

# Power station closures - *what next for workers and the environment?*

NSW power stations are both big employers and big polluters.

The closures dates are in the calendar,  
2023, 2025, 2029, 2033...

Hear from  
speakers and join  
the discussion

## Lake Macquarie

Doyalson RSL

Thursday September 8th,  
6-8pm

## Hunter

East Maitland Bowling Club

Thursday September 15th,  
6-8pm

# Welcome to Darkinjung Country

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Kevin Duncan

*Senior Education & Tourism Officer Darkinjung Local  
Aboriginal Land Council*




# Lake Macquarie coal-ash impacts




September 2022

Presented by Paul Winn, HCEC Senior researcher



CURRENT  
POWER STATIONS



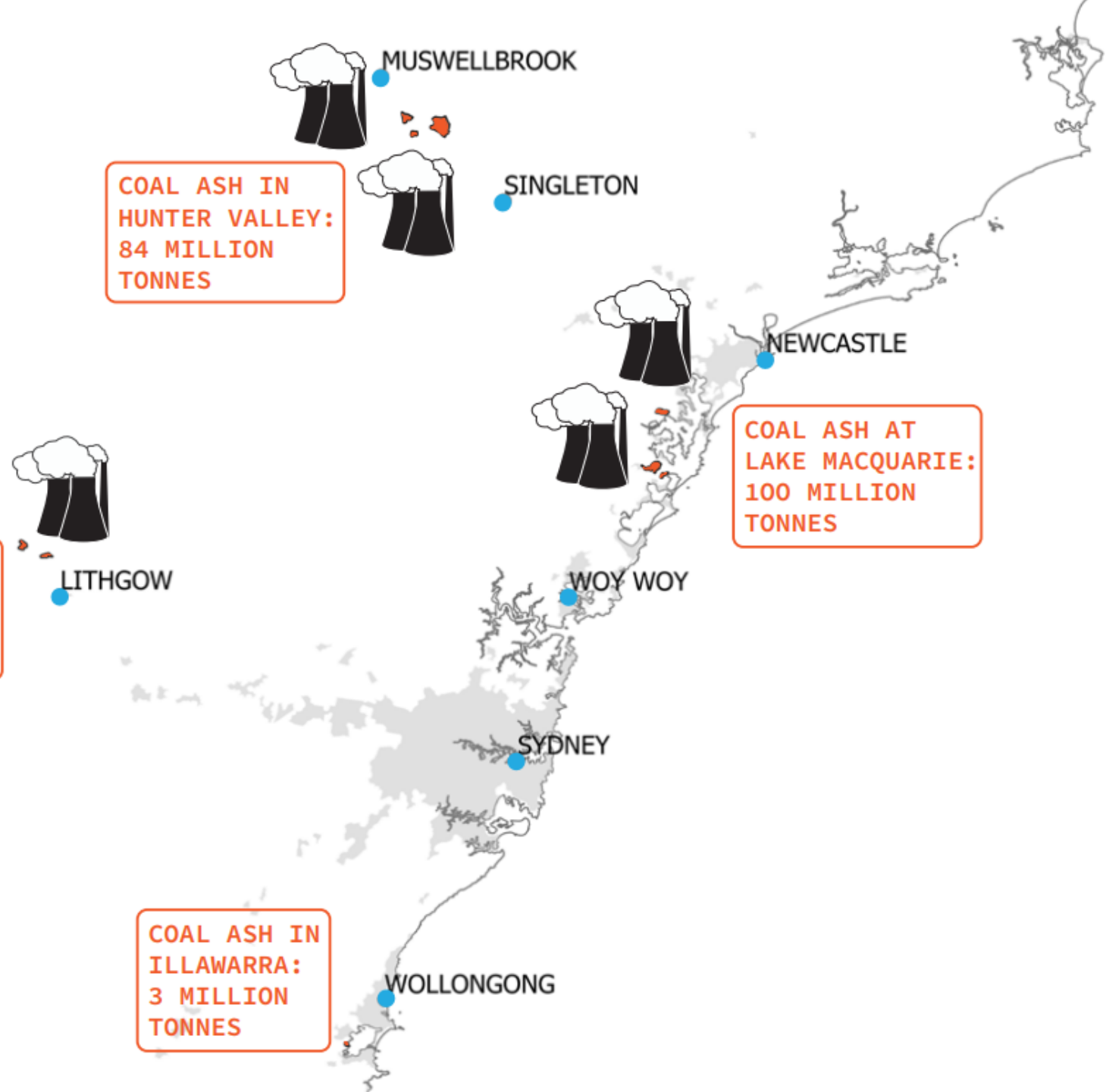
COAL ASH DAMS

COAL ASH  
AT LITHGOW:  
28 MILLION  
TONNES

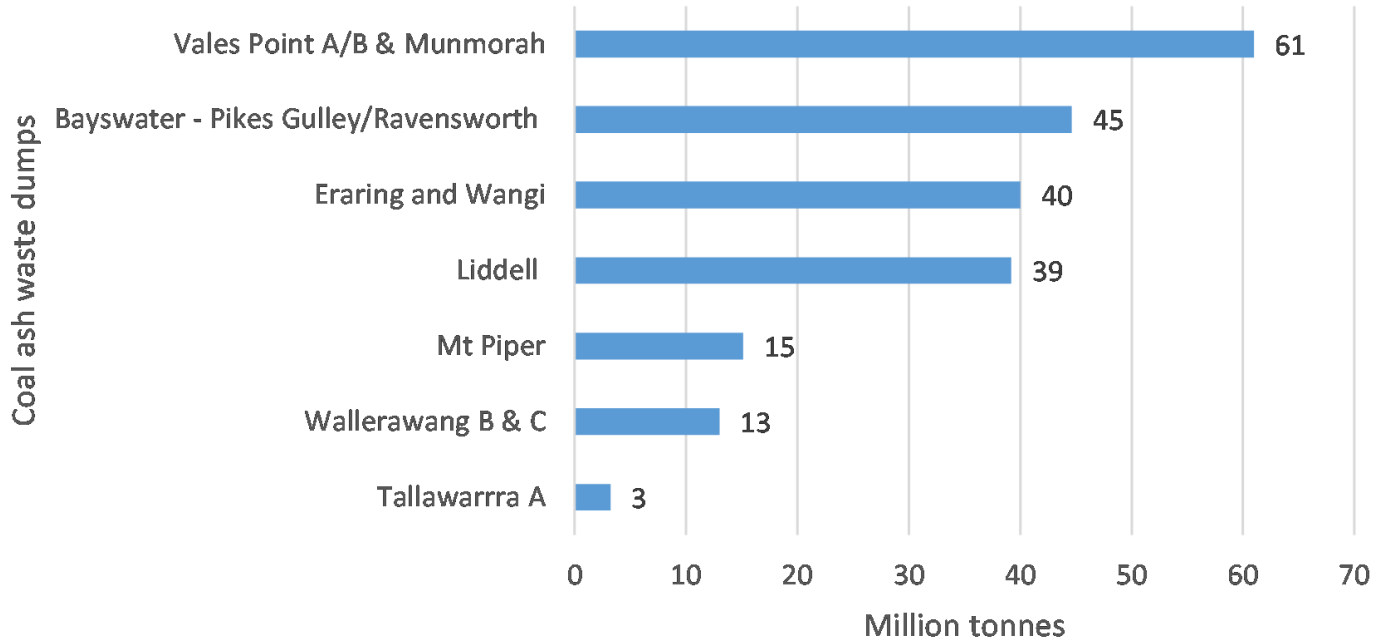
COAL ASH IN  
HUNTER VALLEY:  
84 MILLION  
TONNES

COAL ASH IN  
ILLAWARRA:  
3 MILLION  
TONNES

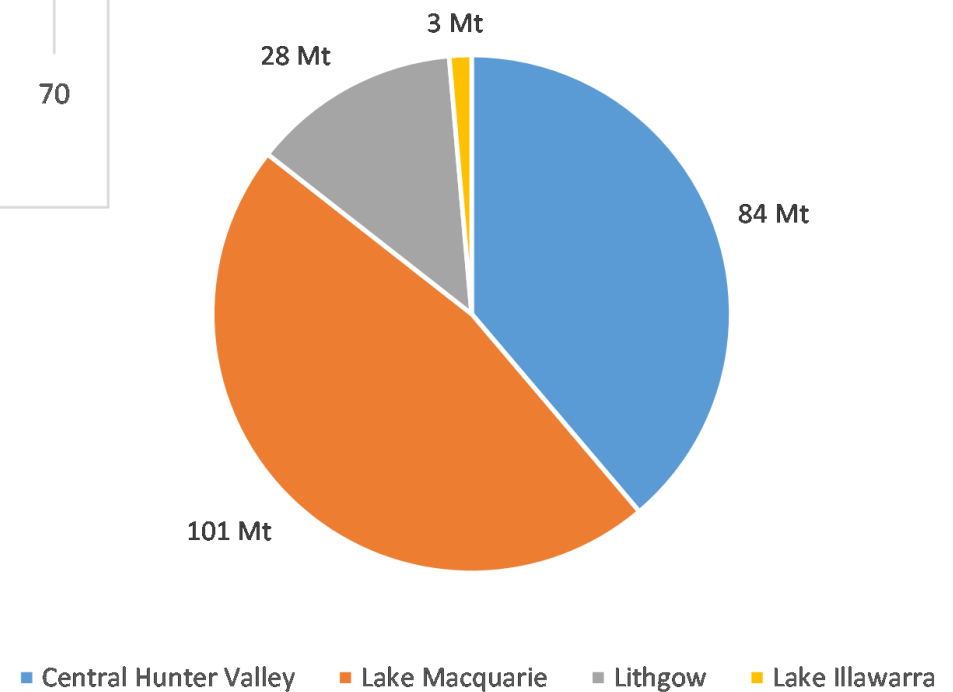
COAL ASH AT  
LAKE MACQUARIE:  
100 MILLION  
TONNES



## Accumulated coal ash waste



## Regional accumulated coal ash waste



# Vales Point Environmental Site Assessment

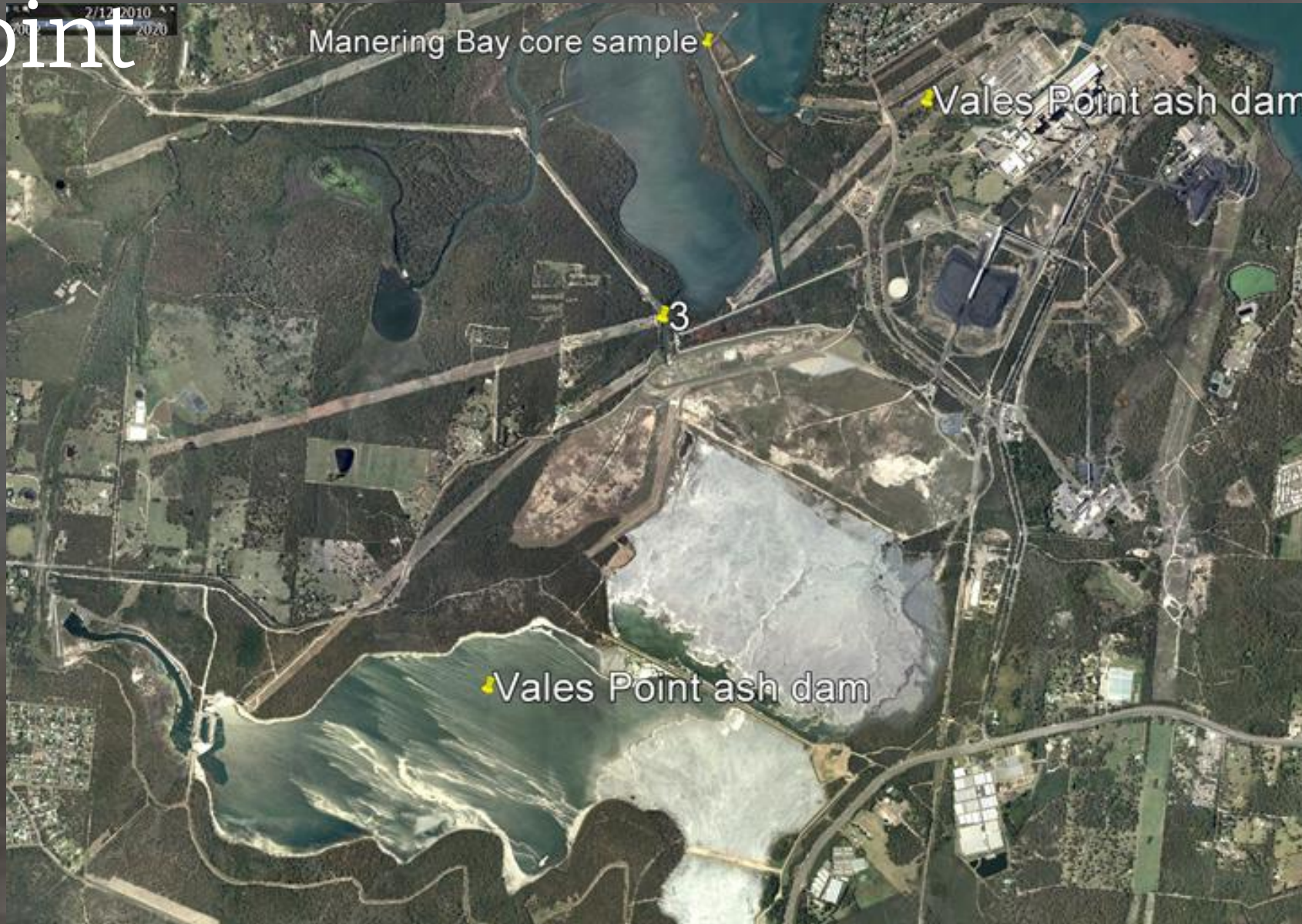
- Acid Sulfate Soil conditions.
- Long term ash disposal, a known sources of metal contaminants, within the Ash Dam, may have contributed to metal impacts in the underlying groundwater.
- The ash dam appears to be a primary source of arsenic and selenium to groundwater and a secondary source of cobalt, copper, lead, manganese, nickel and zinc.

