LandTrack Systems

Improved compliance performance, profit and productivity with our specialised training, tools and support

Environmental Approvals (Mining) – detail

Environmental Essentials WA

OUTCOMES

You will gain an understanding of the various approvals required for mining in Western Australia. In particular…

- Programme of Work
- Mining Proposal:
    - Overview and structure
    - Mining Proposal requirements and guidelines
    - Mine Closure Plan requirements and guidelines.

PoW-S

- Online application process
- Intersects proposed activities with environmental and culturally significant data layers and highlights all potential impacts.
- Proponents can then make adjustments to their proposed activities to avoid impacting sensitive areas.
- Environmental concerns have to be identified before submission. Once submitted, they cannot be amended.
- **Incomplete applications will be rejected**

PoW APPLICATIONS - ENVIRONMENTALLY SENSITIVE AREAS (ESA)

- Environmentally Sensitive Areas are defined in Regulation 6 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*
- Clearing for exploration purposes is exempt from requiring a clearing permit, provided it is not within an Environmentally Sensitive Area (ESA), and is conducted under an authority granted under the *Mining Act 1978* (e.g. an approved Programme of Work)
- Proposals taking place in an ESA requires Native Vegetation Clearing Permit (Clearing Permit)
- Clearing Permit system administered by Department of Water and Environmental Regulation (DWER) not DMIRS

PoW APPLICATIONS - ENVIRONMENTALLY SENSITIVE AREAS (ESA)

- Application for proposed mining activities will need to include:
  - ✓Type of ESA
  - ✓Clearing Permit submission number and lodgement date
- Note: If your proposed activities involve the clearing of Native Vegetation within an ESA, and no Clearing Permit has yet been lodged with DWER Native Vegetation Assessment Branch, you will be unable to proceed with the lodgement process any further.

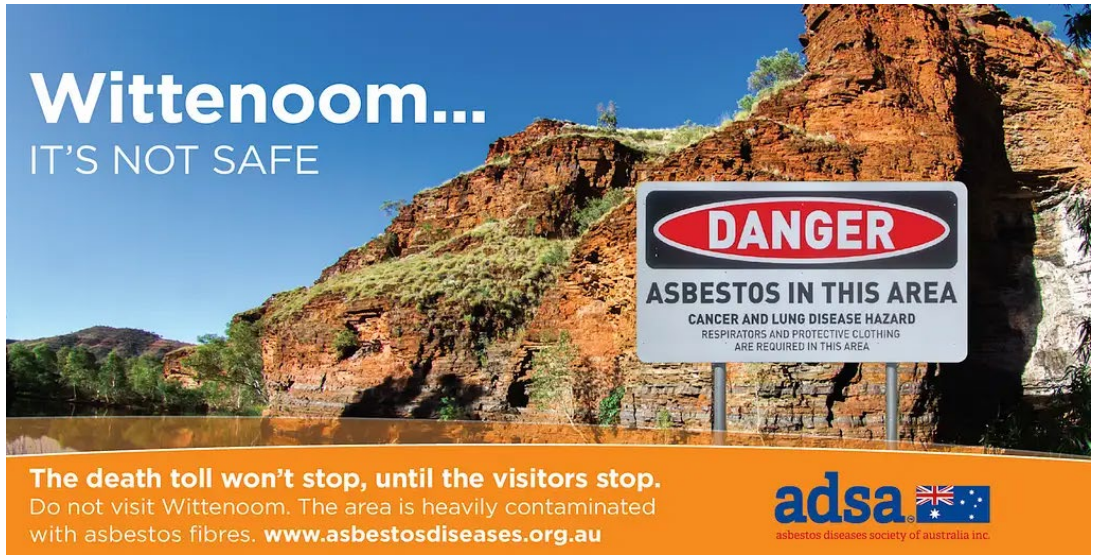
The Clearing Permit System Map can assist those intending to clear to determine whether an area is an ESA and its type.

PoW - ENVIRONMENTAL INFORMATION REQUIRED

- Description of existing landforms, environment and vegetation:
  - Do activities require the clearing of native vegetation?
  - Do activities occur in ESAs?
  - Do activities occur on isolated hills/ranges in the MidWest or Yilgarn (Banded Iron Formations)? E.g. Helena and Aurora Range (Bungalbin)

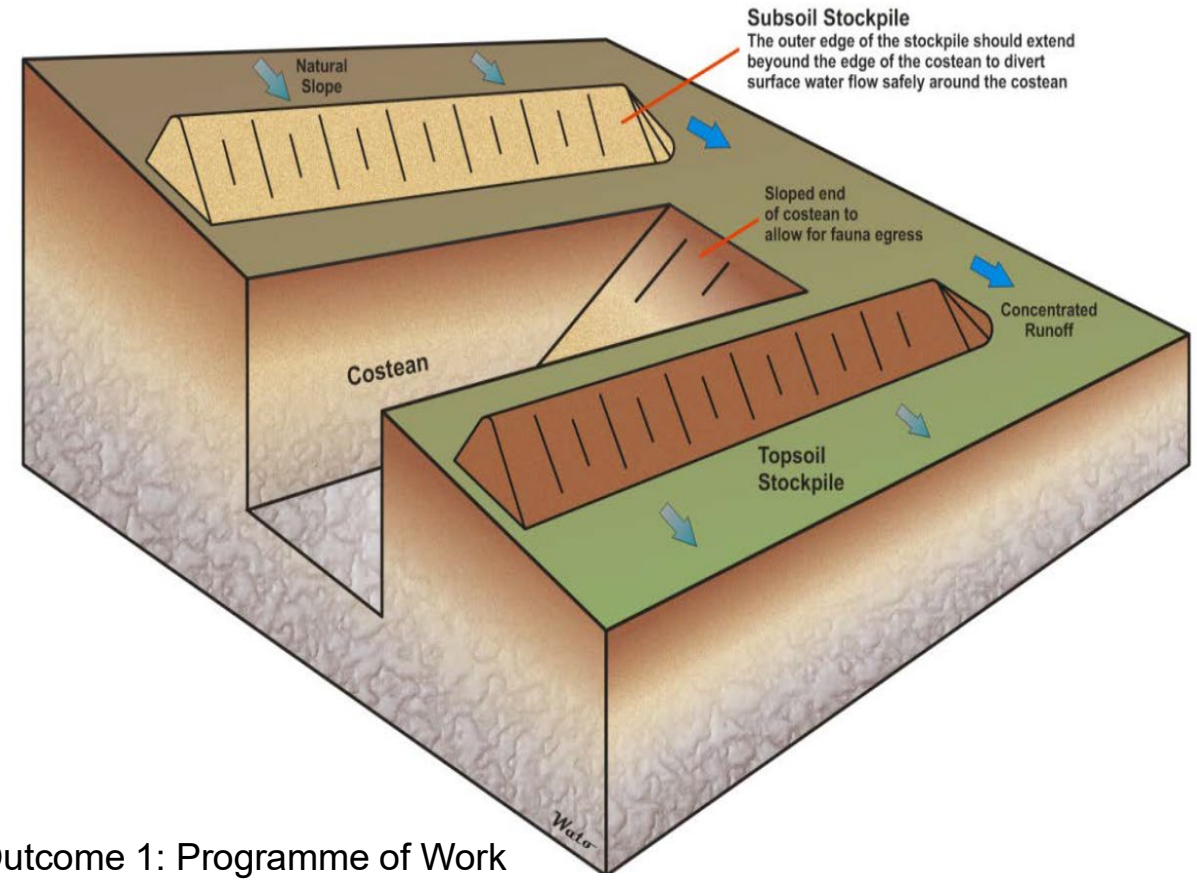
PoW - ENVIRONMENTAL INFORMATION REQUIRED

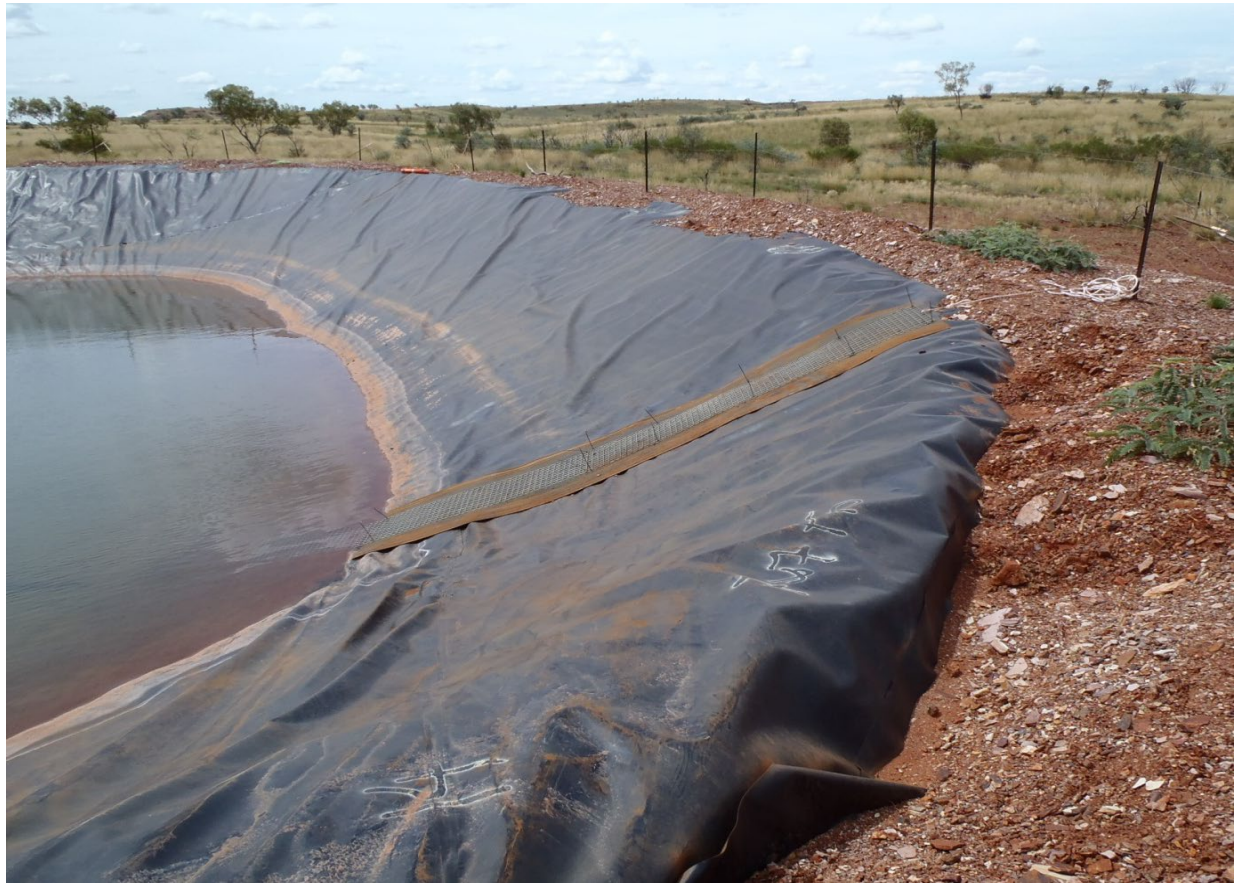
- Description of disturbance to the beds and/or banks of a watercourse
- Safety procedures for fibrous minerals, e.g. asbestos
- Radiation Management Plan — in the event that radioactive material is inadvertently found
- Consideration of *Rights in Water and Irrigation (RIWI) Act 1914*



MINIMISING DISTURBANCE - BEST PRACTICE

- Raised blade during clearing
- Use of existing tracks
- Excavations (sumps, costeans, etc.) appropriately ramped to allow fauna egress





MINIMISING DISTURBANCE - BEST PRACTICE

- Avoiding significant vegetation (large trees and dense patches of vegetation)
- Leaving stands of vegetation or corridors within areas of clearing
- Topsoil and vegetation stockpiled separately for use in rehabilitation
- Use of liners and drip trays under rigs to minimise risk of hydrocarbon spillage
- Appropriate storage of hydrocarbons (if being used on site).
- Use of sumps of appropriate size to contain all water and sediment encountered during drilling (sump to be located away from significant vegetation and watercourses)
- Use of machinery to minimise impacts (e.g. excavator instead of bulldozer, wheeled machinery instead of tracked, specialist drill rig etc.)
- Vehicle hygiene maintained to prevent the spread of plant pathogens (e.g. Phytophthora sp.) and/or invasive species where required.

MINIMISING DISTURBANCE - BEST PRACTICE

Disturbance	Rehabilitation	Yes	No	NA
		If 'No', please provide reasons in the Comments section		
☐ **Scraping, Detecting, Dry blowing**	• Windrows, stockpiles and dumps levelled off.	☐	☐	☐
☐ **Samples**	• Removed from surface of pad and buried. *Not required if material is non-hostile, similar colour to surrounds and not within DBCA Managed Land or a water reserve.*	☐	☐	☐
	• Sample bags/bag farm removed.	☐	☐	☐
☐ **Drill Holes**	• Plugged 400mm below ground level.	☐	☐	☐
	• Backfilled above plug and mounded.	☐	☐	☐
	• Drill spoil removed or scarified.	☐	☐	☐
☐ **Drill Pads**	• Topsoil and vegetation re-spread. *Unless blade clean-up.*	☐	☐	☐
	• Scarified if required.	☐	☐	☐
☐ **Alluvial Wet Plant**	• Infrastructure removed.	☐	☐	☐
	• Tailings rehabilitated.	☐	☐	☐
☐ **Costean, Trenches, Sumps, Test Pits**	• Backfilled and mounded.	☐	☐	☐
	• Topsoil/vegetation respread.	☐	☐	☐

Completing a checklist of these practices on the online application is required to make them legally binding

