a timely manner. Noise respite measures for residents subjected to lengthy periods of noise or vibration included pre-purchased movie tickets or similar and alternative accommodation as required.
L/pool Hosp	Where practical, vibration producing machinery was avoided and alternatives used.
Training	Site induction training included a noise awareness component.

Contractors maintained checklists of noise and vibration controls and mitigation measures at their sites, including:

- Southern Freight Link Alliance (SFL): 2013 01 January Inspection sheet.pdf;
- 3ARail (formerly Arenco): 3ARail OHS&E Checklist 20120613.pdf (refer to Section 30);
- Stations First (formerly Gartner Rose): Stations First Campbelltown Audit Sep 2012.pdf (refer to Section R);
- Abigroup: Abigroup Environmental Inspection Checklist 120604.pdf; and
- Invensys: Invensys Enviro Inspection 26092012.pdf.

The EMR's inspection reporting included a check on noise and vibration issues in order to highlight any areas of non-compliance with the CEMP or Sub Plans.

Strict work hours were implemented throughout the project in accordance with CoA 43. These hours are provided below in **Table 2-2.**

Table 2-2: Approved Project Working Hours

Day of the Week	Work Hours
Monday-Friday	7 am to 6 pm
Saturday	8 am to 1 pm
Sunday and public holiday	No work undertaken

2.2.2 Effectiveness of Controls

Noise

As described in the six-monthly Construction Compliance Reports (SSFL 6 Month Construction Report August 2009 Final.pdf, SSFL 6 Month Construction Report January 2010_Final.pdf, SSFL 12 Month Construction Report January 2011 - Final.pdf, SSFL 6 Month Construction Report July 2011 - Final.pdf, SSFL 6 Month Construction Report Dec 2011 - Final.pdf, SSFL 6 Month Construction Report June 2012 - Final.pdf, SSFL 6 Month Construction Report Dec 2012 - Final.pdf), SSFL Final Construction Report August 2013 - Final Ver.pdf , the monthly periodic construction noise monitoring showed that noise levels for a number of activities exceeded the background noise level by more than 5 dB(A) and in accordance with the EPA New South Wales Construction Noise Guideline, all feasible and reasonable measures were implemented to reduce this L_{A10}. The monthly periodic construction noise reports were used to gain an understanding of the impact of project works on the ambient noise levels.

The number of noise monitoring results exceeding the noise goal for the project are summarised in **Table 2-3**. This table also details the number of noise monitoring results that exceeded the predicted noise levels.

Table 2-3: Noise Monitoring Outcomes

Monitoring period	Noise monitoring results	Results > 5dB(A) above background noise levels		Results exceeding predicted noise levels		Complaints
	(number)	(number)	(%)	(number)	(%)	(number)
29 Nov 08 – 29 May 09	50	44	88%	n/a	n/a	14
29 May 09 – 29 Nov 09	64	49	77%	n/a	n/a	12
29 Nov 09 – 29 Nov 10	120	79	66%	n/a	n/a	2
29 Nov10 – 29 May 11	153	101	66%	21	14%	2
29 May 11 – 29 Nov 11	114	94	82%	37	32%	3
29 Nov11 – 29 May 12	204	138	68%	61	30%	3
29 May 12 – 29 Nov 12	165	125	76%	37	22%	3
29 Nov12 – 2 Aug 13	27	25	93%	12	44%	1

Noise monitoring was undertaken for all out of hours works as per Condition M4 of the EPL (130222 SSFL EPL 12971.pdf). Residents assessed as exposed to "highly intrusive" noise levels (per the TCA - Construction Noise Strategy (Rail Projects) Oct 2010.pdf) were offered respite, in the form of movie tickets or alternative accommodation.

It should be noted that although 66% - 93% of the noise monitoring results in **Table 2-3** were above background noise levels stated in the CNVIS, often the construction noise was inaudible to the human ear during monitoring. This shows that there were changes to background levels from the original CNVIS and if the project were to continue for an extended period of time, a recommendation would have been made to remodel the background noise.

ARTC's contractors undertook all reasonable and feasible mitigation measures to minimise construction noise, and adopted measures outlined in Section O6 of the EPL and in accordance with the recommendations contained within the Construction Noise & Vibration Impact Statements prepared for the SSFL Project.

Noise mitigation measures included, but were not limited to: the selection of quietest plant; maintaining plant to minimise noise; switching off idle plant; locating noisy plant the maximum distance from residents; orienting equipment away from residences; placing hoardings around plant such as generators and pumps (**Figure 4**); loading and unloading of materials and deliveries as far as practical from sensitive receivers; avoiding the simultaneous operation of two or more noisy plant; scheduling works to reduce the cumulative impacts to receivers; scheduling respite periods; and briefing personnel on the sensitivity of working out of hours. Furthermore, in the case of out of hours works where noise impacts on residents were a concern, extra resources were utilised where possible to maximise productivity and reduce the need for night time works. These and other measures are listed in **Table 2-1**.

ARTC adopted the Transport Construction Authority (TCA), now Transport for New South Wales (TfNSW), Construction Noise Strategy (Rail Projects) 2010 (TCA - Construction Noise Strategy (Rail Projects) Oct 2010.pdf). ARTC provided additional mitigation measures for 'noticeable', 'clearly audible', 'moderately intrusive' and 'highly intrusive' noise levels in accordance with the strategy. Details of mitigation measures applied in cases where the noise level of construction activities exceeded the background noise level (noise goal) by more than 5 dB(A) are listed in the construction compliance reports.

The number of noise complaints received in each compliance reporting period are listed in **Table 2-3**, and ranged from 1-14. All noise complaints were addressed as per condition M3.4 of the Project's EPL (130222 SSFL EPL 12971.pdf).

Vibration

Some construction activities required the use of vibration monitoring, which was undertaken in accordance with EPL condition M4. Vibration monitoring was undertaken in areas considered high risk to vibratory works, the results of which are detailed in the six-monthly Construction Compliance Reports (SSFL 6 Month Construction Report August 2009 Final.pdf, SSFL 6 Month Construction Report January 2010_Final.pdf, SSFL 12 Month Construction Report January 2011 - Final.pdf, SSFL 6 Month Construction Report July 2011 - Final.pdf, SSFL 6 Month Construction Report Dec 2011 - Final.pdf, SSFL 6 Month Construction Report June 2012 - Final.pdf, SSFL 6 Month Construction Report Dec 2012 - Final.pdf, SSFL Final Construction Report August 2013 - Final Ver.pdf).

The number of vibration monitoring results exceeding the criteria for human comfort and structural damage in each compliance period are detailed in **Table 2-4**. Human comfort has been assessed using the Office of Environment and Heritage (OEH) publication 'Assessing Vibration: A Technical Guideline' which is based on BS 6472 Standard. Structural Damage criteria has been assessed in accordance with the German Standard 'DIN 4150-3 Structural Vibration Part 3: Effects of Vibration on Structures'.

Table 2-4: Vibration Monitoring Outcomes

Monitoring period	Vibration results monitoring		Results > human comfort criteria		Results > structural damage criteria		Complaints
	Human comfort (total number)	Structural damage (total number)	(number)	(%)	(number)	(%)	(number)
29 Nov 08 – 29 May 09	6	6	2	33%	0	0%	0
29 May 09 – 29 Nov 09	10	12	0	0%	0	0%	6
29 Nov 09 – 29 Nov 10	16	16	0	0%	0	0%	2
29 Nov10 – 29 May 11	2	2	0	0%	0	0%	2
29 May 11 – 29 Nov 11	16	17	0	0%	0	0%	0
29 Nov11 – 29 May 12	7	8	1	14%	1	13%	1
29 May 12 – 29 Nov 12	450	474	35	8%	0	0%	0
29 Nov12 – 2 Aug 13	0	0	0	0%	0	0%	0

Although a small percentage of the monitoring values exceeded the criteria for human comfort, the SSFL Project had a number of mitigation measures in place to manage and minimise these exceedances. These mitigation measures included minimising the time spent in one area undertaking vibratory works, using multiple rolling techniques to avoid the use of vibratory rolling and spreading out the work site to reduce the intensity of the works in any one location.

2.2.3 Innovations to Improve Environmental Management

As the Project progressed and increased in scope, in order to remove the risk of crossover of noisy works times between the operations of different subcontractors, standard hours for noisy works were implemented across the Project.

Stickers were produced and placed on the control panels of all site plant and equipment showing allowable hours for noisy work and reminding staff of the required respite time periods (see **Figure 2** below).

As noted is **Section 1.3.4**, the format of reporting noise monitoring results was refined to provide a more comprehensive and meaningful summary of the results, including the predicted and measured noise levels, as well as the background noise levels, noise level above background (CoA 45), and additional information on construction noise management.

2.2.4 Lessons Learnt During Construction

The improved reporting format of noise monitoring results provided the basis for improved noise and vibration management as the Project progressed. Improved reporting also provided the support for ARTC's application to the EPA for amendments to the EPL, to better streamline its operation.

The EPL was updated in late 2011 to allow a noisy works management regime (number of work hours versus respite periods), which resulted in an additional hour of work available every day.

Changes to the EPL were also approved and implemented to enable the Project to self-approve out-of-hours works. This resulted in a more efficient approval process for the Project, as Project staff did not have to operate within a rigid 28 day approval period for submissions to the EPA.

The SFL undertook background noise monitoring and modelling at Glenfield and Warwick Farm in November 2011. The results of this noise modelling showed a discrepancy between expected versus actual background noise levels (before the addition of noise due to construction work). It is concluded that it would therefore be prudent for those construction projects extending over a long period, to remodel and update background noise levels on a regular basis. This could be done every two years to ensure that the data being used in noise models is representative of the actual background noise levels in the project area.

The measures implemented for the Project worked effectively and could be implemented on future projects.