# Vales Point Environmental Site Assessment

## **Maximum concentrations down-gradient of ash dam;**

- Arsenic -184 ppm
- Cobalt -169 ppm
- Copper 596 ppm
- Lead 231 ppm
- Manganese 17,300 ppm
- Nickel 133 ppm
- Selenium 276 ppm
- Zinc 1,200 ppm.

# HCEC sediment and water testing: Vales Point





# HCEC water testing: Vales Point

Sample location				Vales Point ash dam seepage		ANZECC (2000)				ANZECC (2000) Recreational Use	NHMRC Drinking Water Guidelines
						Marine trigger value					
Sample ID				3wt	3wd	99%	95%	90%	80%		
Field Prep.				TOTAL	DISOLVED						
Type of sample				Water	Water						
Date Sampled				23/5/20	23/5/20						
pH.				4.5		7-8.5					
EC		uS/CM									
Metal/metalloid		Units	PQL								
<b>Aluminium</b>	Al	µg/L	10	81000	75000					200	
<b>Arsenic</b>	As	µg/L	1	43	43					50	10
<b>Boron</b>	Bo	µg/L	20	100	100					1,000	4,000
Barium	Ba	µg/L	1	230	200					1,000	
Cadmium	Cd	µg/L	0.1	0.1	0.2	0.7	0.7	14	36	5	2
<b>Cobalt</b>	Co	µg/L	1	59	60	0.005	1	14	150		
Chromium	Cr	µg/L	1							50	50
<b>Copper</b>	Cu	µg/L	1			0.3	1.3	3	8	1,000	2,000
<b>Iron</b>	Fe	µg/L	10	1700	1700					300	
Lead	Pb	µg/L	1	2	2	2.2	4.4	20	85	50	10
<b>Manganese</b>	Mn	µg/L	5	8600	8600					100	500
Molybdenum	Mo	µg/L	1								
Mercury	Hg	µg/L	0.05			0.1	0.4	0.7	1.4	1	1
<b>Nickel</b>	Ni	µg/L	1	36	36	7	7	200	560	100	20
<b>Selenium</b>	Se	µg/L	1							10	
Thallium	Th	µg/L	1								
Vanadium	V	µg/L	1			50	100	160	280		
<b>Zinc</b>	Zn	µg/L	1	130	130	7	15	23	43	5,000	

# HCEC sediment testing: Vales Point

Vales Point A 1962 when metals increase in sediment.

