Centennial Coal

SUPPLEMENTARY DATA

Volume Three

EPBC Approval 2011/5949

Application to Allow Longwall Mining Under Temperate Highland Peat Swamps on Sandstone on the Newnes Plateau

Springvale Colliery

September 2013

Information Request Regarding Application to Allow Longwall Mining Under Temperate Highland Peat Swamps on Sandstone on the Newnes Plateau (EPBC Approval 2011/5949)

Background

On 7 August 2013 Centennial Coal representatives met with SEWPaC Post-Approvals Compliance Section representatives and gave a presentation on Centennial's Application to Allow Longwall Mining Under Temperate Highland Peat Swamps on Sandstone on the Newnes Plateau (the Application), which is required to be approved by the Minister under EPBC Approval 2011/5949 before mining beneath THPSS within the Controlled Action Area (CAA). Following the presentation, feedback was provided by SEWPaC to Centennial and specific information was requested to supplement the information provided in the Application.

- Further information is required about the findings of East Wolgan Swamp (EWS) investigations.
    - Additional photographic monitoring data from time periods prior to development of the cavity to establish whether mine water discharge had impacted flora in East Wolgan Swamp prior to the formation of the cavity.
- Independent validation of the data sets provided and review of the interpretation of the data sets provided.
    - It was agreed that University of Queensland would conduct the independent review

Scope Of Supplementary Data Submission

This submission is a summary of relevant data and analysis and references specialist reports where relevant. Relevant specialist reports are appended. Volume 3 (below) contains additional information regarding the East Wolgan Swamp case study.

The independent review by University of Queensland will be provided directly to SEWPaC by University of Queensland.

1. Introduction

A review was conducted of all available photographic monitoring data from time periods prior to development of the cavity to establish whether mine water discharge had impacted flora in East Wolgan Swamp prior to the formation of the cavity. This review included photographic monitoring conducted by Craven Elliston Hayes Pty Ltd on behalf of Centennial to allow compliance with the Subsidence Management Plan for Longwalls 411 to 418. It also included a review of photographs and data from Gingra Ecological Surveys, based on their vegetation monitoring conducted for compliance with the Subsidence Management Plan for Longwalls 411 to 418. Relevant photographs, along with locations and dates are included below. The following document is appended:

- Springvale Colliery Longwalls 411 – 418 Subsidence Management Plan Photo Record East Wolgan Swamp Baseline Survey 2-May-2005
- Report from Gingra Ecological Surveys regarding East Wolgan Swamp flora monitoring during the period May 2005 to end 2008.

Evidence of pre-mining erosional features at the Northern (downstream) slumping location has been obtained from photographic monitoring records supplied by Craven Elliston Hayes Pty Ltd and is also presented.

Further evidence of the ongoing presence of surface water since August 2010 in East Wolgan Swamp downstream of the cavity has been obtained from photographic monitoring records supplied by Craven Elliston Hayes Pty Ltd.

Evidence of erosional impacts to East Wolgan Swamp at the Northern (downstream) slumping location has been obtained from photographic monitoring records supplied by Craven Elliston Hayes Pty Ltd and is also presented. It is important to arrest further erosional impacts through the proposed rehabilitation works.

2. Photographic Monitoring East Wolgan Swamp – During and After Mine Water Discharge

2.1. Springvale Colliery Longwalls 411 – 418 Subsidence Management Plan Photo Record East Wolgan Swamp Baseline Survey 2 May 2005

Figure 8.1 is a Photographic Location Plan from Springvale Colliery Longwalls 411 – 418 Subsidence Management Plan Photo Record East Wolgan Swamp Baseline Survey 2-May-2005

Figure 8.2 is a photo of East Wolgan Swamp taken on 2 May 2005 (but incorrectly dated 2 May 2004) from Location 21(upstream of cavity location), showing mine water discharge and swamp vegetation. Note the sedges / rushes along the edges of the flow path of mine water discharge and limited vegetation with the flow path of mine water discharge

Figure 8.3 is a photo of East Wolgan Swamp Swamp taken on 2 May 2005 (but incorrectly dated 2 May 2004) from Location 22 (upstream of cavity location), showing mine water discharge and swamp vegetation. Note the sedges / rushes along the edges of the flow path of mine water discharge and limited vegetation with the flow path of mine water discharge

Figure 8.4 is a graph of Timescaled Volumetric Flow Rates of Mine Water Discharge from Licenced Discharge Points 4,5 and 6 to East Wolgan Swamp and Narrow Swamp . The volume discharged at LDP04 at East Wolgan Swamp is half of the total volume recorded on the graph. Note the discharge rates of up to 6Ml/day up to May 2005 (timing of pre-mining baseline photographic survey) and the much greater emergency discharge rates of up to 12Ml/day which occurred after this date.

2.1.1. Summary of Observations Related to Springvale Colliery Longwalls 411 – 418 Subsidence Management Plan Photo Record East Wolgan Swamp Baseline Survey 2-May-2005

Based on Figures 8.2, 8.3 and 8.4, the following observations can be made:

- Years of mine water discharge changed swamp hydrology from periodically waterlogged (baseline state) to permanently waterlogged
- Discharge Volumes <6Ml/day (av.4Ml/day) prior to baseline survey date
- Discharge Volumes up to 12Ml/day (av.10Ml/day) after baseline survey date
- Sedges and Rushes flourished adjacent to mine water discharge flow path
- Vegetation not present in mine water discharge flow path

2.2. Gingra Ecological Surveys Flora Monitoring Records

Gingra (2013) stated "*Based on my experience and observations, I would ascribe the death of plants to a combination of fluctuation in water levels and chemical conditions rather than soil erosion caused by high flow rates. In the swamps affected by wildfire eroded areas were generally recolonised rapidly. At Kables Sand Quarry in the swamp affected by the December 1997 bushfire plant cover recovered to pre-fire levels within two years.*

Photos of monitoring sites in East Wolgan Swamp taken in February 2006 (see Appendix 2, Figure 1) would seem to confirm this conclusion. The figure for EW01 shows healthy sedges and Coral Fern plants either side of the flowing drainage line. Subsequent photos (Figures 2-4) show drying of the swamp and decline of condition of sedges, rushes and Gleichenia plants. The hydrographs, illustrated in figure 41 of the McHugh (2013) report, show reduction in water levels commencing in February 2006, with the standing water levels in both piezometers declining to the base of the bore from August 2006 to 11 November 2006."