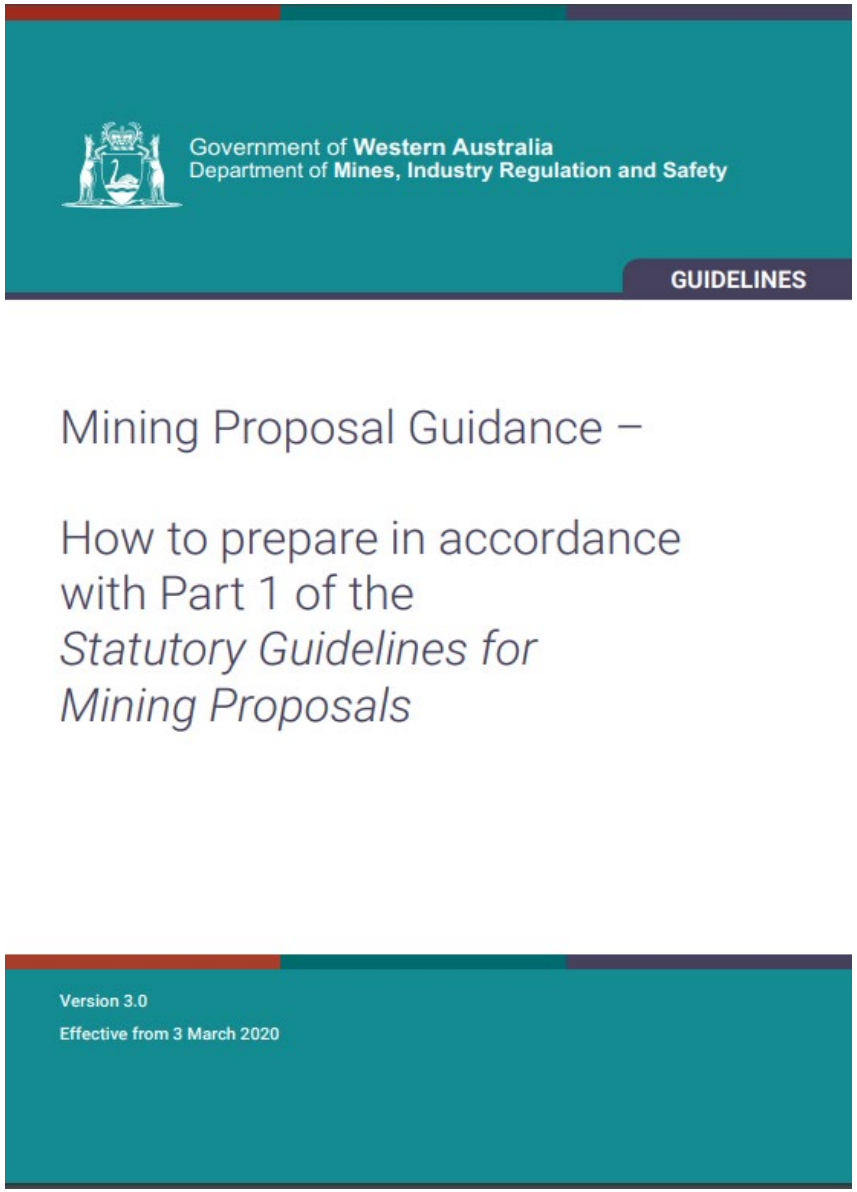
MINIMISING DISTURBANCE - BEST PRACTICE

☐ **Access Tracks, Gridlines**	• Access closed off. • Topsoil and vegetation re-spread. *Unless blade clean-up.* • Scarified if required.	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐
☐ **Campsite**	• Concrete pads removed or broken and buried. • Other infrastructure removed. • Topsoil and vegetation re-spread. • Scarified if required.	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
☐ **All Projects**	• Surface water drainage lines reinstated. • Erosion control implemented. • Survey pegs and marker tape removed. • Rubbish and temporary infrastructure removed. • Cut & fill pads/tracks re-profiled to original slope. • Pads revegetated with local provenance species. • Weeds/invasive species present? • Hydrocarbon spills/contaminated material removed and disposed of appropriately.	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Completing a checklist of these practices on the online application is required to make them legally binding

WHAT IS YOUR EXPERIENCE IN PoW APPLICATIONS?

MINING PROPOSALS



DMIRS' principal environmental regulatory objective:

Resource industry activities are designed, operated, closed, decommissioned and rehabilitated in an ecologically sustainable manner, consistent with agreed environmental outcomes and end land-uses without unacceptable liability to the State.

Mining Proposals should:

- Identify the potential risks that a mining operation could pose to the environment throughout the life of the mine
- Explain how the risks will be assessed and mitigated
- Declare appropriate site-specific environmental outcomes
- and the monitoring and reporting on the success of these outcomes.

MINING PROPOSAL CONTENTS

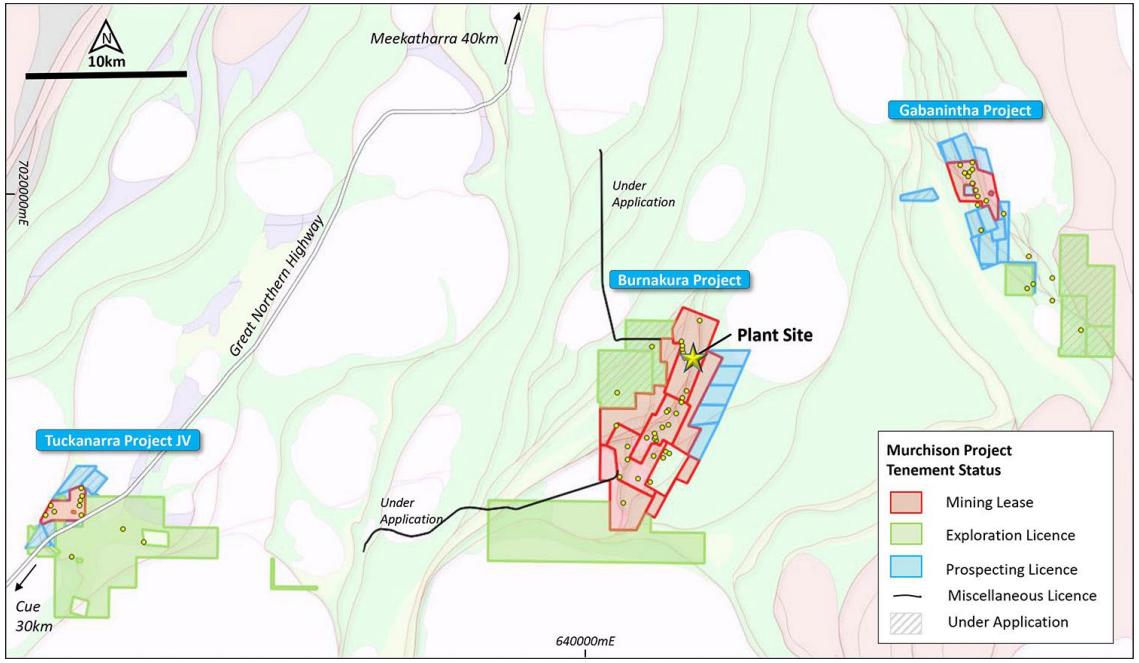
General official information

- Endorsed by a tenement holder(s) or a senior representative, authorised by the tenement holder(s), such as a Registered Manager or Company Director.

MINING PROPOSAL CONTENTS

Environmental Group Site

- Grouping of individual tenements that make up a particular operation for reporting on as a single entity
- It will have one Mining Proposal, one Mine Closure Plan and one Annual Environmental Report (AER).



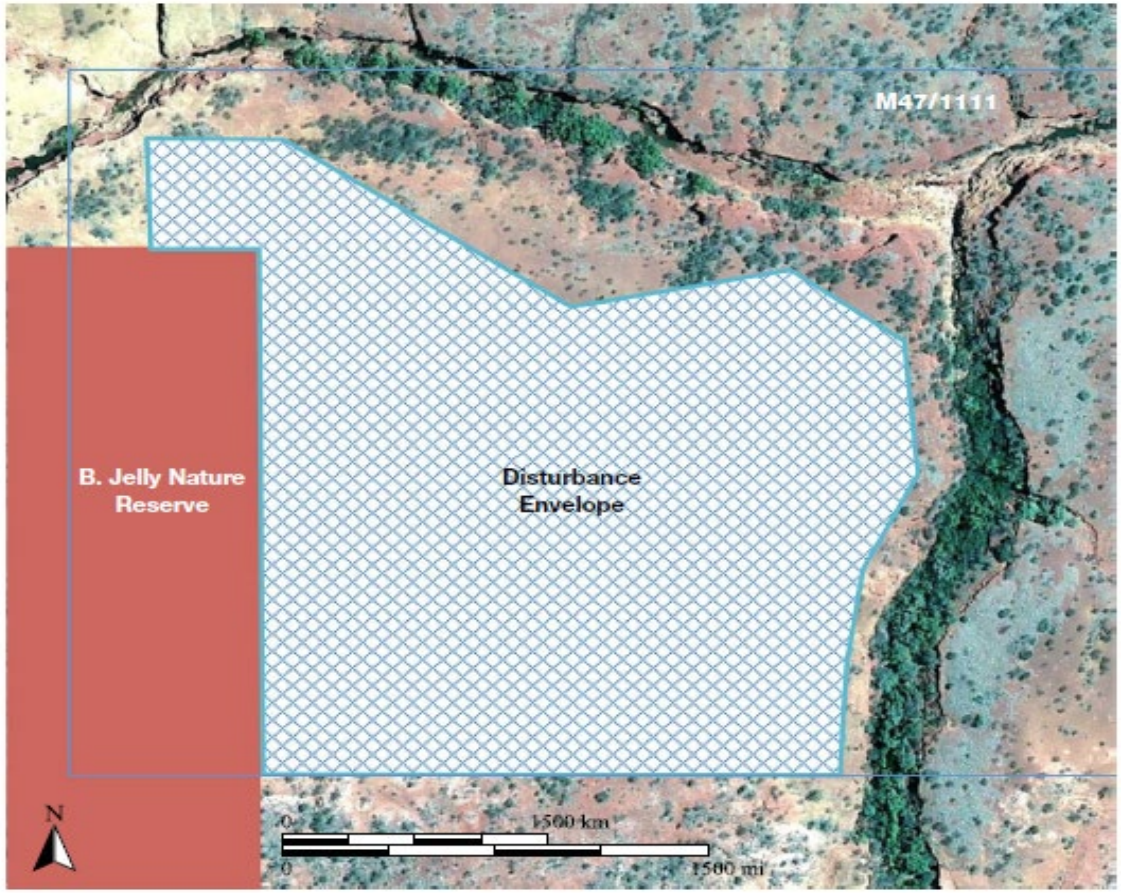
MINING PROPOSAL CONTENTS

Activity Details

- Accurately and concisely record the individual activities for which the proponent is seeking approval and the area within which the activities will occur.
- This includes any amendments to previously approved or new activities/areas proposed for the EGS.
- The scope and scale of the proposed activities form the basis of the approved activities of a Mining Proposal.

Activity Details - Disturbance envelope

A flexible approach can be used to broadly define the maximum area within which the activities will be located (a disturbance envelope).



Activity Details - Spatial Information

- A Mining Proposal must include digital spatial data for the activity envelope within which all activities will occur.

MINING PROPOSAL CONTENTS

Activity Details – Mine Activity Types

- A Mining Proposal must include digital spatial data for the activity envelope within which all activities will occur.
- See Table 2 Mining Proposal Guidelines

Activity Details – Site Plan

- To explain how the mine site will be laid out and function
- Provides additional context to the activity details and risk assessment.
- Multiple plans can be provided to show detail at a sufficient scale.

MINING PROPOSAL CONTENTS

Activity Details –Design details for significant engineered structures

- Proposed facilities with tailings storage facilities (TSFs) and significant geotechnical design, such as a heap leach facility, large evaporation pond/storage pond, significant surface water diversion structure or high waste dumps, the proposal must include detailed design reports.

MINING PROPOSAL CONTENTS

Legislative Framework

- List of all relevant environmental approvals and statutory requirements that will affect the environmental management of the mining project.
- As far as practicable, DMP will not duplicate assessment of any component of an activity that also requires approval from another regulatory agency
- It is recommended that the relevant legislation and approvals are placed in a table highlighting the environmental factor applicable to that particular piece of legislation.

MINING PROPOSAL CONTENTS

Legislative Framework

Relevant legislation	Environmental factor regulated/ affected	Relevant approval/requirement and status of relevant approval
Environmental Protection and Biodiversity Conservation Act 1999	Biodiversity: Impacts to Leipoa ocellata (Malleefowl) and Liopholis kintorei (Great Desert Skink).	Controlled action – listed threatened species. Under assessment.
Environmental Protection Act 1986 (Part IV)	Key environmental factors[3] regulated under Part IV: • Flora and vegetation • Terrestrial fauna • Terrestrial environmental quality • Inland waters	Ministerial approval issued under Part IV of the *Environmental Protection Act 1986*. Conditions set in Ministerial Statement.
Environmental Protection Act 1986 (Part V) Prescribed premises categories[4]: • (5) Processing or beneficiation of metallic or non-metallic ore • (6) Mine dewatering; • (12) Screening etc. of material • (31) Chemical Manufacturing • (44) Metals Smelting or Refining • (54) Sewage facility • (64) Class II or III putrescible landfill site • (84) Electric power generation	Water Resources (pollution) Landforms	Works approval and licence/ registration under Part V issued.
Rights in Water and Irrigation Act 1914	Water resources	5C licence to take 0.5ML/ year of groundwater within the Goldfields Groundwater Management Area 26D licence to construct 8 bores within the Goldfields Groundwater Management Area
Aboriginal Heritage Act 1972	Aboriginal heritage[5]	Section 18 Consent to certain uses issued.

Stakeholder Engagement

- The term stakeholders, includes both internal and external parties who are likely to affect, be affected by, or to have an interest in the proposed mining activities.
- Proponents must demonstrate that effective and appropriate engagement has been undertaken leading up to the submission of the Mining Proposal and that this will continue to be undertaken throughout the mine life.
- Stakeholders must be provided with sufficient information to make an informed assessment of the possible consequences of the activity on the function, interest or activities of the stakeholder and a reasonable period of time must be provided for the consultation process.

Baseline Environmental Data

As per the *Statutory Guidelines for Mining Proposals* the mining proposal must describe the existing environment in which the site is located, including any natural (biological/physical) values and sensitivities and heritage areas that may be affected by the activities. This section must include a description of the baseline data covering the below environmental aspects as well as analysis and interpretation of the baseline data.

This section must cover the following environmental aspects:

- climate;
- landscape;
- materials characterisation;
  - soils
  - geochemical and physical characteristics of subsurface materials and mining waste
- biodiversity;
- hydrology (including surface water and groundwater);
- heritage; and
- environmental threats.

Where environmental surveys or analysis has been undertaken, the findings must be summarised in the mining proposal and all relevant technical reports must be attached as appendices.

Environmental Risk Management

- A risk assessment consistent with the requirements of this section of the guidelines, including details of pre and post-treated risk
- A description of the risk assessment criteria used as part of the risk assessment (see example Appendix J)
- Detail and evaluation of the environmental risks including their sources, potential events, likelihood, consequence and risk analysis methods used to determine these levels
- A demonstration that the environmental impacts and risks are reduced to ‘As Low as Reasonably Practicable’ (ALARP) by applying environmental practices and technologies (treatments) best suited to the site characteristics, activity and location.

Environmental Outcomes and Reporting

Outline the site specific environmental outcomes relevant to the environmental factors that may be impacted by the proposed activity:

- Environmental performance criteria against each outcome to enable the outcomes to be measured, and to define limits for monitoring and environmental reporting.
- The outcomes, performance criteria and monitoring must be outlined in a table.
- It is the proponent's responsibility to monitor mine site performance against the performance criteria specified in the Mining Proposal. Any breach of a performance criterion, or an incident which has caused, or has the potential to cause significant environmental harm, must be reported to DMP in accordance with specified timeframes.