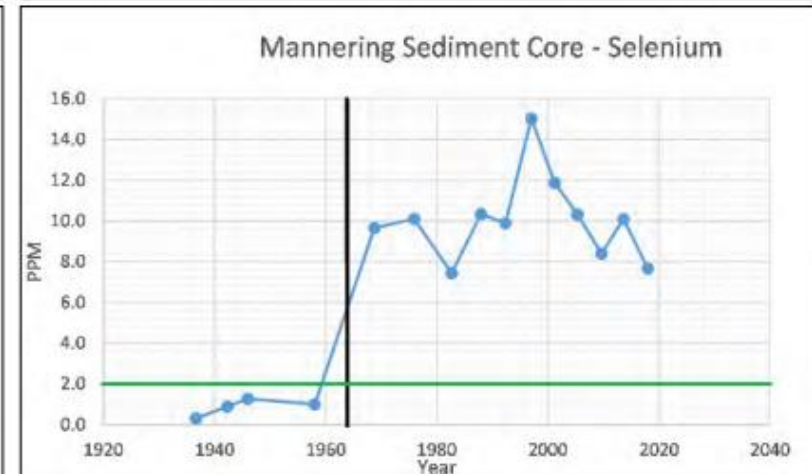
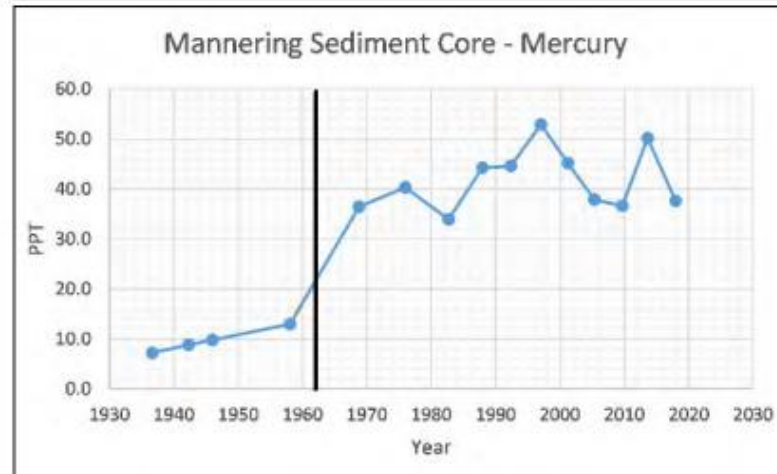
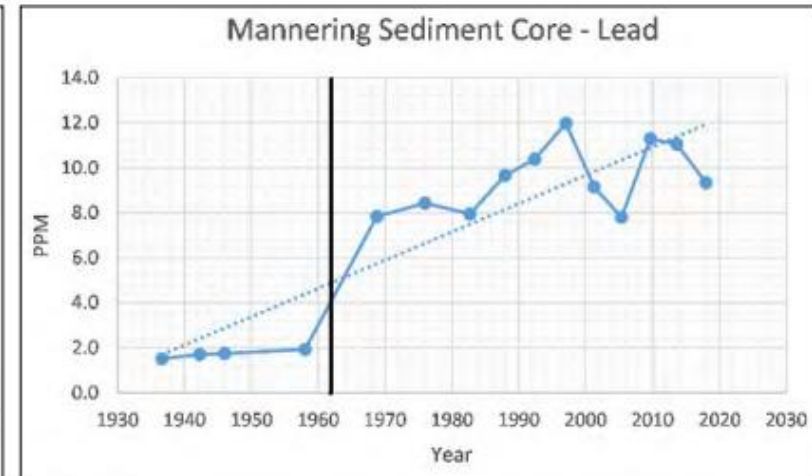
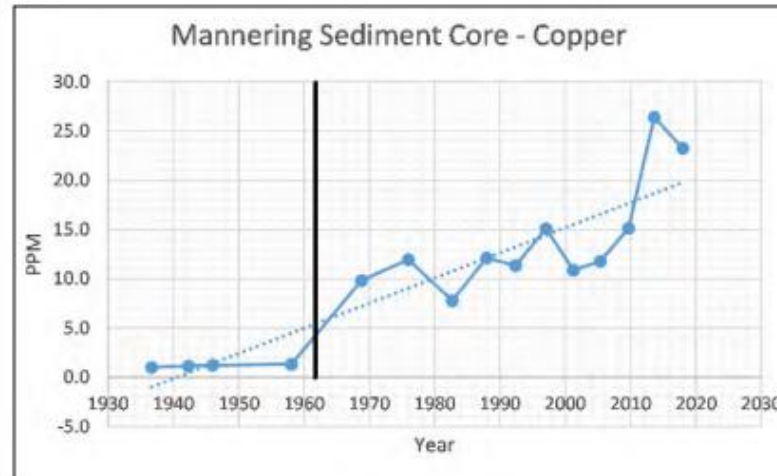
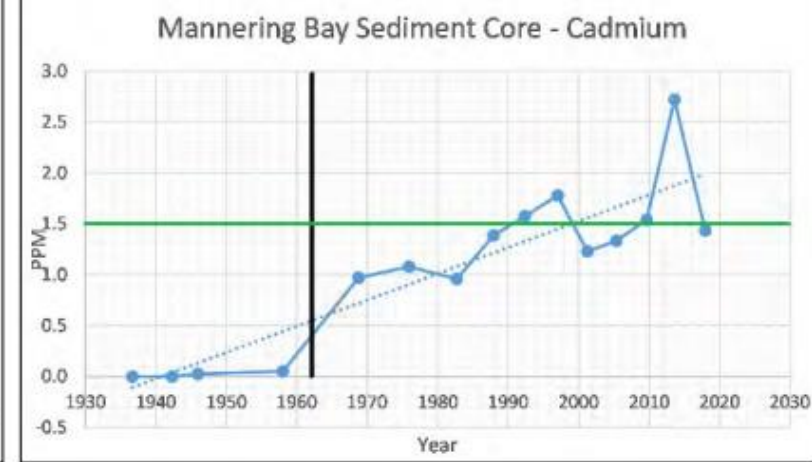
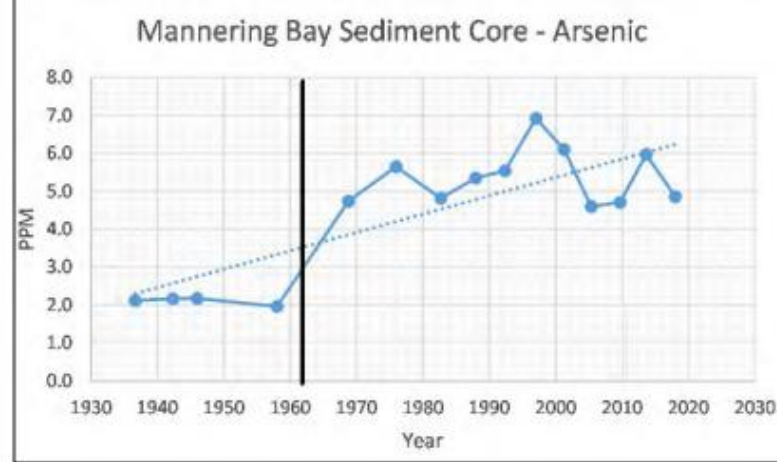
Cadmium x 15

Copper x 10

Selenium x 8

Lead and mercury x 4

Arsenic x 2.5



# Eraring Environmental Site Assessment

- Selenium in offsite sediments down-gradient of the ash dam represent a potential risk to the environment (ecological exposure and ingestion of fish).
- Duty to report exists for exceedances of arsenic, nickel, selenium, benzolalpyrene and vinyl chloride, cadmium, copper, lead, nickel, selenium, and zinc.
- May be effected by Acid Sulfate Soils.

# Eraring Environmental Site Assessment

## Maximum concentrations down-gradient of ash dam;

- Arsenic 73 ppm
- Cadmium 2.8 ppm
- Copper 100 ppm
- Nickel 254 ppm
- Selenium 205 ppm
- Zinc 1,050 ppm

# HCEC water testing: Eraring



# HCEC water testing: Eraring

Sample location				Eraring ash dam overflow Crooked Creek				ANZECC (2000)				ANZECC (2000) Recreational Use	NHMRC Drinking Water Guidelines
								Marine trigger value					
Sample ID				1wt	1wd	2wt	2wd	99%	95%	90%	80%		
Field Prep.				TOTAL	DISOLVED	TOTAL	DISOLVED						
Type of sample				Water	Water	Water	Water						
Date Sampled				23/5/20	23/5/20	23/5/20	23/5/20						
pH.				5.9		4.1		7-8.5					
EC		uS/CM		>3999									
Metal/metalloid		Units	PQL										
<b>Aluminium</b>	Al	µg/L	10	330	290	16000	15000					200	
<b>Arsenic</b>	As	µg/L	1	2	1	8	4					50	10
<b>Boron</b>	Bo	µg/L	20	1900	1900	1800	1800					1,000	4,000
Barium	Ba	µg/L	1	190	250	100	100					1,000	
Cadmium	Cd	µg/L	0.1	0.3	0.3	0.1	0.1	0.7	0.7	14	36	5	2
<b>Cobalt</b>	Co	µg/L	1	4	4	18	19	0.005	1	14	150		
Chromium	Cr	µg/L	1			5						50	50
<b>Copper</b>	Cu	µg/L	1	2		3		0.3	1.3	3	8	1,000	2,000
<b>Iron</b>	Fe	µg/L	10	11000	11000	43000	6400					300	
Lead	Pb	µg/L	1			3		2.2	4.4	20	85	50	10
<b>Manganese</b>	Mn	µg/L	5	1600	1900	5600	5900					100	500
Molybdenum	Mo	µg/L	1	3	2	4							
Mercury	Hg	µg/L	0.05					0.1	0.4	0.7	1.4	1	1
<b>Nickel</b>	Ni	µg/L	1	6	7	21	22	7	7	200	560	100	20
<b>Selenium</b>	Se	µg/L	1			3						10	
Thallium	Th	µg/L	1										
Vanadium	V	µg/L	1			13		50	100	160	280		
<b>Zinc</b>	Zn	µg/L	1	46	53	49	45	7	15	23	43	5,000	

# HCEC sediment testing: Eraring

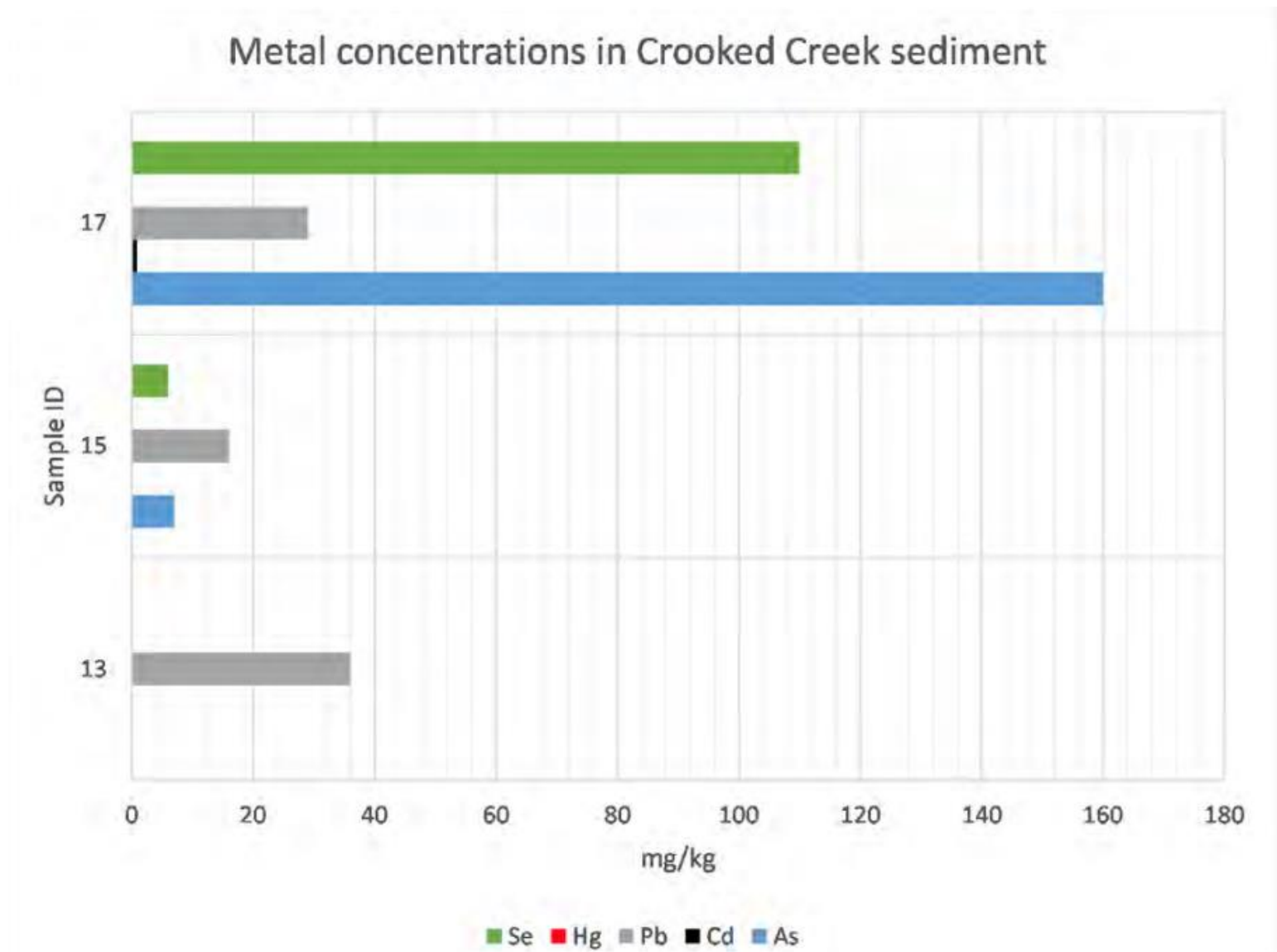
## Maximum concentrations:

Selenium - 110 ppm

Arsenic - 160 ppm

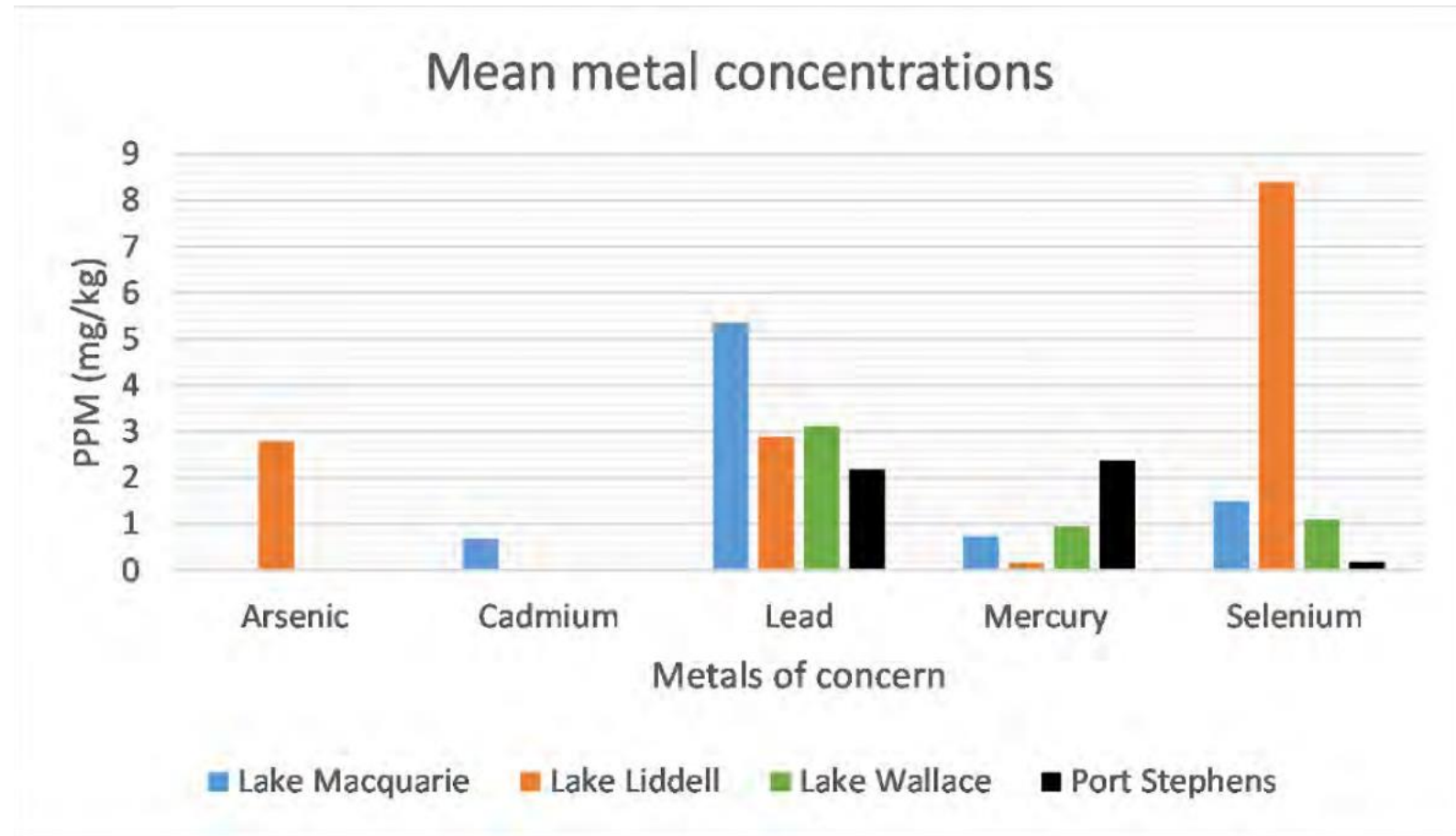
Lead - 36 ppm

Cadmium - 0.9 ppm



# Toxic Habitat: *water birds near power stations*

Half of all birds from which we sampled feathers were potentially suffering health impacts from heavy metals emitted by coal-fired power stations.





# Results: Bird feather study

## Lake Macquarie

- Selenium in 6/14
- Lead in all feathers.
- Cadmium only in 4/14 from Lake Macquarie

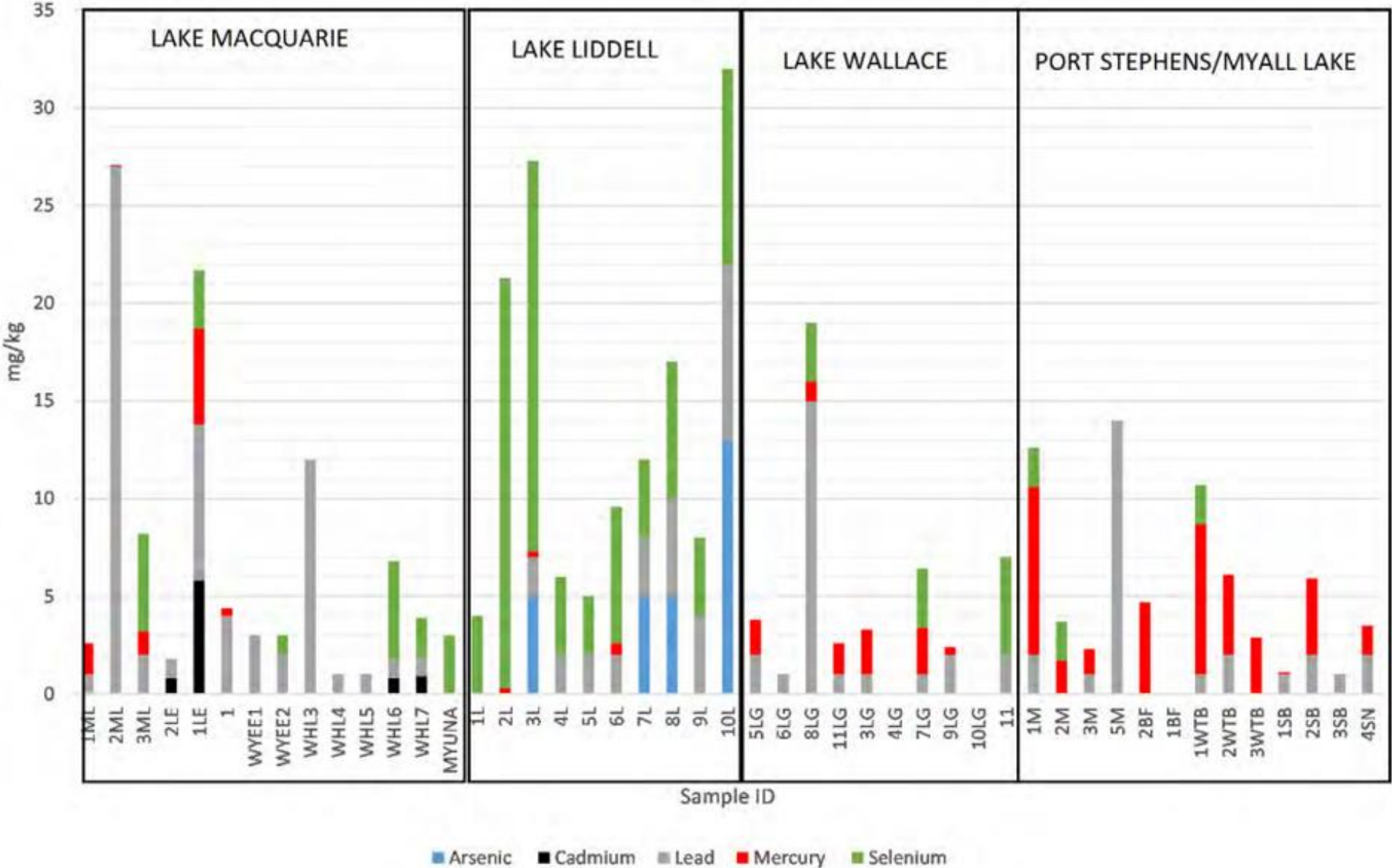
## Lake Wallace

- Lead in all 10
- Mercury in 6/10 -
- Selenium in 7/10 - All above adverse health thresholds

## Lake Liddell

- Selenium in all feathers. Most exceeding health thresholds.
- Arsenic only in 4/10 from Lake Liddell.
- Highest arsenic, lead, and selenium from an adult Black Swan carcass