Figures 8.5 to 8.8 are a series of photos of EW01 Flora Monitoring Quadrat dated between 9 June 2005 and 29 November 2006. Included with the figures is text relating to mine water discharge, standing water level and vegetation condition. Below is a summary of trends which can be observed from Figures 8.5 to 8.8.

2.2.1. Trends from Photographic Monitoring at EW01Quadrat

- There was continuous mine water discharge at up to 8Ml/day until 5 Feb 2006
- There was emergency mine water discharge of up to 9Ml/day on only 13 days between 27 February and 10 November 2006.
- The standing water level at both swamp piezometers WE1 and WE2 fell from ground level to base of bores WE1 (2.5m bgl) and WE2 (1.2m bgl) by the end of July 2006.
- There was a trend of swamp drying within mine water discharge flow path
- Condition of sedges (and other species) adjacent to mine water discharge flow path was healthy during mine water discharge and deteriorated badly following cessation of continuous mine water discharge.

2.2.2. Trends from Flora Monitoring at EW01Quadrat

Figure 8.9 is a table of the Condition of Indicator Species at East Wolgan Swamp. The red border indicates the period in which photos shown in Figures 8.5 to 8.8 (above) were taken. Note the deteriorating condition trends for a number of species during this period. The data is consistent with trends from the photographic monitoring.

2.3. Data Related to Swamp Hydrology at EW01 Flora Monitoring Quadrat

Figure 8.10 shows hydrographs of East Wolgan Swamp and Narrow Swamp Piezometers with standing water levels near EW01 vegetation monitoring quadrat during the photo monitoring intervals shown on Figures 8.5 to 8.8 above. The red borders show a comparison of standing water levels between each pair of adjacent monitoring times. There is a clear trend of falling standing water levels during this period, which illustrates the change of swamp hydrology back to pre-mine water discharge periodically waterlogged conditions.

Figure 8.11 is a plan showing the position of piezometers relative to Longwall 411. Note that at a depth of cover of 315 metres and a distance of 160 metres from the WE1 swamp piezometer to the goaf edge of Springvale Longwall 411, the piezometer falls outside of the angle of draw of Longwall 411. WE2 swamp piezometer falls just inside the angle of draw of Longwall 411.

Figure 8.12 shows hydrographs of East Wolgan Swamp and Narrow Swamp piezometers with standing water levels near EW01 vegetation monitoring quadrat during the photo monitoring intervals shown on Figures 8.5 to 8.8 above. There is a clear trend of falling standing water levels during this period in both Narrow Swamp and East Wolgan Swamp, which illustrates the change of swamp hydrology back to pre-mine water discharge periodically waterlogged conditions. Note the similar behaviour of piezometers in Narrow Swamp and East Wolgan Swamp, with rates of decline in standing water levels increasing after 25 July 2006. The timing of increased rate of decline in standing water levels coincides with Longwall 411 mining within the Angle of Draw of piezometer WE2 (not WE1), but also coincides with the ongoing decline in Cumulative Rainfall Deviation (CRD) due to very low rainfall levels throughout the calendar year of 2006. Note that the rates of decline are generally greater in the East Wolgan Swamp piezometers than the Narrow Swamp piezometers, but the trend is the same.

Figure 8.13 is a plan showing the location of East Wolgan Swamp, mine workings, monitoring locations and cavity location. The cavity is approximately 350 metres from EW01 Vegetation Monitoring Quadrat and 400 – 500 metres from swamp piezometers WE1 and WE2. Note that the behaviour of the swamp piezometers WE1 and WE2 is similar to that of the Narrow Swamp piezometers NS 1 and NS2 (which were also subjected to mine water discharge and were not undermined until January 2009). The piezometer behaviour and swamp hydrology respond to mine water discharge and cumulative rainfall discharge but not to the cavity.

2.3.1. Summary of Data Related to Swamp Hydrology at EW01 Flora Monitoring Quadrat

There is a clear trend of falling standing water levels during the period between March 2006 and November 2006, which illustrates the change of swamp hydrology back to pre-mine water discharge periodically waterlogged conditions.

WE1 piezometer falls outside of the angle of draw of Longwall 411. WE2 swamp piezometer falls just inside the angle of draw of Longwall 411. The behaviour of the swamp piezometers WE1 and WE2 is similar to that of the Narrow Swamp piezometers NS 1 and NS2 (which were also subjected to mine water discharge and were not undermined until January 2009).

The piezometer behaviour and swamp hydrology respond to mine water discharge and cumulative rainfall discharge but not to the cavity.

2.4. Evidence of Pre-Mining Erosional Features at the Northern (Downstream) Slumping and Cavity Location

Figures 8.15 to 8.18 are a series of photos at the Northern (Downstream) Slumping and Cavity Location between May 2006 and June 2008, which indicate the presence of an existing erosional feature at this location at the time of mining.

Figure 8.14 is a plan showing the location of the cavity and the timing of mining in the area (during May 2006).

Figures 8.15 to 8.18 are a series of photos showing the Northern (Downstream) Slumping and Cavity Location between 12 May 2006 and 16 June 2008.

The photos show the area from around the time of mining through to a period between major emergency mine water discharges (which includes part of the period of entire loss of mine water discharge into the cavity.

2.4.1. Interpretation of Pre-Mining Erosional Features at the Northern (Downstream) Slumping and Cavity Location

Based on the photos from Figures 8.15 to 8.18, it is possible that the following sequence of events occurred at the Northern slumping and cavity location.

- Photos from around the time of mining indicate existing slumping / erosion at the Northern slumping and cavity location
- Possible pre-existing open fault plane underlying peat at Northern slumping and cavity location
- Subsidence caused localised re-activation of fault and mine water discharge caused swamp sediment transport and slumping

2.5. Evidence of the Ongoing Presence of Surface Water Since August 2010 in East Wolgan Swamp Downstream of the Cavity

Further evidence of the ongoing presence of surface water since August 2010 in East Wolgan Swamp downstream of the cavity has been obtained from photographic monitoring records supplied by Craven Elliston Hayes Pty Ltd.

Figures 8.19 to 8.25 are a series of photos taken at locations downstream of the cavity since August 2010, which consistently show the presence of surface water downstream of the cavity since August 2010.

There were monthly records available during the period since August 2010. Photos presented in this report were sampled at six monthly intervals in June and December with consistent presence of surface water downstream of the cavity since August 2010.