Environmental Outcomes and Reporting

Broad examples of environmental outcomes, performance criteria and monitoring

Environmental Factor	DMP Objective	Risk Pathways	Environmental Outcome	Performance Criteria[21]	Monitoring
Biodiversity/Flora/ Fauna/ Ecosystem	To maintain representation, diversity, viability and ecological function at the species, population and community level.	Clearing and loss of habitat, dewatering, invasive pest introduction, pit lakes.	No impact to vegetation beyond the mine disturbance boundary.	No clearing beyond mine disturbance boundary.	Quarterly survey of disturbance areas.
			Native fauna impacts minimised within mine disturbance boundary and avoided outside of mine disturbance boundary.	No death of native fauna of conservation significance through entrapment in mine facilities.	Daily TSF and evaporation pond checks. Daily checks of all open trenches.

MINING PROPOSAL CONTENTS

Environmental Management System

Proponents are required to have and maintain an EMS to ensure that environmental impacts are minimised. The EMS is a system of practices and procedures relating to:

- The identification and assessment of the risk of environmental harm occurring as a result of the carrying out of mining operations.
- The implementation of reasonably practicable measures to avoid or minimise the risk of such environmental harm occurring or reduce such environmental harm if it occurs.
- EMS to be maintained and implemented throughout the life of the project.
- A separate EMS is not required for each individual Environmental Group Site.
- If a certified ISO 14001 EMS is to be implemented, no further information is required in the EMS section of the Mining Proposal other than a commitment that this will be implemented.

GREENHOUSE GASES ARE NOT DISCUSSED IN GUIDELINES

- No specific reference to Greenhouse Gas emissions or energy use
- Mine Activity Type - onsite energy generation may be included in “Plant”
- No objective for air included
- Air quality listed within Environmental Threats and other factors (S.8.6)
- DMP expects the Mining Proposal to include baseline data for noise or air quality only in circumstances where these factors may impact on the other environmental factors listed in Table 1 (e.g. noise impacts on native fauna, dust impacts on native vegetation).

DISCUSSION: MINING PROPOSAL APPLICATIONS IN PRACTICE

How are applications handled in your company (re: environmental management)? How can it be done more efficiently and effectively?

Think
P.R.O.C.E.S.S

- Personnel — Who is involved?
- Resources — What factors are in place to accomplish task?
- Obstacles — Any barriers, blockers and problems (define)?
- Communication — Interpersonal, interdepartmental or regulatory information consistently shared to required parties?
- Efficiency — Is what is to be achieved in alignment with resources expended?
- Systemised — Is the process documented and standardised?
- Successful — Does it work? Why does(n't) it work? Improvements?

- Strategic POW lodgement
- Strategic Exploration Planning
- How do we mitigate issues identified?

DMIRS APPROVALS TIMEFRAMES

Stop the clock

DMIRS's approval performance measures exclude the time taken by processes outside DMIRS's control. When an application process is outside DMIRS's control (i.e. with the proponent or another agency), the time taken during this process is not included when calculating DMIRS's approval performance. In effect, the 'clock is stopped'. The clock is started again when DMIRS receives agency advice or information from the proponent. Stop the clock events and dates are recorded on DMIRS's online lodgement and approval tracking system.

Examples of external agency processes outside DMIRS's control include objections under the *Mining Act 1978* lodged in the Warden's Court and other State government assessment processes under the *Environmental Protection Act 1986* or the *Aboriginal Heritage Act 1972*.

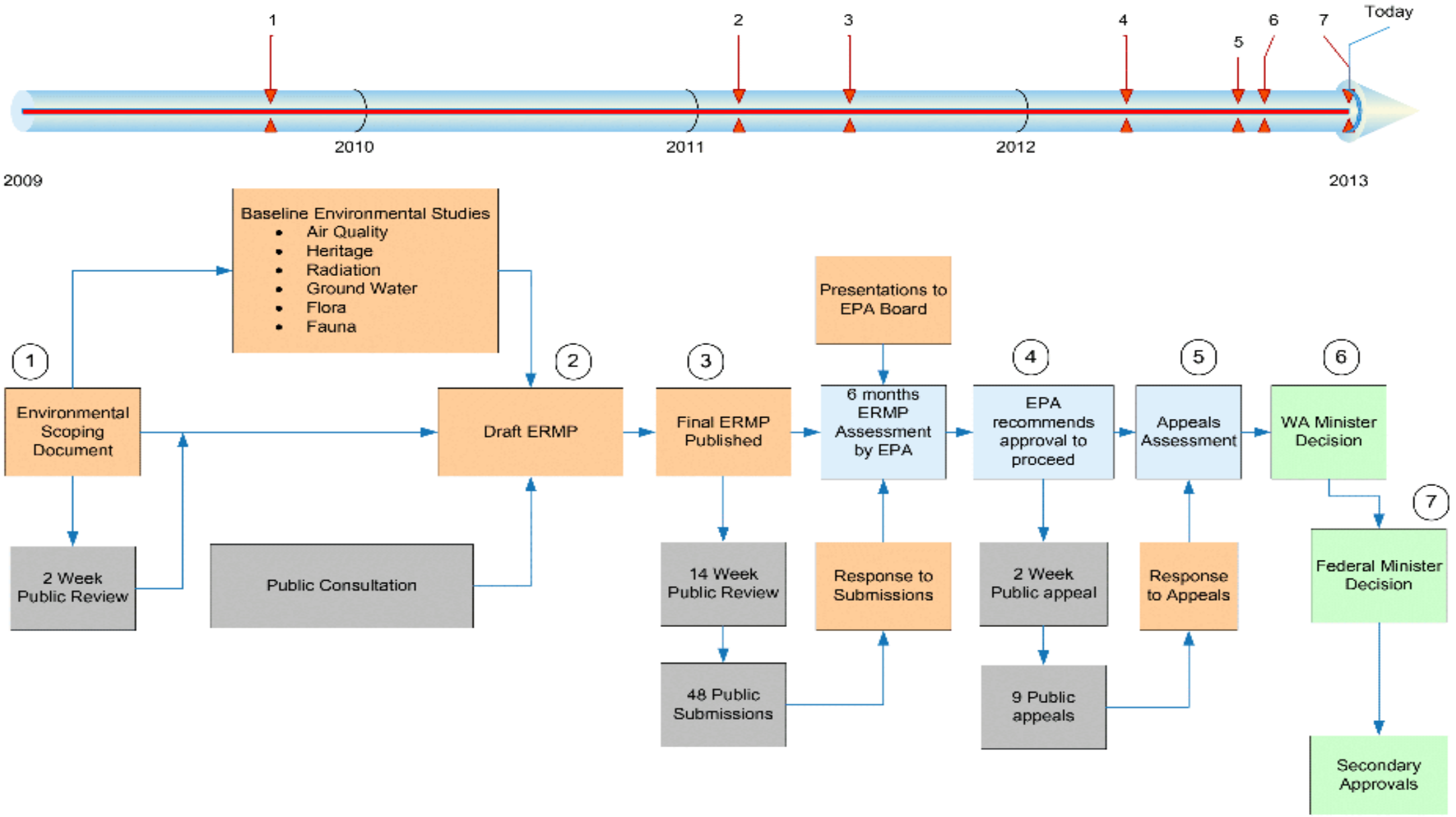
The clock is also stopped for the time taken by a proponent to provide additional information required to complete an application, or respond to a query to finalise an assessment process.

This "stop the clock" approach applies to assessment of other environmental approvals, including Programmes of Work and Mining Proposals, which both have a target assessment timeframe of 30 business days – 100 days is typical

DMIRS APPROVALS TIMEFRAMES

https://www.dmp.wa.gov.au/Documents/Investors/Approvals_Report_Q4_2021.pdf

DMIRS APPROVALS TIMEFRAMES



If you have to take just one thing away…

Contact DMIRS (and DWER) prior to application: They are there to facilitate (within the law), not to block and resist applications.

Early contact:

- *builds relationships*
- *clarifies requirements for applications*
- *saves time (and money) in the long run.*

SUMMARY

Discussed the various approvals required for mining in Western Australia. In particular…

- Programme of Work
- Mining Proposal:
    - Overview and structure
    - Mining Proposal requirements and guidelines

LandTrack Systems

Improved compliance performance, profit and productivity with our specialised training, tools and support

Mine Rehabilitation and Closure

Environmental Essentials WA

OUTCOMES

You will gain an understanding of the processes involved in mine rehabilitation and best practice closure planning. In particular…

- Successful rehabilitation criteria
- Mine Rehabilitation
- Mine Rehabilitation Fund (intent and issues)
- Annual Environmental Reporting
- Mine Closure Good Practice

DMIRS' ENVIRONMENTAL OBJECTIVE FOR REHAB & CLOSURE

Mining activities are rehabilitated and closed in a manner to make them physically safe to humans and animals, geo-technically stable, geo-chemically non-polluting/non-contaminating, and capable of sustaining an agreed post-mining land use, and without unacceptable liability to the State.

Definition

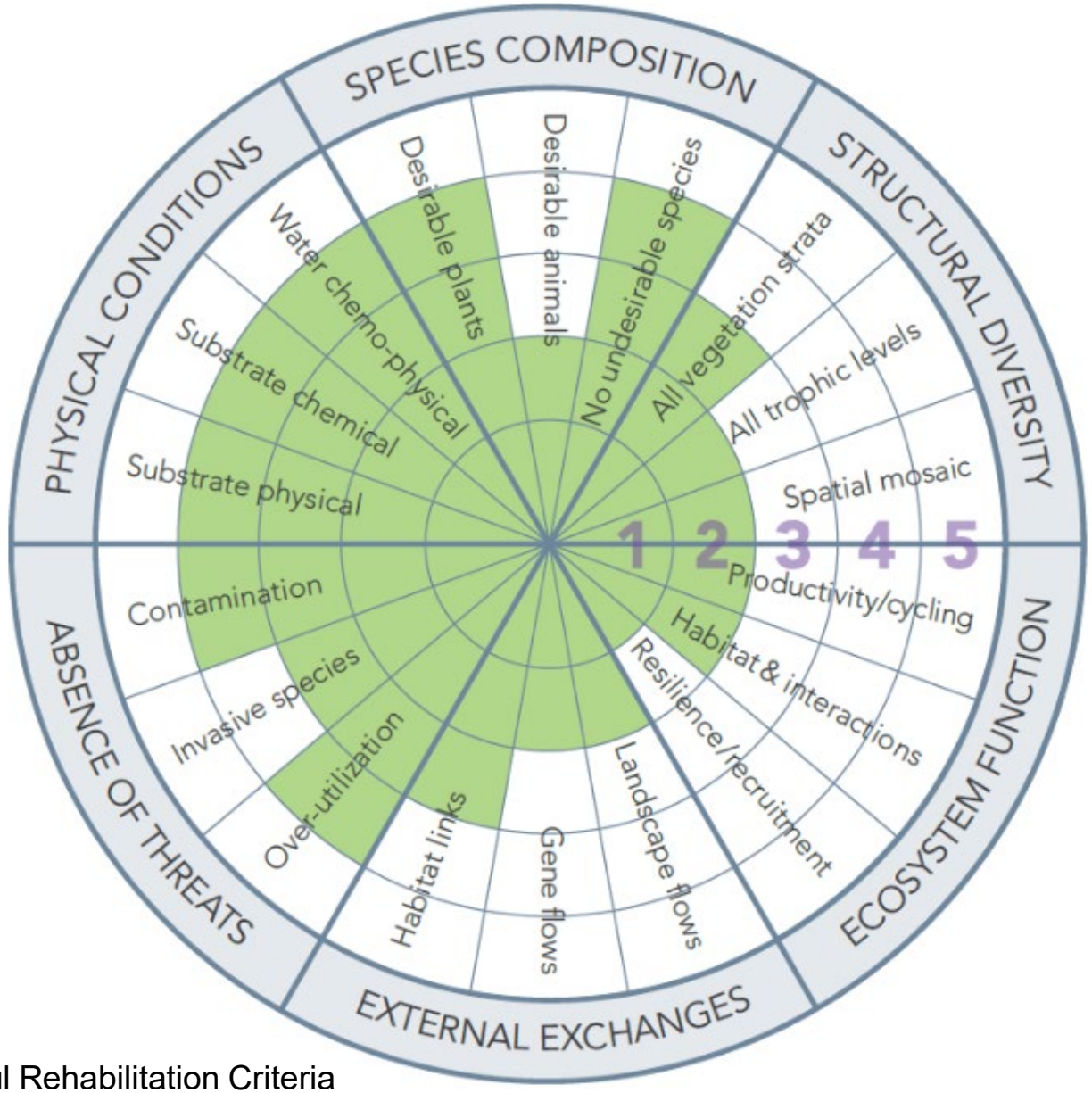
The Society for Ecological Restoration (SER) says that rehabilitation is:

'…the process of assisting the recovery of an ecosystem that has been damaged, degraded or destroyed.'

'…*creation of a self-supporting ecosystem that is resilient…*'

- Specific indicators are selected to help evaluate whether these targets, goals and objectives are being met as a result of the interventions.

REHABILITATION – RECOVERY WHEEL(SER,2004)



- Common indicators only
- Scoring based on informal or formal monitoring indicators for the project
- Indicators should be identified at the outset of the project to provide ecologically meaningful information attributes being evaluated.

Rehabilitation – Wolves in Yellowstone

Outcome 2: What successful rehabilitation might look like

The SER recommends the use of nine ecosystem attributes for measuring rehabilitation success:

1. Similar ecosystem diversity and community structure to those of reference sites
2. Presence of indigenous species
3. Presence of functional groups necessary for long-term stability
4. Capacity of the physical environment to sustain reproducing populations
5. Normal functioning
6. Integration within the landscape
7. The elimination of potential threats
8. Resilience to natural disturbances
9. Self-sustainability.

WHY IS REHABILITATION IMPORTANT?

DISCUSS…

- To deliver a sustainable outcome and meet success criteria
- Public perception: a key performance indicator against which the company's environmental performance is judged
- Poorly rehabilitated mines leave significant legacy problems and risks for all elements of society — governments, communities and companies.

Vale Limited Brazil Web Links

https://www.theguardian.com/world/video/2019/feb/01/terrifying-dam-collapsed-in-brazil-caught-on-camera-video

https://smallcaps.com.au/bhp-hit-billion-claim-vale-brazil-dam-collapse/

https://www.news.com.au/finance/economy/world-economy/eight-vale-staff-arrested-and-19-billion-wiped-from-share-price-after-brazil-dam-burst/news-story/d7aff11c195fb69da04400c9ef1ffecd

REHABILITATION - PROSPECTING AND EXPLORATION PHASE

- Prospecting and exploration activities approved under a Programme of Work (PoW) must be rehabilitated within six months of completion of ground disturbance or following an approved extension.
- Rehabilitation reports should be submitted to DMIRS and include both before and after photographs (including a significant landmark) with captions detailing location, date and a brief description of the content of the photograph.
- The Programme of Work Rehabilitation Report Template can be lodged in hardcopy over the counter at any DMIRS office, or submitted electronically via the DMIRS website.