# Cumulative metals – all sites



# Annual metal leaching from NSW ash

Arsenic 1.6t  
 Cadmium 193kg  
 Chromium 2t  
 Copper 3t  
 Mercury 40kg  
 Nickel 681kg  
 Lead 80kg  
 Selenium 3t  
 Zinc 5t

Metal (mg/k - ppm)		NSW coal-fired power stations					Mean ppm	Estimated annual leachate (kg)
		1	2	3	12	13		
<b>Arsenic</b>	<b>As</b>	<b>12</b>	<b>4</b>	<b>6.6</b>	<b>12</b>	<b>43</b>	<b>16</b>	<b>1,634</b>
<b>Boron</b>	<b>B</b>	25	56	89	75	80	65	<b>44,428</b>
<b>Barium</b>	<b>Ba</b>	393	420	653	393	510	474	<b>29,668</b>
<b>Berillium</b>	<b>Be</b>	22	15	4	9	6	11	<b>1,473</b>
<b>Cadmium</b>	<b>Cd</b>	<b>0.4</b>	<b>0.9</b>	<b>0.25</b>	<b>0.44</b>	<b>0.35</b>	<b>0</b>	<b>193</b>
<b>Cobalt</b>	<b>Co</b>	11	10	6	11	38	15	<b>220</b>
<b>Chromium</b>	<b>Cr</b>	<b>50</b>	<b>40</b>	<b>18</b>	<b>45</b>	<b>72</b>	<b>45</b>	<b>2,017</b>
<b>Copper</b>	<b>Cu</b>	<b>52</b>	<b>50</b>	<b>28</b>	<b>47</b>	<b>151</b>	<b>66</b>	<b>2,940</b>
<b>Gernanium</b>	<b>Ge</b>	40	18	5	10	10	17	<b>2,998</b>
<b>Mercuy</b>	<b>Hg</b>	<b>0.02</b>	<b>0.03</b>	<b>0.15</b>	<b>0.12</b>	<b>0.22</b>	<b>0</b>	<b>39</b>
<b>Lithium</b>	<b>Li</b>	180	28	48	58	106	84	<b>12,540</b>
<b>Manganese</b>	<b>Mn</b>	88	200	899	321	413	384	<b>7,939</b>
<b>Molybdenum</b>	<b>Mo</b>	8	5	5	6	10	7	<b>10,802</b>
<b>Nickel</b>	<b>Ni</b>	<b>41</b>	<b>30</b>	<b>11</b>	<b>24</b>	<b>70</b>	<b>35</b>	<b>681</b>
<b>Lead</b>	<b>Pb</b>	<b>59</b>	<b>60</b>	<b>48</b>	<b>68</b>	<b>48</b>	<b>57</b>	<b>78</b>
<b>Antimony</b>	<b>Sb</b>	2.9	2.3	3.1	3.9	2.9	3	<b>760</b>
<b>Selenium</b>	<b>Se</b>	<b>5.2</b>	<b>4.7</b>	<b>2.5</b>	<b>3.5</b>	<b>3.7</b>	<b>4</b>	<b>3,068</b>
<b>Tin</b>	<b>Sn</b>	<b>10</b>	<b>12</b>	<b>6</b>	<b>10</b>	<b>11</b>	<b>10</b>	<b>13</b>
<b>Vanadium</b>	<b>V</b>	128	120	49	109	172	116	<b>10,896</b>
<b>Tungsten</b>	<b>W</b>	5	7	6	6	3	5	<b>1,805</b>
<b>Zinc</b>	<b>Zn</b>	<b>108</b>	<b>86</b>	<b>67</b>	<b>124</b>	<b>142</b>	<b>105</b>	<b>5,210</b>
<b>Zirconium</b>	<b>Zr</b>	600	440	250	400	450	428	<b>14</b>
<b>TOTALS</b>								<b>139,416</b>

# Critical Minerals in NSW ashes

Alumina	2.2Mt	\$21b
Germanium	3,650t	\$13b
Lithium	18,500t	\$1.2b
Nickel	7,740t	\$285m
Zircon	94,000t	\$235m
Cobalt	3,340t	\$197m
Copper	14t	\$180m

Metal (mg/k - ppm)		NSW coal-fired power stations						Price per USD/Ton	Resources (tonnes) in 220Mt fly ash	Resource value AUD	
		1	2	3	12	13	Mean ppm				
<b>High Purity Alumina</b>								<b>20%</b>	<b>6,500</b>	<b>2,200,000</b>	<b>21b</b>
Arsenic	As	12	4	6.6	12	43	16			-	
Boron	B	25	56	89	75	80	65	750	14,300	16m	
Barium	Ba	393	420	653	393	510	474		104,236	-	
Berillium	Be	22	15	4	9	6	11	3,500	2,464	13m	
Cadmium	Cd	0.4	0.9	0.25	0.44	0.35	0	650	103	98,378	
<b>Cobalt</b>	<b>Co</b>	<b>11</b>	<b>10</b>	<b>6</b>	<b>11</b>	<b>38</b>	<b>15</b>	<b>40,000</b>	<b>3,344</b>	<b>197m</b>	
Chromium	Cr	50	40	18	45	72	45	9,000	9,900	131m	
<b>Copper</b>	<b>Cu</b>	<b>52</b>	<b>50</b>	<b>28</b>	<b>47</b>	<b>151</b>	<b>66</b>	<b>8,500</b>	<b>14,432</b>	<b>180m</b>	
<b>Germanium</b>	<b>Ge</b>	<b>40</b>	<b>18</b>	<b>5</b>	<b>10</b>	<b>10</b>	<b>17</b>	<b>2,370,000</b>	<b>3,652</b>	<b>13b</b>	
Mercuy	Hg	0.02	0.03	0.15	0.12	0.22	0		24	-	
<b>Lithium</b>	<b>Li</b>	<b>180</b>	<b>28</b>	<b>48</b>	<b>58</b>	<b>106</b>	<b>84</b>	<b>45,000</b>	<b>18,480</b>	<b>1.2b</b>	
Manganese	Mn	88	200	899	321	413	384	1,000	84,524	124m	
Molybdenum	Mo	8	5	5	6	10	7	26,000	1,496	57m	
<b>Nickel</b>	<b>Ni</b>	<b>41</b>	<b>30</b>	<b>11</b>	<b>24</b>	<b>70</b>	<b>35</b>	<b>25,000</b>	<b>7,744</b>	<b>286m</b>	
Lead	Pb	59	60	48	68	48	57	2,300	12,452	42m	
Antimony	Sb	2.9	2.3	3.1	3.9	2.9	3	12,000	664	12m	
Selenium	Se	5.2	4.7	2.5	3.5	3.7	4	650	862	824,023	
Tin	Sn	10	12	6	10	11	10	40,000	2,156	127m	
Vanadium	V	128	120	49	109	172	116	650	25,432	24m	
Tungsten	W	5	7	6	6	3	5	6,000	1,188	11m	
Zinc	Zn	108	86	67	124	142	105	3,200	23,188	110m	
<b>Zirconium</b>	<b>Zr</b>	<b>600</b>	<b>440</b>	<b>250</b>	<b>400</b>	<b>450</b>	<b>428</b>	<b>1,700</b>	<b>94,160</b>	<b>235m</b>	
<b>TOTALS</b>								<b>AU\$36b</b>			

# Thank you

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# The power station workforce in the Hunter and Lake Macquarie

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Dr. Ingrid Schraner  
*Economist*



**A snapshot of the power station workforce  
in the Hunter and around Lake Macquarie**

**Presentation for the Hunter Community Environment Centre  
by Dr Ingrid Schraner, Lilli Pilli Consulting Pty Ltd, August 2022**

# Power station workforce

Workforce Liddell & Bayswater: 620

## Geographical distribution of coal-fired power stations



Workforce Eraring 350

Workforce Vales Point 260

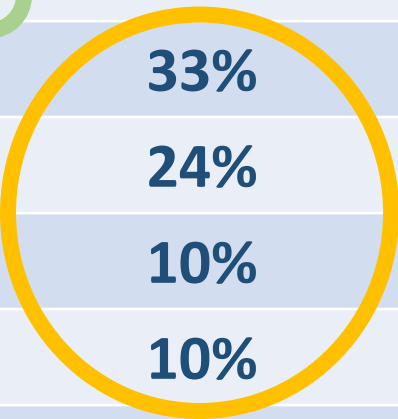
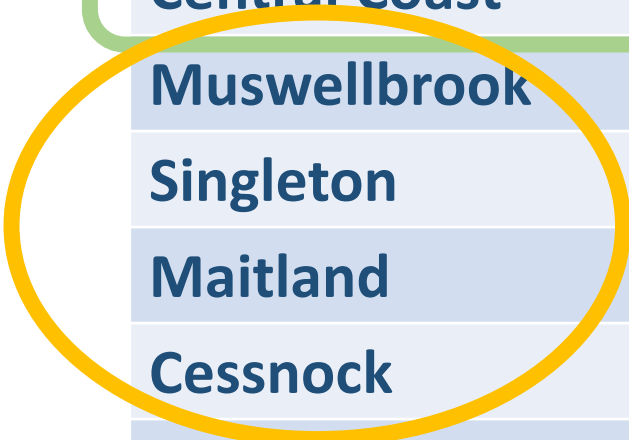
**2016** Census Data "Electricity Generation"  
Hunter Valley, Lake Macquarie, Central Coast



# Where the majority of the “Electricity Generation” workforce lives

2016 Census Data	Central Coast (Vales Point p/s)	Newcastle & Lake Macquarie (Eraring p/s)	Hunter Valley (Bayswater & Liddell p/s)
Lake Macquarie	30%	60%	4%
Central Coast	60%	20%	
Muswellbrook			33%
Singleton			24%
Maitland			10%
Cessnock			10%
Newcastle		10%	4%