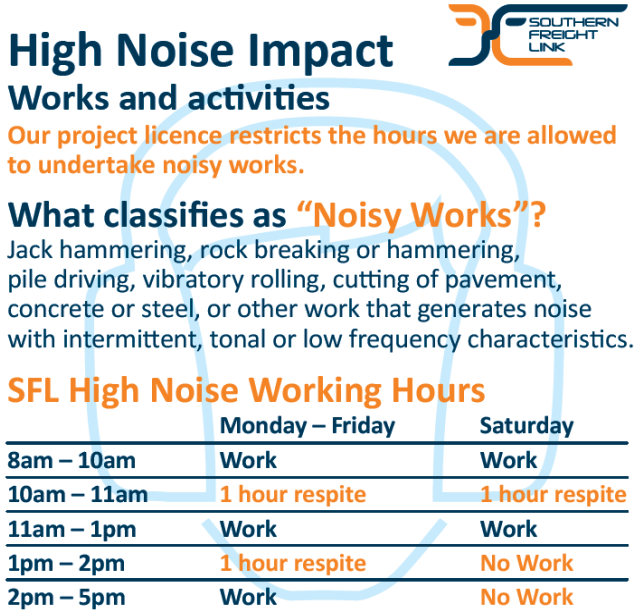

Figure 2: High Noise Impact Sticker

Figure 3: Weekly Toolbox Talk

Figure 4: Hoarding Around Large Generator

2.3 TRAFFIC

2.3.1 Environmental Controls

During the SSFL Project, traffic controls and monitoring were conducted as required by CoAs 55, 56 and 57, and SoCs 69 to 74. The Traffic Management Sub Plan (TMSP) was prepared by Connell Wagner and Parade Consulting as part of the CEMP: SSFL Traffic Management Sub Plan 090219.pdf. It includes:

(a) Traffic Management Reports (TMRs) which were prepared and submitted to the four local Councils (Liverpool, Bankstown, Fairfield, Campbelltown) in February 2009. The TMRs summarised for each LGA the Traffic Management Plans (TMPs) and associated Traffic Control Plans (TCPs) as they became available. SoC 70 outlines the requirements of the TMRs:

- Liverpool: TMR_Liverpool_090203.pdf.
- Bankstown: TMR_Bankstown_090203.pdf.
- Fairfield: TMR_Fairfield_090203.pdf.
- Campbelltown: TMR_Campbelltown_090203.pdf.

(b) TMPs which are located in Section 4 of the TMSP: SSFL Traffic Management Sub Plan 090219.pdf. CoAs 56-59 and SoCs 69 and 85 outline the requirements of the TMPs.

(c) Traffic Control Plans (TCPs) which were prepared on a site specific basis by the Contractors. SoC 74 outlines the requirements of the TCPs. Examples include TCPs by SFL for for Broomfield St, Cabramatta (TCP1025b1 Broomfield Street.PDF) and by Laing O'Rourke for Fraser Rd, Canley Vale (TCP 1013b Fraser Rd.pdf).

2.3.2 Effectiveness of Controls

Road dilapidation reports were prepared for all roads likely to be used by construction traffic. Reports were prepared before Construction commenced and were prepared again after the completion of construction. Table 5-2 of the Traffic Management Sub Plan (SSFL Traffic Management Sub Plan 090219.pdf) states ARTC's commitment to undertake the dilapidation reports, and Appendix D of the TMSP has a list of all roads surveyed for dilapidation.

Examples of the road dilapidation reports are provided for Bareena Street (Bareena St.pdf) and Bathurst Street (Bathurst St.pdf).

Copies of the road dilapidation reports specific to each local government area for all local roads were forwarded to each of the local Councils by mail. Any damage resulting from construction, except that resulting from normal wear and tear, has been repaired at ARTC's cost. Alternatively ARTC negotiated an alternative arrangement for road damage with Bankstown and Liverpool City Councils.

ARTC had no role in the development and approval of TCPs as these were between contractors and Councils. As described in SoC74 of the Construction Compliance Reports, a total of 235 TCPs were prepared for the SSFL Project since November 2009 when records were collected and reported.

The performance criteria for traffic are contained in the Traffic Management Sub Plan and included:

- Ensured safety for all road users, particularly the more vulnerable users (pedestrians and cyclists), was not reduced. Where existing access was likely to be disrupted by construction traffic, measures were put in place to provide reasonable alternative access (with a focus on safety and convenience);
- Minimised half- (or full)-road closures during peak periods or school holidays, where practicable;
- Avoided detouring bus routes off their regular routes unless necessary full-road closures mean that a regular bus route cannot operate. Where detours of bus routes were required, detours were kept to a

minimum with regard to distance detoured, number of missed stops, and duration the detour was required (peak periods were avoided where possible);

- Where half-road closures were required, minimised delays to all road users, in particular emergency vehicles and buses. Where half-road closures could result in long delays, at times it was appropriate to detour general traffic to alternative routes and allow only emergency vehicles and buses to use the half-road direct route;
- Where full-road closures were required, avoided detouring traffic past sensitive land uses such as schools and town/ village centres, where practicable;
- Heavy vehicles were not detoured onto local roads, but were directed onto alternative regional roads;
- Ensured routes for construction traffic (heavy vehicles in particular) to and from work sites avoided streets with sensitive land uses, where practicable;
- Required that TCPs were prepared by a Traffic Engineer of the earthworks or construction contractor for all road and/or bridge work sites, prior to commencement of earthworks or construction work. TCPs were prepared in accordance with the latest RTA Traffic Control at Worksites manual and AS1742.3;
- Engaged in consultation with Bankstown, Liverpool, Fairfield and Campbelltown City Councils in order to schedule any half or full road closures or any other works affecting trafficable areas in such a manner as to minimise disruption to the local road, pedestrian and cycle network.

ARTC's performance against these criteria was through the operation of the TMPs, and with its contractors through the consideration of the criteria in the development and approval of TCPs with Local Councils and the satisfactory implementation of the approved TCPs.

Contractors maintained traffic management checklists including:

- SFL: 12.12.10 Weekly Activities Checklist.pdf;
- 3ARail: 3ARail OHS&E Checklist 20120613.pdf (formerly Arenco): (refer to Section 20);
- Invensys: Invensys Enviro Inspection 26092012.pdf;
- Stations First (formerly Gartner Rose): Stations First Campbelltown Audit Sep 2012.pdf (refer to Section L).

The EMR assessed traffic controls as part of the weekly site inspection (SFL 130304.pdf) and ARTC provided verbal updates to the EMR on traffic management.

Contractors also maintained records of heavy vehicle site entries and exits in materials tracking registers. Examples of the materials tracking registers maintained by SFL and Ford Civil are provided: Materials Movement Register.xlsx and Ford Civil Material Tracking June 2012.pdf.

2.3.3 Innovations to Improve Environmental Management

The SFL consolidated communication between the Project and each Local Council to one point of contact, ensuring that one person was responsible for information transfer and minimising the potential for agreements and legacy items to become lost in layers of management. This was particularly important for the SSFL Project which was carried out over an extended period between 2008 and 2013, and saw many staff changes on both Project and Council teams.

2.3.4 Lessons Learnt During Construction

It is important to ensure that dilapidation surveys carried out prior to the start of construction are comprehensive in extent, with photographic evidence supporting a well written report. This is to enable unambiguous comparison when reviewing the final state of roads following the completion of construction, being able to assess what is fair wear and tear, and being able to assess when areas have been returned in a reasonable state.

Early liaison and agreement with road authorities, including the RMS and Local Councils is necessary to ensure there is an agreed baseline for comparison at the end of the Project.

Clearly identify areas requiring dilapidation surveys prior to the start of work that have the potential to be high profile areas for stakeholders, for comparison at the end of the project.

The measures implemented for the Project worked effectively and could be implemented on future projects.

2.4 FLORA AND FAUNA

2.4.1 Environmental Controls

During the SSFL Project, flora and fauna controls and monitoring were conducted as required by CoA 60, and SoCs 26 to 28. Controls are contained in the Biodiversity Management Sub Plan (BMSP): SSFL Biodiversity Plan 20090602.pdf.

As required by SoC 26, Section 1.3.1 of the BMSP included a description of the *Acacia Pubescens* survey undertaken in each work. Figures 1-3a, 1-3b and 1-3c of the BMSP show the identified locations of *Acacia Pubescens* in relation to the activity. Appendix C of the CEMP included constraints maps for the Project area, which include the locations of the *Acacia Pubescens* populations. Constraints Map 2 is an example of the constraints maps: 2116666D_4002_Constraints_Mapping2.pdf.

The BMSP included information on the survey undertaken for the Green and Golden Bell Frog between Chester Hill and Villawood Railway Stations, as required by SoC 27. The survey indicated that it was unlikely that the Frog would be present in the survey area. Appendix C of the CEMP included constraints maps for the Project area, which include the locations of the Green and Golden Bell Frog survey areas. Constraints Map 1 is an example of the constraints maps, showing the area between Chester Hill and Villawood: 2116666D_4001_Constraints_Mapping1.pdf.

The BMSP included information on the survey undertaken for *Pimelea Spicata* between Minto and Leumeah Railway Stations and Carramar and Leightonfield Railway Stations, as required by SoC 28. No *Pimelea Spicata* were found during the survey, and no suitable habitat for the species was observed.

2.4.2 Effectiveness of Controls

ARTC is revising the BMSP to include performance and completion criteria for management measures and the monitoring of these measures consistent with the requirements of CoA 60. This revision process has been slowed while discussions were held with OEH and DoPI regarding the enhancement plantings in Leacock Park and relevant funding arrangements.

ARTC submitted a modification request to DoPI on 14 January 2011 (20110114 SSFL CoA 60cii modification application.pdf) to amend CoA 60(c)(ii) to allow a funding proposal for enhancement planting at Leacock Park as an alternative to the offset plantings that are currently required under this CoA. This request was approved by DoPI on 23 March 2011 as Modification 5 to the Project Approval (20110323 DoP approval for Mod 5 - CoA 60cii.pdf).

Following this approval, ARTC requested that the OEH commence preparation of the project brief (20110512 SSFL - Condition 60 Part 3A Funding proposal with attachments.pdf). OEH responded to ARTC's requests on 28 March 2013 with a Project Management Proposal. Following review by ARTC, a final proposal was received from OEH on 29 June 2013: 20130629 NPWS Leacock Park updated letter and proposal.pdf. ARTC agreed to this proposal in July 2013, and OEH submitted its first invoice on 29 July 2013.

The BMSP had not been revised up to this point in time as ARTC had been waiting on the project brief/project management proposal to be developed by OEH, to enable the development of performance and completion criteria that relate to the resolution of the offset planting issue. This requirement has now been built into a program of environmental management (addressing the requirements of CoA 60 during operation of the SSFL), monitoring and reporting, which is documented in the OEMP in Section 4.5 and Table 5-1 respectively, in CoA14.

ARTC's performance against the performance criteria for the Biodiversity Management Sub Plan included:

(a) No disturbance to flora and fauna outside the proposed construction footprint and associated access tracks and site compounds. This has been maintained by close liaison between ARTC and contractors' environmental managers and other project staff, and improvement in the maintenance of PC and EPL premises mapping;

(b) No increase in distribution of weeds currently existing within the rail corridor and adjacent areas. Monitoring during the Project was limited to visual inspections. ARTC engaged a weed specialist, Earth Repair, to remove and manage weeds throughout the Project length in mid 2011. Earth Repair commenced work in the northern area in August 2011, and worked progressively along the length of the project until November 2011. Earth Repair provided a weekly inspection report of their progress to ARTC: (Weekly Visual Progress Report 18.11.2011.pdf);

(c) No new weeds introduced to adjacent areas. Monitoring during the Project was limited to visual inspections. A weed specialist was engaged by ARTC to remove weeds along the project length between August 2011 and November 2011 (Weekly Visual Progress Report 18.11.2011.pdf);

(d) Rehabilitation / revegetation with at least 75 per cent success: 130304 EMR Inspection close out.pdf. These landscaping activities were recently completed as part of implementing the Landscape Management Plan, and will be monitored and maintained as part of Contractors' 12 months maintenance period;

(e) Ensured staff awareness of the requirements of relevant sections of documents to be adhered to including the CEMP, any associated work method statements (WMS), environment control plans and all other statutory requirements which were met whilst on site. All staff were made aware through project induction such as that for SFL: SFL Induction Environment_SP 110921.pptx;

(f) Ensured effective communication was maintained with statutory authorities and all statutory requirements were carried out to control impacts on the environment and prevent pollution. Regular communication was held between project staff and State and Local Governments.

