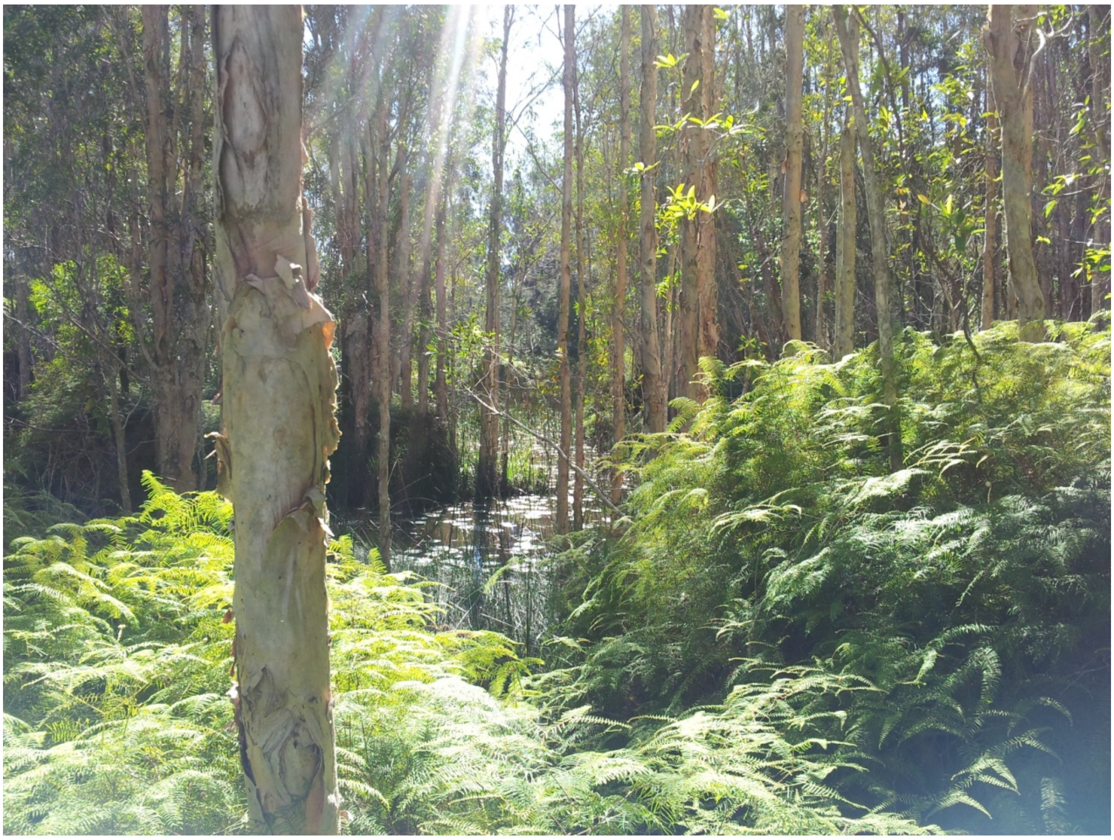
Photograph 2-15 Western end of the 'S' shaped canals, looking east. November 2012.



Photograph 2-16 Central portion of 'S' shaped canals, looking east. November 2012.

2.2 Previous investigations

Previous investigations undertaken at the Site include:

- DMR 1977. *Urunga Mineral Processing Plant Investigation*. Department of Mineral Resources Mines Inspection Branch
- SPCC 1984. *Water Quality in the Bellingen and Kalang Rivers*. State Pollution Control Commission, Northern Rivers Study No. 2
- Hicks 1993, *Investigation of Trace Metal Concentrations in Urunga Lagoon*. Bachelor Degree Thesis, The University of New England- Northern Rivers
- DLWC 1995. *Assessment of Contaminated Crown Land at Urunga*. Department of Land and Water Conservation
- DLWC 1997a. Part 1 Urunga Contaminated Site Background and Results. Department of Land and Water Conservation
- DLWC 1997b. *Part 2 Urunga Contaminated Site Remediation Options.* Department of Land and Water Conservation
- DLWC 2002 Wasteland to Wetland. Evaluation of Options for Remediation of the Former Antimony Processing Plant at Urunga, NSW. NSW Department of Land and Water Conservation, Resource Analysis Unit North Coast
- Repath, P and Body, M 2003. Flora and Fauna Evaluation for the Urunga Antimony Contaminated Site: An inventory assessment for an EIS
- Coffey 2004. Validation Assessment of Stripped Area
- DMR 2004, NSW. Abandoned Minesite Database. Urunga Mineral Preparation Plant. Department of Mineral Resources
- NSW EPA 2008. Former Antimony Processing Plant Soil Sampling Results. Environmental Protection Authority
- SCS 2012. Urunga Antimony Processing Plant. Contaminated Site - Project Application & Preliminary Environmental Assessment Prepared for NSW Department of Planning. Soil Conservation Service
- GHD (July, 2012a). Former Antimony Processing Plant, Urunga, NSW – Preliminary Investigation Report
- GHD (December, 2012b). Former Antimony Processing Plant, Urunga, NSW – Detailed Investigation Report
- GHD (February, 2013). Former Antimony Processing Plant, Urunga, NSW – Detailed Investigation Report Addendum One – Supplementary Sampling Results

These investigations are summarised in Section 2.2.1 and relevant data was incorporated into the detailed investigation report (GHD 2012b) as discussed in Section 2.2.2.

2.2.1 Previous Investigations

Between 1974 and 1977, some initial investigative work was undertaken by the then Department of Mineral Resources (DMR) in an attempt to determine whether or not the waste management practices adopted by Broken Hill Antimony Pty Ltd were polluting Station Creek and Urunga Lagoon. Investigations primarily comprised samples of surface water at three locations including runoff from the tailings dump, an effluent drain and the lagoon, approximately 1 km from the processing plant. Investigations found that antimony and arsenic were the major pollutants present, contamination of the site was serious and the impact on the lagoon was of concern. No action was taken regarding these findings (DLWC 1997).

In 1984, an investigation of metal contamination at the Site was initiated by the (then) owner of the Site, Mr R. Tickner. The investigation was completed by the Soil Conservation Service (SCS) and the findings of the investigation confirmed that the tailings were contaminated with aluminium, lead, antimony and arsenic.

In 1984, the then State Pollution Control Commission (SPCC) also investigated sediment and water samples at nine sites throughout the lagoon and wetland. The main conclusions of this investigation were that contamination occurred in the immediate vicinity of the plant, metal contamination was still detectable approximately 1 km from the site, and trace metal contamination was not evident in the lagoon.

A survey of metal contaminated sediments was undertaken by Hicks (a student) in 1993 in response to the past investigations. The study focussed on the wetland as well as the Urunga Lagoon. Sediment samples were collected from nine stations and analysed for size fractions and select metals in different particle fractions. The study concluded excessive metal concentrations were present within close proximity to the antimony processing plant, especially for antimony and arsenic but concentrations were found to decrease with distance away from the plant, being detectable for approximately one km and no contamination was found in the lagoon.

In 1995, the then Department of Land and Water Conservation (DLWC) conducted a soil/sediment analysis to assess the levels and extent of metal contamination on the Crown land portion of the study area. Soil or sediment samples were taken from ten stations distributed over the Site. These investigations concluded significant metal contamination was present, as high as 850 times the selected thresholds. The volume of contaminated tailings at the Site was estimated by DLWC to be 8,500 to 9,500 m^3.

In 1997, based on previous investigations, the then Centre for Natural Resources (a department within DLWC) was commissioned by the State Lands Service (also DLWC) to undertake more comprehensive investigations and develop remediation options for the tailings area. DLWC noted that although the highest levels of metals were generally found in tailings layers, significant contamination was also detected in the underlying peat, shallow wetland sediments and in the imported fill layer. Deeper natural soil materials showed low levels or no contaminants. DLWC found that the surface waters of the wetland and creek are contaminated by heavy metals (Arsenic, Antimony, Copper, Aluminium and Iron) and to a lesser extent, cyanide (CN). High concentrations of CN found upstream of the tailings suggests that its source was not confined to the tailings. Concentrations of As and Sb were highest followed by Cu and Pb. Arsenic concentrations were highest in the area of the wetland, immediately downstream of the tailings. Although Hg was found in the soil / sediment, it was not present in detectable levels within the surface waters. DLWC stated that while metal concentrations within the groundwater were above acceptable levels for the protection of aquatic ecosystems, they were considerably less than that present within the tailings, suggesting that under the prevailing conditions the mobility of metals offsite through the groundwater system is limited. DLWC also examined a number of remediation options.

On 2 August 2002, the EPA declared the site to be a remediation site under the Contaminated Land Management Act 1997. The Site was considered to present a significant risk of harm to human health and the environment. Further details regarding the reasons for the declaration were provided in the declaration.

Coffey Geosciences Pty Ltd (Coffey) conducted an assessment of a portion of Lot 1 to validate clean up measures consisting of the stripping of surface soils. No details of the stripping were provided. The area (approximately 2000 m^2) was validated as part of a proposed development which extended over four separate allotments including Lot 1, and consisted of mixed commercial activities and an aged care village (Coffey 2003).

As a result of the Coffey investigation and report, an area defined in the north-west part of Lot 1, DP874874 (where the existing residences are located) was removed from the Remediation Site Declaration dated 2 August 2002. The declaration remained in force for the remainder of Lot 1, all of Lot 2 and the adjoining crown land.

A flora and fauna assessment of the Site was undertaken by Redpath and Body in 2001 and reported in 2003. This is further discussed in Section 6.4

In 2008 EPA staff conducted X Ray Fluorescence (XRF) sampling of surface soils with a focus on the tailings area.

In November 2011, Entech was engaged by the EPA via Bellingen Shire Council to remove some of the surface waste from the site. The hazardous chemical waste was removed from site, transported to Chemsal's licenced hazardous waste facility and the treated waste disposed of to landfill. Some of the bulk debris was also removed.

