THE RANGE OF IMPACTS OBSERVED IN THE SPECIAL AREAS DUE TO LONGWALL COAL MINING

A. Subsidence Impacts

Longwall mining subsidence impacts on natural features are generally manifested on the surface as:

1. Loss of surface flows due to streambed cracking – undermined sections of creeks and rivers can simply disappear leaving a dry riverbed and local extinction of water dependent eco-systems

2. Upwelling of contaminated groundwater, typically heavily stained with iron oxide as chemicals are leached from newly fractured rock underground and brought to the surface when some water re-emerges beyond fracture zone

3. Fugitive methane emissions as gases escape through fractured bedrock

4. Swamp desiccation due to bedrock cracking, leading to fire vulnerability, erosion and total collapse

5. Surface cracking resulting in ground fissures opening up to 1m wide and 15m deep, resulting in increased infiltration of water to depth which should be surface runoff to storage reservoirs.

6. Cliff falls

B. Surface disturbance for infrastructure

C. Remediation

A 1. Severe streambed cracking and loss of surface flow - Waratah Rivulet, 2006

Collapsed rockbar and what was once a waterfall

Waratah Rivulet - completely drained pool, 2006

Waratah Rivulet, Feb. 2014 - another completely drained 100m long pool in current mining area, approved 2009

A 2. <u>Upwelling of contaminated groundwater</u>, typically heavily stained with iron oxide as chemicals are leached from newly fractured rock underground and brought to the surface when some water re-emerges beyond fracture zone

Waratah Rivulet 2011

Waratah Rivulet, 2012

A 3. <u>Fugitive methane emissions</u> as gases escape through fractured bedrock

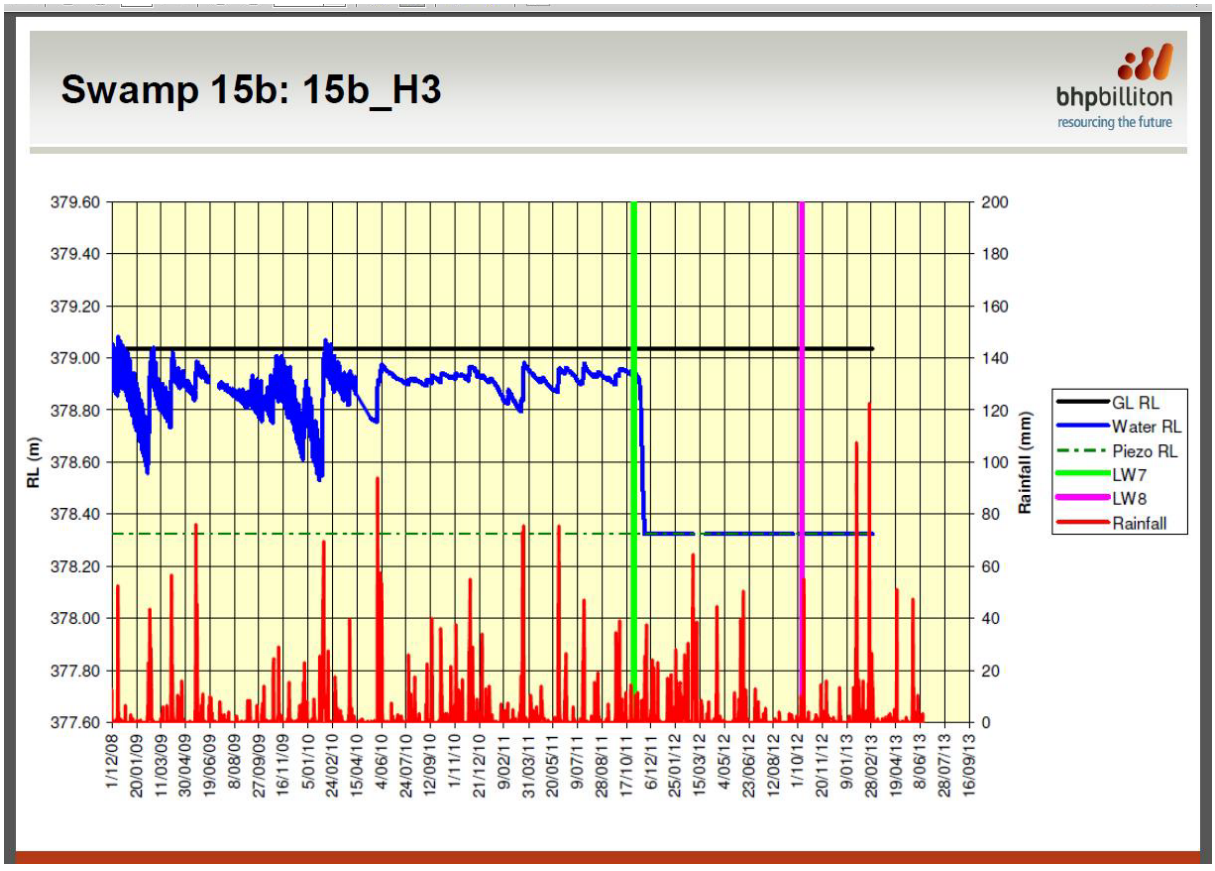
Waratah Rivulet, 2011

A 4. <u>Swamp desiccation</u> due to bedrock cracking, leading to fire vulnerability, erosion and total collapse