Contractors maintained flora and fauna checklists including:

- SFL: 2013 01 January Inspection sheet.pdf;
- 3ARail (formerly Arenco): 3ARail OHS&E Checklist 20120613.pdf (refer to Sections 34 and 35);
- Invensys: Invensys Enviro Inspection 26092012.pdf; and
- Abigroup: Abigroup Environmental Inspection Checklist 120604.pdf.

As described in **Section 1.3.4**, with the changes to the program for delivery commenced in September 2010, ARTC developed a monthly environmental reporting checklist in collaboration with the contractor organisations: SSFL Monthly Enviro Reporting Checklist.PDF. The checklist provided a template against which

each organisation reported each month, including for fauna and flora. The first use of the new reporting was in January 2011.

2.4.3 Innovations to Improve Environmental Management

During the first two stages of the Project, contractors used their own systems and processes to meet environmental requirements. For the final stage, the SFL standardised systems and processes, such as Permit to Pump (Permit To Pump Form - final.xls) and Pre-Clearance Surveys (N992- Pre-Clearing Ground Disturb Insp Checklist_Permit_Rev1.doc), across all contractors on the Project to ensure consistency. This gave greater certainty that the appropriate hold-points were in place.

Landscaping was installed as soon as practicable after completion of construction in each area, provided no further reworking was required in that area, so that the area was permanently stabilised and the growth of vegetation given a "head start". One example of this approach was landscaping of the realigned Bow Bowing Creek downstream of Gilchrist Basin, where rock batters were planted with vegetation and the top banks were grassed in 2012, well before the end of construction.

2.4.4 Lessons Learnt During Construction

Ensure that contractors are provided with updated drawings clearly showing surveyed property boundaries, Principal Contractor boundaries and EPL premises boundaries so that contractors know which areas can be cleared of vegetation and which areas are to be protected. It must be emphasised to contractors that they should not rely on fence lines in the field which may or may not be correctly located.

The early works stage of a project should include provision for a surveyor independent of contractors to mark out project property boundaries. This then provides an unambiguous reference for Principal Contractor boundaries and EPL premises boundaries. All contractors and sub-contractors on the project would be briefed on the clearly defined boundaries as part of induction meetings prior to commencing work.

In relation to landscaping:

- Implement landscaping works as early as practicable during construction, provided no further reworking is required, to help stabilise final works and give vegetation growth a "head start";
- Conduct appropriate landscape design for batters, including an assessment of the grade of batter and suitability of treatment. This assessment should include elements such as the requirement for drainage, stability of the batter dictating the need for immediate/temporary ground cover versus long term planting requirements, and suitability of options requiring thicker application of top soil versus options such as "Eco Blanket": 130207 EMR Inspection close out.pdf;
- Terramesh walls require attention to drainage design and additional maintenance for growing vegetation if the walls are going to succeed. Problems with their design and construction include poor drainage of water away from the top of the wall resulting in water erosion from the top of the embankment through the wall, and poor take-up of vegetation growth in the face of the wall.

The measures implemented for the Project worked effectively and could be implemented on future projects.

2.5 EROSION AND SEDIMENT CONTROL

2.5.1 Environmental Controls

During the Project, erosion and sediment controls and monitoring were conducted as required by CoAs 59 and 61, and SoCs 49 and 50. Controls were contained in the Erosion and Sediment Control Sub Plan (ESCSP) - SSFL Erosion & Sediment Control 20090710.pdf - and in the Soil and Water Management Sub Plan (SWMSP) - SSFL Soil & Water 20090710.pdf.

The ESCSP is a stand-alone document that is fully integrated with, and intended to be read in conjunction with, the Spoil and Fill Management Sub-Plan: SSFL Spoil & Fill 090219.pdf.

The SWMSP contains references to other sub plans including the Dust, Erosion & Sediment Control, Acid Sulphate Soils, Spoil and Fill, and Waste Management Sub Plans.

The following key controls were implemented to reduce the movement of sediment through the construction sites as a result of construction activities and to prevent water quality issues:

- Monthly visits were made by a soil conservationist to monitor erosion and sediment control issues in all construction areas (20120820 SFL ERSED Inspection AMacleod.docx);
- Monthly visits were made by a soil conservationist (TREES) to monitor erosion and sediment control issues in 3ARail construction areas (TREES Inspection Report -26 June 2012.pdf);
- Weekly visual joint inspections were made by ARTC and the EMR to monitor erosion and sediment control management measures. Examples of reports from the EMR are included for some of the contractors inspected (3A Rail 120619.pdf, Abigroup 120620.pdf, Ford 120926.pdf, SFL 130205.pdf and SFL 130227.pdf);
- Contractors were required to close out all issues within one week of the inspection (3ARAil 120619 Incident Report - Signed Off.pdf, Abigroup 120620 Latest EMR Close Out.msg, Ford Civil EMR Inspection Reports 26 September 2012.msg, 130205 EMR Inspection close out.pdf, and 130227 EMR Inspection close out.pdf);
- Sediment movement was prevented by the installation of sediment fencing, hay bales, diversion channels and the use of spray grassing as required;
- Erosion and sediment issues and controls were included in site inductions for all personnel (SFL Induction Environment_SP 110921.pptx; GRSSFL Construction Induction Pack.PPT; ArencoSSFL Induction Handout.DOC and Arenco SSFL Induction Questionnaire.DOC);
- Toolbox talks updated water quality issues when they arose.

Activities with the potential to generate water quality issues through lack of erosion and sediment control during the Project included:

- Poor erosion and sediment control leading to:
  - excess nutrients in waterways attached to sediments;
  - carriage of weeds to waterways;
  - sedimentation of waterways;
  - decreased visual amenity of waterways;
- Ineffective dust controls on haul roads and around construction areas;
- Delays in revegetation of stockpiles and on completed construction areas;
- Drainage works;

- Compounds and bunded areas.

Checklists of sediment and erosion controls were maintained by contractors to ensure erosion and sediment controls were in place and properly maintained. These included:

- SFL: 12.12.10 Weekly Activities Checklist.pdf;
- 3ARail: 3ARail Weekly Sed and Erosion Control Checklist 20120605.PDF;
- Stations First: Stations First Campbelltown Audit Sep 2012.pdf (refer Section R);
- Ford Civil: Ford Civil Environmental Checklist 21.03.2012.pdf;
- Abigroup: Abigroup Enviro Inspect Checklist 120604.PDF; and
- Invensys: Invensys Enviro Inspection 26092012.pdf.

3ARail also utilised their site specific inspection report (3A SSFL Inspection Report -26 June 12.pdf). Stations First, Abigroup and Invensys used their site environmental audits (Stations First Campbelltown Audit Sep 2012.pdf, Abigroup Enviro Inspect Checklist 120604.PDF, Invensys Enviro Inspection 26092012.pdf), and SFL used their weekly environment checklist (12.12.10 Weekly Activities Checklist.pdf). SFL also used their environmental inspection register to monitor environmental performance (2013 01 January Inspection sheet.pdf).

These checklists and audits, combined with on-going inspections by the soil conservationists allowed the contractors to continually review and improve erosion and sediment control measures and respond effectively and efficiently to any issues that arose.

2.5.2 Effectiveness of Controls

Details on impact predictions made in the ESCSP that were managed during construction included:

1. Earthworks (excavation): Bow Bowing and Glenfield Creeks, reduction of incline/decline along the alignment, extending maintenance access ways;
2. Earthworks (fill): included levelling of specific areas along the route, reduction of incline/decline, realignment of Bow Bowing Creek, extending of maintenance access ways;
3. Levelling of site: risk of exposing acid-sulphate soils, erosion due to actions of rainfall/runoff and wind;
4. Soil stockpiles: risk of erosion due to actions of wind and rainfall/runoff;
5. Extension of existing embankments: changes to the natural ground levels which may have resulted in alteration of natural flow path, risk of soil erosion from embankments prior to stabilisation;
6. Vegetation clearing: once vegetation was removed before the commencement of earthworks the unbound topsoil had the potential to be eroded by wind and water;
7. Excavation of embankments: potential exposure of acid sulphate soils;
8. Handling, storage and disposal of contaminated soils.

ARTC's performance against the following performance criteria for the ESCSP was maintained by close liaison between ARTC and contractors' environmental managers and other Project staff, weekly visual joint inspections by ARTC and the EMR to monitor erosion and sediment control management measures, and inclusion of erosion and sediment issues and controls in site inductions for all personnel:

- No pollution of waterways due to runoff leaving construction sites;
- Minimise the risk of groundwater impacts due to siting or operation of sediment control structures;
- All necessary erosion controls in place prior to construction and appropriately maintained for the duration of construction;

- Erosion controls maintained until disturbed areas have been stabilised;
- Limit disturbance to surrounding areas outside the construction boundary.

As detailed in **Section 2.5.1** these performance criteria were assessed daily by site staff, and weekly by ARTC and the EMR. Required improvements were addressed within a specific timeframe (SFL Area 3 130115.pdf and 130115 EMR Inspection close out.pdf).

There was one waterway pollution incident due to site runoff during the Project, on 15 February 2012. This was rapidly addressed, as described in Table 4-15 in report: SSFL 6 Month Construction Report June 2012 - Final.pdf.

During the first half of 2012, multiple occurences of sediment laden water flowing through the site into Glenfield Creek as a result of the operations of a neighbouring development contractor required management. ARTC's notification to the EPA hotline established that this was a non-licenced development under the control of Campbelltown City Council. SFL informed the EPA that it was not responsible for the polluted water, and reported the events to Council:TRN water incident 28032012.msg. ARTC continued to work with Council and the neighbouring contractor to monitor and notify flow events, facilitate site inspections and provide expertise on to how to manage run-off from the site.

2.5.3 Innovations to Improve Environmental Management

During the first two stages of the Project, contractors developed their own erosion and sediment (ERSED) control plans. For the final stage, the SFL developed ERSED plans for the whole Project which were used by all contractors and subcontractors working on the Project.