2.6. Erosional Impacts to East Wolgan Swamp Northern Slump Area

Evidence of erosional impacts to East Wolgan Swamp at the Northern (downstream) slumping location has been obtained from photographic monitoring records supplied by Craven Elliston Hayes Pty Ltd and is also presented. It is important to arrest further erosional impacts through the proposed rehabilitation works.

Figure 8.26 to 8.28 are photos taken at the Northern (downstream) slumping location, which show a trend of stabilising slumping and vegetation regrowth over time (after the cessation of mine water discharge) between November 2009 and December 2011.

Figure 8.29 is a hydrograph of East Wolgan Swamp piezometers and cumulative rainfall deviation. It can be seen that there were major rainfall events in February and March 2012. During this period, the rainfall was 266mm greater than long term average (up to 75mm / day). There was evidence of water flow depth up to 0.5m

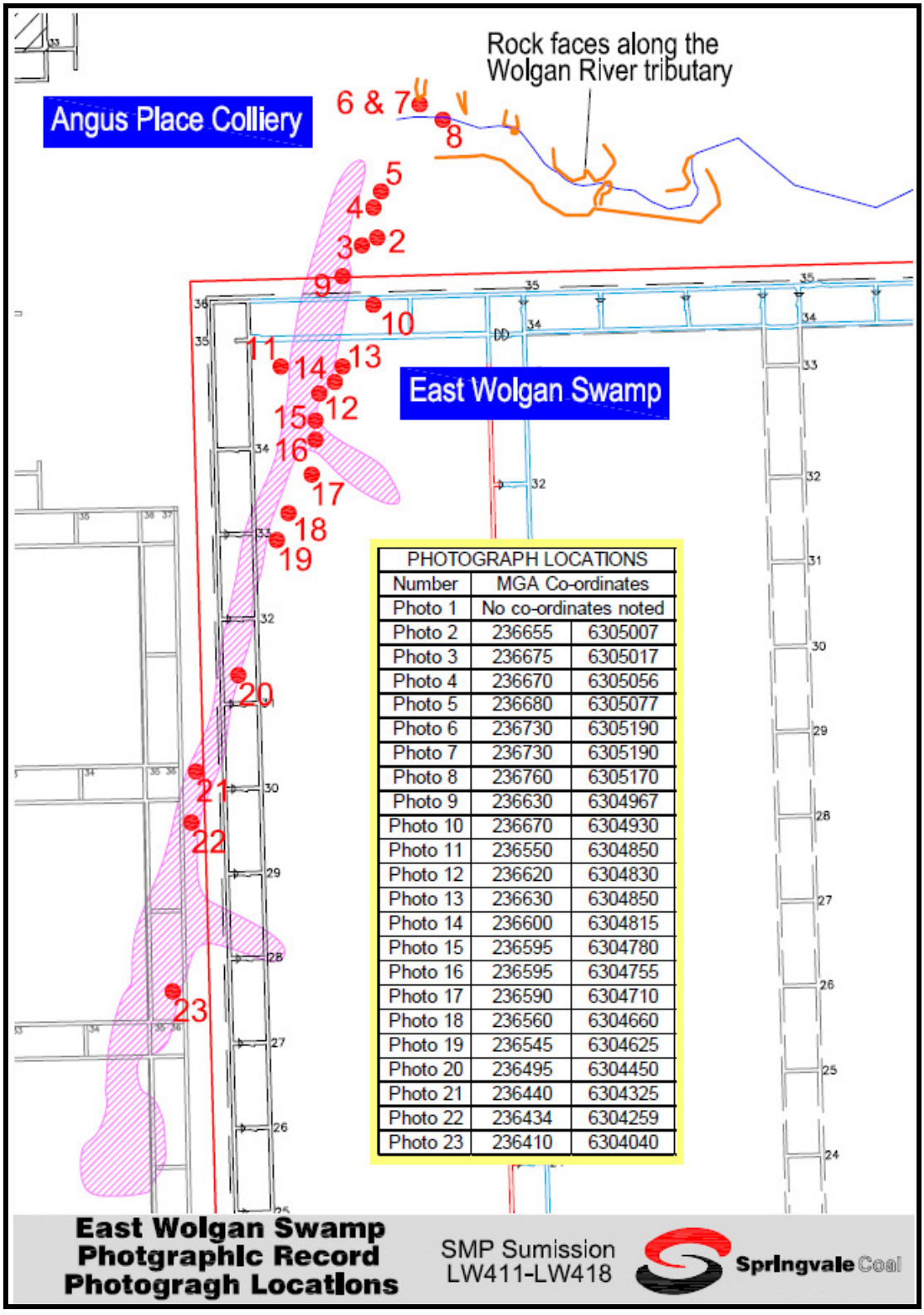
and major erosion along the length of East Wolgan Swamp from photographic monitoring.

Figure 8.30 to 8.32 are photos taken at the Northern (downstream) slumping location between April 2012 and April 2013, which show the aftermath of the major rainfall / erosion events in February and March 2012.

2.6.1. Summary of Erosional Impacts to East Wolgan Swamp Northern Slump Area

- Slumping stabilised following cessation of mine water discharge in April 2010
- Vegetation regrowth progressively being established between April 2010 and January 2012
- Major rainfall events in February / March 2012 caused extensive erosion of Northern slump area (and other areas in East Wolgan Swamp)
- Major rainfall events in February / March 2012 caused a significant setback to swamp regeneration
- Remediation is required as soon as possible to prevent further erosion / degradation

East Wolgan Swamp Case Study Supplementary Figures



PHOTOGRAPH LOCATIONS		
Number	MGA Co-ordinates	
Photo 1	No co-ordinates noted	
Photo 2	236655	6305007
Photo 3	236675	6305017
Photo 4	236670	6305056
Photo 5	236680	6305077
Photo 6	236730	6305190
Photo 7	236730	6305190
Photo 8	236760	6305170
Photo 9	236630	6304967
Photo 10	236670	6304930
Photo 11	236550	6304850
Photo 12	236620	6304830
Photo 13	236630	6304850
Photo 14	236600	6304815
Photo 15	236595	6304780
Photo 16	236595	6304755
Photo 17	236590	6304710
Photo 18	236560	6304660
Photo 19	236545	6304625
Photo 20	236495	6304450
Photo 21	236440	6304325
Photo 22	236434	6304259
Photo 23	236410	6304040

Figure 8.1 Photographic Location Plan from Springvale Colliery Longwalls 411 – 418 Subsidence Management Plan Photo Record East Wolgan Swamp Baseline Survey 2-May-2005

Figure 8.2 – Photo of East Wolgan Swamp taken 2 May 2005 from Location 21(upstream of cavity location), showing mine water discharge and swamp vegetation. Note the sedges / rushes along the edges of the flow path of mine water discharge and limited vegetation with the flow path of mine water discharge. NB These photos were taken on 2 May 2005, but were incorrectly labelled 2 May 2004.