In July 2011, the NSW Food Authority conducted soil and sediment sampling and testing for metals in fish (flathead), crabs and oysters caught in Urunga Lagoon. None of the results exceeded the Food Standards Code (FSC), however further analysis was recommended to determine inorganic arsenic levels (as the FSC is based on inorganic not total arsenic) and for lead levels in the oyster samples as greater sensitivity was needed to assess compliance with the FSC limits for lead.

A university of NSW PhD student was reported to have monitored water quality in the Urunga Lagoon below the Urunga sewerage treatment plant in the lagoon. This data was not available at the time of time of writing.

On the 16 November 2011, the EPA released Management Order 20111405 regarding the Site which is the order that led to the remediation currently being proposed. The Management Order calls for:

- The preparation of a remedial action plan;
- Implementation of the remedial action plan; and
- The carrying out of directions consistently with the EPA guidelines.

On 22 May 2012, Management Order 20111405 was amended to reflect the transfer of Lots 1 & 2, DP 874874 from Harry Ross Tickner to the State of New South Wales hence adding Lots 1 and 2 to Management Order 20111405. The Amended Management Order also excludes the north-west part of Lot 1 DP874874 located adjacent to Hillside Drive, Urunga as defined by the map included as part of Notice Number 22004. Additionally, due to the delays in the transfer of land, the deadline dates of the Management Order were also revised.

2.2.2 Recent Investigation Summaries

In 2012, the Soil Conservation Service was engaged by NSW Catchment & Lands - Crown Lands to project manage the rehabilitation of the Site. GHD was then engaged to undertake a series of investigations as summarised below. Sampling locations are presented in Figure 2-3.

Preliminary Investigation Report, July 2012

A Preliminary Investigation Report (PIR) by GHD (July 2012) found more than twenty sources of relevant data including eight previous contaminant investigations and four historic aerial photographs. An assessment of the reliability of the historic data was conducted with four sources of data deemed reliable for use in ongoing assessments. Other historic data was used to aid in the understanding of the sources and extent of the contamination. The investigation also included:

- Interviews with former site staff.
- An assessment of the historic data that confirmed the main contaminants of concern as antimony, arsenic and mercury.
- Development of a preliminary conceptual site model (CSM) identifying contaminant sources, exposure pathways and receptors.
- Identification of data gaps.
- Development of a sampling analysis and quality plan.

Detailed Investigation Report, December 2012

A Detailed Investigation Report (DIR)(GHD, December 2012) incorporated data from the PIR and a field investigation comprising sampling and analysis of soil, sediment and water from:

- 63 soil boreholes.
- 38 sediment boreholes.
- 9 surface water locations.
- 4 groundwater monitoring wells.
- 3 stockpiles and 2 loading ramps.
- Brick stockpiles.

Findings of the investigation were used to update the CSM that was developed in the PIR (GHD 2012) and included:

- Antimony and arsenic were evident as the key contaminants of concern (COC)s.
- Other COCs included mercury, chromium, nickel, zinc, copper, lead and cyanide.
- In nearly all cases, where one of the COCs was present in significant concentrations, more significant concentrations of either antimony or arsenic were present. As a result, these analytes were deemed to be representative indicator analytes and the governing contaminants.
- Incidental contaminants may also be present on the Site including:
  - Total Petroleum Hydrocarbons
  - Polynuclear Aromatic Hydrocarbons
  - Organochlorine Pesticides
  - Polychlorinated Biphenyls
  - Asbestos.
- Surface water and sediment (and to a lesser extent, groundwater) were noted as the main media for the transportation of COCs on the Site.
- Generally, contaminants exceeding relevant assessment criteria in surface water, groundwater and sediment correlated with those that exceeded assessment criteria in the soils.
- In most cases, the leachable concentrations of COCs in the soil and sediment were significantly less than total concentrations, suggesting the physical migration of contaminated soil or sediment has been the more important contaminant migration pathway.

- Notwithstanding the above, where there were significant concentrations of antimony and arsenic in soil or sediment samples, the corresponding leachable concentrations were well above ANZECC trigger values for protection of aquatic ecosystems.
- For "soil" samples (being those taken from "dry" areas of the site, including the tailings area, during GHD's investigations) the degree of contamination generally reduces quite quickly so that the site can be divided into significantly impacted and relatively unimpacted areas. The exceptions to this are primarily adjacent to the 'L' shaped canal (where contamination is either within 10 times the assessment criteria, or covered by cleaner material), the south western corner of the site, and the area of disturbance at the north east corner of the site.
- For the majority of the COCs, dissolved concentrations were similar to total concentrations in the surface and groundwater samples, indicating the measured concentrations of contaminants are mobile in the water and not just bound to suspended particles.
- Concentrations of the main COCs in the soil recorded in this investigation were within a similar order of magnitude as those recorded in the historical investigations.
- Reduced total concentrations of COCs in the surface water were noted from the 1997 round of sampling to the present. This may be due to many factors and does not necessarily indicate an overall reduction in concentrations.
- The interpreted extent of the contamination was defined, as discussed in Section 2.3.
- Estimated volumes of impacted soil and sediment were included but were updated following the supplementary investigation as discussed below.
- The soils and sediment in the vicinity of the tailing deposit were analysed and are considered to be Acid Sulfate soils. Accordingly, the CEMP is to include details regarding acid sulfate soil management in accordance with the requirements of the *Acid Sulfate Soils Management Advisory Committee (ASSMAC) guidelines* (Ahern et al. 1998).
- The groundwater table onsite ranged from approximately 0.4 to 1.4 mbgs and groundwater is interpreted to discharge into the wetland. The tailings material and underlying peat are expected to be highly permeable and hence the contaminants are likely to have high groundwater connectivity to the wetland. Characteristics of deeper groundwater or groundwater flow into the site are not known.

Supplementary Investigation Summary, February 2013

A supplementary sampling program was completed to address data gaps identified in the DIR and assist in the definition of the area requiring remediation and the development of the Remediation Action Plan.

The investigation incorporated data from the DIR and a field investigation comprising an additional ten soil and 14 sediment sample locations as well as samples from a soil stockpile and two solidified cores of waste concentrate (referred to as 'mercury plugs') that were identified following completion of the detailed investigation report.

Results from the supplementary sampling and analysis were used to update the Conceptual Site Model that was developed in the DIR. Changes were made regarding the horizontal extent of the impact on the soil such that it:

- Includes moderate impact downgradient of the 'mercury plugs'.
- Includes a portion of the vegetated area between the former ore stockpile area and the tailings area.

- Does not extend beyond the boundary fence to the west of the former processing facility.
- Extends approximately 30 m west of the site boundary, south of the former processing area, but is not fully delineated in the south western portion of the site.

Changes to the CSM were made regarding the extent of the impact on the sediment such that it:

- Extends further to the south east of the tailings deposit than interpreted in the DIR.
- Shows impact in the base of the 'L' Shaped canal to be generally less than that outside of the canal.
- Is of a similar area but of a lesser magnitude in the area to the east of the 'L Shaped' canal than interpreted in the DIR.

Results from the stockpile (Stockpile 4) indicated relatively minor exceedances of the adopted health based assessment criteria for antimony and arsenic only.

Results from the two 'mercury plugs' indicated significantly elevated concentrations of antimony (up to 41,900 mg/kg), mercury (up to 5,840 mg/kg) and arsenic (up to 1,660 mg/kg).

Ongoing surface water monitoring

Ongoing surface water monitoring has been carried out on an approximately monthly basis from January 2013 until the present and data compiled by the SCS. Sampling locations include adjacent to the tailings deposit, Station Creek and the sea lido in Urunga.

A comparison of arsenic and antimony concentrations with primary contact-recreation thresholds can be summarised as:

- Exceeding the thresholds adjacent to the tailings deposit in most sampling events, with concentrations showing a degree of correlation with rainfall events
- Exceeding thresholds in Station Creek during three sampling events
- Being below thresholds a the sea lido

A comparison of arsenic and antimony concentrations with aquatic ecosystem thresholds can be summarised as:

- Exceeding the thresholds adjacent to the tailings deposit in all sampling events, with concentrations showing a degree of correlation with rainfall events
- Exceeding thresholds in Station Creek during most sampling events
- Being below thresholds a the sea lido

2.3 Adopted assessment criteria

The adopted soil assessment criteria (Table 2-1) were initially established as part of the PIR, with further review and development of antimony criteria as described in the RAP. As the proposed future use of the Site is as a reserve, the most applicable default exposure setting was considered to be 'NEHF E- Parks, Recreational, Open space' as published in DEC (2006). This exposure setting corresponds with the NEPM HIL (E) from NEPC (1999). These criteria were developed prior to the release of the *National Environment Protection (Assessment of Site Contamination) Measure* 1999 (the NEPM) as amended in May 2013 (NEPC, 2013). Assessment criteria for arsenic and antimony (being the governing contaminants) have been reviewed in the context of the amended NEPM for finalisation of the RAP, as required by EPA guidance for adoption of the amended NEPM, It is noted that the former exposure setting E is now referred to in the amended NEPM as HIL C.

No criteria are given in NEPC 2013 for antimony, therefore the following assessment criteria have been adopted for assessment of antimony concentrations:

- ANZECC/NH&MRC (1992) Environmental Investigation level - 20 mg/kg
- HIL C – 120 mg/kg, which will be considered for validation in areas where there is a particular potential for more frequent exposure by young children
- HIL for 'bushland' open space / recreational area' – 300 m/kg (site specific criterion developed in accordance with NEPC 2013 methodology, and essentially the same as the HIL of 310 mg/kg used in investigations and assessment preceding the RAP), which is considered applicable to the majority of the site.

Further information regarding the derivation of these assessment criteria is provided in the RAP (Appendix E).

Table 2-1 Adopted Soil Assessment Criteria

Analyte	Units	NEPM 1999 HIL E	NEPM 2013 EIL
Antimony[(1)]	mg/kg	120 – *310**	20
Arsenic	mg/kg	*200* / 300*	*20* / 40*
Cadmium	mg/kg	40	3
Chromium (III+VI)[(2)]	mg/kg	200	50[(2)]
Cyanide Total[(3)]	mg/kg	500	-
Copper	mg/kg	2000	100
Lead	mg/kg	600	600
Manganese	mg/kg	3000	500
Mercury	mg/kg	30	1
Nickel	mg/kg	600	60

* Criteria used in initial assessment shown in italic, subsequently updated for the RAP in accordance with the amended NEPM (NEPC 2013).