The SFL used one spoil and erosion specialist for the Project across the various contractors. This gave the regulator confidence that the Project was being managed holistically rather than on a segmented basis.

The same improvement in regulator confidence resulted from implementing a standardised Permit to Pump process across the Project for all contractors. This process included a centralised review and standard for testing and checking prior to any water being pumped.

2.5.4 Lessons Learnt During Construction

Having each contractor responsible for developing their own process and systems for ERSED management and Permit to Pump on a large project such as the SSFL results in a piecemeal approach, with the potential for reduced regulator confidence that the site is being well managed. ERSED management and Permit to Pump should be centralised practices with one standard of implementation for all contractors on the Project.

Furthermore, it is important that ERSED plans are a hold point for all works, and that they are undertaken with site Environment staff prior to any new works being established or works being changed.

The safeguards implemented for the Project worked effectively and could be implemented on future projects.

2.6 Spoil and Fill

2.6.1 Environmental Controls

Spoil and fill controls and monitoring were conducted during the SSFL Project as required by SoCs 57 and 58. Controls are contained in the Spoil and Fill Management Sub-Plan (SFMSP): SSFL Spoil & Fill 090219.pdf.

The SFMSP was a stand-alone document that was fully integrated with, and intended to be read in conjunction with the Erosion and Sediment Control Sub Plan (ESCSP) - SSFL Erosion & Sediment Control 20090710.pdf - and the Soil and Water Management Sub Plan (SWMSP) - SSFL Soil & Water 20090710.pdf.

The SFMSP required:

- The locations of major (defined as a volume greater than 500 cubic metres) spoil stockpiles;
- The source of imported fill material and where it was to be stockpiled and used;
- Methods to re-use or dispose of excess or unsuitable spoil material including estimated volumes and disposal sites;
- The following general stockpile management measures:
    - Construction of erosion and sediment controls around stockpiles and immediately down-slope of any excavation areas to minimise siltation and sedimentation;
    - Separately stockpile different materials;
    - Separate different soil and earth layers to minimise the opportunity for mixing of soil types;
    - Water (as required) soil and spoil stockpiles to keep them moist and minimise dust and wind erosion;
    - Minimise the size of stockpiles and bund or cover stockpiles at the end of each day;
    - No stockpiling of material near roadways or stormwater drains;
- The stockpile management and mitigation measures contained in Section 12.3.1 of Volume 1 of the Environmental Assessment.

Section 1.4.1 and Table 5-1 of the SFMSP stated the policies in relation to maximising the re-use of material generated from construction activities.

The management objective to maximise the reuse of suitable excavated material within the Project, and minimise the amount of material going to landfill was continued during the Project. Only contaminated material, material classified as general solid waste, or material not suitable for reuse was sent to landfill. The majority of imported fill was recycled material from RailCorp activities, with only small volumes of engineered fill purchased (e.g. capping fill).

In October 2009, ARTC established a large site at Wetherill Park, outside the project boundary, for the purposes of storing excavated material and also for blending excavated material in preparation for use as fill on the project. The stored material at the major stockpile sites at that time (Blue Circle Cement Plant, Minto Council Viaduct Site, Cabramatta Triangle) was moved to Wetherill Park, and Ecocyle was engaged by ARTC to operate the stockpiling and material handling at the Wetherill Park facility.

Before being sent to Wetherill Park, excavated material was tested in situ to determine suitability for reuse. An example of a validation test conducted by Parson Brinkerhoff on excavated material is provided: Validation Test SSFL-PB-SPR-037.pdf.

At the Wetherill Park site, imported material from Kemps Creek Quarry (crushed rock) was blended with the excavated material from within the SSFL site to raise the CBR (California Bearing Ratio) to over 6% to allow the blended material to be used as fill within the project. This is because the excavated material generally had a CBR of 2% which was too low for direct reuse as general or shoulder fill. In addition, material was also imported from RailCorp's Chullora site for use as structural fill. A validation report for this material is provided: Chullora Structural Fill Testing Envirolab.pdf.

Use of the Wetherill Park stockpile site was discontinued on 30 June 2011. While operational, all material movements were recorded: Wetherill Park Fill Summary 29112010 to 29052011.pdf, Wetherill Park Fill Register 29112010 to 29052011.pdf and Wetherill Park - Example of Final Invoice.pdf.

All of the major stockpile sites within the project boundary were decommissioned in mid 2011. The "Toll Yard" – an active stockpile site operating since December 2010 at Miller Road, Villawood– was shut down in October 2011. The active stockpile site at the Birrong Site Compound was discontinued. A stockpile at Casula containing some contaminated material was disposed of to licensed facilities in September and October 2011. Approximately 9,500 m^3 of material were moved offsite.

Temporary stockpile sites at Farrow Road, Campbelltown; Goldsmith Avenue, Macarthur; near Cabramatta Creek; Casula Golf Course and at the Blue Circle Cement Plant in Villawood were utilised during 2012 and 2013. SFL maintained material movement registers for the movement of bulk materials: Materials Movement Register.xlsx.

Ford Civil maintained registers to record the movement of bulk earthworks within the Casula Access Road site, and to record the movement of materials to and from the site: Ford Civil Material Tracking June 2012.pdf.

All temporary stockpiles were removed from the Project area at the end of construction.

The SFL reused as much spoil on site as possible, in embankments, wall backfills, mounds to provide visual amenity, and to create laydown areas and infill hummocky areas to facilitate maintenance of the rail corridor. As a result, only 24,350 m^3 of excess spoil material were moved from site and disposed of at landfill by SFL at the end of the Project (details at the end of **Section 2.6.2**).

2.6.2 Effectiveness of Controls

The stockpile management measures described in **Section 2.6.1** were practiced. Wherever possible, excavated spoil and fill was reused at different sites within the project where spoil or fill was required.

ARTC's performance against the following performance criteria for the SFMSP was maintained by close liaison between ARTC and contractors' environmental managers and other project staff; weekly visual joint inspections by ARTC and the EMR to monitor drainage lines, spoil and fill excavation, dust control and stockpile management; and inclusion of these issues in site inductions for all personnel:

- Maintain natural surface water drainage lines;
- Ensure that there was no discernable release of sediment into any waterway as a consequence of works;
- Ensure spoil and fill excavation was in compliance with excavation plans;
- Ensure that dust generation and cross-contamination of soil types in stockpiles did not occur;
- Ensure that stockpile management, and the movement of spoil and fill, minimised impacts on the environment.

These criteria were assessed daily by site staff, and weekly by ARTC and the EMR (SFL Area 2 120718.pdf). Environmental monitoring consisted of:

- Monthly visits by soil conservationist to monitor erosion and sediment control issues in all construction areas (20120820 SFL ERSED Inspection AMacleod.docx);
- Monthly visits by soil conservationist (TREES) to monitor 3ARail stockpile sites: (TREES Inspection Report -26 June 2012.pdf);
- Checklist inspections by contractors of their own sites, for example: 3ARail OHS&E Checklist 20120613.pdf (Section 26 and 33) and 2013 01 January Inspection sheet.pdf;
- Audit inspections by contractors of their own sites, for example: Waste Segregation Audit Jul 2012.pdf;
- Regular joint inspections by the EMR and ARTC of stockpile areas: SFL Area 2 120718.pdf and Ford 120606.pdf.

As described in **Section 1.3.4**, ARTC developed a monthly environmental reporting checklist in collaboration with the contractor organisations: SSFL Monthly Enviro Reporting Checklist.PDF. The checklist provided a template against which each organisation reported the reuse of suitable excavated material within the construction work premises. The first use of the new reporting was in January 2011.

There were no incidents of pollution of waterways due to runoff from stockpiles during the Project.

The SSFL Environmental Assessment (EA) (Parsons Brinckerhoff – April 2006) provided an approximation of cut and fill volumes required to undertake the Project. The EA stated that approximately 253,300 m^3 of fill would be required to be imported, 61,355 m^3 of cut material would be reused on site and 97,420 m^3 of cut material would be excess or unsuitable for reuse on site.

Although details of spoil excavation, movement, import, use and disposal were maintained throughout the Project and included in monthly reports to the EPA, given the number of contractors operating in Stages 1 and 2 of the Project it has been difficult to compile cumulative totals for those Stages. However, in the Final Stage the SFL introduced a "Reuse" docket system (described in **Section 2.6.3**) which better enabled the movement and tracking of spoil around the Project for reuse. During this Stage 128,250 m^3 of material was excavated from earthworks; 74,350 m^3 of structural and capping fill was imported; 103,900 m^3 of material was used in embankments, wall backfill and mounds; other material was used to create laydown areas and infill hummocky areas to facilitate maintenance of the rail corridor; and 24,350 m^3 of cut material was excess or unsuitable for reuse and was disposed off site.

The total amount of cut material excess or unsuitable for reuse on site for the Project was 33,800 m^3 which is less than the 97,420 m^3 of material predicted in the SSFL EA.

2.6.3 Innovations to Improve Environmental Management

Introduction of a "Reuse" docket system, replacing a "Waste Transfer" docket system, enabled the movement and tracking of spoil around the Project for reuse. It also ensured excellent record keeping of what material was being moved, how much was being reused and how much was being disposed of.

Appropriate training of traffic controllers on the gates resulted in excellent records of truck movements to enable reconciliation of dockets to the number of truck movements.

Early training of engineers and foremen as to why the waste transfer dockets were required and when and how to fill them out, resulted in a top-down and bottom-up approach to records management, and a comprehensive data set on spoil movement and disposal.

2.6.4 Lessons Learnt During Construction

An essential component of a comprehensive spoil register is that there be someone allocated with the responsibility of maintaining the register and regularly auditing the quality of the information being entered. It is also important at a management level to regularly review that the data is being inputed into the system, thereby keeping any data backlog to a minimum.

The safeguards implemented for the Project worked effectively and could be implemented on future projects.

2.7 Acid Sulphate Soils

2.7.1 Environmental Controls

The Acid Sulphate Soil Management Sub Plan (ASSMSP) - SSFL Acid Sulphate Soils 20090114.pdf – and appendices - SSFL Acid Sulphate Soils - Appendices.pdf - required by SoC 52 included:

- Consistency with the Acid Sulphate Soils Manual as described in Section 2.2;
- Contingency plan in Section 4.5;
- Water quality monitoring program in Section 4.3.2;
- Assessment of the presence of acid sulphate soils in Section 2.2;
- Depth to groundwater in Appendix C;

- Measures to neutralise groundwater, contained in Section 4.1 and Appendix B;
- Details of further investigations to be undertaken in Section 4.2;
- Methods identified in Table 12.8 of Volume 1 of the Environmental Assessment, identified in Table 4-1;
- Details of treatment, management and disposal options for excavated material in Section 4.3.