Figure 8.3 – Photo of East Wolgan Swamp taken 2 May 2005 from Location 22 (upstream of cavity location), showing mine water discharge and swamp vegetation. Note the sedges / rushes along the edges of the flow path of mine water discharge and limited vegetation with the flow path of mine water discharge. NB These photos were taken on 2 May 2005, but were incorrectly labelled 2 May 2004.

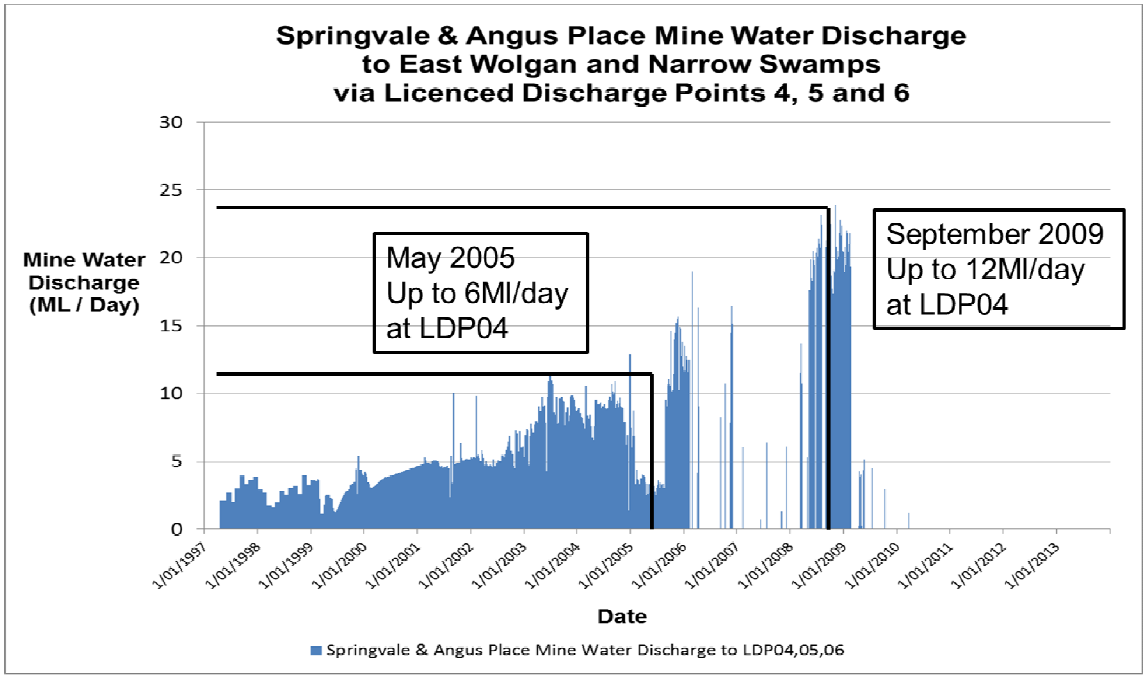


Figure 8.4 – Graph of Timescaled Volumetric Flow Rates of Mine Water Discharge from Licenced Discharge Points 4,5 and 6 to East Wolgan Swamp and Narrow Swamp . The volume discharged at LDP04 at East Wolgan Swamp is half of the total volume recorded on the graph. Note the discharge rates of up to 6Ml/day up to May 2005 (timing of pre-mining baseline photographic survey) and the much greater emergency discharge rates of up to 12Ml/day which occurred after this date.

Figure 8.5 Photo of EW01 Flora Monitoring Quadrat dated 9 June 2005 (Winter). At this time:

- There had been continuous MWD at 2-5Ml/day for several years
- Standing Water Level was at Ground Level in mine water discharge flow path
- Sedges Flourishing adjacent to mine water discharge flow path

Figure 8.6 Photo of EW01 Flora Monitoring Quadrat dated 3 March 2006 (Autumn). At this time:

- There had been continuous mine water discharge at up to 8Ml/day to 5 Feb 2006
- There had been emergency mine water discharge at up to 7Ml/day 27 Feb - 1 Mar 2006
- Standing Water Level was at Ground Level in mine water discharge flow path
- Sedges Flourishing adjacent to mine water discharge flow path

Figure 8.7 Photo of EW01 Flora Monitoring Quadrat dated 12 May 2006 (Winter). At this time:

- There had been minor emergency mine water discharge (9 days) at up to 9Ml/day from 3 March to 12 May 2006
- Standing Water Level was falling (0.1m to 1.1m Below Ground Level)
- Swamp was drying within mine water discharge flow path
- Condition of sedges adjacent to mine water discharge flow path was deteriorating

Figure 8.8 Photo of EW01 Flora Monitoring Quadrat dated 29 November 2006 (Spring). At this time:

- There had been minor emergency mine water discharge (4 of 182 days) at up to 9Ml/day from 12 May to 10 November 2006
- Standing Water Level Fell to base of Bores WE1 (2.5m bgl) and WE2 (1.2m bgl) for 4 months
- Trend of Swamp Drying within MWD flow path NB there is emergency mine water discharge in this photo (recorded 10-30 November 2006)
- Condition of sedges adjacent to mine water discharge flow path was deteriorating further

SPECIES	Aut 05	Win 05	Sum 06	Aut 06	Win 06	Spr 06	Sum 07	Aut 07	Win 07	Spr 07	Sum 08	Aut 08	Win 08	Spr 08
EW01														
Baumea rubiginosa	5	5	5	5	4	2	3	1	1	1	1	2	2	5
Empodisma minus	NR	5	5	5	4	3	3	3	4	NR	4	NR	4	5
Gleichenia dicarpa	5	5	5	5	5	4	4	2	2	3	4	4	3	3
Grevillea acanthifolia	5	5	5	5	4	5	4	3	3	4	4	2	4	4
Leptospermum grandifolium	5	5	5	5	3	3	2	1	2	1	2	2	2	4
Leptospermum obovatum	5	5	5	5	3	3	5	3	3	5	2	2	3	4
Baloskion australe	5	5	5	5	5	5	4	4	5	5	5	5	3	5
EW02														
Baumea rubiginosa	5	5	5	5	5	5	2	2	1	1	4	4	4	5
Gleichenia dicarpa	5	5	5	4	3	5	4	2	2	1	4	4	2	3
Grevillea acanthifolia	5	5	5	4	2	5	5	3	4	5	5	5	3	5
Leptospermum grandifolium	5	5	5	3	2	5	1	2	2	2	2	2	3	4
Leptospermum obovatum	5	5	5	2	3	5	2	2	3	2	2	2	3	4
Baloskion australe	5	5	5	5	4	5	4	5	4	5	4	5	3	5

Figure 8.9 - Condition of Indicator Species at East Wolgan Swamp. The red border indicates the period in which photos shown in Figures 8.5 to 8.8 (above) were taken. Note the deteriorating condition trends for a number of species during this period.