PROGRESSIVE REHABILITATION

MINE CLOSURE & REHABILITATION

Mining provides the critical minerals and metals needed for society. However, mining activities can impact local environment and biodiversity when not properly managed.

The mines of today prepare for a rehabilitated landscape right from the beginning, in a process known as **Progressive Reclamation**.

WHAT IS PROGRESSIVE RECLAMATION?

Progressive reclamation, also known as **rehabilitation**, plans for post-closure activities during the entire mining process, from start to finish.

BEFORE MINING

INTEGRATED MINE PLANNING FOR CLOSURE AND RECLAMATION

The rehabilitation planning process starts before mining begins.

Detailed closure and reclamation plans are integrated into the permitting process for mine development.

DURING MINING

PLANNING FOR CLIMATE CHANGE IMPACTS AND LAND USE

An area of the mine can be reclaimed even as other parts of the mine are in operation.

Mitigating the impacts of land disturbance during operations are critical to returning the land to a viable state.

Climate change impacts (e.g., precipitation, erosion and chemical processes) should also be accounted for in this ongoing process to ensure successful closure and reclamation.

AFTER MINING

CLOSURE AND RECLAMATION

Once the mining process is complete, the land can be returned to a natural state and prepared for post closure reuse.

Evidence of the mining operation must be removed as much as possible.

Mine closure and rehabilitation activities need to take local environmental conditions into account.

Continuous monitoring throughout the whole life cycle of the mine.

Continuous engagement and dialogue with Indigenous peoples, communities, and regulators.

Continuous updates to ensure closure and reclamation plans complement any modifications to the mine during operation (including financial considerations).

ENVIRONMENTAL STUDIES
Data gathering, and establishing biodiversity baseline.

FINANCIAL OPTIONS
Secure funding for closure and reclamation activities.

MITIGATING IMPACTS
Ongoing minimizing, monitoring and assessment of waste materials where appropriate. E.g., soil removed during excavation can be saved for reclamation work.

WATER MANAGEMENT
Surface and mine waters are treated to ensure compliance, water recycle, watershed management.

CONTINUED RELATIONSHIP
Incorporate traditional knowledge into planning and work with Indigenous people and communities, including leveraging local employment to monitor and obtain field samples.

EVALUATING REHABILITATION
Compare water quality and end land use to baseline.

REUSING THE LAND
Mine sites can be repurposed for other uses, including for agriculture, solar panel farms, biofuel production, and even recreational and touristic use.

EXAMPLE: A SOLAR PANEL FARM

Mining operations can generate business opportunities for new industries in the region and create local benefits.

Reverting mines to a rehabilitated state will ensure that the landscape can support life for centuries to come.

Presented by: The Canadian Minerals and Metals Plan / Le Plan canadien pour les minéraux et les métaux
Funded by Natural Resources Canada / Financé par Ressources naturelles Canada
VISUAL CAPITALIST

MINING LEASE REHABILITATION

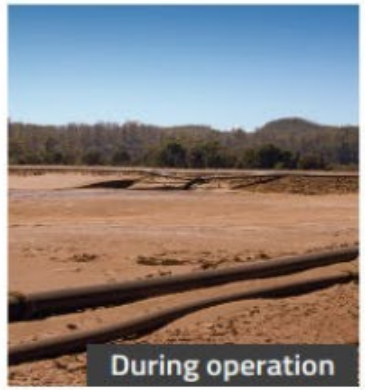
Poor rehabilitation performance of the industry to date:

- Complex design life and durability standards pertaining to mine waste landforms such as tailings storage facilities and waste rock dumps against which performance can be assessed
- Unique and diverse array of sites and material available for landform construction creates complex issues — no one size fits all scenarios
- A highly informed and sceptical public may no longer accept assurances that structures will be forever risk free

Industry and the regulator therefore must present realistic expectations, be clear about, and have *mechanisms* in place to manage possible residual risks.

Rehabilitation Examples

CROPPING Coal & Allied are rehabilitating land for crop production, producing a hybrid of wheat and rye. After three years of production, hay yields are now above the district average.

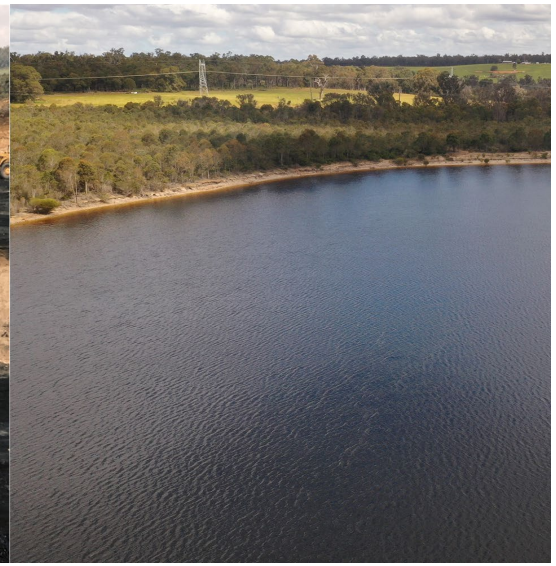


CONSERVATION Bluestone Mines and CSIRO have revealed a way to create a cap to exclude oxygen and neutralise water. Once implemented, water quality rapidly improved and environmental standards met.

GRAZING Glencore land is now used as a grazing pasture with cattle growing faster and averaging an extra 79 kgs over neighbouring pasture cattle. This returned a 25% price increase at the abattoir.

NATIVE RESTORATION Cristal Mining have re-stablished a semi-arid vegetation ecosystem with native flora species and native lizard and bird species now resettled in the area.

From Western Five to Lake Kepwari



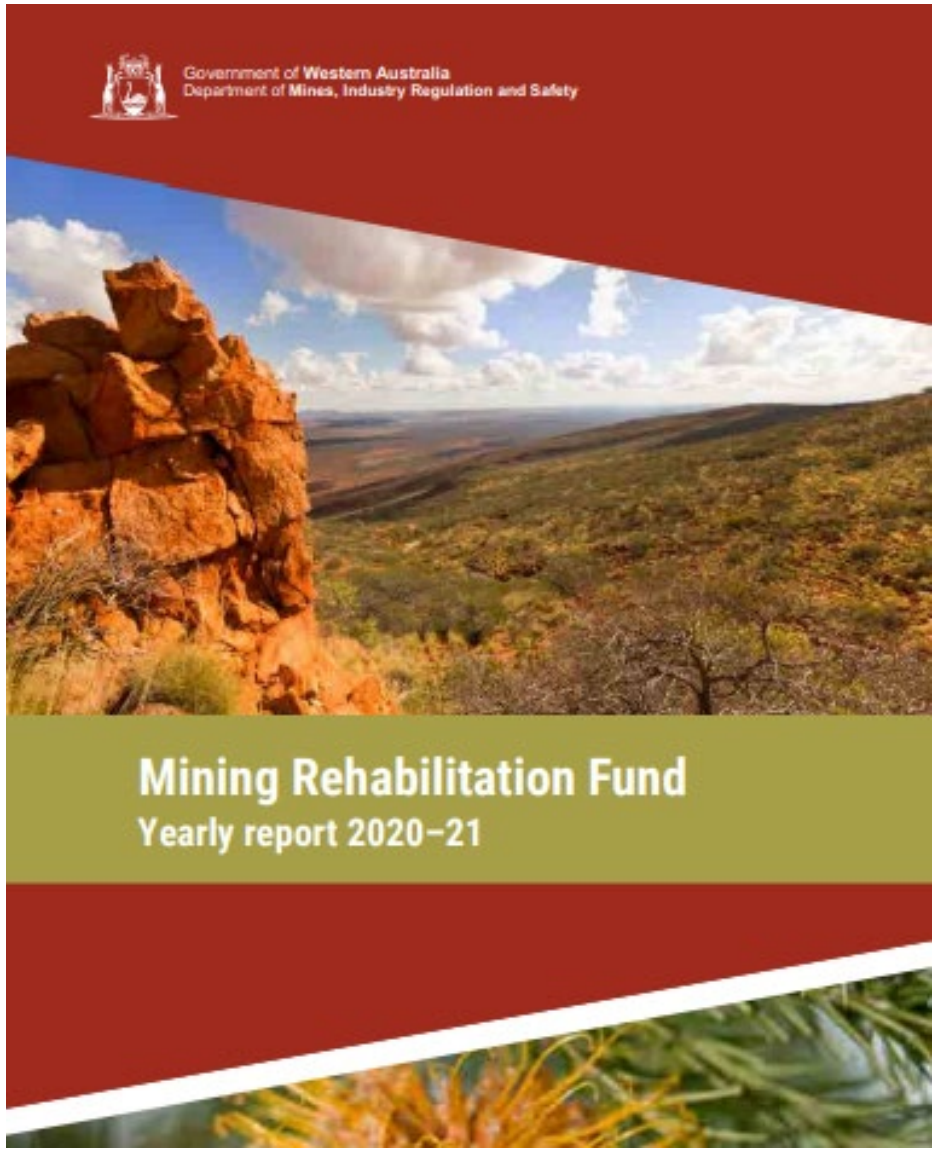
- Rare WA rehabilitation success story
- Best practice
- Mine closed in 1996
- Relinquished 220 hectares in total, 120 hectares of which is revegetated land around the lake
- Government has invested over $5 million
- https://resourc.ly/index.php/2020/12/09/world-class-wa-rehab-transforms-old-coal-mine-into-aquatic-playground/

MINE REHABILITATION FUND

- The MRF Act allows for monies owed for rehabilitation work on abandoned sites to be recovered through the Courts from those responsible.
- Fund created to enhance the State's capacity to manage and rehabilitate abandoned mines to lead to better environmental and community safety outcomes.
- Money in the fund is available to rehabilitate abandoned mines across the State in circumstances where the tenement holder/operator has failed to meet rehabilitation obligations and efforts to recover funds from the holder/operator have been unsuccessful.
- All tenement holders operating on Mining Act 1978 (Mining Act) tenure are required to report disturbance data and contribute annually to the fund.
- The Rehabilitation Liability Estimate (RLE) Calculator assists tenement holders to estimate their rehabilitation liability and the associated MRF levy under a variety of scenarios.

MRF estimate works out to approximately $30,000 per hectare of tenement activity

MINE REHABILITATION FUND



https://www.dmp.wa.gov.au/Documents/Environment/MRF_Yearly_Report-2020%e2%80%9321.pdf

COMMON ISSUES IN MRF REPORTING - Exploration and prospecting

- Each report must account for all of the work that you have done so far under the Programme of Work (PoW).
- If you have approval to do exploration or prospecting (meaning, a Programme of Work has been approved) but you haven't yet started work, you will still need to lodge an MRF report.
- Work that does not involve disturbing the ground (like detecting) does not count as an 'activity'.

Reporting Period

- Required to report any disturbance on the surface of the tenement, whether or not you have undertaken any activity during the current reporting period. This means that, if you have not done any work during this reporting period but have disturbed the land previously, you would normally report the same as you did in the previous period (except for exploration and prospective activity as mentioned previously).

Essentially – you report the footprint of the activity as it exists on the day that you assessed it.

COMMON ISSUES IN MRF REPORTING

‘Rehabilitation’ v ‘Land under Rehabilitation’

- A mining activity cannot be considered as ‘rehabilitated’ unless all of the closure obligations in the mining proposal have been met and signed off by an appropriate officer within the Environmental Compliance Branch.
- A mining activity cannot be considered as ‘land under rehabilitation’ until all required earthworks have been completed in accordance with closure obligations and you have commenced work toward revegetation and monitoring. If you provide an Annual Environmental Report to the department, this would be consistent with having completed Stage 1 (i.e. Stage 2 rehabilitation has commenced).

Common Issues in MRF Reporting

‘Historical’ or ‘Legacy’ mining activities or infrastructure

- When you purchase a tenement from another party, you effectively inherit all of their rights and obligations as if you, yourself, had held that tenement from the time it was granted.
- If a disturbance pre-dates the grant of the tenement (for example, old workings, roads or infrastructure), you would not normally need to include them in your report unless you have disturbed them or used them yourself.

- A condition requiring the submission of an AER is imposed on the tenement following the approval of a mining proposal
- Document the activities which have occurred over the reporting period specific to the tenement or group site
- Online AER submission currently requires all activity on mining tenure to be reported, including exploration
- This satisfies the reporting requirements under the PoW and a separate report is not required.

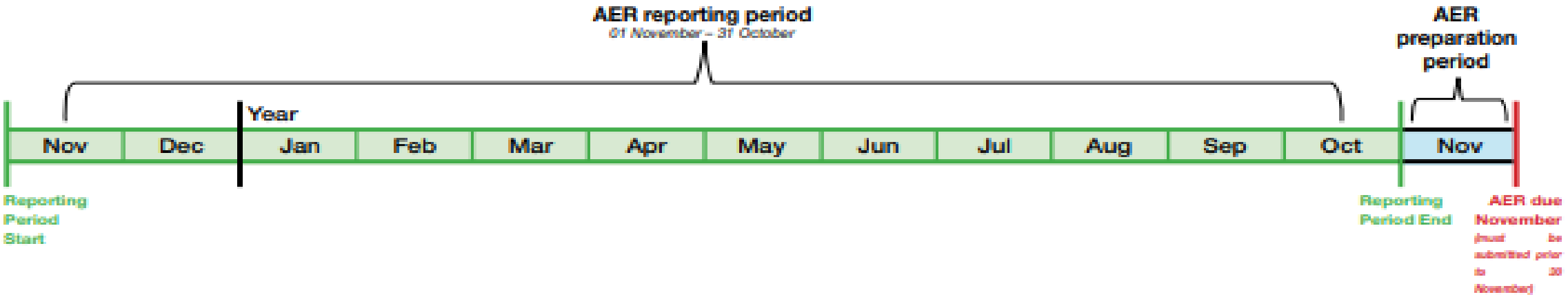


FIGURE 1: AER Reporting Period

Objectives

- To concisely document the major mining activities for the reporting year and proposed activities for the following year.
- To enable the Department to understand operator environmental management and rehabilitation activities for the reporting year and proposed activities and developments in the following year.
- To encourage operators to conduct an environmental analysis of the project.
- To assist operators in self regulation, i.e. to monitor and report on their own environmental compliance and performance.
- Encourage operators to be prepared for mine closure through reviewing the status of rehabilitation and mine closure planning on an annual basis.
- To provide basic information to the Department about the extent of mining operations in the State and the standard of environmental management and mine closure planning being achieved.