The 1:25,000 Acid Sulphate Soils Risk Map for Liverpool indicated two areas intersecting with the SSFL route which potentially contained ASS. These areas were recognised as the crossing of Prospect Creek, and the area adjacent to the Georges River north of Liverpool Station. These areas were investigated by drilling boreholes and field testing the soils obtained. None of the field indicator tests returned positive results to either AASS or PASS and hence no samples were sent to the laboratory for confirmatory POCAS testing.

The results of the ASS testing undertaken during the Geotechnical Investigation were not deemed to be conclusive proof of the existence or absence of ASS. However, as the ASS Risk Map clearly indicated the possibility of ASS being encountered in the two areas noted above, the ASSMSP recommended that all soils excavated in these areas were considered to be ASS and managed in accordance with the management plan.

Activities requiring attention included pile foundation construction, ground improvement under abutment embankments, and ground anchoring.

Monitoring reports were to be prepared by the site construction contractor and presented to ARTC at fortnightly periods during excavations within potential ASS areas. The reports were to include the volumes of excavated soils within ASS areas; results of field indicator testing; areas requiring lime dosages (if encountered) and records of the work; location of treated soils; and any contingency actions required and records of their implementation.

SFL undertook soil testing during 2012 to confirm the presence or lack of ASS at Bow Bowing Creek, near the SFL Glenfield Compound (EMS12 9540 Acid Sulfate Soils Investigation Report Glenfield Compound Creek Area 20 03 12.pdf). The assessment report concluded that the soils in this area were not ASS, and that a site Acid Sulphate Soils Management Plan was not required for works in the area.

3ARail, the only other contractor working in areas of potential Acid Sulphate Soils, had an acid sulphate soils management plan titled "Handling of Potential and Actual Acid Sulphate Soils" (Arenco acid sulphate management plan.pdf). As reported in Construction Compliance Reports, at its BR5 site at the Georges River, where ASS was suspected to be potentially present, 3ARail commissioned Daracon (and Environmental Investigation Services) to test the soils. The sampling report showed the soils were not ASS: Arenco EIS ASS Report Liverpool.pdf. 3ARail also undertook an ASS checklist inspection of the site in August 2009: ASS Management checklist Aug 09.pdf.

2.7.2 Effectiveness of Controls

For the SSFL Project, the hierarchy of risk control for ASS was:

1. Avoid construction in land where ASS occur;
2. If this was not possible, then avoid disturbing land where ASS were present;
3. If this was not possible, then prevent oxidation of the sulphides;
4. If this was not possible, then allow oxidation of the sulphides, but neutralise the acid as it is produced.

Since only limited areas were considered to be at risk of containing ASS, the ASSMSP proposed that a testing regime of excavated soils be put in place to detect the presence of ASS. Where encountered, the ASS material and/or groundwater was to be blended with sufficient neutralising buffer as required and where possible time of exposure was to be minimised to reduce the potential for sulphide oxidation. A mitigation strategy based on

this assumption was presented within Section 4.3 of the ASSMSP. Mitigation included soils treatment, and water testing, containment and treating.

ARTC's performance against the performance criterion for ASS in the Soil and Water Management Sub Plan - SSFL Soil & Water 20090710.pdf included ensuring ASS management measures were in place prior to disturbance of soils in locations mapped as being acid sulphate prone soils. This was achieved by implementing the above described hierarchy of risk control for ASS with contractors' environmental managers and project managers.

There were no reported occurrences of ASS during construction of the Project.

2.7.3 Innovations to Improve Environmental Management

As there were no reported occurrences of ASS during construction of the Project, no innovations to improve environmental management were required.

2.7.4 Lessons Learnt During Construction

While it eventuated that there were no ASS to be managed on the Project, it was reassuring to have undertaken a process of comprehensive testing in the early stages of the Project, to establish possible hotspots, enable more detailed testing in key areas, and to have these areas cleared as the Project progressed. This also built regulator confidence in the Project and its ability to properly address and manage ASS if it was located during construction.

The safeguards designed for the Project could be implemented on future projects.

2.8 SURFACE WATER AND GROUNDWATER

2.8.1 Environmental Controls

The construction of the SSFL had the potential to affect surface water and groundwater quality. To mitigate this, CoA 61 required the preparation of a Soil and Water Management Sub Plan (SSFL Soil & Water 20090710.pdf), an Erosion and Sediment Control Sub Plan (SSFL Erosion & Sediment Control 20090710.pdf), a Groundwater Management Sub Plan (SSFL Groundwater Sub Plan 090225.pdf) and a Surface and Groundwater Monitoring Program.

During the various stages of the Project's construction, the potential for erosion was ever-present on site due to vegetation clearance, ground disturbance and the temporary alteration of drainage paths. Construction activities that create erosion potential included excavation, drainage works, bridge works, fill placement and stockpiling. On-site erosion could generate coarse and suspended sediment that would, if not managed correctly, adversely affect water quality in local and regional waterways, land and river use, and ecological systems.

The focus of water quality control during the Project was on minimising impacts on downstream waterways.

Environmental controls that were adopted included:

- Implementation of the Erosion and Sediment Control Sub Plan (see **Section 2.5** above), including related surface water monitoring;
- Quarterly groundwater monitoring and reporting;
- Maintenance of site controls;
- Management of waste water.

2.8.2 Effectiveness of Controls

Waterways at risk from immediate contamination from the SSFL Project included the Georges River, Prospect Creek, Cabramatta Creek, Glenfield Creek, Bow Bowing Creek and other watercourses. The greatest potential source of pollution was seen to be sediment laden runoff from exposed earthworks (**Table 2-5**). Accidental spillages were also considered some threat to the quality of water.

Table 2-5: Predicted versus Actual Water Quality Impacts

Predicted Impacts	Actual Impacts
Bridge piers being constructed in close proximity to creeks	All bridge pier construction in close proximity to creeks was completed satisfactorily. No negative impacts were identified through the water quality monitoring or site inspections.
Removal of riparian vegetation	Riparian vegetation was removed to undertake creek realignment works during the Project. No impacts on water quality occurred during riparian vegetation removal works. All other areas of riparian vegetation were protected on site.
Earthworks	Major earthworks were undertaken throughout the Project. All controls for the protection of the waterways were established in the early phases of construction and continue to be maintained for the duration of construction, including any sites that have been decommissioned.

Construction related changes to groundwater could have affected surrounding bore users, groundwater dependent ecosystems and species, or existing and project related structures and infrastructure within and adjoining the rail corridor. One such activity was the excavation of the **Sefton Dive** to allow freight trains to run beneath the current suburban lines. 3ARail conducted a hydrogeological study of the area and encountered unconsolidated clay and silty clay overlying shale. Test bores yielded very low quantities of poor quality groundwater, as expected from the shale marine sediment and its erosion products: 20100819 Report E1167.1BC-Sefton Dive Hydrogeo Study.PDF.

During excavation, groundwater seepage was collected in a sump in the lowest part of the excavation, treated and pumped into the local stormwater drainage system for disposal. 3ARail constructed a comprehensive water treatment and storage system at its Birrong Compound adjacent to Sefton Dive, including raw water storage tanks; water treatment, filtration and reverse osmosis; and treated water storage tanks, capable of handling 150kL/day. During the construction of Sefton Dive only negligible volumes of groundwater were intercepted for treatment and disposal.

ARTC liaised with Bankstown City Council staff and with the NSW Office of Water staff on the subject of water disposal. The Office of Water confirmed that a dewatering licence was not required (20101026 Office of Water advice on groundwater licence.MSG) provided:

- Dewatering was temporary and water would not need to be pumped once construction was completed;
- The excavation would be constructed in sections, and sealed progressively with shotcrete as planned.

Sefton Dive is equipped with a pump station to pump out any surface water inflows resulting from rainfall events, and any residual groundwater seepage. Following construction of the Dive, the volumes and quality of groundwater seepage have been monitored to inform whether or not ARTC will need to apply for a groundwater licence. Around 20 m^3/d of saline groundwater seepage is being pumped from the Dive. Under the recently released Draft NSW Aquifer Interference Policy Stage 1 this seepage is exempt from requiring a volumetric access licence, as the water is taken as a result of rail infrastructure construction by an authority within the meaning of the Transport Administration Act 1988.

ARTC constructed four monitoring bores (three for water monitoring and one for gas monitoring) adjacent to the **Glenfield Waste Disposal Facility** to replace four Waste Facility monitoring bores which were decommissioned when the Glenfield Flyover was constructed. Parsons Brinkerhoff undertook the comparative monitoring and assessment study.

ARTC sought approval from the EPA to replace the original bores on 12 May 2011: 20110512 ARTC letter to OEH re PB monitoring report.pdf. The EPA granted approval to replace the original bores on 29 September 2011: 20110929 Letter from OEH re EPL 4614.pdf. The EPA confirmed that the original bores could be decommissioned on 17 November 2011: 20111117 RE Glenfield Waste Disposals.msg.

The bores were decommissioned on 5 May 2012 to the EPA's requirements, as reported by Parsons Brinkerhoff: 20120601 PB re SSFL Well Decommissioning.pdf.

Parsons Brinkerhoff Groundwater Monitoring

The groundwater monitoring program was outlined in Section 6 of the Groundwater Management Sub Plan, with monitoring on a quarterly basis. In 2009, two groundwater bores were moved due to a clash with SSFL construction works. Parson Brinkerhoff was engaged to move the bores, including decommissioning of the existing bores and drilling, construction and licensing of the new bores. The Parsons Brinkerhoff proposal to undertake this work is provided: 20090812-PB proposal replacement MW.PDF.

In 2012, an additional two bores were identified for replacement, and ARTC has replaced these bores.

The quarterly groundwater monitoring reports by Parsons Brinkerhoff such as that for April 2013 are evidence of the groundwater monitoring program: 201304 SSFL GW Monitoring Report.pdf. No other contractors conducted groundwater monitoring.

2.8.3 Innovations to Improve Environmental Management

The Permit to Pump (PTP) system was introduced and comprehensively undertaken on the Project, for both the movement and testing of water. This included equipping the Environment Team with PTP carbon copy books, training of engineers and foremen about the "when and where" a permit was needed and having a top down management approach to reinforce the need for compliance with this system, and the seriousness of non-compliance. Implementation of the PTP system gave a high level of confidence that the risk of uncontrolled discharge from site was reduced.

2.8.4 Lessons Learnt During Construction

It is essential that the project team be appropriately resourced with a sufficient number of skilled environment staff to ensure prompt response times when site measures need implementation and to ensure that appropriate environmental management practices are being undertaken. This is particularly important in the early stages of the project when environmental management systems and processes are being established and first being implemented.

The measures implemented for the Project worked effectively and could be implemented on future projects.