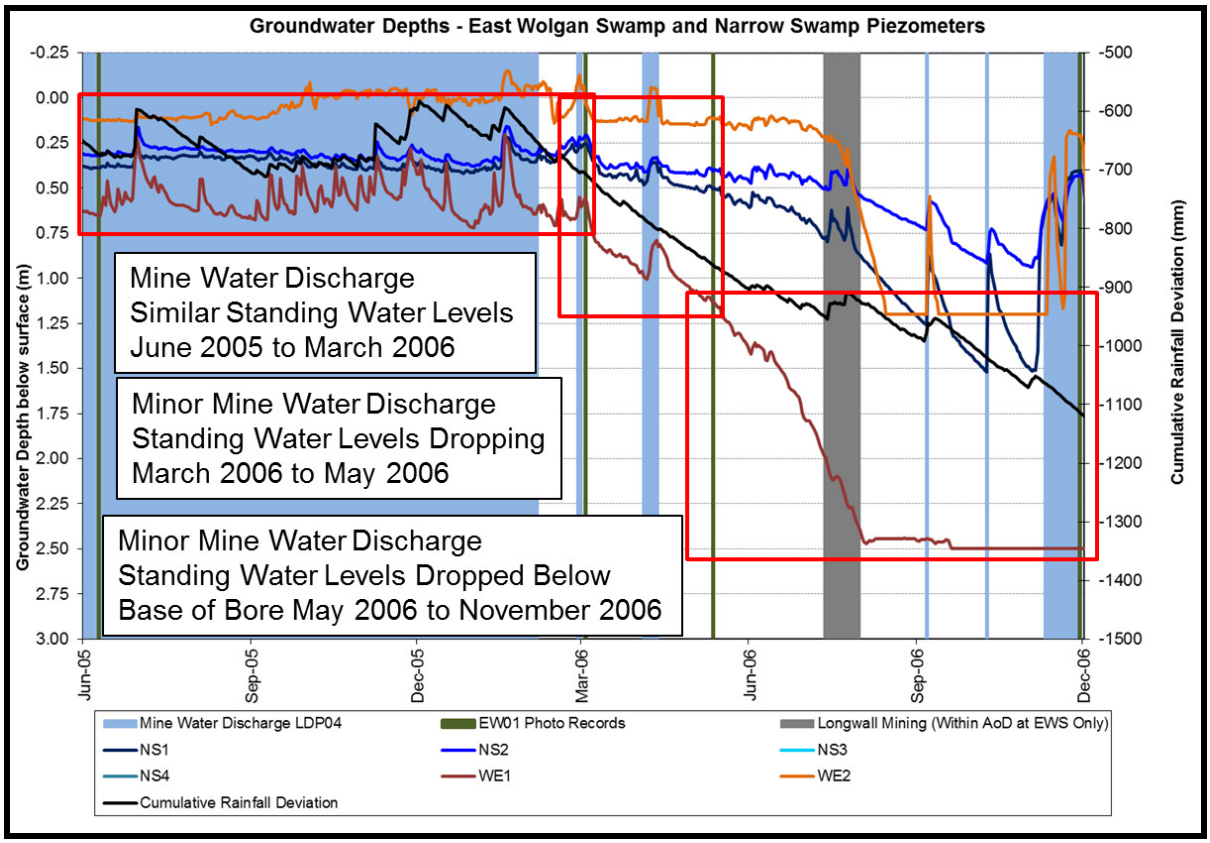


Figure 8.10 – Hydrographs of East Wolgan Swamp and Narrow Swamp Piezometers showing standing water levels near EW01 vegetation monitoring quadrat during the photo monitoring intervals shown on Figures 8.5 to 8.8 above. The red borders show a comparison of standing water levels between each pair of adjacent monitoring times. There is a clear trend of falling standing water levels during this period, which illustrates the change of swamp hydrology back to pre-mine water discharge periodically waterlogged conditions.