Report Content

- Report Details — name, site details, reporting period, contact person
- Review Tenements – will auto-populate based on tenement groupings
- Environmental Group Site — the individual tenements for the purposes of further distinguishing the operations which make up a particular Project. Includes: site summary, materials balance, closure plan, site plan, etc.
- Mining Activities — exploration activity, ore processed, waste moved, operational status
- Area of Activity — per tenement voids, dump, haul road workshop etc., survey method e.g. GPS
- Compliance — compliance with env. approvals, document env. Incidents
- Rehabilitation and Closure Planning
- Future work — description of the mining activities, env. management and rehabilitation proposed for the following year

The 4 Tenets of Mine Closure

- Safety
- Stability
- Non-polluting
- Sustainability

Mine Closure – Status in WA

Mine Closure in Western Australia

- 2015 MCP Guidelines released
- Size of MCP documents have increased
- Greater number of MCPs submitted since the requirement for MCPs in Mining Proposals
- Many consultants have emerged providing support to industry
- Mines are not actually closed:
  - Care and Maintenance
  - Close-up shop or abandon the site (Ellendale)
  - Sell to another company who may or may not understand the risk.

Mine Closure – Status in WA

Status of Mine Closure in Western Australia

- Mine footprints growing
- Stakeholder knowledge and expectations increasing
- Minimal investment in closure related R&D
- The real cost to close not fully understood
- Closure planning governance developing
- Divestment of liability at closure still happening
- Benchmarking required to improve understanding.

Mine Closure – Conceptual to Detailed

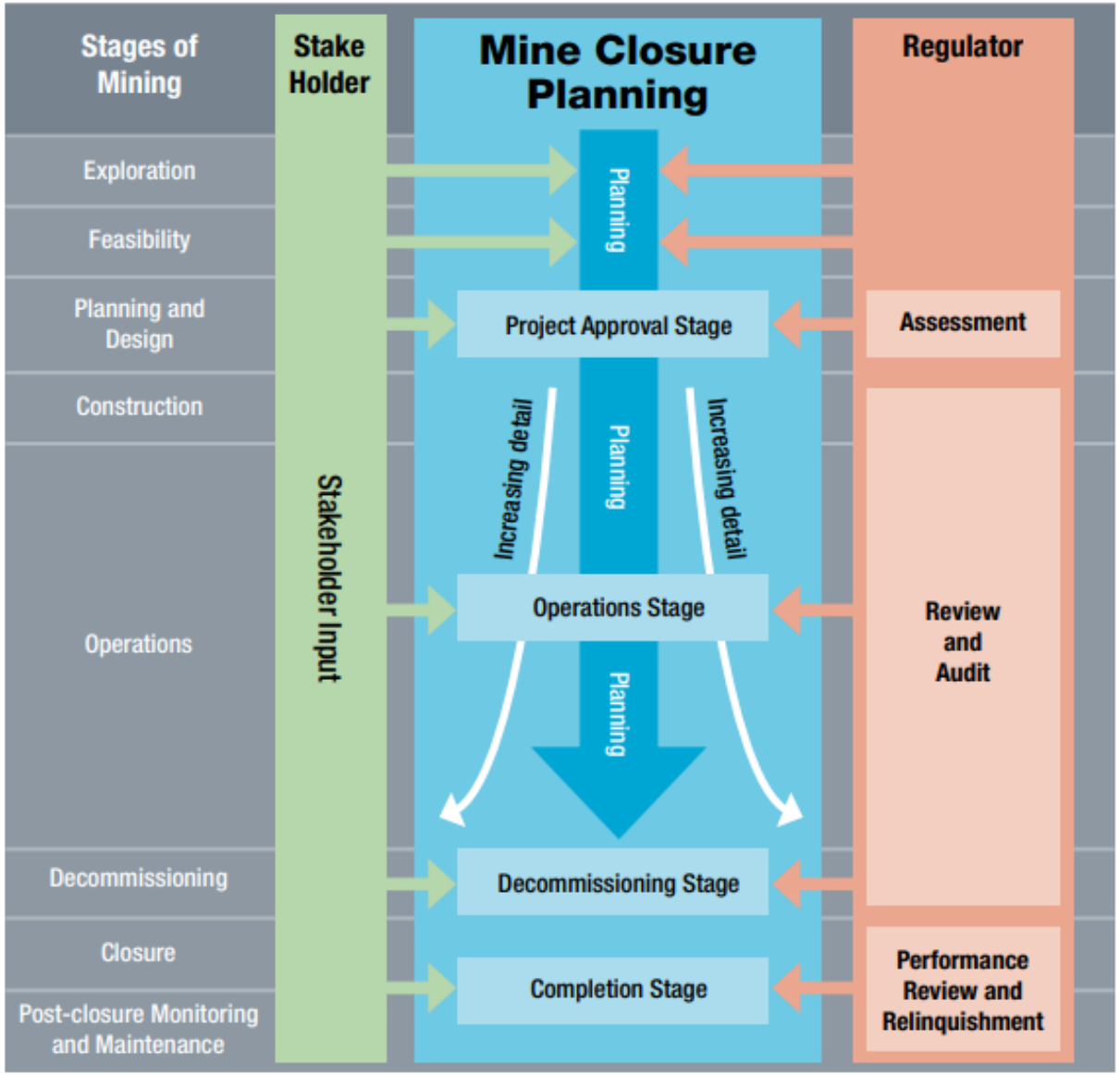
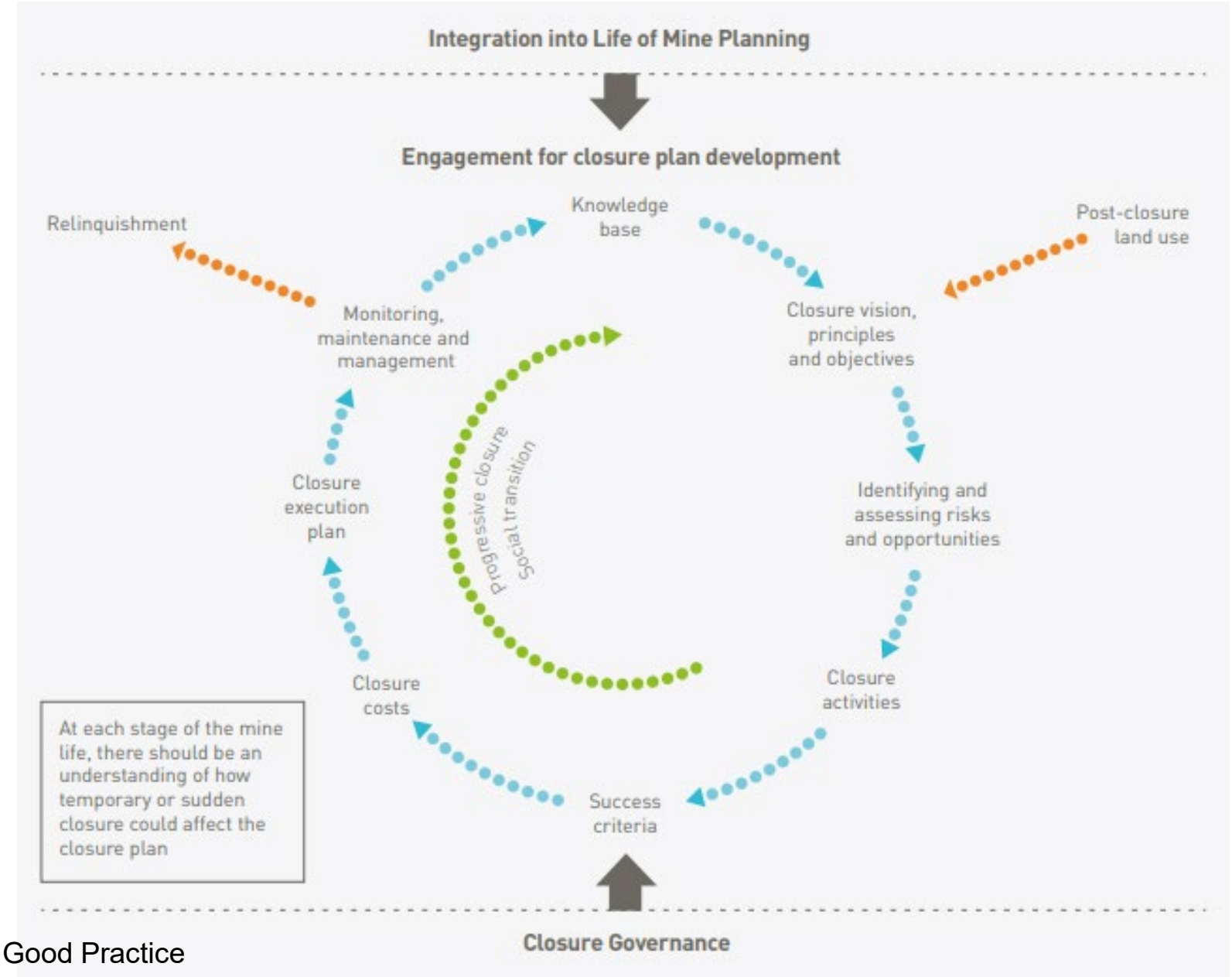


Figure 2 Integrating stages of mining and mine closure planning (adapted from DITR 2006, ICMM 2008)

Mine Closure Plan Contents

- The 2010 amendments to the Mining Act require a Mine Closure Plan to be submitted to DMP for assessment and approval as part of Mining Proposal applications.
- DMP's Draft Guidelines for Preparing Mine Closure Plans 2019, available on the DMP website:
  - Project Summary
  - Closure obligations and commitments
  - Stakeholder engagement
  - Baseline closure data and analysis
  - Closure risk assessment
  - Post mining land use and closure objectives
  - Closure outcomes; closure criteria and closure performance indicators
  - Closure Implementation
  - Closure Monitoring and Maintenance
  - Financial Provisioning for Closure
  - Management of Information and Data

ICMM - Integrated Mine Closure



ICMM - Integrated Mine Closure

INTEGRATED MINE CLOSURE

ICMM International Council on Mining & Metals | MINING WITH PRINCIPLES

Integrated closure is a dynamic process that considers environmental, social and economic aspects at an early stage of mine development and is fully incorporated into mine planning.
Planning for closure is an iterative process with the plan being updated throughout the Life of Asset (LoA). Closure planning is cyclic as information is updated from different sources, such as ongoing stakeholder engagement, studies undertaken to address knowledge gaps or learnings gained through progressive closure.
This image provides some of the key elements of mine closure planning and implementation and a pathway through them, although the steps through the planning cycle will not necessarily be sequential. In practice, there are many feedback loops that interconnect each element – hence the need for an iterative process.

Local Communities
Ongoing community and stakeholder engagement throughout closure plan development and implementation

Knowledge Base
Ongoing collection of background data to inform all aspects of closureplanning and execution.

Closure vision, principles, objectives
Identification of frameworks and outcomes of site-specific closure activities.

Identifying risks & opportunities
Management of tasks and accountabilities required to prevent and mitigate risks and maximise benefits.

Designing closure activities
Planning for the physical works needed to achieve closure objectives.

Closure costs
Estimation of costs for the design and implementation of mine closure activities.

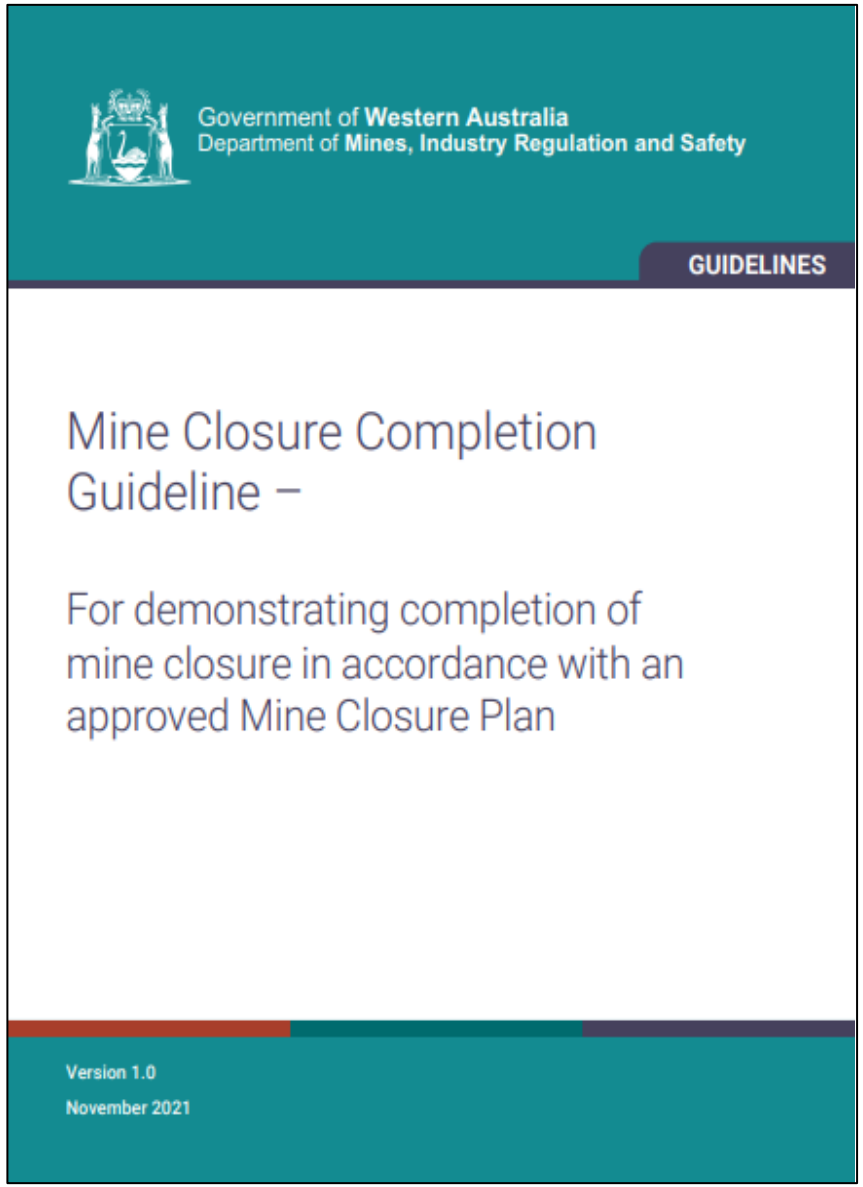
Agree success criteria
Specifications, measurements or requirements that show the success of closure activities against closure objectives.

Implement closure execution plan
Identification of the actions and resources needed to support planning and implementation of closure.

Monitoring & management
Demonstrating success of agreed closure criteria through inspection, documentation and evaluation.

Relinquishment
Return of ownership to the corresponding jurisdiction following completion of closure activities.