The adopted sediment assessment criteria (Table 2-2) for most analytes were derived from the ANZECC /ARMCANZ (2000) *Interim Sediment Quality Guidelines*. No criterion was available from ANZECC /ARMCANZ (2000) for cyanide. The Dutch intervention values (MHSPE 1994) for sediment of 20 mg/kg for free cyanide and 50 mg/kg for complex cyanides, have been adopted in this case.

Table 2-2 Adopted Sediment Assessment Criteria

Analyte	Units	ISQG- Low	ISQG- High
Antimony	mg/kg	2	25
Arsenic	mg/kg	20	70
Cadmium	mg/kg	1.5	10
Chromium	mg/kg	80	370
Copper	mg/kg	65	270
Cyanide	mg/kg	20	50
Lead	mg/kg	50	220
Mercury	mg/kg	0.15	1
Nickel	mg/kg	21	52
Zinc	mg/kg	200	410

The adopted water assessment criteria for water (Table 2-3) were derived from the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC 2000) for Freshwater. As the Site is deemed to be a 'slightly to moderately disturbed system', the 95%

level of protection of species was identified as being applicable in conjunction with the 99% level for selected analytes deemed to have a bioaccumulative effect.

Table 2-3 Adopted Water Assessment Criteria

Analyte	Units	ANZECC 2000 Fresh Water Slightly-moderate disturbed system
Aluminium	mg/L	0.05
Antimony	mg/L	0.009
Arsenic	mg/L	0.013
Cadmium	mg/L	0.0002
Chromium (III)[1]	mg/L	0.00331
Chromium (VI)	mg/L	0.001
Copper	mg/L	0.0014
Cyanide Total	mg/L	0.007
Lead	mg/L	0.0034
Mercury (inorganic)[2]	mg/L	0.00006
Mercury (methyl)	Mg/L	ID2
Nickel	mg/L	0.011

2.4 Extent of soil and sediment contamination

As part of the most recent round of investigations completed by GHD, the interpreted extent of contamination was presented as areas:

- Exceeding the adopted assessment criteria.
- Exceeding ten times the adopted assessment criteria.
- Exceeding thirty times the adopted assessment criteria.

These areas are presented on Figure 2-3 to Figure 2-6. The interpreted extent of the contamination in the soil can be summarised as:

- Approximately correlating with the absence of vegetation.
- Including the tailings deposit, former processing area and portions of the former unprocessed ore stockpiling area.
- Extending into the south west corner of the site and likely across the property boundary near the wetland, however the extent of this impact has not been fully delineated.
- Extending along the embankment in the vicinity of the ‘L’ shaped canal, at a depth of 1 m to 1.7 m from the current ground surface (likely associated with the original soil surface prior to placement of spoil from excavation of the canal).
- Not extending into the north east portion of the site with the exception of an area of unknown disturbance, to the north of the ‘L’ Shaped canal.
- Not extending to the southern side of the wetland.
- Varying in depth from approximately 0.5 metres below ground surface (mbgs) in the north west portion of the impact to 2.2 mbgs near the water’s edge and at some locations within the tailings deposit.

The extent of the impact in the sediment can be summarised as:

- Showing highest levels of impact adjacent to the tailings deposit, extending approximately 50 m downstream of the tailing deposit, extending across the wetland some 50 m to the south of the tailings deposit (roughly correlating with vegetation dieback), and within and adjacent to the north eastern portion of the 'L' shaped canal.
- Including the western and south eastern portions of the 'S' shaped canals.
- Ranging from depths of about 1 mbgs near the tailings to 0.1 mbgs in the southern portion of the wetland.
- Generally having greatest antimony and arsenic concentrations in the surface sediment (0-0.1 mbgs).
- Generally corresponding with the visual presence of tailings sediment (grey silt).

2.5 Volume of soil and sediment contamination

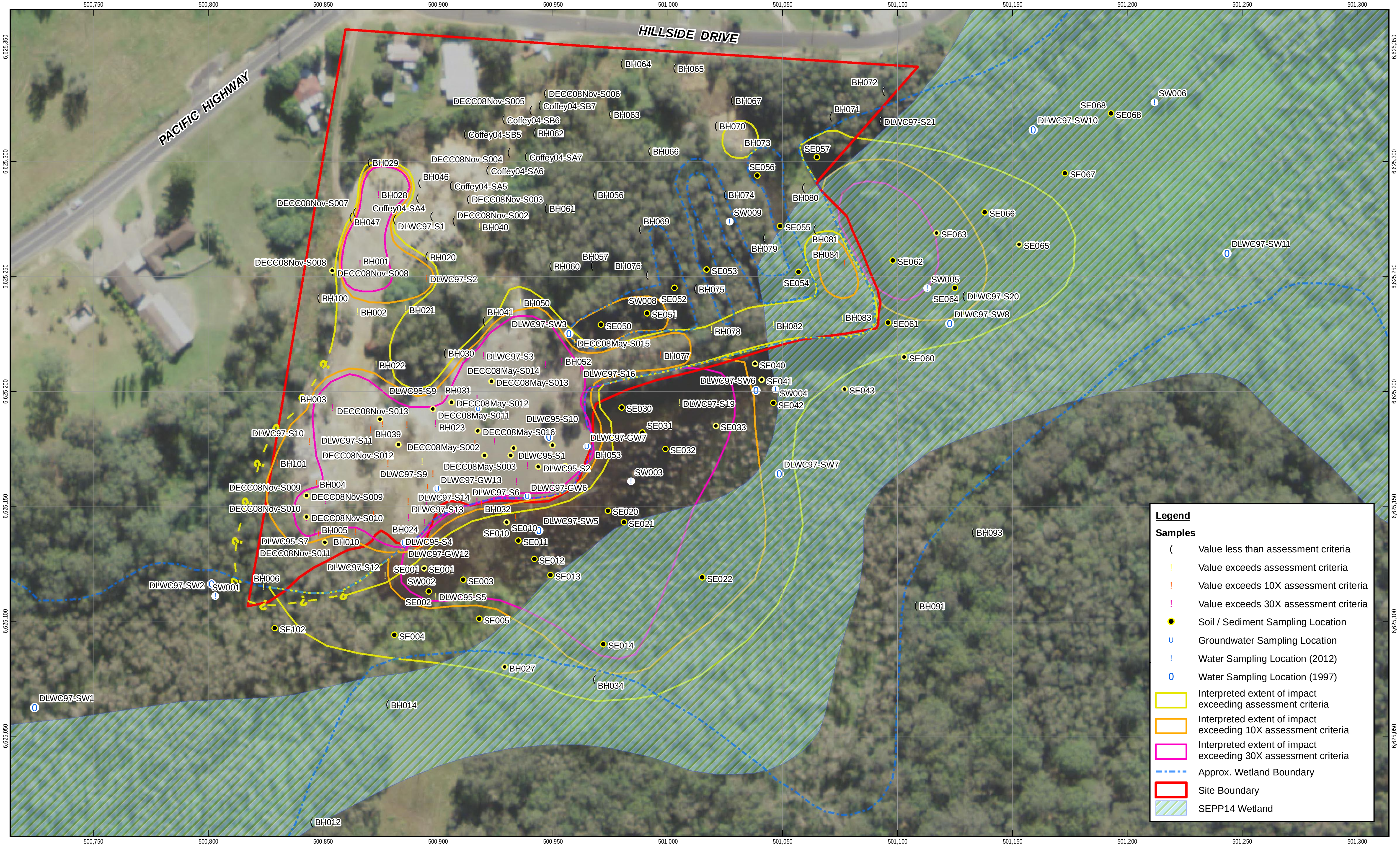
Estimates of the volumes of impacted soil and sediment are as follows:

Soil (adopted assessment criteria 310 mg/kg antimony, 200 mg/kg arsenic)

- 5,800 m^3 exceeding 30 times the adopted assessment criteria.
- 14,000 m^3 (encompassing the volumes above) exceeding 10 times the adopted assessment criteria.
- 28,300 m^3 (encompassing the volumes above) exceeding the adopted assessment criteria.

Sediment (adopted assessment criteria 25 mg/kg antimony, 70 mg/kg arsenic)

- 2,600 m^3 exceeding 30 times the adopted assessment criteria.
- 4,600 m^3 (encompassing the volumes above) exceeding 10 times the adopted assessment criteria.
- 10,200 m^3 (encompassing the volumes above) exceeding the adopted assessment criteria.