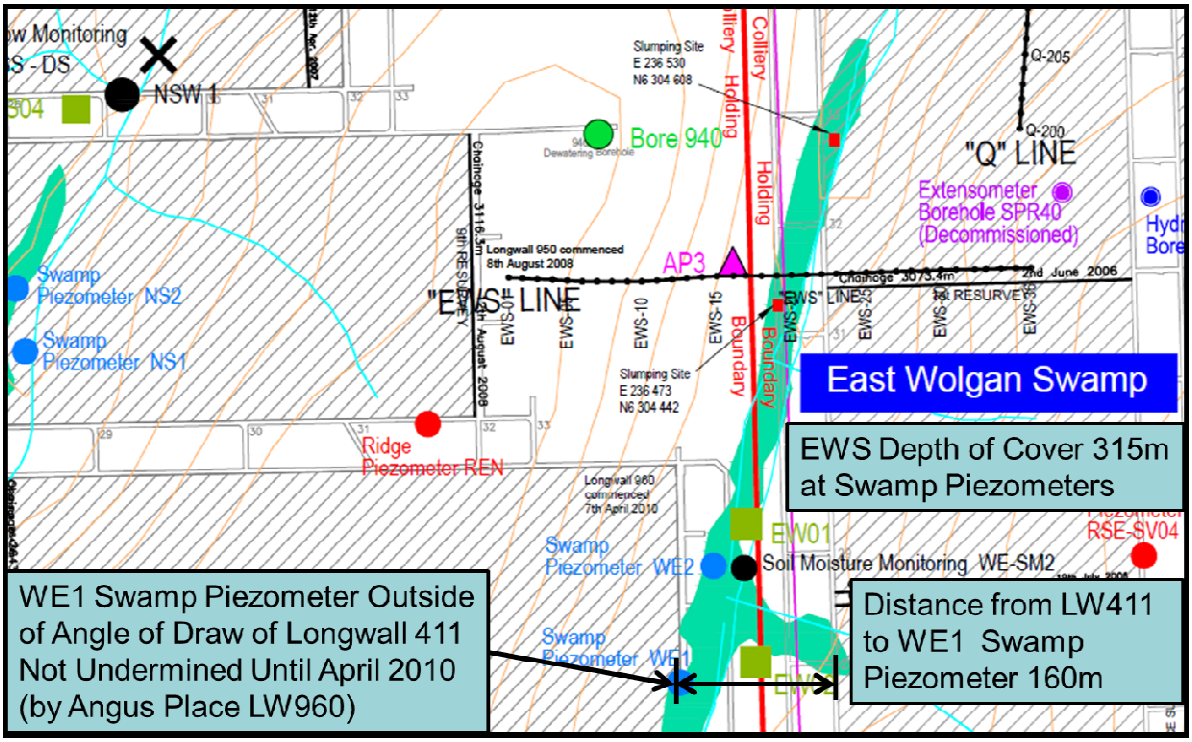


Figure 8.11 - Position of Piezometers Relative to Longwall 411. Note that at a depth of cover of 315 metres and a distance of 160 metres from the WE1 swamp piezometer to the goaf edge of Springvale Longwall 411, the piezometer falls outside of the angle of draw of Longwall 411. WE2 swamp piezometer falls just inside the angle of draw of Longwall 411.

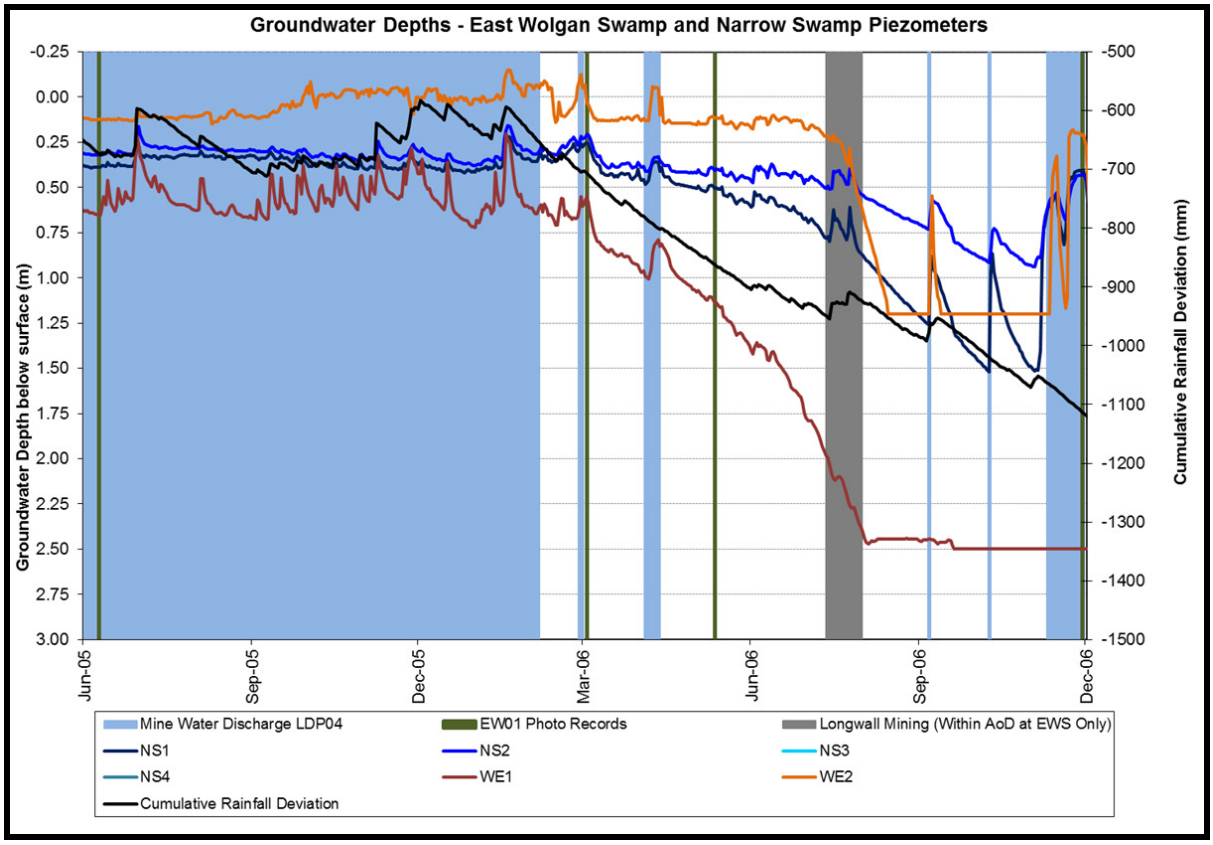


Figure 8.12 – Hydrographs of East Wolgan Swamp and Narrow Swamp Piezometers showing standing water levels near EW01 vegetation monitoring quadrat during the photo monitoring intervals shown on Figures 8.5 to 8.8 above. There is a clear trend of falling standing water levels during this period in both Narrow Swamp and East Wolgan Swamp, which illustrates the change of swamp hydrology back to pre-mine water discharge periodically waterlogged conditions. Note the similar behaviour of piezometers in Narrow Swamp and East Wolgan Swamp, with rates of decline in standing water levels increasing after 25 July 2006. The timing of increased rate of decline in standing water levels coincides with Longwall 411 mining within the Angle of Draw of piezometer WE2 (not WE1), but also coincides with the ongoing decline in Cumulative Rainfall Deviation (CRD) due to very low rainfall levels throughout the calendar year of 2006. Note that the rates of decline are generally greater in the East Wolgan Swamp piezometers than the Narrow Swamp piezometers, but the trend is the same.