2.9 AIR QUALITY

2.9.1 Environmental Controls

The dust control measures employed on the SSFL Project were as identified in Table 6 of the Dust Management Sub Plan (SSFL Dust Management 20090114.pdf). These controls included:

- Using water carts to control dust emissions during works and keeping exposed excavation surfaces dampened to control dust generation;

- Ensuring vehicle speeds within the worksite areas were kept to a minimum;
- Preventing and where necessary cleaning any dirt tracked onto public roadways from construction vehicles;
- Covering spoil loads and securing tailgates prior to trucks leaving the worksite;
- Being prepared to cease/ modify work practices if excessive dust generation from construction activities occurs (e.g. from high winds, surface dirt accumulation etc), until dust emissions could be controlled;
- Conducting regular visual inspections of worksites to assess effectiveness of dust control measures.

In addition, Table 6 in the Plan identified a number of controls that related to the minimisation of emissions to reduce emission impacts associated with construction activities.

Sixteen dust related complaints were made by the community during the Project.

2.9.2 Effectiveness of Controls

Table 4 of the Dust Management Sub Plan outlined the deposited dust level objective for the Project, being 4 g/m^2/month. A number of controls were implemented at each site as outlined in the Dust Management Sub Plan. The comprehensive dust monitoring program outlined in Section 4.9.3 of the Plan was the main strategy to measure compliance with the dust objective. There were 61 exceedences of the dust level objective in the Project, as described in the Construction Compliance Reports.

Dust monitoring was undertaken throughout the Project as required by condition M4.5 of the EPL. Dust monitoring methods were in accordance with the DEC guideline "Approved Methods for Sampling and Analysis of Air Pollutants in NSW", which is attached as Appendix A to the Dust Management Sub Plan. The monitoring devices were left unattended each month to collect all deposited dust, which could have resulted from both ARTC works and outside sources. Dust monitoring was conducted by 3ARail, Ford Civil and the SFL, and the results were collated by SFL. The EPA could request these dust monitoring reports at any time under R4.5 of the EPL.

Weather monitoring was also conducted, and reported on in the EPL reports. Weather stations were in place at two locations since February 2009, with one at Llewellyn Avenue, Villawood and the other at Manning Street, Warwick Farm. These weather stations monitored wind conditions (wind direction and speed) as well as temperature and humidity. The Warwick Farm weather station was decommissioned in November 2010 following ARTC's application to amend Section 6 of the CEMP Dust Management Sub Plan to operate only one weather station, at Villawood (20101112 Letter to DoP - SSFL Dust Management Sub Plan.pdf). DoPI approved the change to the CEMP Dust Management Sub Plan on 26 November 2010 (20101126 Approval for Condition 13 _revised Dust Management Plan approval.pdf).

During December 2011 two additional weather monitoring station were established in the Minto Compound at Montore Road, Minto and at the Glenfield Compound, Glenfield Road, Glenfield due to the shift in construction work to the central and southern areas of the project. The Villawood weather monitoring station remained in place until June 2013, when it was decommissioned, with EPA approval, with the demobilisation of the Villawood Compound. In mid February 2013 the weather monitoring station at Glenfield Compound was moved to a more suitable location adjacent the southern viaduct due to the closure and rehabilitation of the Glenfield Compound.

SFL, 3ARail, Stations First, Abigroup and Invensys all undertook regular checks of dust control implementation and effectiveness at their construction sites:

- SFL: 2013 02 Feb Inspection sheet.pdf and 2013 02 Feb Inspection sheet (2).pdf;
- 3ARail: 3ARail OHS&E Checklist 20120613.pdf (refer Section 28);

- Stations First: Stations First Campbelltown Audit Sep 2012.pdf (refer Section R);
- Abigroup: Abigroup 120620.pdf; and
- Invensys: Invensys Enviro Inspection 26092012.pdf.

In addition to checks related to dust control, there are also a number of checks undertaken on plant and equipment to ensure emissions were controlled. SFL (Daily Site Plant Checklists - SFL.pdf), 3ARail (3ARail Birrong Plant Risk Assessment 5 Jun 12.pdf), Stations First (SF Plant Pre Starts August 2012.pdf), Ford Civil (Ford Civil Plant Prestart Sep 12.pdf), Invensys (Invensys Plant GF-29.8.12-0533.pdf) and Laing O'Rourke (Laing O'Rourke Plant Dockets Aug 12.pdf) undertook such checks. Contractors also maintained plant registers: Plant Procurement Log 001 - 500.xlsx.

2.9.3 Innovations to Improve Environmental Management

Construction projects are always seeking dust suppressants and often opt for a 'one size fits all' solution. On this Project, the Final Stage Alliance tested two products designed with different specialities, one for trafficable areas and one for stable non-trafficable areas. These products worked very well and provided an alternate cost effective solution: the product for stable non-trafficable areas was more expensive but needed infrequent reapplication, whereas the product for trafficable areas needed regular reapplication but was far less expensive. As a result construction teams were more likely to respray knowing it was cost effective.

2.9.4 Lessons Learnt During Construction

As with all contruction involving earthworks, pre-planning to include the cost of water carts and street sweepers to manage dust and dirt on site is an important part of the strategy to control dust on site.

The measures implemented for the Project worked effectively and could be implemented on future projects.

2.10 Greenhouse Gases and Sustainable Energy

2.10.1 Environmental Controls

Six monthly energy audits (green power or other) of the SSFL Project were required as described by SoC63. Furthermore, ARTC's contractors were required use electrical energy derived from a renewable energy source accredited by the National Green Power Accreditation Steering Group (or equivalent) for the supply of at least 50% of the on-site electrical energy requirements for the Project's Construction if possible (CoA67).

Contractors' power consumption data obtained for the Project was presented in the Construction Compliance reports. As the majority of contractors' sites for the SSFL Project utilised power from generators rather than from mains electricity due to the locations of the sites, it was often not possible for the contractors to purchase green power from mains providers.

In January 2011, 3ARail re-approached their energy provider, Energy Australia, and were advised that they could purchase green power for their main site compound, located at Teresa St, Birrong: Change of Account Notice 3ARail 20110117.pdf.

3ARail's other sites either utilised diesel generator power, or were of such a small size that Energy Australia did not meter the sites, but provided an estimated bill. 3ARail advised ARTC that it was not possible for green power to be purchased from electricity providers for unmetered sites.

ARTC continued to investigate any sites where it may have been possible for contractors to purchase green power.

2.10.2 Effectiveness of Controls

As described in SoC 63, promotion of energy efficient work practices on the SSFL Project was the responsibility of the Contractors. As noted above:

- As the majority of contractors' sites for the SSFL Project utilised power from generators rather than from mains electricity due to the locations of the sites, it was often not possible for the contractors to purchase green power from mains providers;
- 3ARail successfully converted to green power at their main site compound, located at Teresa St, Birrong: Change of Account Notice 3ARail 20110117.pdf.

Contractors undertook many of the measures to comply with this condition, including:

- Implemented energy efficiency procedures and guidelines;
- Conducted internal training to increase awareness of energy conservation requirements and methods (SSFL Enviro and Comms Presentation GR Jan 11.PPT);
- At all sites derived power from diesel generators, switched off all generators at the end of each work day to ensure no air conditioning, lights, or office equipment were left on or running overnight;
- Minimised night-time works (SFL Induction Environment_SP 110921.pptx);
- Switched off idle equipment;
- Ensured energy efficient and waste management procedures were complied with (Waste Segregation Audit Jul 2012.pdf);
- Conducted regular maintenance of plant and equipment to ensure machinery operated at optimum efficiency – refer to SoC 62;
- Programmed construction works to minimise handling of construction materials;
- Salvaged suitable excavation material for re-use – refer to SoC 58;
- Ordered exact calculated quantities of materials required and limited materials packaging;
- Clearly identified and separated recyclable materials (Stations First Campbelltown Audit Sep 2012.pdf refer to section R, Abigroup Environmental Inspection Checklist 120604.pdf, Invensys Enviro Inspection 26092012.pdf, 3ARail OHS&E Checklist 20120613.pdf);
- Recycled materials. Stations First provided an example of the recycling of concrete, timber, steel and mixed waste as evidence of the reuse of recyclable materials (Waste Management - Leumeah June 2012.xlsx), SFL's material movement registers tracked movements of vegetation, concrete, fill, metal and general waste to be recycled: 121114 Area 1 Waste Database.xlsx, Area 2 Waste and Resource Use Database v2.xlsx and Area 3 Waste Database 20120830.xlsx;
- Provided paper (both standard and secure) recycling at the main SFL Alliance office, and at site compounds. The SFL provided examples of recycling invoices (SFL Paper Recycling Docket Jun 12.pdf, SFL Paper Recycling Docket Aug 12.pdf, SFL Paper Recycling Docket Sep 12.pdf; SFL Paper Recycling Docket Oct 12.pdf and SFL Veolia Recycling Invoices.pdf);
- Provided container and printer toner recycling facilities in the main SFL Alliance office.

ARTC worked with contractors to ensure that measures taken to promote energy efficiency as outlined by this condition were documented and reported to ARTC.

2.10.3 Innovations to Improve Environmental Management

Those contractors who purchased mains electricity in sufficiently large loads were able to purchase green power from their energy provider. Other contractors practiced the controls listed in Section 2.10.2 to promote energy efficiency.

2.10.4 Lessons Learnt During Construction

The use of green energy and other sustainable measures should be investigated during the project planning phase, and sustainable inititatives built into the initial cost estimate of the project. It is very difficult to have sustainability measures included in a construction project if they are not built in to the planning stage.

The measures implemented for the Project worked effectively and could be implemented on future projects.

2.11 HAZARD AND RISK

2.11.1 Environmental Controls

The Hazard and Risk Management Sub Plan (SSFL Hazard & Risk Sub Plan 20080715.pdf) identified a number of hazards and risks for the SSFL Project. These included:

- Oil, fuel and chemical spills;
- Contamination of soil, air or water due to inappropriate storage or disposal of oil or chemicals;
- Minimising disturbance of contaminated soil, water or Acid Sulphate Soils;
- Construction safety issues.

This section focuses on the environmental controls rather than the safety related controls, as was required by the wording of CoA 10.