**“Electricity Generation”**  
= power station workers  
& sub-contractors



\* SA4 Statistical Area Level 4  
\*\* POW Point of Work

## Workforce age structure in 2016

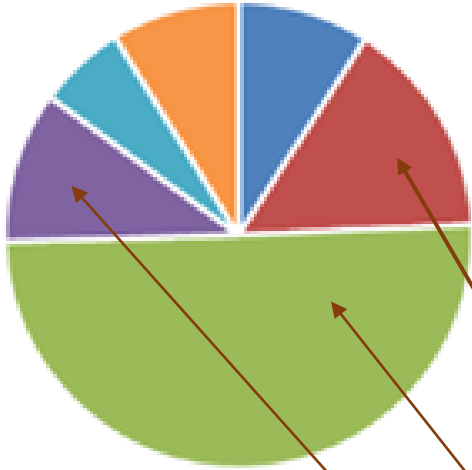
2016 Census SA4* (POW)**	Central Coast (Vales Point p/s)	Hunter Valley excl. Newcastle (Bayswater & Liddell p/s)	Newcastle & Lake Macquarie (Eraring p/s)	Total
15 – 49 years	39%	61%	67%	58% or ~700
50 – 64 years	52%	33%	30%	36% or ~440
Total workforce	260 or 20%	620 or 50%	350 or 30%	1,230 or 100%

**Power stations:** early retirement funding for less than 440 people

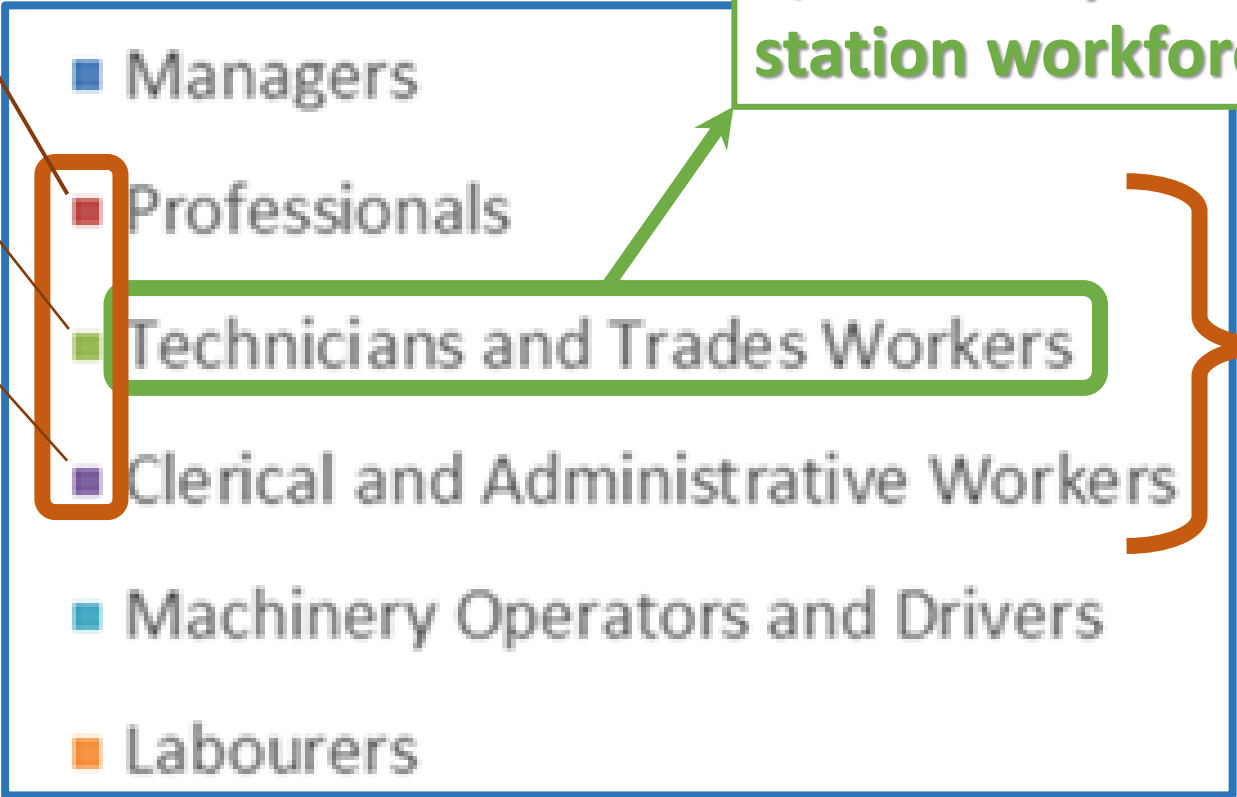
**However:** local economy needs 1,230 new jobs – not only 700

# Occupations in Hunter Valley, Lake Macquarie, and Central Coast

Electricity Generation



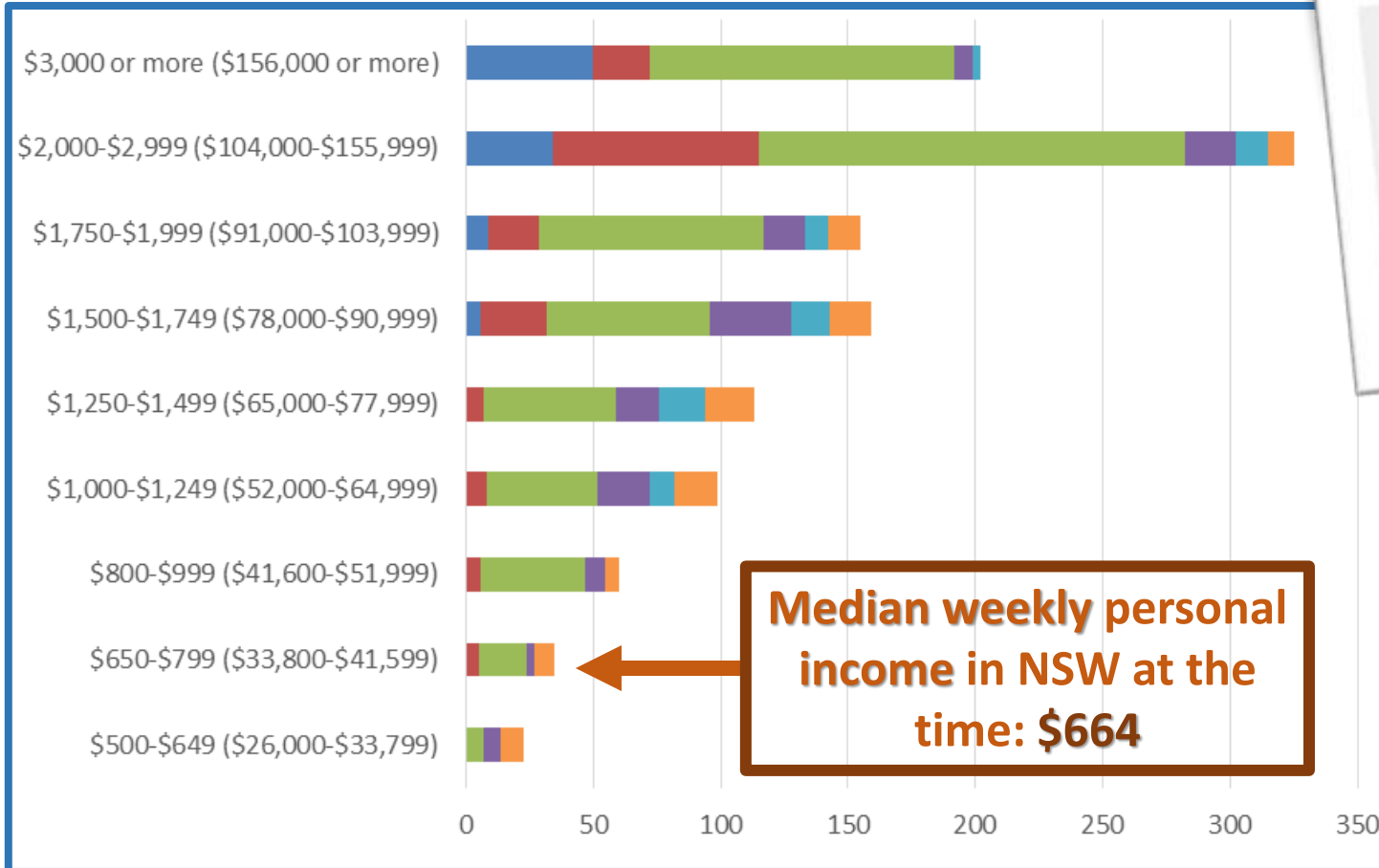
All Industries



1/2 of the power station workforce

3/4 of the power station workforce

# Income structure by occupation in Electricity Generation



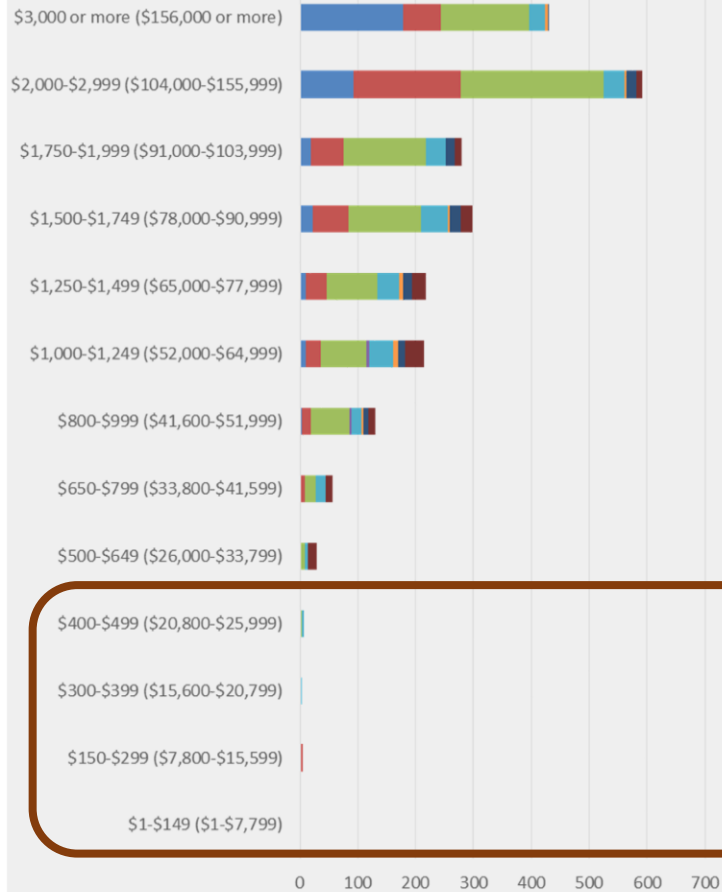
**Hunter Valley,  
Lake Macquarie,  
and Central Coast**