Mine Closure Completion Guidelines



- First released by DMIRS February 2020
- Updated November 2021
- Provides guidance on demonstrating completion of the agreed closure obligations and environmental conditions as outlined in their Mine Closure Plan

https://www.dmp.wa.gov.au/Documents/Environment/REC-EC-237D.pdf

DMIRS' ENVIRONMENTAL OBJECTIVE

Mining activities are rehabilitated and closed in a manner to make them physically safe to humans and animals, geo-technically stable, geo-chemically non-polluting/non-contaminating, and capable of sustaining an agreed post-mining land use, and without unacceptable liability to the State.

Good practice example: https://www.yancoal.com.au/page/en/sustainability/

OUTCOMES

You will now have an understanding of the processes involved in mine rehabilitation and best practice closure planning. In particular…

- Successful Rehabilitation Criteria
- Mine Rehabilitation
- Mine Rehabilitation Fund (intent and issues)
- Annual Environmental Reporting
- Mine Closure Good Practice

LandTrack Systems

Improved compliance performance, profit and productivity with our specialised training, tools and support

Pollution Prevention

Environmental Essentials WA

OUTCOMES

You will gain a general overview of pollution, their impacts and how they can be controlled and managed. In particular:

- What is Pollution?
- What is Pollution Prevention?
- Types, sources, control and mitigation of:
  - Air Pollution
  - Water Pollution
  - Noise Pollution
  - Light Pollution
- What is waste?
- Understand why waste should be managed.

RELEVANCE TO WA INDUSTRIES

- *Environmental Protection Regulations 1987*
- *Environmental Protection (Unauthorised Discharges) Regulations 2004*
- Includes discharges to: Soil, surface water, groundwater, air, stormwater drains, vessels or receptacles which are connected to the environment, any other place that has direct connectivity to the environment (for example road surfaces, forecourts, carparks or hardstands).
- Materials burning (causing visible smoke)

ENVIRONMENTAL PROTECTION REGULATIONS 1987

- *Clean Air (Determination of Air Impurities in Gases Discharged to the Atmosphere) Regulations 1983*
- *Environmental Protection (Abattoirs) Regulations 2001*
- *Environmental Protection (Abrasive Blasting) Regulations 1998*
- *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*
- *Environmental Protection (Concrete Batching and Cement Product Manufacturing) Regulations 1998*
- *Environmental Protection (Controlled Waste) Regulations 2004*
- *Environmental Protection (Domestic Solid Fuel Burning Appliances and Firewood Supply) Regulations 1998*
- *Environmental Protection (Fibre Reinforced Plastics) Regulations 1998*
- *Environmental Protection Goldfields Residential Areas Sulfur Dioxide Policy and Regulations 2003*
- *Environmental Protection (Kwinana) (Atmospheric Wastes) Regulations 1992*
- *Environmental Protection (Metal Coating) Regulations 2001*
- *Environmental Protection (NEPM-NPI) Regulations 1998*
- *Environmental Protection (Noise) Regulations 1997*
- *Environmental Protection (Packaged Fertiliser) Regulations 2010*
- *Environmental Protection (Petrol) Regulations 1999*
- *Environmental Protection (Recovery of Vapours from the Transfer of Organic Liquids) Regulations 1995*
- *Environmental Protection (Rural Landfill) Regulations 2002*
- *Environmental Protection (Unauthorised Discharges) Regulations 2004*
- *Noise Abatement (Noise Labelling of Equipment) Regulations (No. 2) 1985*

WHAT IS POLLUTION?

- The introduction of contaminants into the natural environment that cause adverse change.
- Direct or indirect alteration of the environment
- Can take the form of chemical substances, or energy, such as noise, heat, light or electromagnetic radiation.
- The components of pollution, can be either foreign substances/energies or naturally occurring contaminants
- Can be point source (from a single source) or non-point source pollution (multiple sources).

POLLUTION PREVENTION

- Practice that reduces, eliminates, or prevents pollution at its source - "source reduction"
- Not the same as recycling, treatment and disposal

AIR POLLUTION

Chemical additions to the atmosphere by natural events or human activities in high enough concentrations to be harmful

Two categories

- Primary Air Pollutant
  - Harmful substance that is emitted directly into the atmosphere
- Secondary Air Pollutant
  - Harmful substance formed in the atmosphere when a primary air pollutant reacts with substances normally found in the atmosphere or with other air pollutants

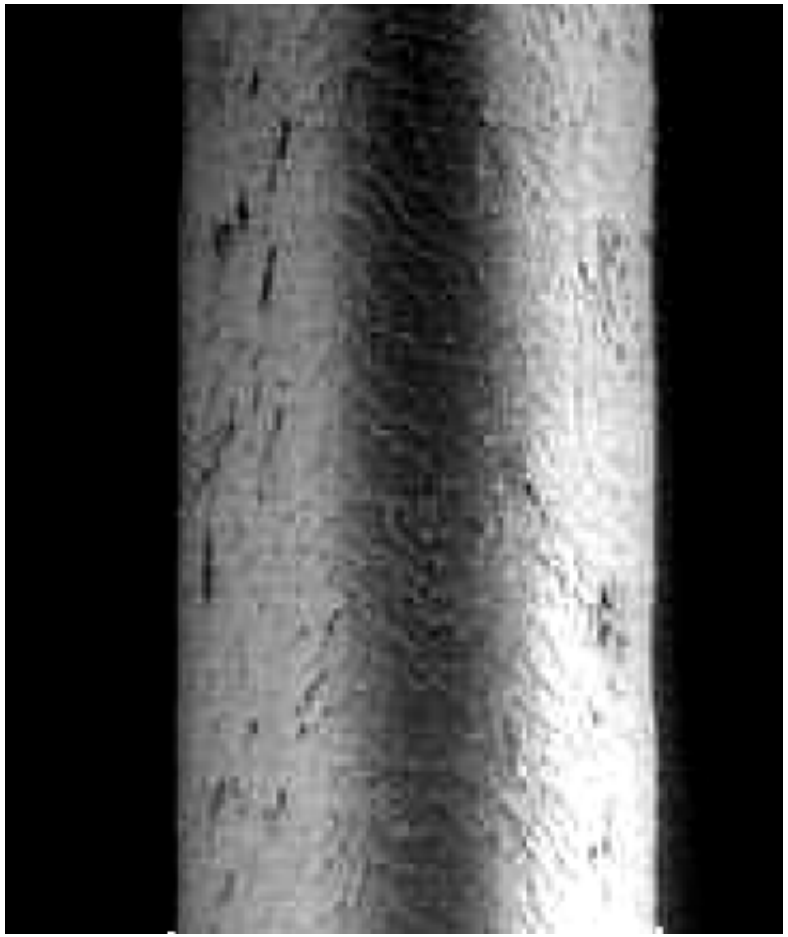
CHARACTERISTICS OF MAIN AIR POLLUTANTS

Pollutant	Composition	Primary or Secondary	Characteristics
Particulate matter			
Dust	Variable	Primary	Solid particles
Lead	Pb	Primary	Solid particles
Sulfuric acid	H_2SO_4	Secondary	Liquid droplets
Nitrogen oxides			
Nitrogen dioxide	NO_2	Primary	Reddish-brown gas
Sulfur oxides			
Sulfur dioxide	SO_2	Primary	Colorless gas with strong odor
Carbon oxides			
Carbon monoxide	CO	Primary	Colorless, odorless gas
Carbon dioxide*	CO_2	Primary	Colorless, odorless gas
Hydrocarbons			
Methane	CH_4	Primary	Colorless, odorless gas
Benzene	C_6H_6	Primary	Liquid with sweet smell
Ozone	O_3	Secondary	Pale blue gas with acrid odor
Air toxics			
Chlorine	Cl_2	Primary	Yellow-green gas

Some standards

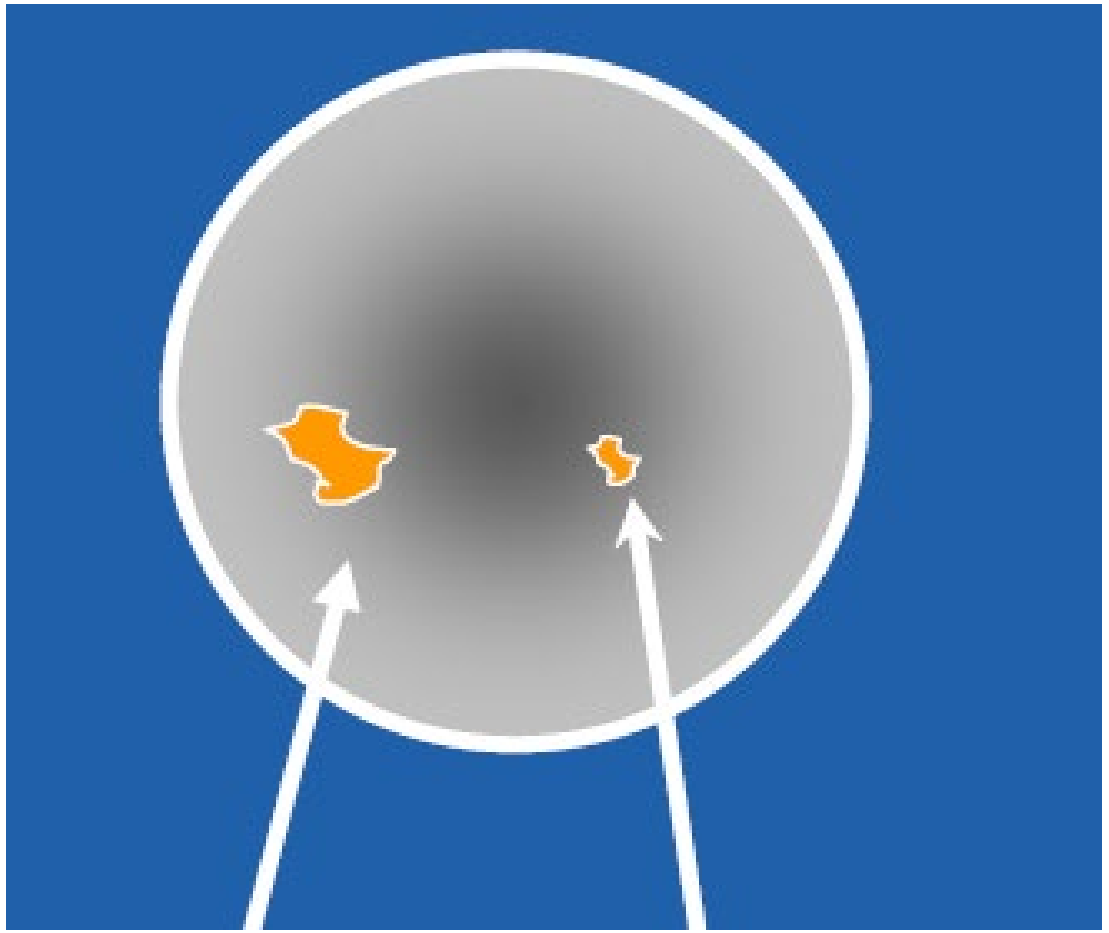
Pollutant	Averaging period	maximum concentration standard	Exceedance
Carbon monoxide	8 hours	9.0 ppm	None allowed
Nitrogen dioxide	1 hour 1 year	0.08 ppm 0.015 ppm	None allowed
Photochemical Oxidants (ozone)	8 hours	0.065 ppm	exceptional events
Sulphur dioxide	1 hour 1 year	0.10 ppm 0.02 ppm	None allowed
Lead	1 year	0.50 μg m^{-3}	None allowed
Particles as PM_{10}	1 day 1 year	50 μg m^{-3} 25 μg m^{-3}	exceptional events
Particles as $PM_{2.5}$	1 day 1 year	25 μg m^{-3} 8 μg m^{-3}	exceptional events

Particulate Matter



Human hair

(70 µm diameter)



PM 10

(10 µm)

PM 2.5

(2,5 µm)