Section 5 of the Hazard and Risk Management Sub Plan outlined the various mitigation measures identified to address the potential environmental impacts identified in Section 4 of the Sub Plan. Mitigation measures for environmental impacts included:

- Undertook a final hazard analysis (FHA) prior to construction (refer to CoA 68). DoPI approved the FHA and the peer review on 19 September 2008: Approval of CoA68 and CoA69.pdf;
- Prepared and implemented an Acid Sulphate Soils Management Sub Plan (refer to SoC 52). The Acid Sulphate Soil Management Sub Plan dated 14 January 2009 (SSFL Acid Sulphate Soils 20090114.pdf) and appendices (SSFL Acid Sulphate Soils - Appendices.pdf) were submitted to DoPI on 14 January 2009;
- Undertook a Phase 1 contamination assessment along the SSFL route (refer to SoC 99). The Phase 1 contamination assessment was dated 26 September 2008: SSFL Phase 1 Assessment Report.pdf;
- Prepared a Contamination Management Plan that included an Asbestos Management Plan. ARTC developed a Contamination Management Plan which was finalised and distributed in September 2009. Briefings were held with all relevant contractors on the implications of the Plan. The Plan aimed to provide additional detail to that included in the Hazard and Risk Management Sub Plan. The Plan was provided: SSFL Contamination Management Plan.pdf;
- Safe storage of all fuel, oil and chemicals stored on SSFL construction sites. These were checked regularly by both ARTC and contractors, as described in **Section 2.11.2** below.

2.11.2 Effectiveness of Controls

ARTC's performance against the following performance criteria for the Hazard and Risk Management Sub Plan were maintained by close liaison between ARTC and contractors' safety and environmental managers and other project staff; weekly visual joint inspections by ARTC and the EMR to monitor spills, contamination, disturbance and safe working practices; and inclusion of these issues in site inductions for all personnel:

- No fuel/oil and other chemical spills;
- No contamination of soil or groundwater from site activities;
- Minimised disturbance of potentially contaminated soil, surface and groundwater and acid sulphate soils;

- No incursion into the railway safety zone by construction equipment or personnel unless under the appropriate safe-working regime.

The various mitigation measures identified in Section 5 of the Hazard and Risk Management Sub Plan were implemented. As a result, there were no major spills or contamination events due to leaks during the Project. There was one minor sewage leak on 20 March 2009.

Asbestos contaminated soil was encountered within the rail corridor and was managed to appropriate guidelines, as detailed in Section 4.11.2 of each of the Construction Compliance Reports: (SSFL 6 Month Construction Report August 2009 Final.pdf, SSFL 6 Month Construction Report January 2010_Final.pdf, SSFL 12 Month Construction Report January 2011 - Final.pdf, SSFL 6 Month Construction Report July 2011 - Final.pdf, SSFL 6 Month Construction Report Dec 2011 - Final.pdf, SSFL 6 Month Construction Report June 2012 - Final.pdf, SSFL 6 Month Construction Report Dec 2012 - Final.pdf) and SSFL Final Construction Report August 2013 - Final Ver.pdf.

Contractors undertook regular assessments of hazards and risks including:

- SFL: WEAC 20121129_001.pdf;
- 3ARail (formerly Arenco): 3ARail OHS&E Checklist 20120613.pdf;
- Stations First (formerly Gartner Rose): Stations First Campbelltown Audit Sep 2012.pdf;
- Invensys: Invensys Enviro Inspection 26092012.pdf and SSFL2_Hydro Excavation_04-051212.pdf;
- Abigroup: Abigroup Environmental Inspection Checklist 120604.pdf.

2.11.3 Innovations to Improve Environmental Management

As noted in Section 1.3.4, with the changes to the program for delivery commenced in September 2010, ARTC developed a contamination checklist in collaboration with the contractor organisations: Contamination Incident Checklist.pdf. The checklist provided a template against which each organisation could report and recorded contamination incidents as per the Contamination Management Plan, resulting in a consistent Project-wide report.

The Final Stage of the Project coincided with the implementation by the EPA of new legislation on pollution incident management and the requirement for the Project to develop and implement a Pollution Incident Response Management Plan (PIRMP). This resulted in a review of processes for the Project, renewed training and a change in focus for the immediate management of pollution incidents on-site.

2.11.4 Lessons Learnt During Construction

The new legislation required the inclusion of a discussion of hazards and risks and their management in the PIRMP, at a point where the Project was three-quarters completed. For future projects, the defining of hazards and risks and their management early in the project planning stage will be beneficial, not only for developing a PIRMP, but also for implementing a robust incident and risk management process for the project from its commencement.

The hazard and risk management measures implemented for the Project worked effectively and could be implemented on future projects.

2.12 BUILT AND INDIGENOUS HERITAGE

2.12.1 Environmental Controls

The Built Heritage Management Sub Plan (BHMSP) (SSFL Built Heritage Sub Plan 20090114.pdf) addressed each of the condition requirements:

(a) The BHMSP contained details of the built heritage and archaeological investigations undertaken for the SSFL Project in Section 1.4. The required approvals are shown in Table 2-1 in the BHMSP;

(b) Procedures followed during construction if historical relics are discovered were outlined in Section 1.5 of the BHMSP;

(c) The awareness program for site personnel was described in Section 1.5 of the BHMSP;

(d) The Interpretation Strategy was described in Section 1.6 of the BHMSP;

(e) The minimisation of impacts to heritage items was outlined in Section 4 (the impacts) and Section 5 (the mitigation measures) of the BHMSP.

The Aboriginal Heritage Management Sub Plan (AHMSP) (SSFL Aboriginal Heritage Sub Plan 090220.pdf) included:

(a) Table 5-1 which outlined the archaeological investigations undertaken. Table 2-1 of the AHMSP outlined the licences and approvals required;

(b) The procedures followed if previously unidentified Aboriginal objects were discovered during construction were shown in Table 5-1 of the AHMSP;

(c) Table 5-1 which detailed the education program included in the induction for construction personnel.

2.12.2 Effectiveness of Controls

ARTC's performance against the following performance criteria for the BHMSP and the AHMSP was maintained by close liaison between ARTC and contractors' environmental managers and other project staff:

- Managed built heritage items, artefacts and historical relics that might be impacted by the construction of the SSFL with due diligence and in accordance with the requirements of the NSW Heritage Act 1977 as amended;
- Ensured items of built heritage and artefacts were not damaged, and historical relics were not disturbed during pre-construction, construction and post-construction;
- Managed the site identified as SSFL 1 to avoid damage to or destruction of Aboriginal heritage items, and protected the heritage value of the site;
- Avoided the site at SSFL 2;
- Avoided damage to or destruction of additional identified items of Aboriginal heritage;
- Ensured any additional identified sites/artefacts of Aboriginal heritage significance were managed throughout the project in accordance with legislative requirements.

The various awareness and mitigation measures identified in both the BHMPS and the AHMPS were implemented. All project personnel were made aware of the conditions for protecting Built and Indigenous Heritage through ARTC's induction program for the project.

Eleven unexpected historical items were encountered during the Project, including a timber culvert beneath Miller Road overpass, a concrete footing of the old Liverpool Railbridge extending further underground than anticipated, a concrete and brick drain just east of Cooper Road Birrong, engine shed pits were discovered in Campbelltown, the Campbelltown turntable was discovered, a brick arch culvert was discovered in Minto, a

footing structure was discovered in Villawood, a timber shutter structure was discovered at Fraser Road Canley Vale, building foundations and water cistern was found in Badgally Road Campbelltown, and a brick arch culvert was discovered in Macarthur. A concrete footing structure at Canley Vale was determined to have no historical significance. One photographic archival recording was undertaken for bridge abutments at Bow Bowing Creek Narellan prior to removal for construction activities.

There were no instances of previously unidentified Aboriginal objects being discovered during construction of the Project.

As described in **Section 1.3.4**, with the changes to the program for delivery commenced in September 2010, ARTC developed a monthly environmental reporting checklist in collaboration with the contractor organisations: SSFL Monthly Enviro Reporting Checklist.PDF. The checklist provided a template against which each organisation reported each month, including reporting historical relics and Aboriginal objects.

Contractors also maintained heritage checklists including:

- SFL Area 1 (2013 01 January Inspection sheet.pdf), Area 2 (12.12.03 Weekly Activities Checklist.pdf) and Area 3 (WEAC 20121129_001.pdf);
- 3ARail (formerly Arenco): 3ARail OHS&E Checklist 20120613.pdf (refer to Section 36);
- Abigroup: Abigroup Environmental Inspection Checklist 120604.pdf;
- Invensys: Invensys Enviro Inspection 26092012.pdf.

2.12.3 Innovations to Improve Environmental Management

While there were no innovations to improve the environmental management of built and indigenous heritage, the availability of a dedicated ARTC position of Heritage Manager and of clearly defined ARTC processes assisted the Project's management of unexpected heritage finds.

2.12.4 Lessons Learnt During Construction

It was important that all contractors followed the same process for managing unexpected finds during construction. This ensured compliance with the Project Approval and helped develop regulator condfidence that a robust system was in place to assess and record any unexpected find.

A key component to the successful implementation this process is training. The practice of identifying and notifying an unexpected find depends on the understanding of site teams as to why this process is important, and on having management staff lead the process.

The measures and controls implemented for the Project worked effectively and could be implemented on future projects.

2.13 Waste Management and Recycling

2.13.1 Environmental Controls

The Waste Management Sub Plan (SSFL Waste Management Sub Plan 090219.pdf) completed the requirements addressed in SoC 100. It addressed the management of wastes during the construction stage in accordance with the NSW Government's Waste Reduction and Purchasing Policy. The Sub Plan identified requirements for:

- The application of the waste minimisation hierarchy principles of avoid/reduce/reuse/recycle/dispose;
- Waste handling and storage;
- Disposal of wastes. Specific details were provided for cleared vegetation, contaminated materials, glass, metals and plastics, hydrocarbons (lubricants and fuels) and sanitary wastes;

- Any waste material that was unable to be re-used, re-processed or recycled was disposed at a facility approved to receive that type of waste.

Railway construction has the potential to generate a range of waste materials due to activities such as:

- Clearing of vegetation;
- Demolition of structures and redundant roads;
- Replacement of utilities and services that cross the railway corridor;
- Demolition and replacement of rail infrastructure, which could lead to the generation of asbestos contaminated soil;
- Management of contaminated soils and material unsuitable for engineered fill;
- Purchasing large quantities of packaged materials;
- Installation of infrastructure and new road infrastructure;
- Plant and equipment maintenance;
- Concrete batch plant operations;
- Curing of concrete pavements;
- Office and crib hut activities and sanitary facilities;
- Decommissioning of the site.

The waste management hierarchy (see the Waste Management Sub-plan for further details) based on the principles 'Avoid, Reduce, Reuse, Recycle, Dispose' was continually implemented during the Project to manage any possible wastes generated.

Employees and site personnel were reminded of the importance of these strategies and the recycling facilities available during the Project through ARTC and contractor inductions (SFL Induction Environment_SP 110921.pptx, SSFL Joint Induction - FINAL June 11.ppt; ArencoSSFL Induction Handout.DOC), training presentations (SSFL Enviro and Comms Presentation GR Jan 11.PPT), toolbox training and other communication methods.

Tables 5, 6 and 7 in the Waste Management Sub Plan identified numerous waste management strategies and controls. Table 6 arranged actions into the categories of "avoid", "reduce", "reuse", "recycle" and "dispose". Table 7 split the controls into specific waste streams for the waste categories general waste and litter, green waste, building waste, construction waste, hazardous waste, wastewater, and workshop waste.