**Median weekly personal  
income in NSW at the  
time: \$664**

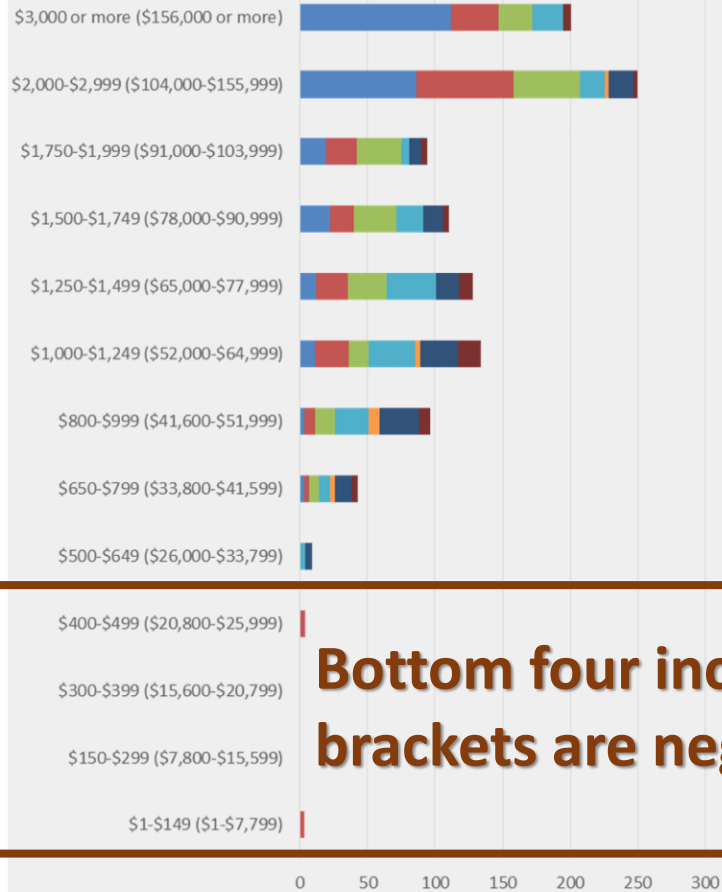
- Managers
- Professionals
- Technicians and Trades Workers
- Clerical and Administrative Workers
- Machinery Operators and Drivers
- Labourers

# Income structure by occupation (NSW)

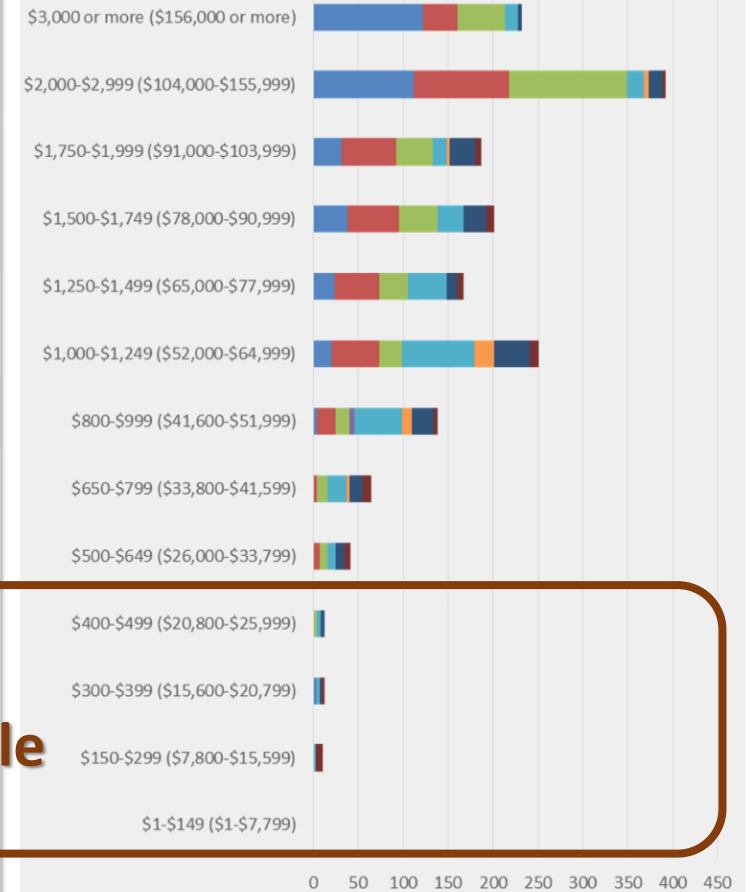
## Electricity Generation



## Petroleum & Coal Product Manufacturing



## Basic Chemical Manufacturing



**Bottom four income brackets are negligible**

# A successful Flagship Project

- **300 jobs for each local economy, all above median income,**
- **Half the jobs for Tradies, at least half of them in top 3 income brackets (\$91,000/year or more)**
- **Sizeable apprenticeship programs for all trades**
- **Career paths to top management in all trades**
- **Project to be integrated in local economy**
- **Low carbon footprint and ongoing social licence**

# INTERMISSION

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# Address from Justin Page

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*Hunter Jobs Alliance, Former NSW State Secretary,  
Electrical Trades Union (ETU)*



# Address from Cory Wright

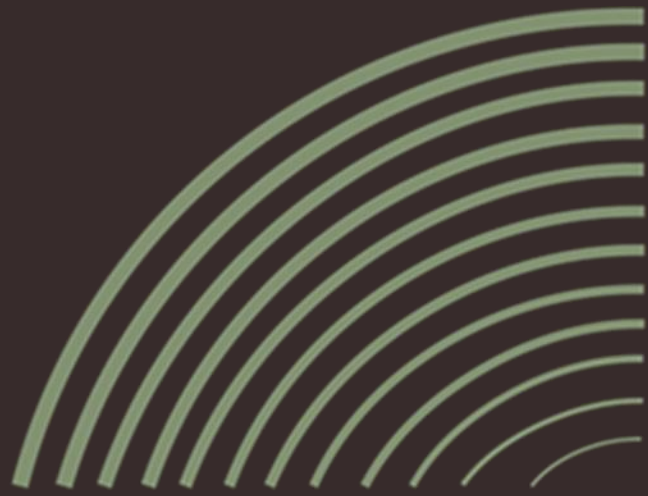
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*NSW State Secretary, Australian Manufacturing Workers Union (AMWU), Hunter Jobs Alliance*

# Starting to empty coal-ash dams

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Dr Ingrid Schraner  
*Co-Founder Wilco Envirotech*



re.  
source

**Wilco Envirotech** REGENERATING COMMUNITIES  
& THEIR ENVIRONMENTS

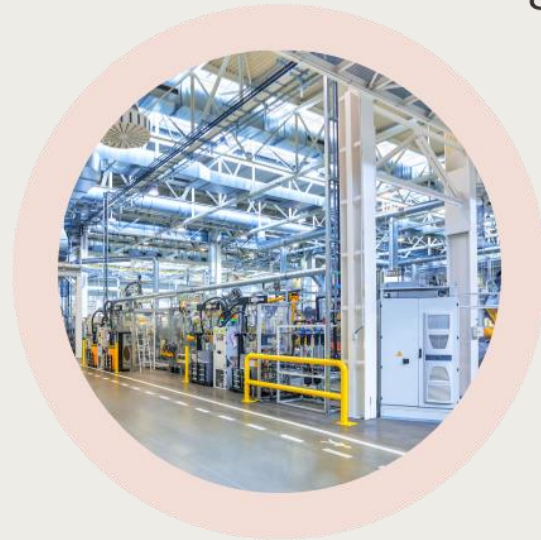
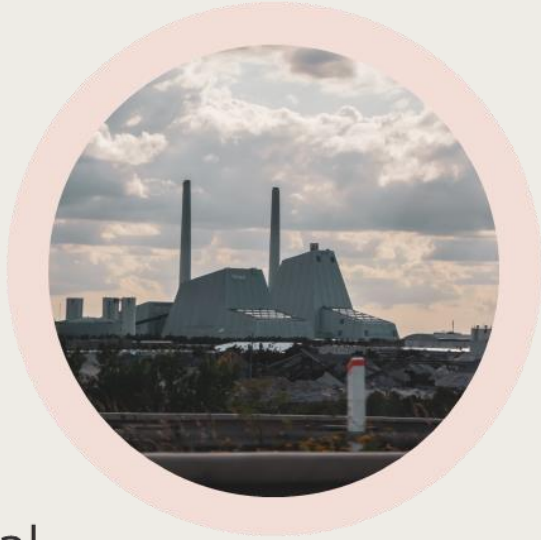
**CONCEPT PACK**

from the 2022 Accenture Venture Studio  
a part of WWF Australia's *Innovate 2 Regenerate* Challenge

## HOW IT WORKS

# Our Process

We use a novel combination of established chemical processes and existing equipment from the mining and chemical industries to empty coal-ash dams across Australia and manufacture environmentally safe products.