1:1,500 Paper Size A3

0 10 20 40 60 80

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

O

GHD

NSW Catchment and Lands - Crown Lands
Former Antimony Processing Plant, Urunga NSW
Detailed Investigation Report

Job Number 22-16251
Revision A
Date 06 Dec 2012

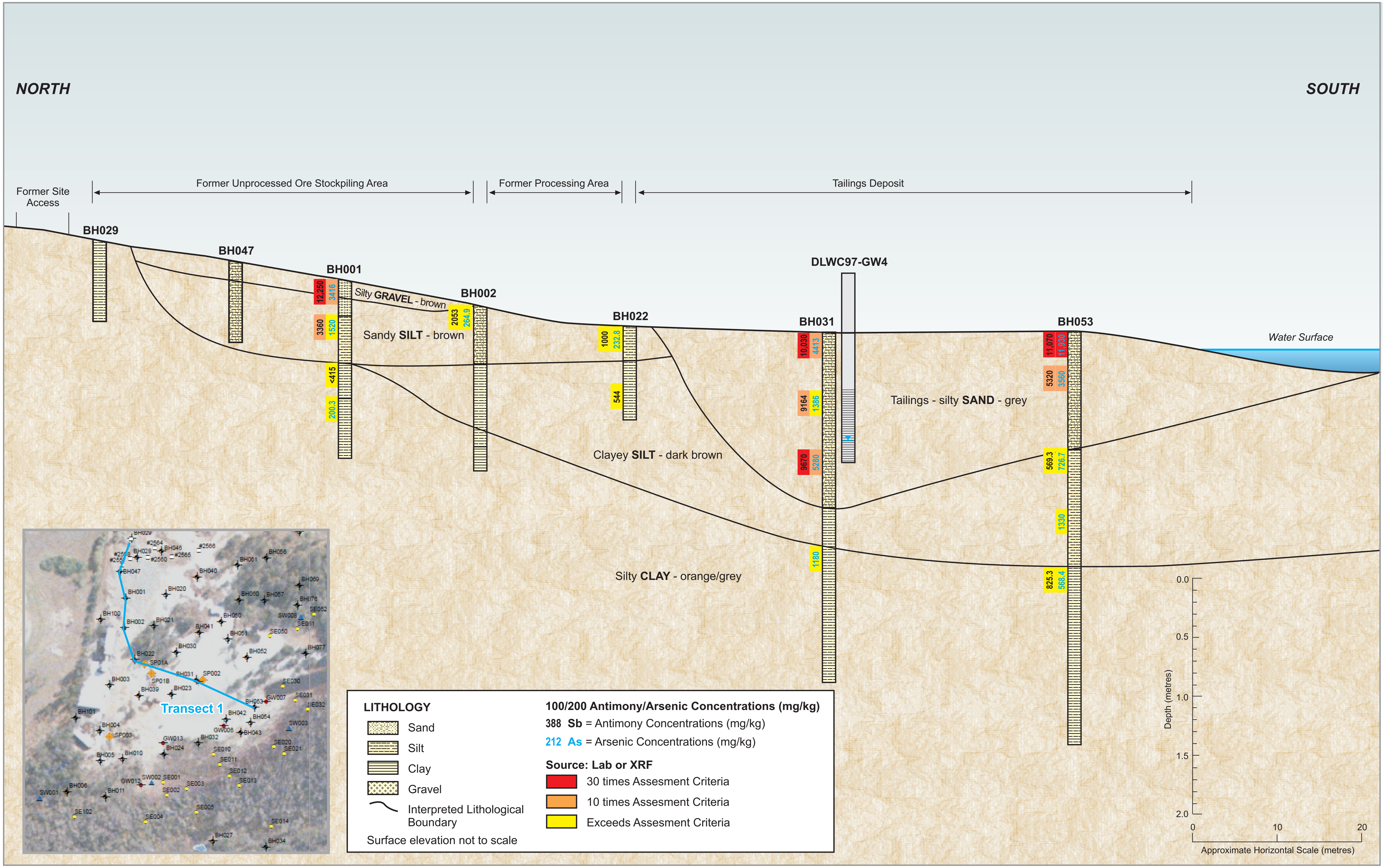
All Sampling Locations (historic and current) with Interpreted Extent of Impact

Figure 2-3

C:\Projects\22\16251\GIS\Maps\Deliverables\22_16251_09_soilsOverview_revA.mxd

230 Harbour Drive Coffs Harbour NSW 2450 **T** 61 2 6650 5600 **F** 61 2 6652 6021 **E** cfsmail@ghd.com **W** www.ghd.com.au

Data source: DPI, Aerials, 2012. Created by:ihamilton



N

GHD

NSW Catchment and Lands - Crown Lands
Former Antimony Processing Plant, Urunga, NSW
Detailed Investigation Report

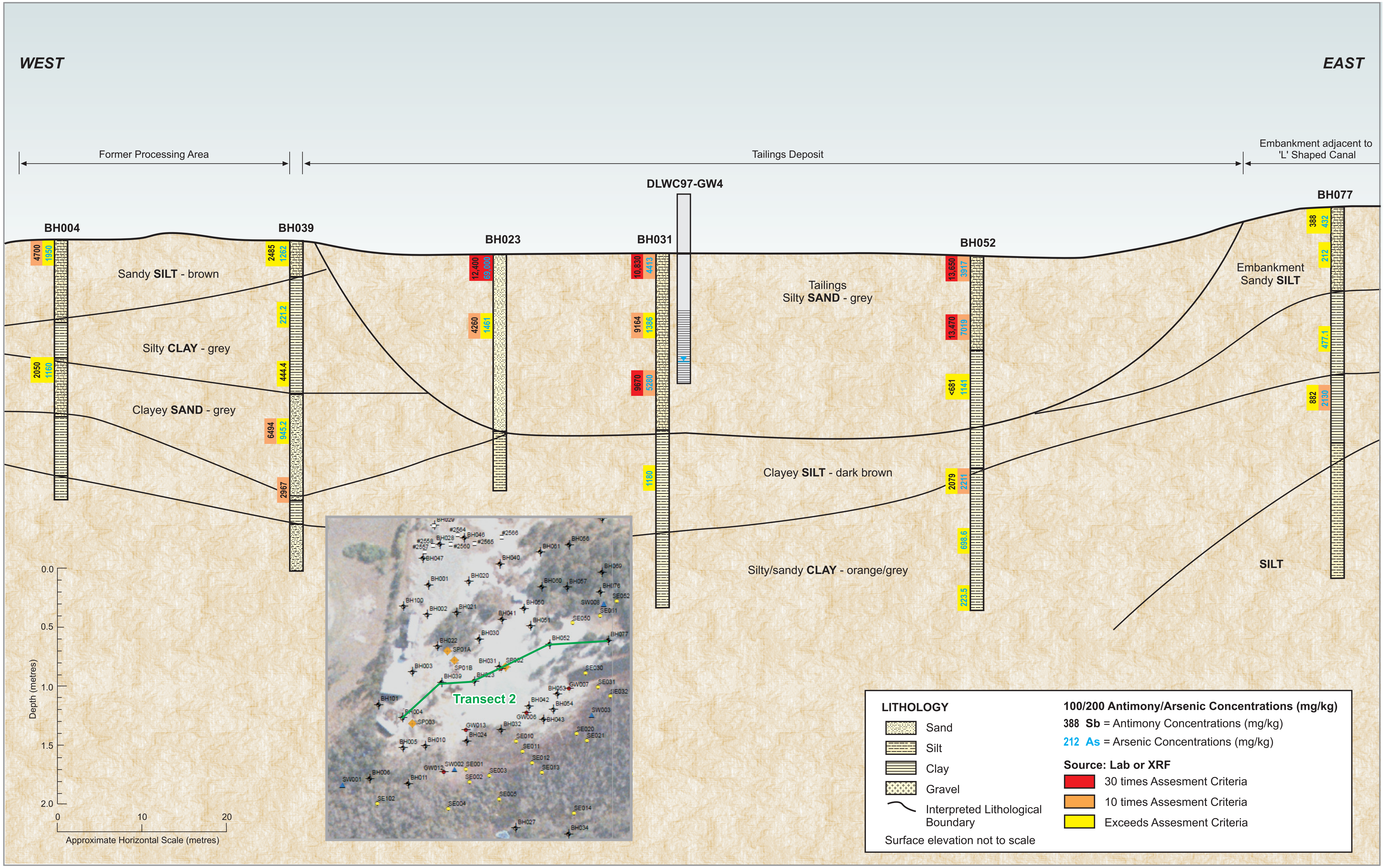
Section Transect 1

Job Number	22-16251
Revision	A
Date	5 Oct 2012

Figure 2-4

GHD\Launceston\22\2216251_LTN_02.cdr

230 Harbour Drive Coffs Harbour NSW 2450 **T** 61 2 6650 5600 **F** 61 2 6650 5601 **E** cfsmail@ghd.com **W** www.ghd.com



NSW Catchment and Lands - Crown Lands
Former Antimony Processing Plant, Urunga, NSW
Detailed Investigation Report