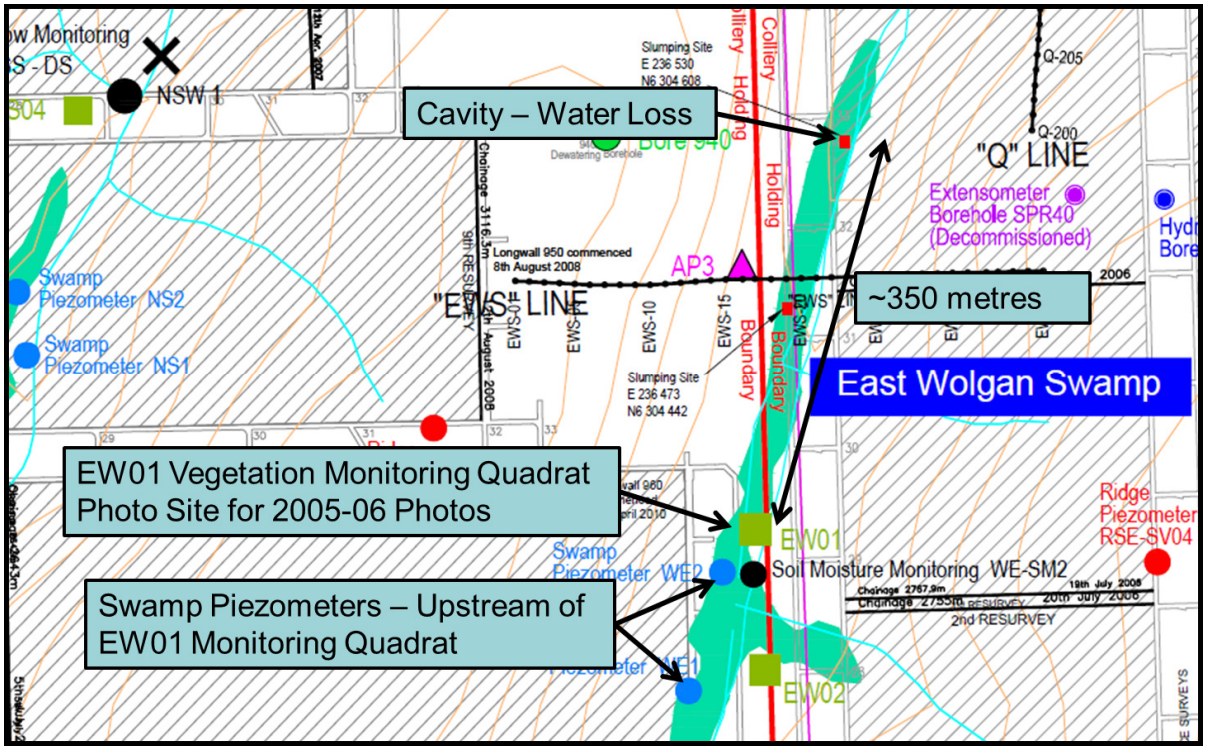


Figure 8.13 – Plan showing the location of East Wolgan Swamp, Mine Workings, Monitoring Locations and Cavity Location. The cavity is approximately 350 metres from EW01 Vegetation Monitoring Quadrat and 400 – 500 metres from swamp piezometers WE1 and WE2. Note that the behaviour of the swamp piezometers WE1 and WE2 is similar to that of the Narrow Swamp piezometers NS 1 and NS2 (which were also subjected to mine water discharge and were not undermined until January 2009). The piezometer behaviour and swamp hydrology respond to mine water discharge and cumulative rainfall discharge but not to the cavity.

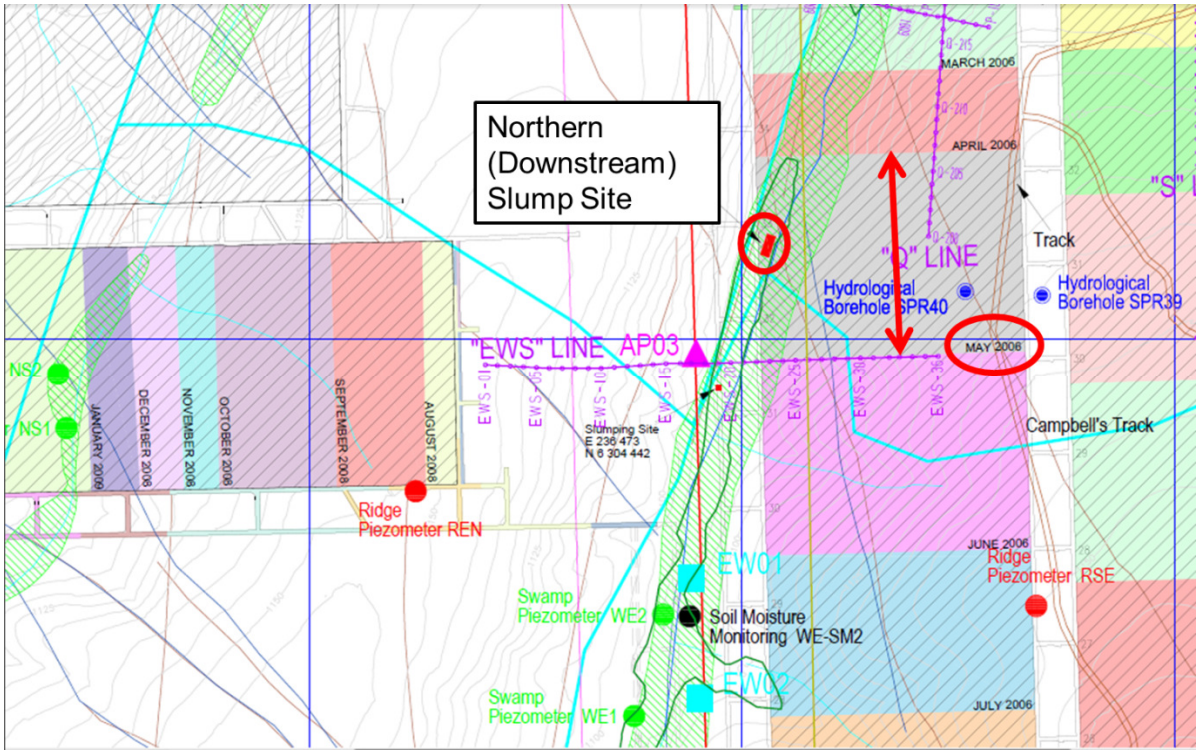


Figure 8.14 Plan Showing the Location of the Cavity and the Timing of Mining in the Area (during May 2006).