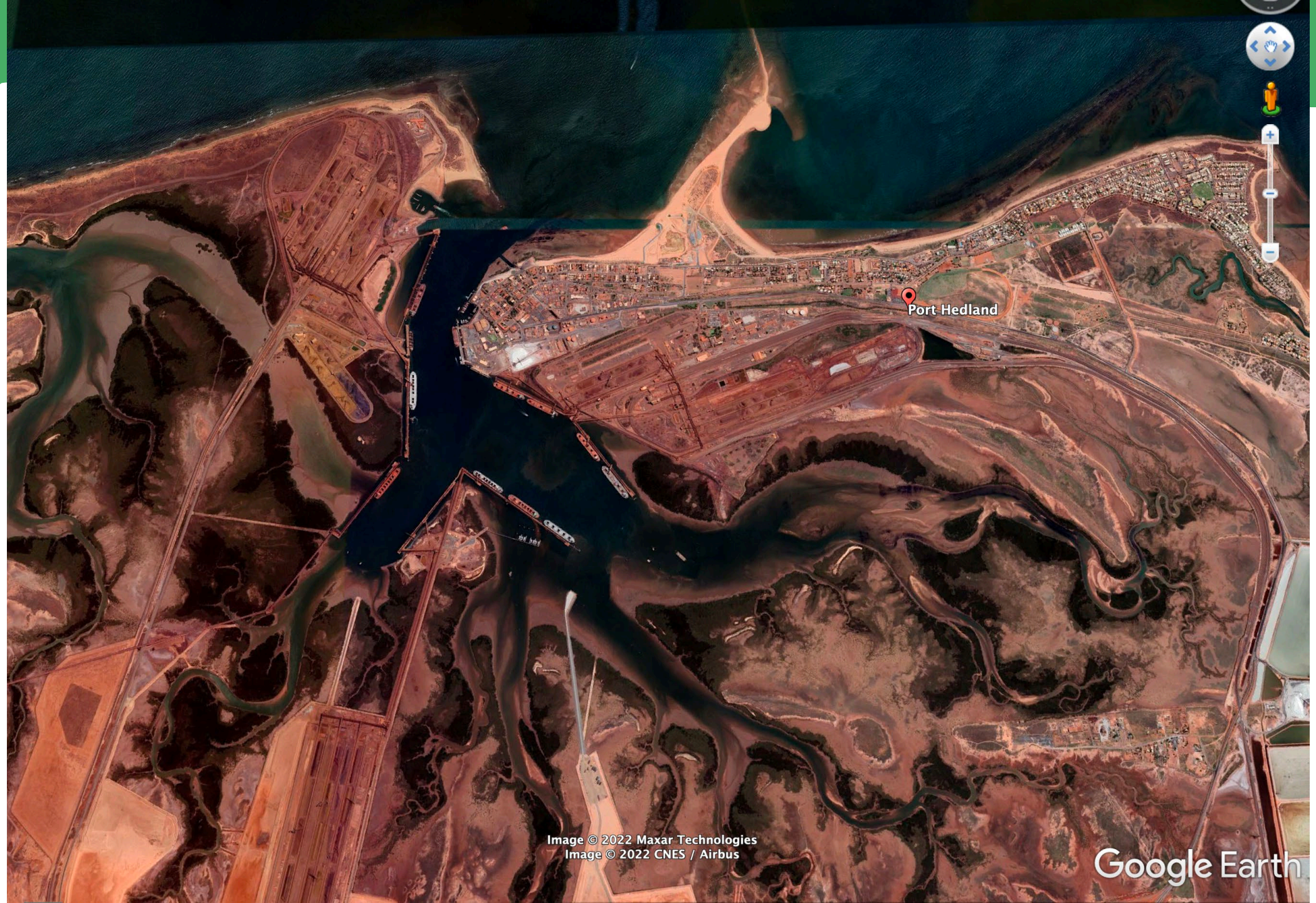
SOURCES AND EFFECTS OF AIR POLLUTION

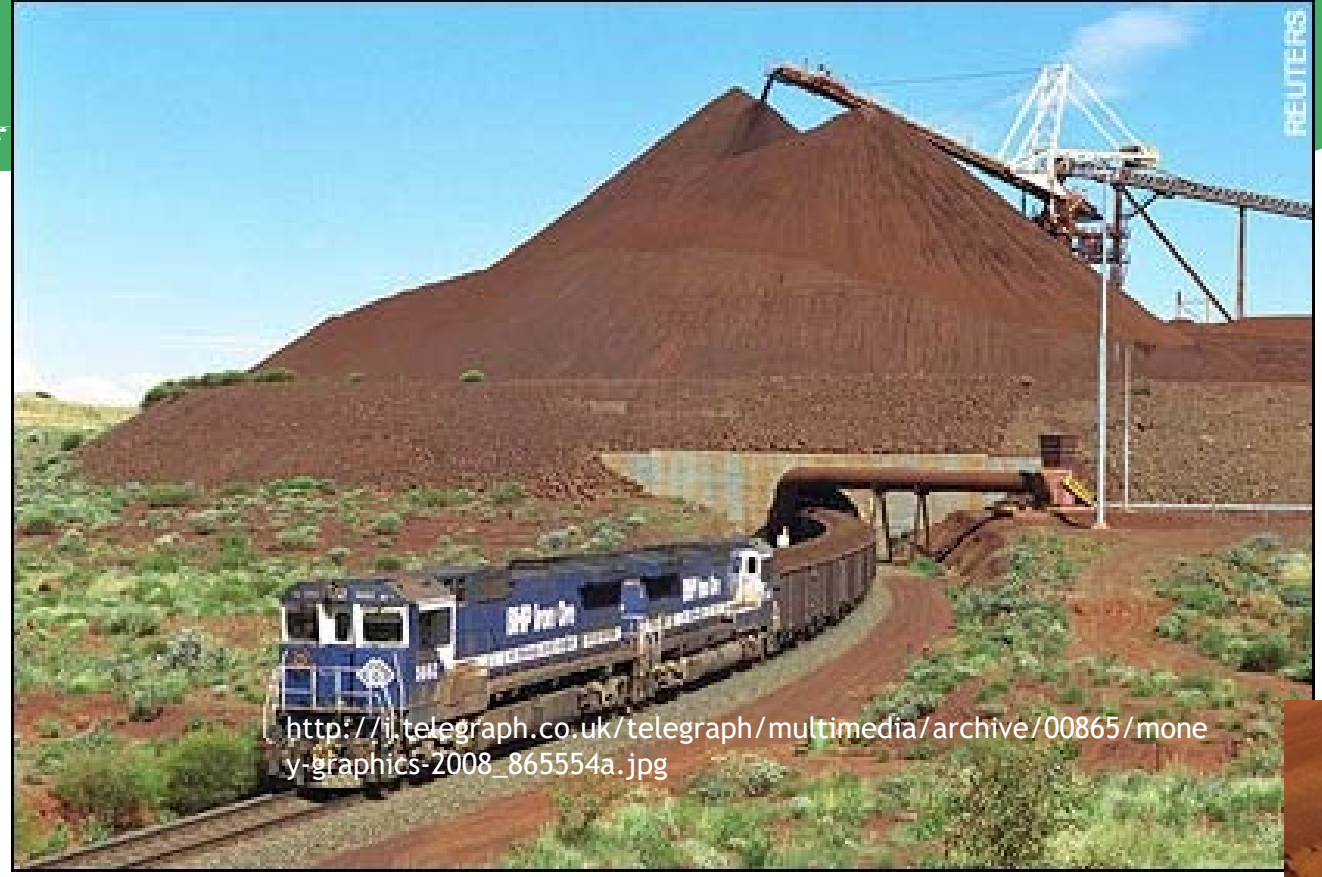
Pollutant	Source	Effects
Particulate	Industries, electric power plants, motor vehicles, construction, agriculture	Aggravates respiratory illnesses; long-term exposure may cause increased incidence of chronic conditions such as bronchitis; linked to heart disease; suppresses immune system; some particles, such as heavy metals and organic chemicals, may cause cancer or other tissue damage
Nitrogen oxides	Motor vehicles, industries, heavily fertilized farmland	Irritate respiratory tract; aggravate respiratory conditions such as asthma and chronic bronchitis
Sulfur oxides	Electric power plants and other industries	Irritate respiratory tract; same effects as particulates
Carbon monoxide	Motor vehicles, industries, fireplaces	Reduces blood's ability to transport oxygen; headache and fatigue at lower levels; mental impairment or death at high levels
Ozone	Formed in atmosphere (secondary air pollutant)	Irritates eyes; irritates respiratory tract; produces chest discomfort; aggravates respiratory conditions such as asthma and chronic bronchitis

- CO_2 and hydrocarbons contribute to climate change

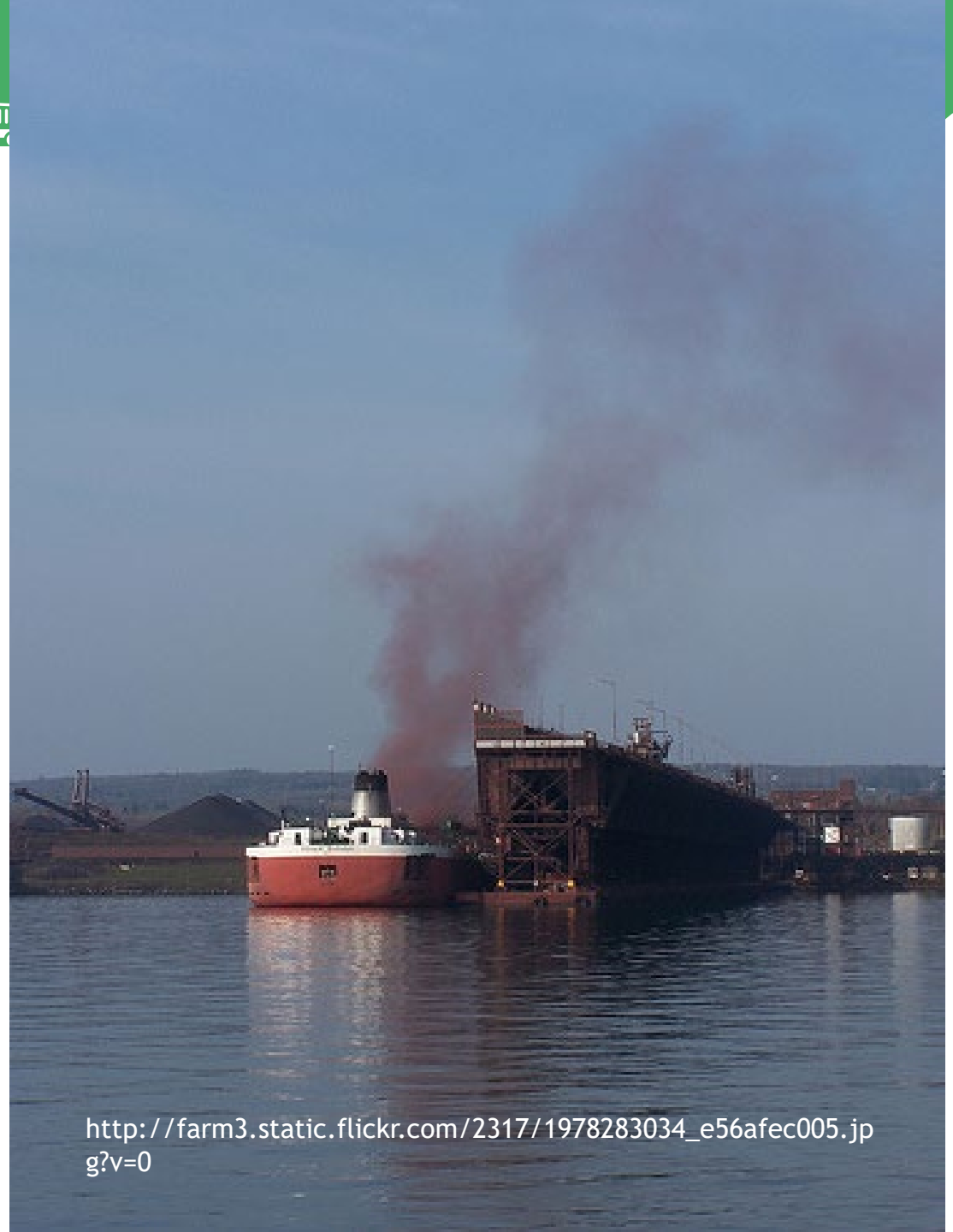
Port Hedland and dust

- Sources
  - Natural – dust storms
  - Iron ore handling


Port Hedland
Image © 2022 Maxar Technologies
Image © 2022 CNES / Airbus
Google Earth



http://i.telegraph.co.uk/telegraph/multimedia/archive/00865/money-graphics-2008_865554a.jpg



http://farm3.static.flickr.com/2317/1978283034_e56afec005.jpg?v=0

Dust

- Particulates
- Size is an issue
- Concentration of particulates
- PM_{10} and more recently $PM_{2.5}$
  - Particulate matter (PM)
  - Size – e.g. 10 micrometers or less in diameter

Health impacts

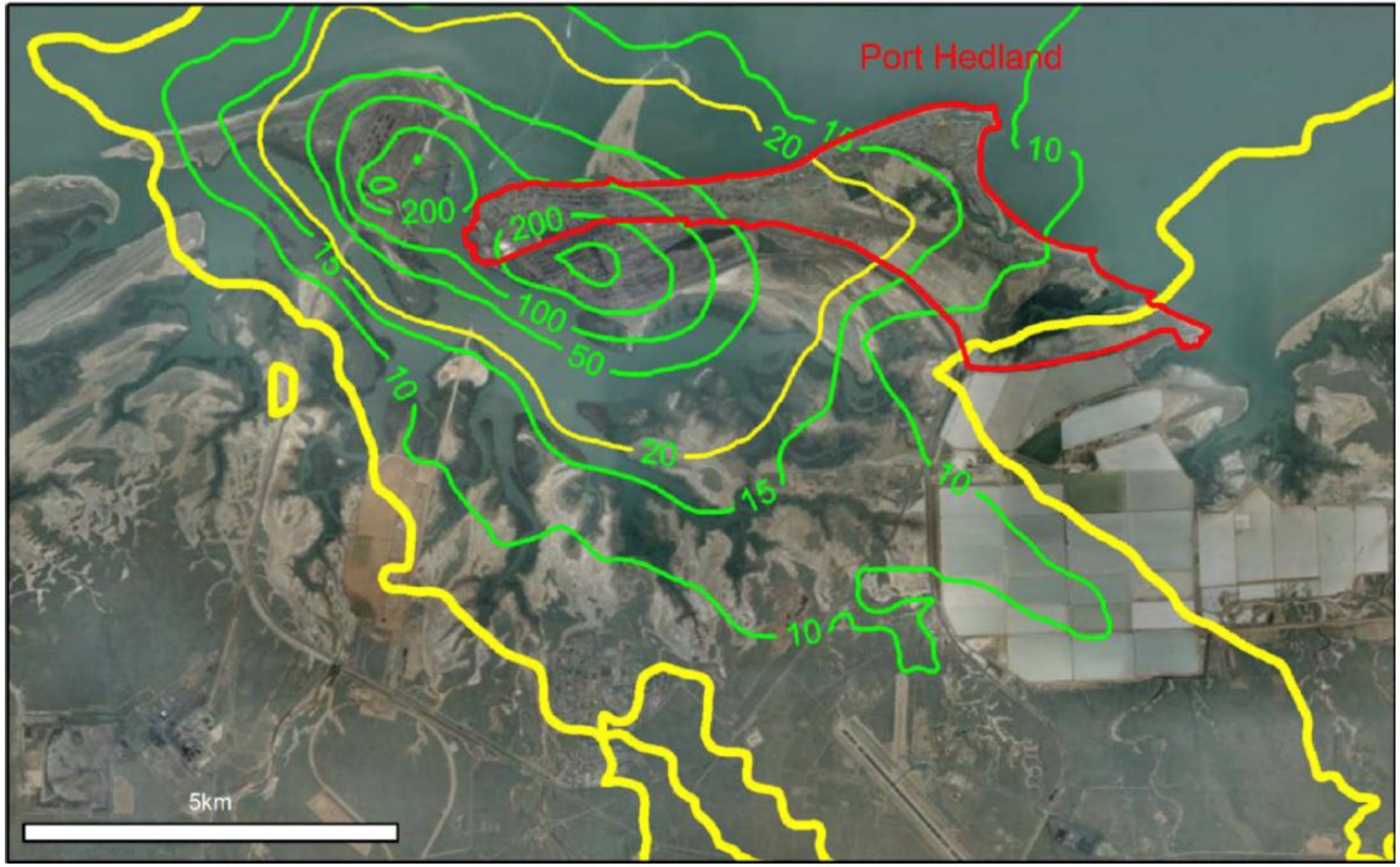
- Toxic effects by absorption into the blood (e.g. lead, cadmium, zinc)
- Allergic or hypersensitivity effects (e.g. some woods, flour grains, chemicals)
- Bacterial and fungal infections (from live organisms)
- Fibrosis and cancer (e.g. asbestos, quartz)
- Irritation of mucous membranes (e.g. acid and alkalis)
- Increased respiratory symptoms, aggravation of asthma and premature death.
- Sensitive groups - elderly and children.

Dust criteria

Table 1: Air NEPM Particle Standards and Goals

Pollutant	Averaging period	Standard (Maximum concentration)	Goal (Maximum allowable exceedences)
Particles (as PM_{10})	1 day	50 µg/m^3	5 days a year
Particles (as $PM_{2.5}$)	1 day	25 µg/m^3	Goal is to gather sufficien data nationally to facilitate review of the Advisory Reporting Standards
	1 year	8 µg/m^3	

Figure 1: Current Number of Exceedences of 50µg/m3




Port Hedland

The ‘values’

- Protecting human health,
- Port the main employer in the Town,
- Export income and Royalties,
- Financial contribution to Town.