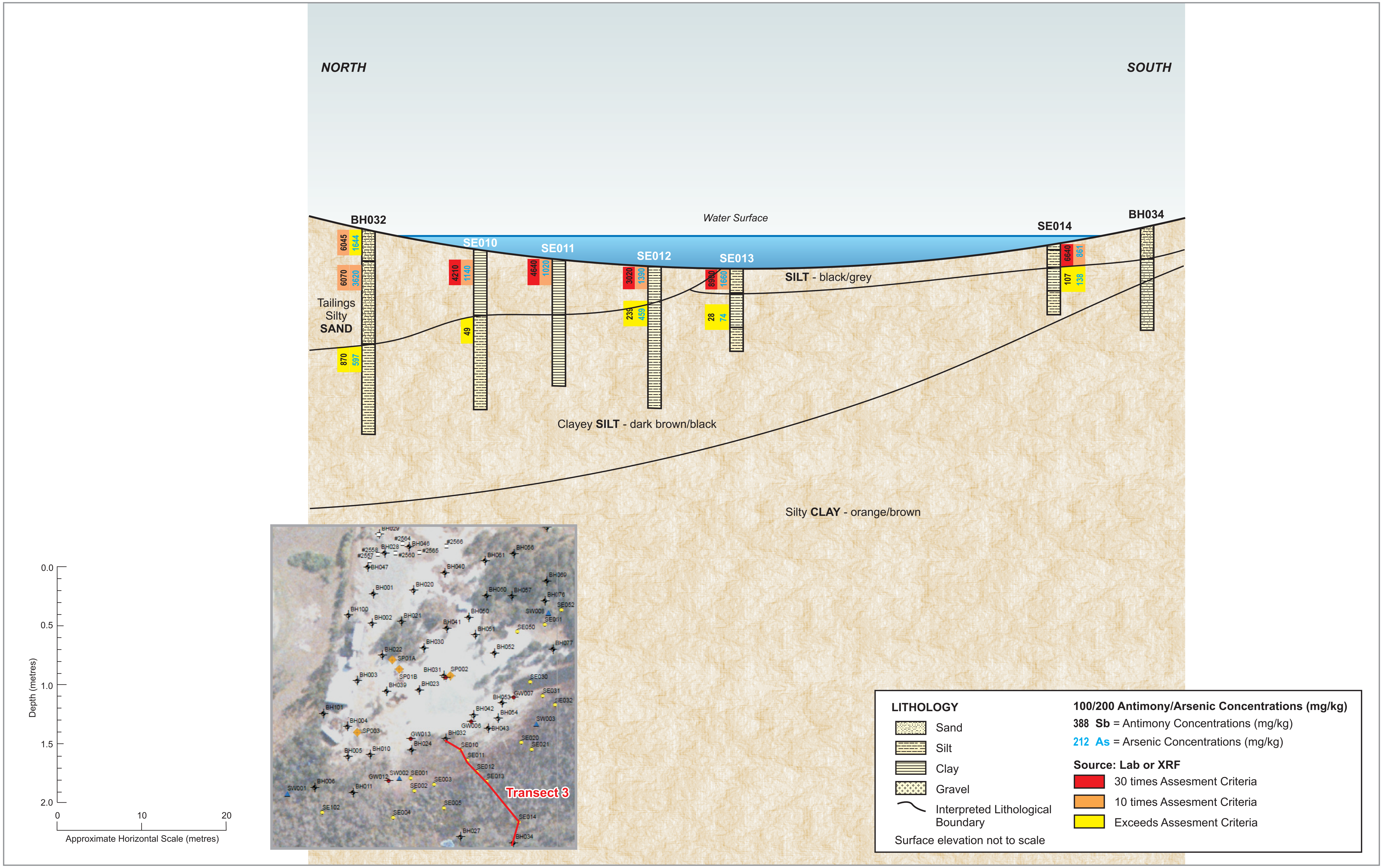
Section Transect 2

Job Number	22-16251
Revision	A
Date	5 Oct 2012

Figure 2-5

GHD\Launceston\22\2216251_LTN_03.cdr

230 Harbour Drive Coffs Harbour NSW 2450 **T** 61 2 6650 5600 **F** 61 2 6650 5601 **E** cfsmail@ghd.com **W** www.ghd.com



NSW Catchment and Lands - Crown Lands
Former Antimony Processing Plant, Urunga, NSW
Detailed Investigation Report

Section Transect 3

Job Number	22-16251
Revision	A
Date	5 Oct 2012

Figure 2-6

GHD\Launceston\22\2216251_LTN_04.cdr

230 Harbour Drive Coffs Harbour NSW 2450 T 61 2 6650 5600 F 61 2 6650 5601 E cfsmail@ghd.com W www.ghd.com

2.6 Surface water contamination

As well as being a primary receptor of contamination at the site, surface water is one of the main media for the transportation of COCs from the Site. In summary, contamination of surface water in the vicinity of the site can be summarised as:

- Aluminium, antimony, arsenic and copper concentrations exceeded assessment criteria through the wetland to Station Creek.
- In relation to antimony and arsenic concentrations:
  - Relatively low antimony and arsenic concentrations upstream of the Site.
  - A rapid increase in the concentrations within the proximity of the tailings.
  - Maximum concentrations within 50m downstream of the tailings.
  - A relatively linear decrease in concentrations with increasing distance, downstream of the tailings.
  - Reduced total concentrations from the 1997 round of sampling to the present. This may be due to many factors (e.g. recent rainfall events, sampling methodology) and does not necessarily indicate an overall reduction in concentrations.
- Dissolved antimony concentrations were, on average, about 75% of the total concentrations, indicating the majority of the antimony is present in soluble form.
- Dissolved arsenic concentrations were, on average, 40% of the total concentrations, indicating a greater proportion of the arsenic was bound to suspended particles.

Ongoing surface water monitoring has been carried out on an approximately monthly basis from January 2013 until the present and data compiled by the SCS. Sampling locations include adjacent to the tailings deposit, Station Creek and the sea lido in Urunga.

A comparison of arsenic and antimony concentrations with primary contact-recreation thresholds can be summarised as:

- Exceeding the thresholds adjacent to the tailings deposit in most sampling events, with concentrations showing a degree of correlation with rainfall events
- Exceeding thresholds in Station Creek during three sampling events
- Being below thresholds a the sea lido

A comparison of arsenic and antimony concentrations with aquatic ecosystem thresholds can be summarised as:

- Exceeding the thresholds adjacent to the tailings deposit in all sampling events, with concentrations showing a degree of correlation with rainfall events
- Exceeding thresholds in Station Creek during most sampling events
- Being below thresholds a the sea lido

2.7 Groundwater contamination

Seven groundwater wells are installed onsite. A summary of contamination of the groundwater includes:

- Antimony and arsenic concentrations in the vicinity of the tailings deposit exceed 30 times the assessment criteria and antimony concentrations in groundwater were approximately an order of magnitude higher than surface water concentrations. Arsenic concentrations in groundwater were approximately three orders of magnitude higher than surface water concentrations.

- Antimony and arsenic concentrations in groundwater were generally consistent throughout the tailings area.
- Assessment criteria exceedances were also noted for aluminium, chromium, copper, lead, mercury, nickel and zinc. Copper and zinc concentrations were of similar magnitude to those in surface water, with the concentrations of the other metals generally at least an order of magnitude higher than in surface water.

The potential transportation of contaminants through the migration of groundwater is supported by the elevated concentrations of COCs in the groundwater within the vicinity of the tailings deposit and the expected permeable characteristics of the tailings. Analysis in GHD's investigations was for dissolved metals, so the reported concentrations can be expected to be mobile in the groundwater.

3. Need and options considered

3.1 Strategic need for the proposal

Under the provisions of the CLM Act, Management Order (No. 20111405) applies to Lot 253, DP 46013 (NSW EPA 2011) and a declaration of a remediation site (No. 21020, Area 1089) applies to Lot 1 and Lot 2, DP 874874 and Lot 253, DP46013 (NSW EPA 2002).

A portion of Lot 1, DP 874874 was removed from remediation area 1089 by means of a Notice to End Remediation Declaration (No. 22004) in November 2005 (NSW EPA 2005). This was reflected in a Notice to Amend Management Order (No. 20124407) issued on May 22, 2012 (NSW EPA 2012a). The dates for each milestone of the Management Order were revised in a further Notice to Amend Management Order (No. 20124422) issued on September 9, 2012 (NSW EPA 2012b). A copy of the Management Order and amendments are presented in Appendix A.

The proposed remediation is in compliance with the following requirements of the Management Order:

1) Engage a qualified, experienced and reputable remediation contractor to implement the RAP as approved in writing by the EPA.

2) Engage a qualified, experienced and reputable environmental consultant to prepare a validation report that describes the remedial works that were undertaken and makes recommendations for additional works, maintenance, monitoring and/or contingency plan implementation to ensure that the significant contamination is appropriately managed in the long term.

3) Submit the validation report to the EPA.

3.2 Proposal objectives

The objectives of the Proposal are to:

- Achieve compliance with the Management Order 20111405
- Remediate the contamination at the Site so that any further impact on the adjacent wetland and receiving environment is minimised
- Allow the Site to be opened to public access without unacceptable risk to human health

The intention of Crown Lands is to use the site as Public Open Space. Considering this proposed land use and the location of the site (adjoining a SEPP 14 wetland and upstream of Urunga Lagoon), the Proposal also aims to meet the following requirements:

- Remediation should result in final landforms that facilitate beneficial use of the site as public open space, and satisfy relevant stakeholders to the maximum practical extent.
- Remaining contamination should not present any unacceptable risks to the environment.
- Remediation works should not cause greater environmental or health impacts than would occur if the contamination is left in place.
- Concentrations of contaminants should be below appropriate health-based assessment criteria in surface soils and soils likely to be disturbed during use of the site (taking into account potential redevelopment works).
- Concentrations of contaminants exceeding ecological investigation levels must not be placed in a location or manner that could reasonably be expected to exacerbate existing risks of potential impact to ecological receptors.

- Remediation must be able to be completed within the funding available for the work.

The adopted remediation activity must also:

- Be cost effective to ensure maximum reduction in bio-available contaminants over the long term.
- Consider the latest approaches to stabilisation of the key contaminants of concern.
- Allow for the impact of periodic flooding and tidal influence at the Site.
- Favour solutions that separate contaminated material from water within the hydrological zones.
- Effectively manage acid sulfate soils (ASS).
- Be in compliance with all relevant Commonwealth, State and Local legislation.

3.3 Alternatives and options considered

3.3.1 Identified options

Four broad options for remediating the Site were identified as part of the RAP (Appendix E). These were developed from a conceptual site model which was presented in the Detailed Investigation Report (GHD 2012b). The four remediation options are summarised in the following subsections.

Option 1 – Off-site reprocessing and disposal

- Option 1 would involve the removal of source material, long haul transport (to as far as Ipswich, Queensland), off-site reprocessing and disposal at an appropriate ore processing facility or landfill (Option 1B). The processing facility considered during the assessment was Hillgrove Mine (near Armidale NSW) because it is the closest antimony processing area to the Site hence minimising transport cost. Hillgrove Mine has infrastructure to process similar minerals, although the tailings dam at the facility would likely need to be upgraded to accommodate the additional material.
- An alternative option i.e. Option 1B, is the disposal of the untreated material at an appropriately licenced landfill able to accept the untreated material. The landfills investigated were in south-east Queensland because NSW does not have landfills licenced to accept much of the untreated material.

The main tasks involved with Option 1 and 1B would include:

- Site and access establishment
- Removing existing infrastructure and rubbish
- Installing environmental management controls (eg water, soil, clearing limits)
- Excavation of material
- Haulage of material to reprocessing site or landfill
- Reprocessing or disposal at landfill
- Rehabilitation of excavation area

Option 2 - Off-site disposal

- Option 2 would involve removal of source material, treatment on-site or off-site, long haul transport, and disposal to a licensed facility (Grafton Landfill) within a containment cell or isolated (segregated) portion of the landfill.