2.13.2 Effectiveness of Controls

No specific waste quantities were predicted in the Waste Management Sub Plan. Recycling targets were established for the Project as outlined in the Sub Plan with the aim to maximise the quantity of material that could be recycled during the construction phase. These targets were:

- 100% of waste oil and lubricants to be collected for recycling;
- 100% of cleared vegetation to be reused in revegetation, or other beneficial reuses such as sediment control and habitat recreation;
- No material that was commercially recyclable was to be disposed to landfill;
- All cut was to be reused as general fill for embankments, unless contaminated;
- Collected runoff water to be used for dust suppression, in preference to drawing water from watercourses or potable supplies;

- 100% of weed free topsoil to be recovered for reuse in landscaping and revegetation; and topsoil from threatened species areas to be salvaged for reuse in translocation program.

ARTC worked with contractors to ensure that measures taken by them to promote waste management and recycling as required by this condition were documented and reported to ARTC.

Most contractors provided evidence of site recycling and waste management practices:

- SFL's material movement registers tracked movements of vegetation, concrete, fill, metal and general waste to be recycled: 121114 Area 1 Waste Database.xlsx, Area 2 Waste and Resource Use Database v2.xlsx and Area 3 Waste Database 20120830.xlsx;
- Stations First provided an example of the recycling of concrete, timber, steel and mixed waste as evidence of the reuse of recyclable materials: Waste Management - Leumeah June 2012.xlsx;
- Abigroup provided evidence of waste segregation audits: Waste Segregation Audit Jul 2012.pdf.

Contractors also maintained waste management and recycling checklists including:

- 3ARail (formerly Arenco): 3ARail OHS&E Checklist 20120613.pdf (refer to Section 31);
- Stations First (formerly Gartner Rose): Stations First Campbelltown Audit Sep 2012.pdf (refer to Section R);
- Abigroup: Abigroup Environmental Inspection Checklist 120604.pdf; and
- Invensys: Invensys Enviro Inspection 26092012.pdf.

Section 2.6 contains details of the reuse of excavated material within the SSFL project, including descriptions of the spoil and fill management and evidence of reuse.

2.13.3 Innovations to Improve Environmental Management

As outlined in Spoil and Fill innovations (Section 2.6.3), the introduction of a re-use docket system improved the ability of the Project to reduce waste from site and credibly demonstrate material reuse. The use of the dockets for both waste and reuse formed the basis for the waste tracking register.

Training of staff dedicated to managing the docket system (engineers through to traffic controllers on the gates) ensured that the waste tracking register was populated by reliable data with high confidence that the material moving on and off site were recorded

2.13.4 Lessons Learnt During Construction

It is essential to a comprehensive waste register that there be someone allocated with the responsibility of maintaining the register and regularly auditing the quality of the information being entered. It is also important at a management level to regularly review that the data is being inputed into the system so as not to end up with an enormous backlog of data to be entered.

3 RECOMMENDATIONS

Information in this chapter summarises the recommendations for future projects, and is drawn from the innovations identified and lessons learnt discussed in Chapter 2. Information is presented in the order in which the area of environmental compliance occurs in the main sections of the Project Approval, as listed in Chapter 2.

Overview

1 Elevate environmental management to a status similar to that of safety in the project culture, using a range of measures described in Section 2.1.2, to promote the importance of environmental management and the individual accountability of staff and contractors.

2 Appropriately resource the project team with a sufficient number of skilled environment staff to ensure prompt response times when site measures need implementation and to ensure that appropriate emvironmental management practices are being undertaken. This is particularly important in the early stages of the project when environmental management systems and processes are being established and first being implemented.

3 Develop and implement a streamlined monthly environmental reporting checklist and schedule such that information is collected once by contractor organisations and the project, and used for multiple reports in a timely manner. This results in a streamlined reporting and compliance process for any project.

4 Format the EMR report to clearly classify actions as *non-conformances*, *corrective actions* or *improvement opportunities*, resulting in actions being suitably prioritised, addressed and reported in a timely manner.

5 Maintain up-to-date registers of environmental-related documentation, including monitoring data for noise, spoil and fill, etc, and EMR reports and close outs, for effective compliance management.

Noise and Vibration

6 Implement standard hours for noise works across the project to remove the risk of crossover of noisy works times between the operations of different subcontractors.

7 Produce stickers and place them on the control panels of all site plant and equipment showing allowable hours for noisy work and reminding staff of the required respite time periods.

8 Reporting of noise monitoring results should include the predicted and measured noise levels, as well as the background noise levels and noise level above background, and comprehensive information on construction noise management. This provides the basis for improved noise and vibration management.

9 When drafting and negotiating the EPL with the EPA, look for opportunities to:

6.1 Allow a noisy works management regime for work time versus respite, which may result in an additional hour of work available every day.

6.2 Self-approve out-of-hours works, resulting in a more efficient approval process for the project.

10 For construction projects extending over a long period, remodel and update background noise levels on a regular basis (for example, every two years) to ensure that the data being used in noise models is representative of the actual background noise levels in the project area.

Traffic

11 Consolidate communication between the project and each Local Council to one point of contact, ensuring that one person is responsible for information transfer and minimising the potential for agreements and legacy items to become lost in layers of management.

12 Dilapidation surveys carried out prior to the start of construction must be comprehensive in extent, with photographic evidence supporting a well written report; to enable unambiguous comparison when reviewing the final state of roads following the completion of construction, being able to assess what is fair wear and tare, and being able to assess when areas have been returned in a reasonable state.

13 Early liaison and agreement with road authorities, including the RMS and Local Councils is necessary to ensure there is an agreed baseline for comparison at the end of the project.

14 Clearly identify areas requiring dilapidation surveys prior to the start of work that have the potential to be high profile areas for stakeholders, for comparison at the end of the project.

Flora and Fauna

15 Standardise systems and processes for managing flora and fauna across all contractors on the project to ensure consistency, particularly with the pre-clearance checklist, thereby giving greater certainty that the appropriate hold-points are in place.

16 Contractors are to be provided with updated drawings clearly showing surveyed property boundaries, Principal Contractor boundaries and EPL premises boundaries so that contractors know which areas can be cleared of vegetation and which areas are to be protected, and emphasise to contractors that they should not rely on fence lines in the field which may or may not be correctly located.

17 The early works stage of a project should include provision for a surveyor independent of contractors to mark out project property boundaries, thereby providing an unambiguous reference for Principal Contractor boundaries and EPL premises boundaries. All contractors and sub-contractors on the project must be briefed on the clearly defined boundaries as part of induction meetings prior to commencing work.

18 Implement landscaping works as early as practicable during construction, provided no further reworking is required, to help stabilise final works and give vegetation growth a "head start".

19 Conduct appropriate landscape design for batters, including an assessment of the grade of batter and suitability of treatment. Assessment should include elements such as the requirement for drainage, stability of the batter dictating the need for immediate/temporary ground cover versus long term planting requirements, and suitability of options requiring thicker application of top soil versus options such as "Eco Blanket".

20 Terramesh walls require attention to drainage design, with good drainage of water away from the tops of walls, and additional maintenance for growing vegetation in wall faces, if the walls are going to succeed.

Erosion and Sediment Control

21 Develop erosion and sediment (ERSED) control plans for the whole project which should be used by all contractors and subcontractors working on the project. Use ERSED plans as a hold point for all works, and undertake them with site Environment staff prior to any new works being established or works being changed.

22 Use one spoil and erosion specialist for the project across the various contractors to give the regulator confidence that the project is being managed holistically rather than on a segmented basis.

23 Implement a standardised Permit to Pump process across the project for all contractors, including a centralised review and standard for testing and checking prior to any water being pumped.

Spoil and Fill

24 Use a "Reuse" docket system instead of a "Waste Transfer" docket system, to enable the movement and tracking of spoil around the project for reuse, and for record keeping of what material was being moved, how much was being reused and how much was being disposed.

25 Station appropriately trained traffic controllers on gates to enable reconciliation of dockets to the number of truck movements.

26 Train engineers and foremen as to why the reuse dockets are required and when and how to fill them out, resulting in a top-down and bottom-up approach to records management, and a comprehensive data set on spoil movement and disposal.

27 Allocate a project officer the responsibility of maintaining the spoil register, regularly audit the quality of the information being entered, and regularly review that the data is being inputed into the system keeping any data backlog to a minimum.

Acid Sulphate Soils

28 Undertake a process of comprehensive Acid Sulphate Soils testing in the early stages of the project, to establish possible hotspots, enable more detailed testing in key areas, and to have these areas cleared as the project progresses.

Surface Water and Groundwater

29 Use the Permit to Pump (PTP) system on the project for both the movement and testing of water, including equipping the Environment Team with PTP carbon copy books, training engineers and foremen about when and where a permit is needed, and having a top down management approach to reinforce the need for compliance with this system and the seriousness of non-compliance.

Air Quality

30 Use appropriate dust suppressants designed with different specialities, one for trafficable areas and one for stable non-trafficable areas, for cost-effective solutions.

31 Pre-plan contruction earthworks to include the cost of water carts and street sweepers to manage dust and dirt on site, as part of the strategy to control dust on site.

Greenhouse Gases and Sustainable Energy

32 Those contractors who purchase mains electricity in sufficiently large loads should be encouraged to purchase green power from their energy provider. All contractors should practice the controls listed in Section 2.10.2 to promote energy efficiency.

33 The use of green energy and other sustainable measures should be investigated during the project planning phase, and sustainable inititatives built into the initial cost estimate of the project.

Hazard and Risk

34 Developed a contamination checklist to be used by all contractors on a project. This provides a template against which each organisation should report and record contamination incidents as per the Contamination Management Plan, resulting in a consistent project-wide report.

35 The defining of hazards and risks and their management early in the project planning stage will be beneficial, not only for developing a PIRMP, but also for implementing a robust incident and risk management process for the project from its commencement.

Built and Indigenous Heritage

36 All contractors should follow the same process for managing unexpected finds during construction. Key to the successful implementation of this process is training. The practice of identifying and notifying an unexpected find depends on the understanding of site teams as to why this process is important, and on having management staff lead the process.

Waste Management and Recycling

37 Use a re-use docket system to reduce waste from site and credibly demonstrate material reuse. The use of the dockets for both waste and reuse formed the basis for the waste tracking register.

38 Train staff dedicated to managing the docket system (engineers through to traffic controllers on the gates) to ensure that the waste tracking register is populated by reliable data with high confidence that the material moving on and off site is recorded.

39 Allocated a project officer the responsibility of maintaining the waste tracking register, regularly audit the quality of the information being entered, and regularly review that the data is being inputed into the system.