Exposed swamp bedrock cracking – Dendrobium Swamp 1, 2008

Swamp sediments cracked and dried out – Dendrobium Swamp 1, 2008

Banksia robur, a key swamp indicator species, dies once the swamp dries out.
Dendrobium Swamp 1 , 2009



Piezometer monitoring graph showing typical response of swamp water level as soon as undermining occurs (green line). As the swamp bedrock cracks, the water level plummets immediately and does not recover despite good rainfall (red spikes). This swamp is now dry, swamp vegetation is dying and other woody plant species are already starting to colonise. There is no water exiting this swamp. The entire exit stream is dry.

A collapsed swamp - Swamp 18, Elouera Mine, 2007

This swamp, undermined in the 1990s, dried out and then was subject to burning by severe bushfires in 2001. Subsequent heavy rain has eroded the dried out peat, creating deep gullies. The swamp vegetation has been replaced by wattles and eucalypts.

Healthy swamps survive fires, as the waterlogged peat does not burn. The vegetation above ground burns but regenerates quickly.

5. <u>Surface cracking</u> resulting in ground fissures opening up to 1m wide and 15m deep, allowing increased infiltration of water to depth which should be surface runoff to storage reservoirs.

Dendrobium Area 2, 2007

A massive rock outcrop split apart.

Dendrobium, 2010

6. Cliff falls

Dendrobium Area 1, 2008

B. Surface disturbance for infrastructure

Underground mining involves a lot of surface disturbance. This starts with the exploration phase where seismic lines are cleared in a grid pattern across the landscape so that the extent of the resource can be determined. These criss cross the lease areas and are slow to regenerate.

This is followed by bore holes to test the depth and quality of the coal. Each borehole involves more clearing and access tracks to bring in the heavy equipment required.

As the longwalls move further away from the pit-top, which is outside the Special Area, vent shafts have to be constructed to allow foul air to be expelled and fresh air to be drawn into the mine below. These vent shafts are huge, requiring a large footprint to be cleared for the shafts themselves as well as major access roads complete with high voltage power lines. They are also very noisy when in operation.

The actual construction of these shafts is a major engineering operation over many months with constant heavy vehicle traffic trundling through the Special Area every day. This is repeated across the catchments as each mine expands.

Large area cleared for drilling a bore hole – Dendrobium, 2012

Road built to construct and access Dendrobium vent shafts #3, 2008

Upcast and downcast vent shafts - Dendrobium, 2009

C. Remediation

Remediation efforts in the Special Areas have been hugely expensive, done a long time after the damage occurred and have met with only limited success.

This remediation has concentrated on restoring the water-holding capacity of pools and/or surface stream flow. This is done by boring hundreds of holes across a rock bar and injecting millions of litres of polyurethane resin (PUR) to form a “grout curtain” or barrier to restore the integrity of the fractured rock.

This has been done at only one point on the Waratah Rivulet and, according to the SCA, is only about 50% successful. Its durability is questionable.

Because it acts like the expanding gap-filler foam you can buy in an aerosol can at a hardware store, it has oozed out at many points with very ugly results.

The effort required to carry out this remediation involved bringing in lots of heavy equipment and clearing a large area which still remains bare.

Remediation of gaping ground fissures up to 1m wide and at least 15m deep in the Dendrobium lease area has been limited to fire trails used by vehicles only. Gaps extending into bushland are considered impractical to remediate as the effort of getting the materials and equipment in would cause more damage to the otherwise pristine bushland. They remain as massive pitfall traps for animals and no-one monitors this.

BHP admitted under questioning at the Southern Coalfield Inquiry hearings in 2007 that they had no knowledge of any successful remediation of an upland swamp whose bedrock had been cracked by subsidence. This situation has not changed. In order to find the cracks and and fill them, the swamp sediments would have to be removed, thus destroying the swamp anyway.

Next page – polyurethane resin oozing from remediated cracks on a rock bar – Waratah Rivulet, 2012

The area cleared for access and remediation equipment at one site on Waratah Rivulet, 2012