The main tasks involved in Option 2 would include:

- Site and access establishment
- Removing existing infrastructure and rubbish
- Installing environmental management controls (eg water, soil, clearing limits)
- Excavation of material
- Treatment of material
- Possible establishment of a containment cell at the landfill
- Haulage to landfill
- Rehabilitation of excavation area

Option 3 - On-site disposal

- Option 3 would involve removal of source material, possible treatment on-site (Option 3A) or onsite containment without treatment (Option 3B), short haul transport for disposal to a containment cell on-site.

The main tasks involved in this option would include:

- Additional investigations to better define constraints/parameters for this option
- Site and access establishment
- Removing existing infrastructure and rubbish
- Installing environmental management controls (eg water, soil, clearing limits)
- Excavation of material
- Treatment of material
- Establishment of an on-site containment cell
- Placement of material in containment cell
- Rehabilitation of excavation area
- Ongoing monitoring of groundwater and surface water quality

Option 4 - In-situ containment

- Option 4 would involve leaving the source material in place, possibly with stabilisation or treatment (Option 4B), and construction of a containment system in-situ to prevent direct exposure or mobilisation and separate contaminated material from surface and ground waters.

The main tasks involved in this option would include:

- Additional investigations to better define constraints/parameters for this option
- Site and access establishment
- Removing existing infrastructure and rubbish
- Installing environmental management controls (eg water, soil, clearing limits)
- Possible treatment of material
- Establishment in-situ containment cell
- Monitoring of groundwater and surface water quality

Option 5 – Do nothing

The option of 'Do Nothing' was not assessed in detail as it was not considered appropriate due to the identified, current impact resulting in a lack of vegetation in the vicinity of the tailings deposit and potential risk associated with further, potential mobilisation of impacted soil, sediment and water. This option, however may apply to "fringe" areas of the site, where the impact of any form of remediation is deemed to outweigh any marginal benefits from completing the remediation.

3.3.2 Methodology for selection of preferred option

The preferred option was based on the following factors:

- Long term feasibility
- Technical feasibility
- Data gaps
- Cost
- Site characteristics
- Availability of appropriate disposal sites (for excavation and off-site disposal)
- Implementation timeframe
- Contractor availability
- Resource availability (e.g. backfill)
- Legislative requirements
- Ongoing monitoring requirements
- Ongoing liabilities
- Health, Safety and Environment (HSE) requirements
- Community acceptance
- Other environmental considerations

Inputs to the decision making process were obtained via:

- Previous investigation reports and site conceptual models
- Community and Government agency consultation
- Consultant advice
- Civil contractor advice and costings

3.3.3 Analysis of options

An analysis of the four options was carried out as part of the RAP (Appendix E). Essentially, all options could be designed to meet the Proposal objectives, with the main differences (apart from cost) being whether most contaminated material is removed from Site (hence liability for long-term management passes to other parties) and the degree of certainty that contamination will be securely contained on site without unacceptable adverse long term impacts.

Within the options of 'on-site containment (Option 3) and in-situ containment (Option 4), a risk assessment was also carried out as part of the RAP (Table 3-1) to assess the level of compliance with the Proposal objectives and environment and health risk.

A summary of the findings of the analysis of the options and the risk assessment is presented in the following subsections.

Option 1A – Off-site reprocessing and disposal

Off-site reprocessing was considered a desirable outcome because it would remove the contamination from the site, and would recover resources (eg. gold and antimony) from the contaminated material that could be sold to offset the costs of processing. While the concentration of valuable metals available for extraction is not sufficient to justify the cost of transport and processing, the cost of this option is reasonable compared to the other options.

However, due to the limited resource recovery potential, no processor has been found that is willing to take the material. The on-going off-site liability relating to the management of the residual contaminated material inherited by the reprocessing plant is also considered undesirable. There were also strong community concerns and public opinion against any reprocessing facilities receiving the material, arising in part from previous discharges to the environment from off-site antimony mining and processing facilities.

Option 2 - Off-site disposal

Off-site disposal provides the advantages of limiting the on-going liability and risk. It would remove the contamination from the site using an established waste management process and facilities, and thus offers a high level of reliability and is also likely to be acceptable to the community. The cost associated with this option is the most significant disadvantage, particularly if landfill levies apply (although these levies may be considered representative of the costs of cell construction and ongoing monitoring that are borne by the landfill facility). The transport and treatment of the material at a hazardous waste landfill at Ipswich, Queensland was also assessed. Again, the transport and disposal costs combined to make this option very expensive.

Depending on available funding, the cost of this option would limit the area that could be remediated.

Option 3A – On-site treatment and disposal

On-site disposal is technically similar to the off-site disposal option, however the contamination would remain on site, and there would be on-going liability and risks which may not be acceptable to the community. The site constraints and technical feasibility, especially in the long term, are also limitations associated with this option. The main advantage of this option, compared to off-site disposal, is the lower cost because it would avoid transport and disposal fees. However, the construction costs (which would be related to the degree of on-going liability and risk) as well as the on-going management and monitoring required for this option would offset some of the cost savings of the remediation works. Further understanding of site conditions (groundwater and geotechnical) would also be required for a robust design of the on-site containment cell.

Option 3B – On-site disposal without treatment

The advantages and disadvantages of this option are similar to Option 3A. It is less expensive than Option 3A but also presents more risks because the contaminants would be more mobile due to a lack of treatment.

Option 4A – In-situ containment without treatment

In-situ containment is considered to be the lowest cost and best value for money option, with the least impact during remediation and requiring the least off-site resources, but would also entail the greatest on-going liability and risk. Additional investigations (in particular groundwater and geotechnical) would be required to determine the viability of this option and the technical details required for adequate in-situ containment. The additional investigations, combined with the greater on-going management and monitoring required for this option would offset some of the cost savings of the remediation works. This option may also be considered a medium term solution until more funding is available in the future or new technologies provide more cost effective, onsite treatment options.

Option 4B – In-situ containment with treatment

This option would be similar to Option 4A but includes treating the material which reduces contaminant mobilisation and associated risks. However, this option would be more expensive and a similar cost as Options 3A and 3B which have a similar or lower risk.

3.4 Preferred option

Option 3A was selected as the preferred option by the stakeholders including Bellingen Shire Council (BSC), Crown Lands, EPA and the Soil Conservation Service (SCS). This option would remove the material, immobilise the most leachable materials and place it in a containment cell onsite. This option was considered to be the most appropriate form of remediation when considering the above constraints, particularly in relation to:

- Cost
- Long term reliability
- Site characteristics and suitability
- Ongoing liability
- Ongoing management
- Potential environmental impact

Table 3-1 Risk assessment of onsite containment cell options

Scenario	Status Quo	In-situ containment without treatment	In-situ containment with treatment	Engineered Containment Cell with treatment	Engineered Containment Cell without treatment
Direct Exposure to Contamination	[red]	[yellow]	[green]	[green]	[yellow]
Leachate migration direct from material, via surface water or via groundwater	[red]	[yellow]	[yellow]	[green]	[yellow]
Migration of contaminated tailings / sediments through direct erosion or release	[red]	[yellow]	[green]	[green]	[green]
Stabilisation is or becomes ineffective	NA	[yellow]	[green]	[green]	NA
Failure of leachate collection systems	NA	NA	NA	[green]	[green]
Release of leachate through liner.	NA	NA	NA	[green]	[yellow]
Failure of cap – small scale leaks	NA	[yellow]	[yellow]	[green]	[yellow]
Failure of cap – large scale erosion	NA	[yellow]	[yellow]	[yellow]	[yellow]
Unplanned disturbance to cell	NA	[yellow]	[green]	[green]	[yellow]
Flood damage to containment	NA	[yellow]	[green]	[green]	[yellow]
Batter instability	NA	[green]	[green]	[yellow]	[yellow]
Mass movement – slumping	NA	[yellow]	[green]	[green]	[green]
Mass movement – sliding	NA	[green]	[green]	[yellow]	[yellow]

Scenario	Status Quo	In-situ containment without treatment	In-situ containment with treatment	Engineered Containment Cell with treatment	Engineered Containment Cell without treatment
Liquifaction (eg seismic)	NA				
Mass movement – settlement	NA				
Effects on local hydrology (flooding)	NA				

V – Very high risk, immediate action required involving emergency response.
H – High risk, immediate action required by site management.
M – Medium risk, management action required. Check frequently (eg. monthly).
L – Low risk, manage with standard operating procedure. Check periodically (eg. annually).

3.5 Extent of remediation

An additional phase of the assessment of options was to determine the most appropriate extent of the remediation. This was carried out via a qualitative assessment of the benefits of remediating additional area verses the impacts associated with that remediation, and an assessment of the volume and mass of the contamination removed with an increase in the area remediated as presented in Figure 3-2.

3.5.1 Risk assessment

It was considered that the main function of a site specific risk assessment would be to establish concentrations of the contaminants of concern (COCs) that would result in a particular level of impact/species protection at the periphery of the areas of contamination. Concentrations of COCs in the most significantly impacted areas of the Site are clearly above the relevant assessment criteria and are having an evident impact on the environment (and hence clearly require remediation or management). Even with site specific risk assessment, there would still be some uncertainty as to acceptable concentrations of COCs at the periphery of the impacted area, and other factors such as the cost and net environmental benefit of extending the area of remediation are likely to have greater influence on the decision process than a more precise understanding of the level of risk. The RAP has therefore concentrated primarily on evaluating the most appropriate remediation methodology to manage the most significant areas of impact, with decisions on the subsequent extent of remediation in peripheral areas to be made in consultation with the stakeholders.

3.5.2 Volume and mass of contamination removed

The cost of remediation and the impacts incurred during the remediation works were assessed against the impacts and risks of leaving areas of contamination in place. It was proposed that areas do not warrant remediation where the following conditions apply:

- Contamination is present at concentrations less than relevant health investigation levels (on a statistical basis for the subject area) and/or the potential for exposure is acceptably low.
- Contamination concentrations are nominally less than 10 times the ecological investigation levels, or higher exceedances are relatively isolated in extent and in an area where there would be a high risk of ecological impact by remediation activities.
- The area is physically stable and has a good cover of viable vegetation.
- Extensive disturbance of the area would be required to remove or treat the contamination.