Figure 8.15 Northern Slump Site 12 May 2006 (Around Time Undermined) showing existing erosion

Figure 8.16 Northern Slump Site 17 January 2008 – Before Major Emergency Discharges

Figure 8.17 Northern Slump Site 23 May 2008 – During Major Emergency Discharges

Figure 8.18 Northern Slump Site 16 June 2008 – Between Major Emergency Discharges

Figure 8.19(a) East Wolgan Swamp Surface Water Downstream of Cavity 20 August 2010

Figure 8.19(b) East Wolgan Swamp Surface Water Downstream of Cavity 20 August 2010

Figure 8.19(c) East Wolgan Swamp Surface Water Downstream of Cavity 20 August 2010

Figure 8.19(d) East Wolgan Swamp Surface Water Downstream of Cavity 20 August 2010

Figure 8.20(a) East Wolgan Swamp Surface Water Downstream of Cavity 21 December 2010

Figure 8.20(b) East Wolgan Swamp Surface Water Downstream of Cavity 21 December 2010

Figure 8.20(c) East Wolgan Swamp Surface Water Downstream of Cavity 21 December 2010

Figure 8.21(a) East Wolgan Swamp Surface Water Downstream of Cavity 4 June 2011

Figure 8.21(b) East Wolgan Swamp Surface Water Downstream of Cavity 4 June 2011

Figure 8.21(c) East Wolgan Swamp Surface Water Downstream of Cavity 4 June 2011

Figure 8.21(d) East Wolgan Swamp Surface Water Downstream of Cavity 4 June 2011

Figure 8.22(a) East Wolgan Swamp Surface Water Downstream of Cavity 5 December 2011

Figure 8.22(b) East Wolgan Swamp Surface Water Downstream of Cavity 5 December 2011

Figure 8.22(c) East Wolgan Swamp Surface Water Downstream of Cavity 5 December 2011

Figure 8.23(a) East Wolgan Swamp Surface Water Downstream of Cavity 7 June 2012

Figure 8.23(b) East Wolgan Swamp Surface Water Downstream of Cavity 7 June 2012

Figure 8.23(c) East Wolgan Swamp Surface Water Downstream of Cavity 7 June 2012

Figure 8.23(d) East Wolgan Swamp Surface Water Downstream of Cavity 7 June 2012

Figure 8.24(a) East Wolgan Swamp Surface Water Downstream of Cavity 4 December 2012

Figure 8.24(b) East Wolgan Swamp Surface Water Downstream of Cavity 4 December 2012

Figure 8.25(a) East Wolgan Swamp Surface Water Downstream of Cavity 4 June 2013

Figure 8.25(b) East Wolgan Swamp Surface Water Downstream of Cavity 4 June 2013

Figure 8.25(c) East Wolgan Swamp Surface Water Downstream of Cavity 4 June 2013

Figure 8.25(d) East Wolgan Swamp Surface Water Downstream of Cavity 4 June 2013

Figure 8.25(e) East Wolgan Swamp Surface Water Downstream of Cavity 4 June 2013

Figure 8.26 EWS Northern Slump 16 November 2009 – Major Emergency MWD Ceased May 2009

Figure 8.27 EWS Northern Slump 21 December 2010

Figure 8.28 EWS Northern Slump - 5 December 2011

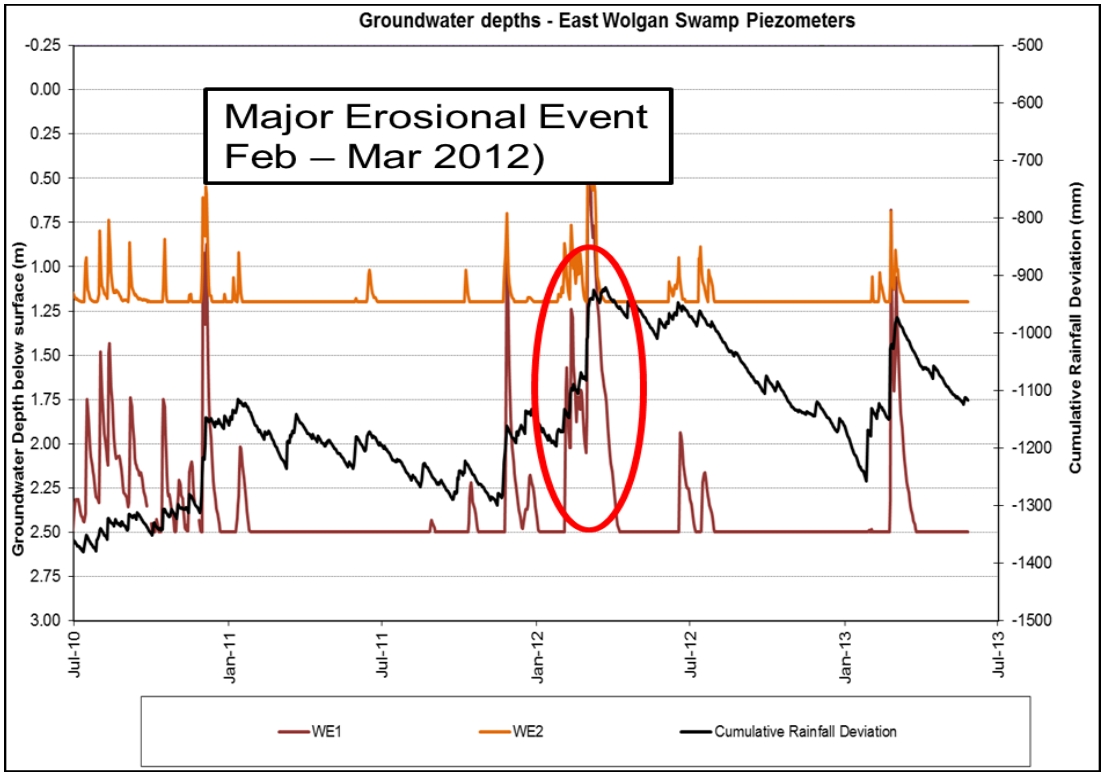


Figure 8.29 Erosion Due to Major Rainfall Event in February /March 2012

Figure 8.30 EWS Northern Slump - 10 April 2012

Figure 8.31 EWS Northern Slump - 12 September 2012

Figure 8.32 EWS Northern Slump - 12 April 2013

Appendix 1

Springvale Colliery Longwalls 411 – 418
Subsidence Management Plan Photo Record
East Wolgan Swamp Baseline Survey
2-May-2005

Appendix 2

Gingra Ecological Surveys Report

East Wolgan Swamp Flora Monitoring

May 2005 to End 2008