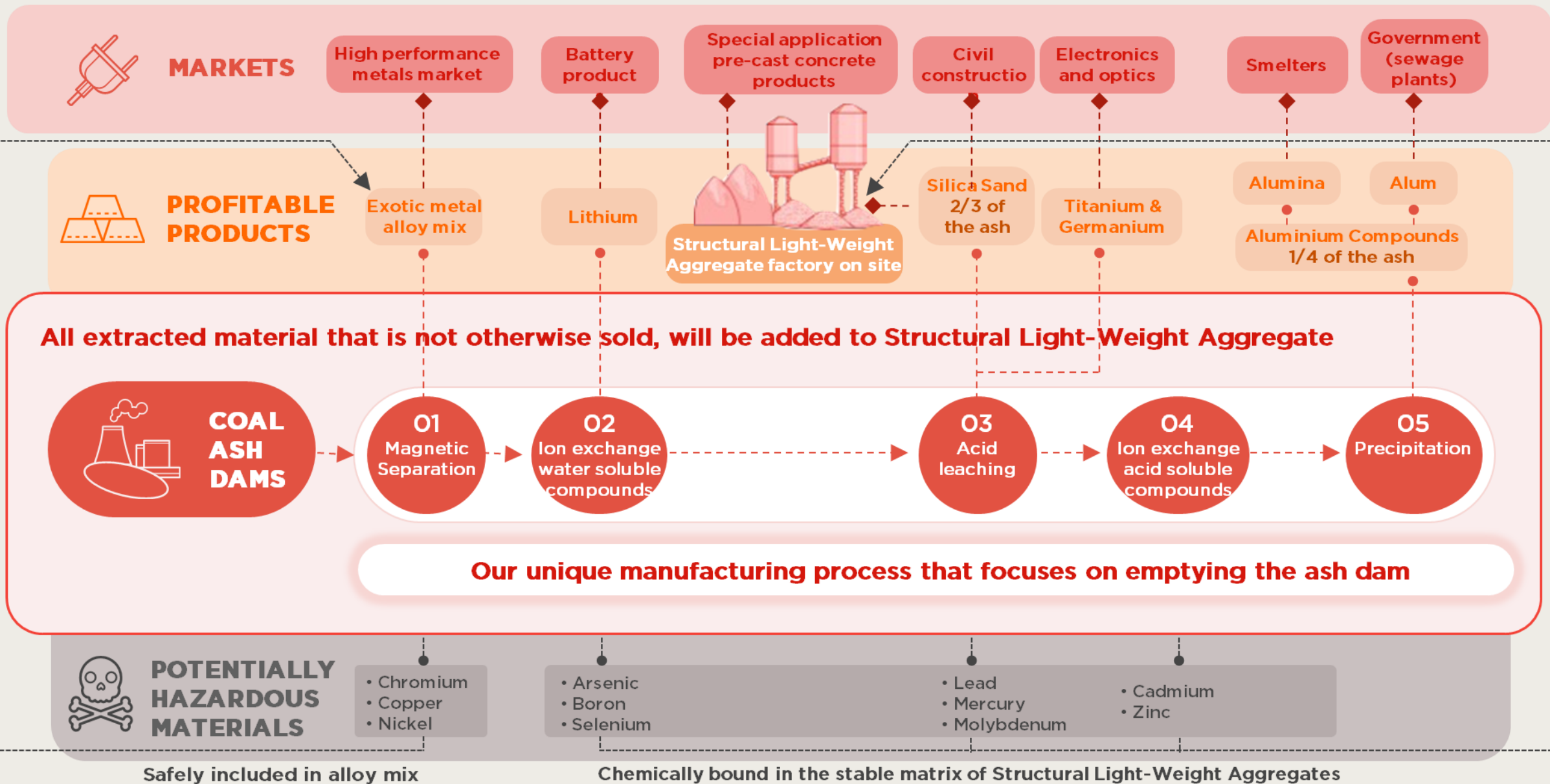
We work with coal-fired power stations to build advanced chemical manufacturing plants and structural lightweight aggregate factories.

The sale of valuable minerals will fund the processing of potentially hazardous elements into environmentally safe products, serving well-established markets with large growth potential.



# OUR PATENTED PROCESS

How we turn industrial waste into a palette of valuable & safe products, emptying the entire dam.



## HOW IT WORKS

# Our Impact

A facility that processes one million tonnes of coal-ash and employs some 330 people - in jobs that have comparable occupational and remuneration characteristics to the jobs in coal-fired power stations.



With 5% of the commercial profits we will fund a not-for-profit organisation that will enable local communities to develop, manage and own projects with a focus on First Nations, youth and women-led projects.

# OUR REGENERATION PLATFORM

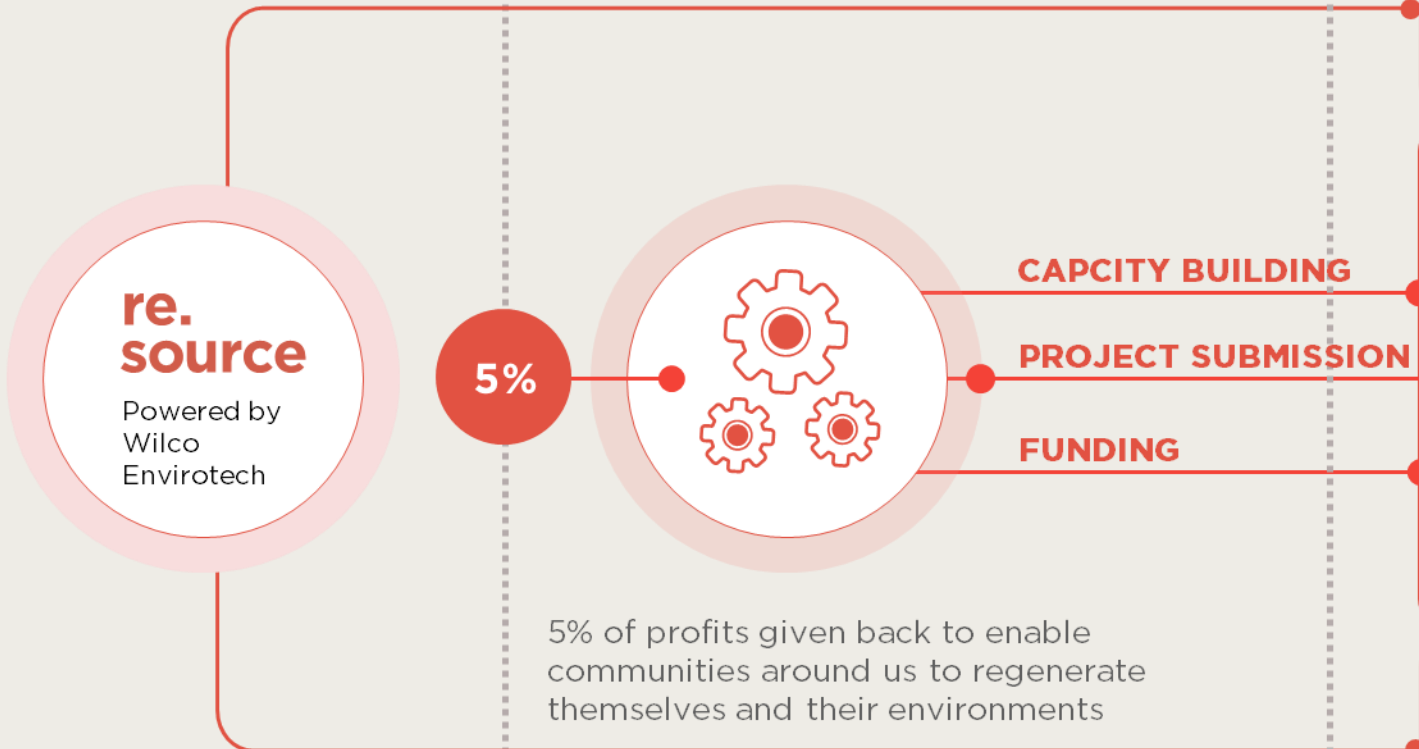
## OUR COMPANY AND PROCESS

Our focus on supporting the regeneration of communities and their environments

## OUR NOT-FOR-PROFIT ORGANISATION

A replicable model for mainstream businesses to be part of the circularity of wealth with limited risks and fully community controlled projects.

## WHERE WE PROVIDE IMPACT



5% of profits given back to enable communities around us to regenerate themselves and their environments

### Environment

A novel manufacturing process that empties the whole ash dam and re-uses all components of the ash, setting the highest standards for modern chemical manufacturing.



### Communities

Enable First Nations, youth and women groups to identify, develop, manage and own their projects, so that they can regenerate themselves and their environments.



Youth & their organisations



Women & their organisations



First Nations People & their organisations

### Keeping a Skilled Workforce

Creating local jobs that make use of the skilled workforce at power stations, invest in apprenticeships and research & development, collaborate with the local university and TAFE colleges - be the place where people want to work.





# DISTINGUISHING FEATURES



## We are a regenerative business

We give back more than we take – through a model that empowers communities to be in control, without putting undue risks on our business.

We re.source a not-for-profit organisation that enables communities to formulate their priorities, develop their projects, and successfully manage and own them.



## We care about our environment

We developed a novel process to extract all of the potentially hazardous material and all the material that can become a re.source for others – until all the coal-ash has been safely used up and the local communities can regenerate their environments.



## We create good jobs for our communities

Half of a power station's workforce used to be local trades people. We re.source our workforce from here, locally – slightly shifting together from electrical to chemical engineering, but with the same high-quality and high-remuneration jobs.



## We are building circular economies

We use power station waste as our key re.source, together with their workforce.

We support modern manufacturing industries, from local lithium battery production to greener aluminium smelting, from solar panel production to specialist precast concrete products.

And we circulate the wealth created, together with our local communities.

# Questions & discussion

# Thank you