A summary of areas potentially requiring remediation are presented Table 3-2 and Figure 3-1 along with conservative estimates of the volume of material contaminated and the mass of antimony in each area. Figure 3-2 illustrates the cumulative effect and the diminishing returns after the main areas of contamination have been remediated.

3.5.3 Outcome of assessment of extent of remediation

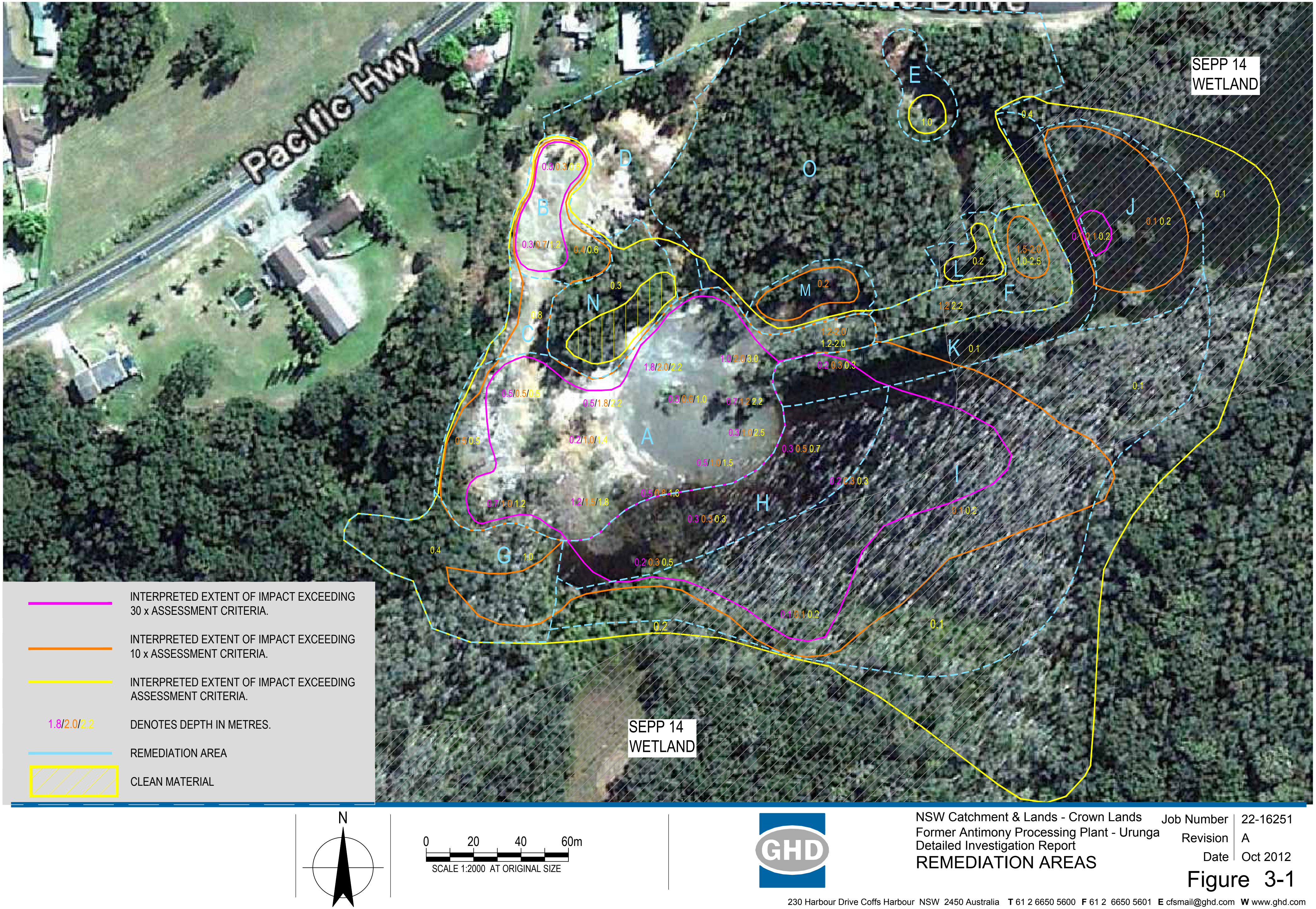
In summary:

- Area A is considered the priority for remediation due to the concentration and mass of contamination plus its proximity to the edge of the wetland. Remediating this area would remove approximately 82% of the overall amount of contamination identified onsite.
- Extending the remediation area to include Areas B, C and H would increase the overall mass of antimony removed from the site to 266 tonnes or 93% of the total amount

identified onsite. These areas could be remediated relatively easily and with minimal impact.

- Area I also has a relatively large volume and mass of contamination but access would be difficult and the impact of remediation in relation to the benefit needs to be considered.
- Contamination exists at Areas F, J, K, M and N but there is limited volume and most areas are covered in vegetation or under water. Area M could be relatively easily remediated but the cost and damage caused by remediating the other areas may be greater than the benefits.
- Area G is not as contaminated as other areas and is heavily vegetated, but may require remediation because it is offsite.
- It is also recommended that Areas D and E be rehabilitated during the remediation because access is readily available and it would improve the aesthetics of the site.
- No remediation is considered necessary at Areas L and O.

The recommendations listed above would result in removal of approximately 97% of the contamination identified onsite. Removal of contamination from the remaining areas is not deemed beneficial as the potential negative environmental impacts on those areas is deemed to exceed the potential positive environmental impacts from contaminant removal.



NSW Catchment & Lands - Crown Lands
Former Antimony Processing Plant - Urunga
Detailed Investigation Report
REMEDIATION AREAS

Job Number	22-16251
Revision	A
Date	Oct 2012

Figure 3-1

230 Harbour Drive Coffs Harbour NSW 2450 Australia T 61 2 6650 5600 F 61 2 6650 5601 E cfsmail@ghd.com W www.ghd.com

Plot Date: 3 April 2014 - 12:40 PM Plotted by: Ian Gould Cad File No: G:\22\16251\CADD\Drawings\22-16251-FIG 1 & 2.dwg

Table 3-2 Remediation areas

Area	Description	Characteristics	Area (m^2)	Estimated Contaminated Volume (m^3)	Estimated Mass of Antimony (tonnes)	Comment
A*	Main tailings and former processing area	Significant contamination, exceeding 30 x HIL E in most of area. Contains tailings, remnant stockpiles and miscellaneous contamination / waste materials. Little or no vegetation. Groundwater exceeds ANZECC criteria by more than 30 times.	10,300	19,000	240	Requires remediation. Extent is relatively insensitive to selected clean-up levels, as there is a relatively quick cut-off to lower levels at boundaries of area.
B*	Former ore stockpile area	Significant contamination, exceeding 30 x HIL E. Level area with little or no vegetation.	1,730	1,170	13	Requires remediation. Extent may vary somewhat, but not expected to have significant effect on overall volumes or remediation strategy.
C*	Between ore stockpile and process area	Level area with little or no vegetation.	700	580	2	Requires remediation. The extent is relatively shallow and may vary laterally, but not expected to have significant effect on overall volumes or remediation strategy.
D*	Former site access area	Relatively well characterised, no significant contamination. Little vegetation, likely because area has been excavated to bedrock.	3,430	<1	<1	Will require rehabilitation for aesthetic reasons.
E*	North eastern disturbed area	Some contamination less than 10 x HIL E, XRF data indicates significant lead and zinc contamination. No vegetation. Drainage pathway. Likely source of impact to north end of S shaped canals and north end of L shaped canal (elevated zinc).	900	200	<1	Likely to require remediation subject to further characterisation. Will require rehabilitation for aesthetic reasons.
F	Panhandle adjoining L shaped canal	Contamination exceeds 10 x HIL E at some locations, at former ground level generally beneath at least 0.5 m 'clean' soil. Vegetation is healthy. Boundary between Area A and Area F to be determined.	1,950	970	5	Low risk to health or environment due to relatively limited extent (likely previously impacted natural soils) and lack of exposure to contamination. Could be managed by installing a boardwalk through this area, also making use of the physical characteristics for beneficial future use of the site.
G*	South west of processing plant	Contamination exceeds criteria and extends into adjacent property. Extend of contamination extends to	3,400	280	<1	Remediation likely to be required, subject to further delineation to define

Area	Description	Characteristics	Area (m^2)	Estimated Contaminated Volume (m^3)	Estimated Mass of Antimony (tonnes)	Comment
	and tailings area.	at least 0.5 mbgs and additional work required to delineate horizontal extent. Area is extensively vegetated.				extent and degree of contamination, including on adjacent property. Extent of remediation will need to be determined.
H*	Wetland adjoining south of tailings area.	Significant impact exceeding 30 x HIL E and 30 x sediment criteria. Surface water exceeds ANZECC criteria by more than 10 times. Significant impact to vegetation apparent. Boundary between Area H and Area I to be determined. Further delineation of extent and degree and ecology / ecotoxicology studies (eg. field survey) recommended to aid decisions on extent of remediation.	4,000	1,930	11	Remediation considered being required, extent will require consideration of cost, impacts during remediation vs risks associated with leaving contamination in place. Boundary between Area H and Area I to be determined.
I*	Southern side of wetland.	Significant impact exceeding 30 x sediment criteria, but vegetation does not show as significant impact as Area H.	18,800	2,280	10	May not warrant remediation due to considerations of cost and impacts during remediation vs risks associated with leaving contamination in place.
J	Wetland east of L shaped canal.	Significant impact exceeding 30 x sediment criteria. Vegetation does not show significant impact. Further delineation of extent and degree and ecology / ecotoxicology studies recommended to aid decisions on extent of remediation.	3,800	350	1	May not warrant remediation due to considerations of cost and impacts during remediation vs risks associated with leaving contamination in place.
K	L shaped canal	Areas of contamination adjacent to tailings but less than adjacent wetland sediments. Significant depth likely to limit potential exposure.	3,300	520	2	Likely no remediation, subject to further sampling and possibly ecotox survey.
L	SE corner of S shaped canal	Elevated As, Sb and Zn with respect to sediment criteria and EILs, but not significantly above HIL E. No apparent impact, well vegetated, low potential for migration offsite.	660	60	<1	No remediation proposed.
M*	Western end of S shaped canals.	Adjoins tailings area, apparent impact from migration of sediments from tailings area. Sb and As greater than 10 times HIL E and sediment criteria, little vegetation, potential for exposure.	1,125	120	<1	Remediate in conjunction with Area A.
N	Vegetated area between ore stockpile area and tailings area.	The extent of impact was noted to extend into the north western portion of the vegetated area. Contamination extended to approximately 0.2 mbgs.	2,140	635	1	Remediate the northern western portion in conjunction with Area B and C.

Area	Description	Characteristics	Area (m^2)	Estimated Contaminated Volume (m^3)	Estimated Mass of Antimony (tonnes)	Comment
O	North eastern portion of site.	Mainly densely vegetated, no significant signs of impact, relatively well characterised, contaminant concentrations less than 10 x HIL E and in most cases less than EILs.	15,550	0	0	No remediation proposed.

*Indicates areas to be remediated

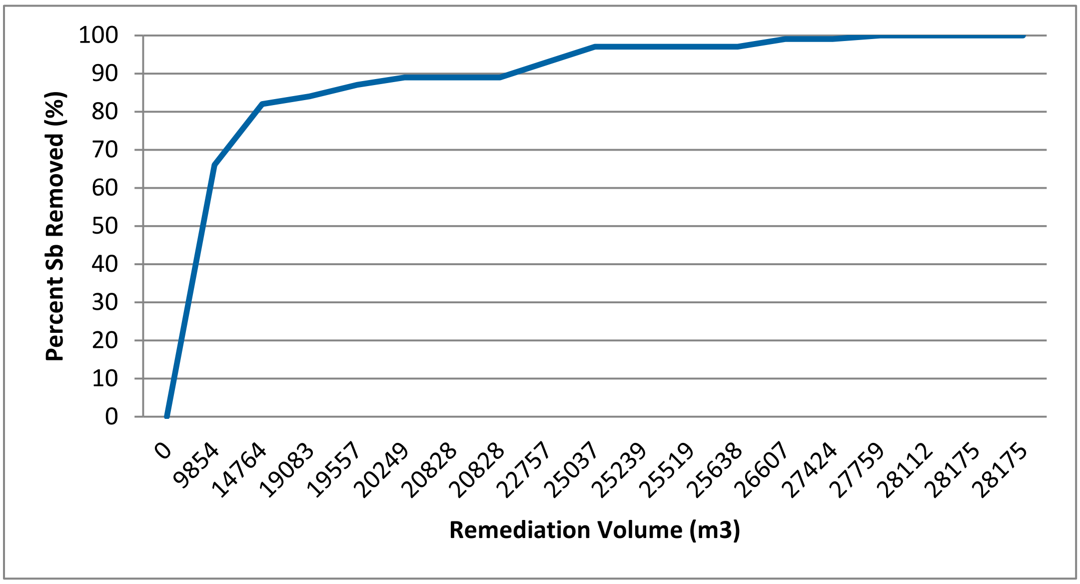


Figure 3-2 Proportion of antimony removed compared to the volume of material removed

4. Proposal description

4.1 Proposal overview

As discussed in Section 3.4, remediation option 3A – Onsite Disposal with Treatment was selected as the option that best met the remediation objectives. A detailed methodology for the Proposal is presented in the RAP (Appendix E). Treatment requirements would vary depending on the degree of contamination, leachability and physical characteristics (eg. soil type) of the excavated material. As discussed in Section 3.5, the proposed extent of remediation would involve excavation of areas A, B, C, D, E, G (part), H, I (part) and M, as shown on Figure 4-1. The extent of excavation within Areas I and G would be limited to where healthy vegetation commences. An overview of remediation methodology is summarised in the following subsections.

The Proposal will generally involve:

- Removal of old processing facility remnants and surface debris
- Removing power poles
- Clearing of vegetation for the purpose of extracting underlying contaminated material
- Landform earthworks to divert uncontaminated clean water away from the site and control the flow of surface water across the contaminated site
- Construction of the containment cell
- Importing clean material for engineering purposes including construction of containment cell, surface capping, void filling, land reshaping or habitat purposes
- Excavating contaminated material within the wetland for the purpose of bulk removal
- Stabilisation / treatment of excavated contaminated materials
- Placement of the contaminated material into the containment cell
- Dewatering of surface or groundwater which enters the excavation works
- Capping and completion of the containment cell
- Revegetation

In addition to the proposal, and under a separate Early Works Package, the site will be prepared as much as practical ahead of the remediation works. This includes:

- Removal of existing dwelling & office
- Clearing of garden plants
- Remove and reuse brick stockpile
- Remove electricity power lines/conductors
- Importing clean material for future use in the remediation

These works are the subject of a development application (2014/DA-00115) recently approved by Bellingen Shire Council and affect the uncontaminated parcel of land only.

4.2 Site Establishment

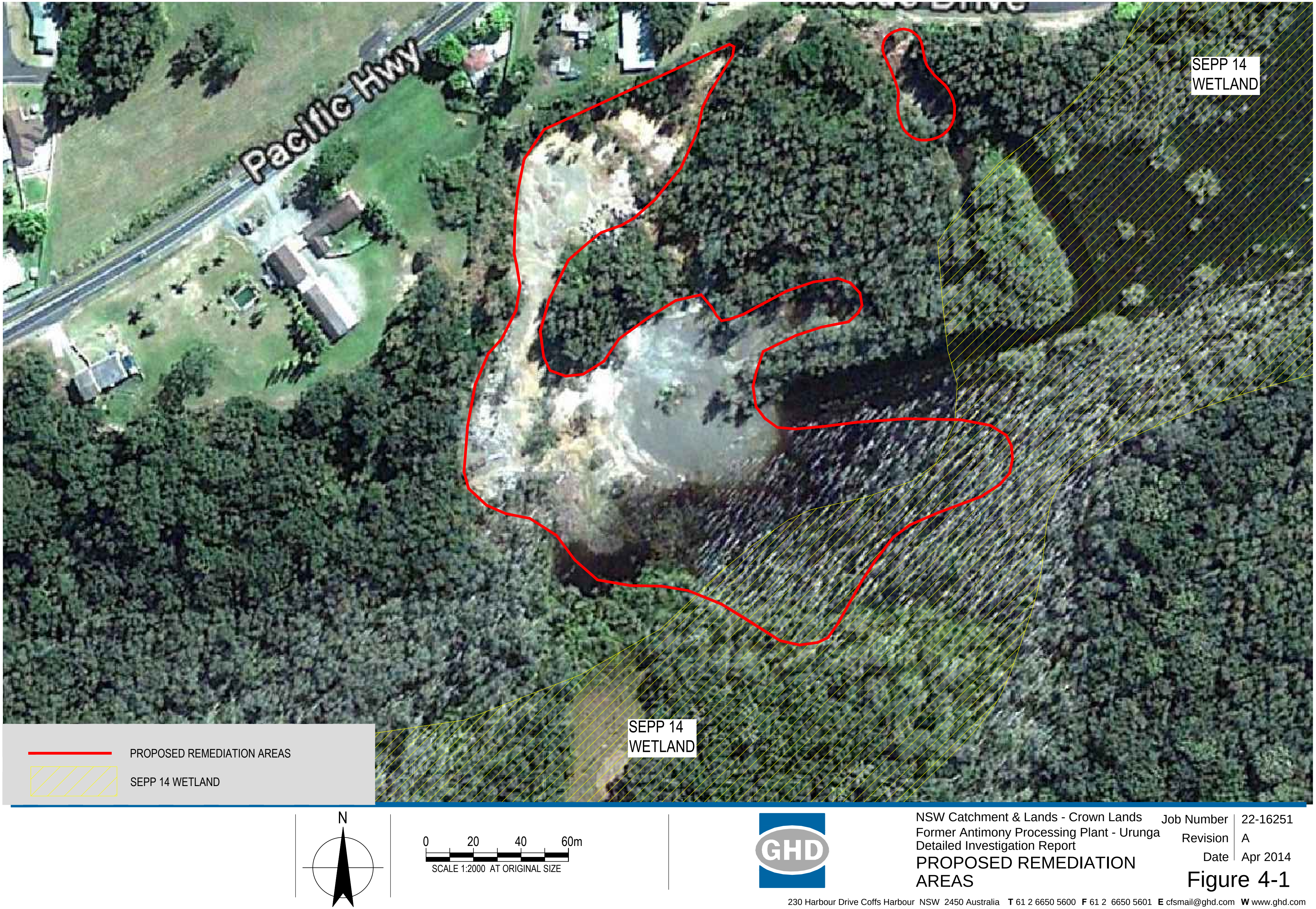
The remediation works would be subject to key management plans including:

- Workplace Health & Safety (WHS) Management Plan
- Quality Management Plan

- Construction Environmental Management Plan (CEMP) which incorporates details regarding:
  – Soil and water management
  – Acid sulfate management
  – Waste management
  – Noise management
  – Air quality management
  – Flora and fauna management, including a Vegetation Management Plan
  – Traffic Management Plan

Site establishment would also require:

- Establishing access to, from and within the site
- Setup of a site compound
- Full perimeter of security fencing (to water's edge)
- Appropriate warning signs related to construction and hazardous waste
- Disposal of residual building waste including old processing mill structures and stockpiles
- Clearing of vegetation



GHD

NSW Catchment & Lands - Crown Lands
Former Antimony Processing Plant - Urunga
Detailed Investigation Report

PROPOSED REMEDIATION AREAS

Job Number 22-16251
Revision A
Date Apr 2014

Figure 4-1

230 Harbour Drive Coffs Harbour NSW 2450 Australia **T** 61 2 6650 5600 **F** 61 2 6650 5601 **E** cfsmail@ghd.com **W** www.ghd.com

Plot Date: 9 April 2014 - 3:37 PM Plotted by: Ian Gould Cad File No: G:\22\16251\CADD\Drawings\22-16251-FIG 1 & 2.dwg