Options

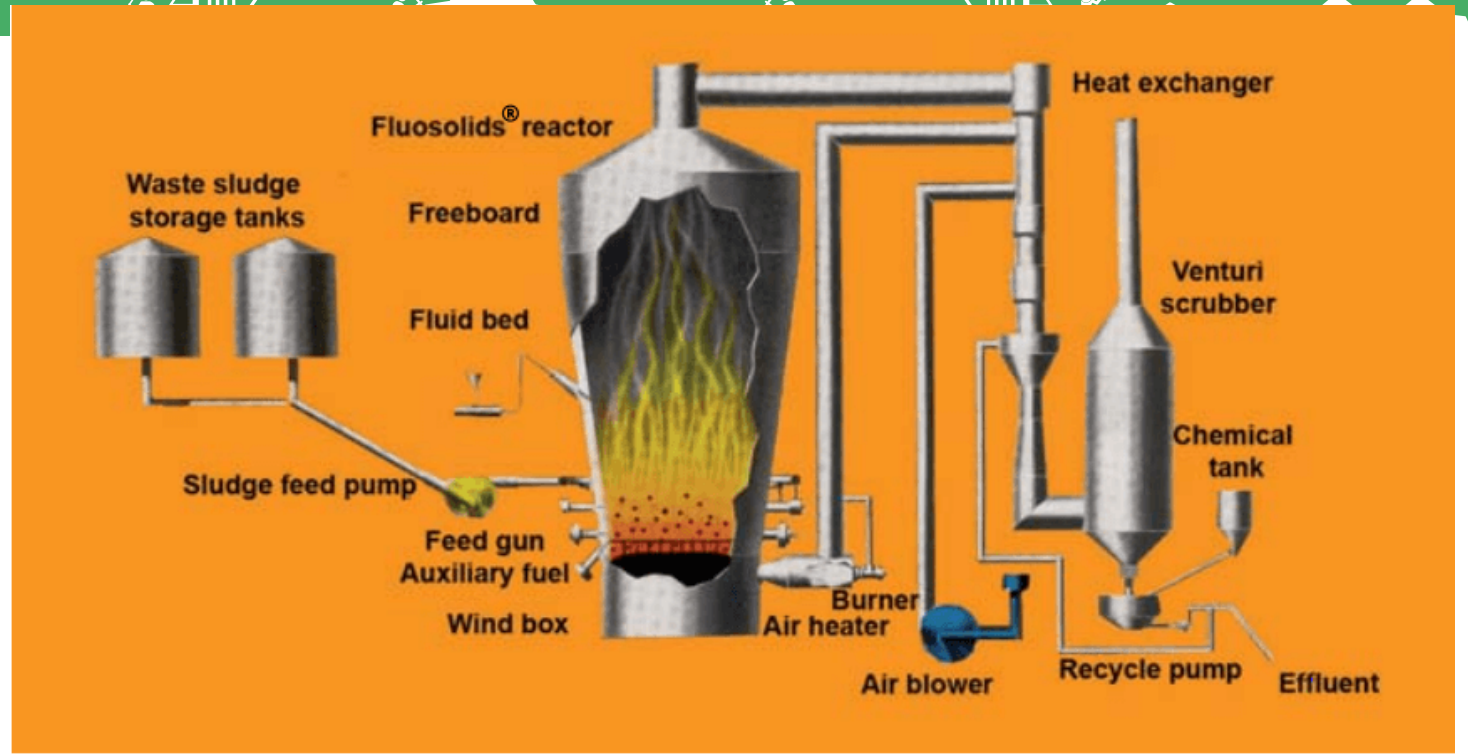
- Accept poor air quality
- Better regulation of the port operators
- Move the Port
- Move the affected people


Port Hedland

Air quality and Kalgoorlie

33% Sulphur

https://www.911metallurgist.com/blog/wp-content/uploads/2016/02/orpiment.png



Combustion system

Kalgoorlie Gold roasting and SO_2

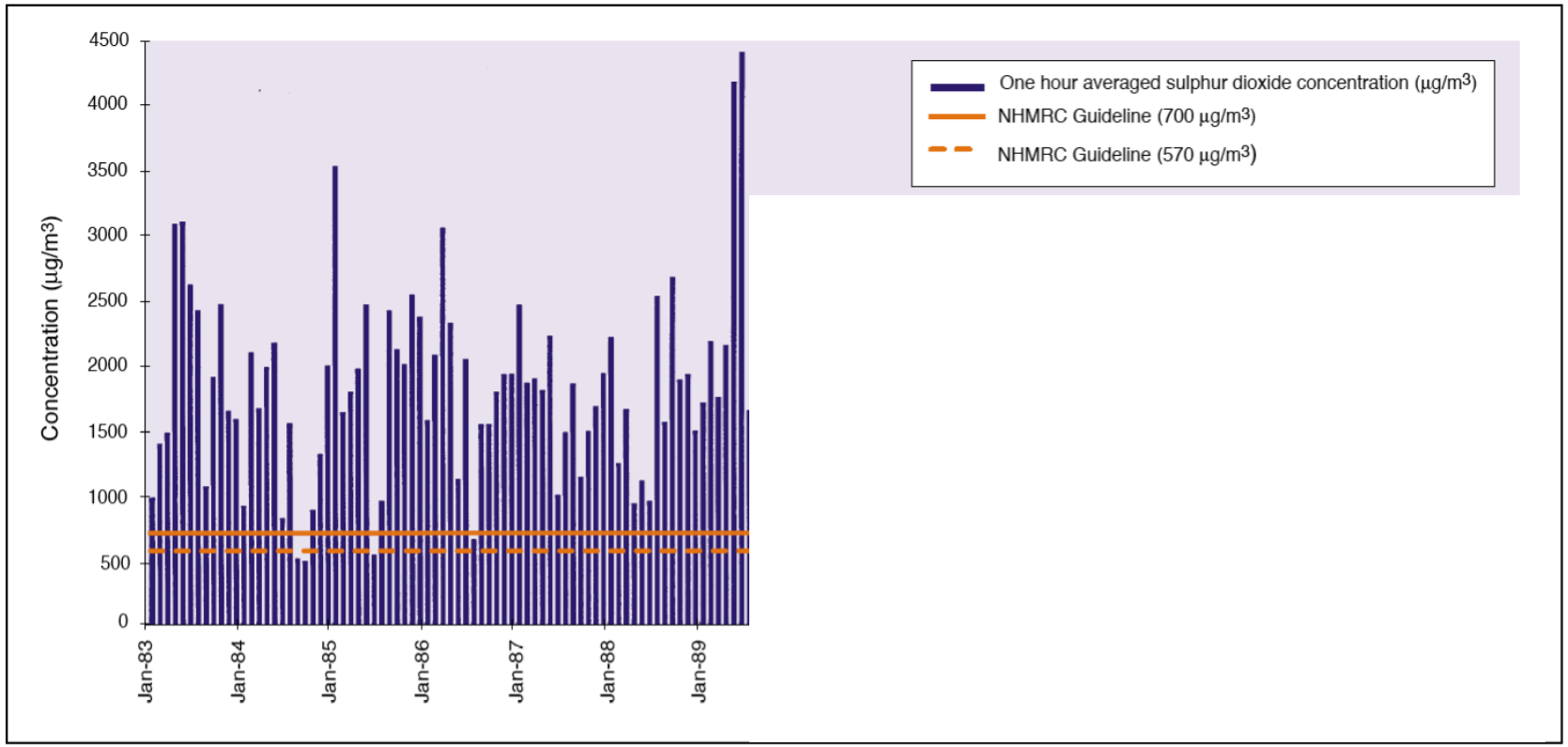


Figure 14. *Maximum average hourly sulphur dioxide levels at Kalgoorlie Hospital with significant events resulting in changes to the ambient sulphur dioxide concentration (Source: Department of Environmental Protection).*

Kalgoorlie – environmental regulation and industry cooperation

What happened

- Several small and old technology roasters in town;
- Then DoE pushed hard to regulate the emissions to improve air quality;
- Push back from industry, but pressure from DoE and EPA meant relocation of roaster to out of town and improved technology

The roasters

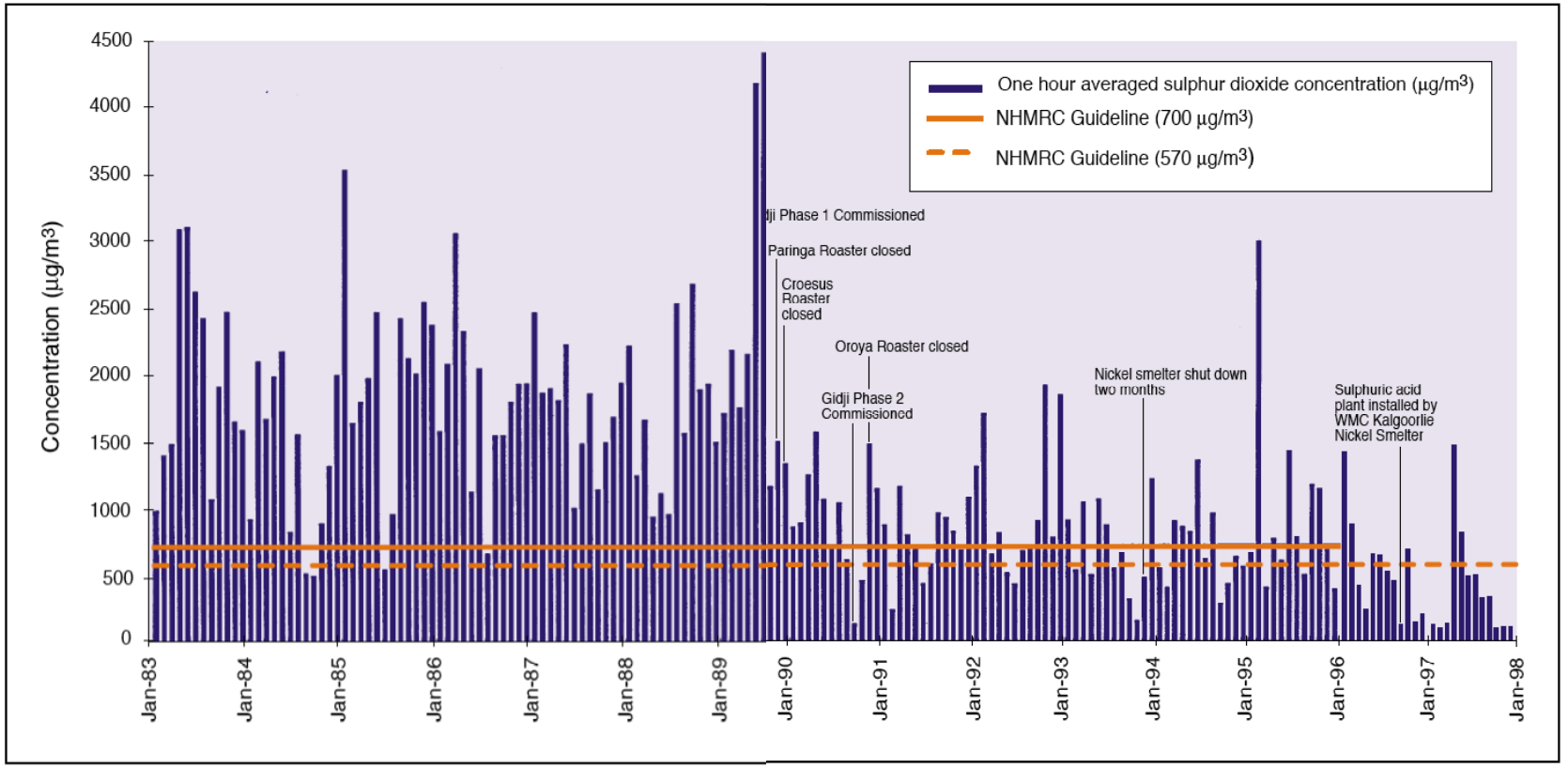


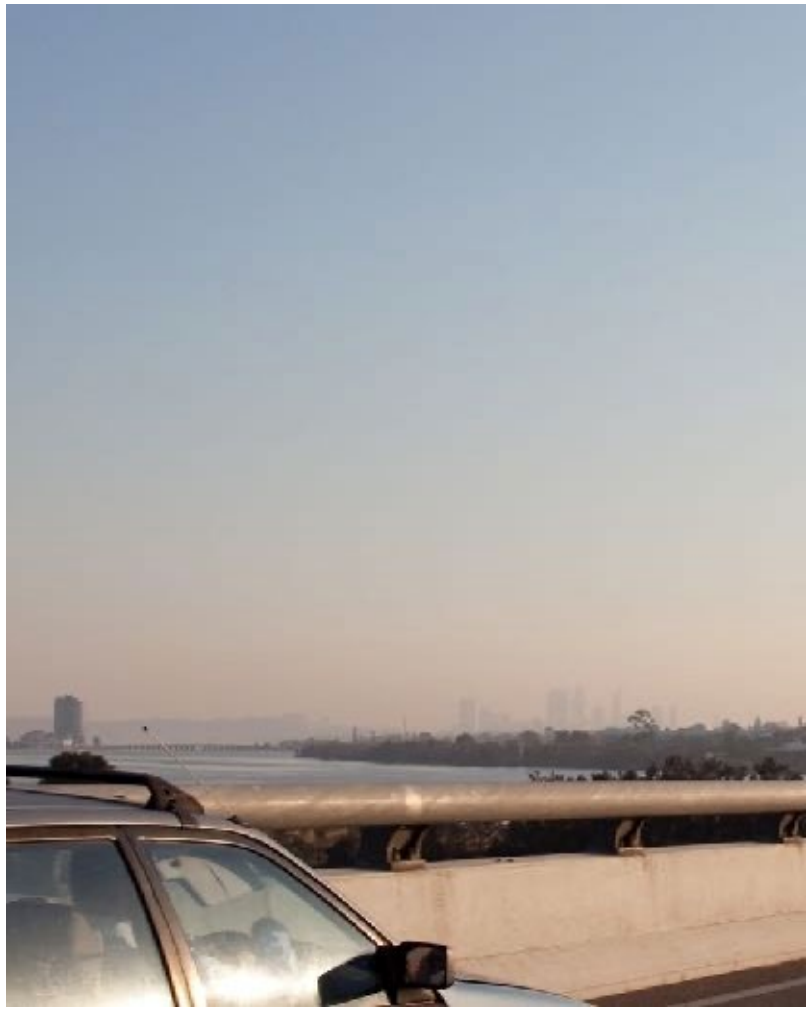
Figure 14. *Maximum average hourly sulphur dioxide levels at Kalgorlie Hospital with significant events resulting in changes to the ambient sulphur dioxide concentration (Source: Department of Environmental Protection).*

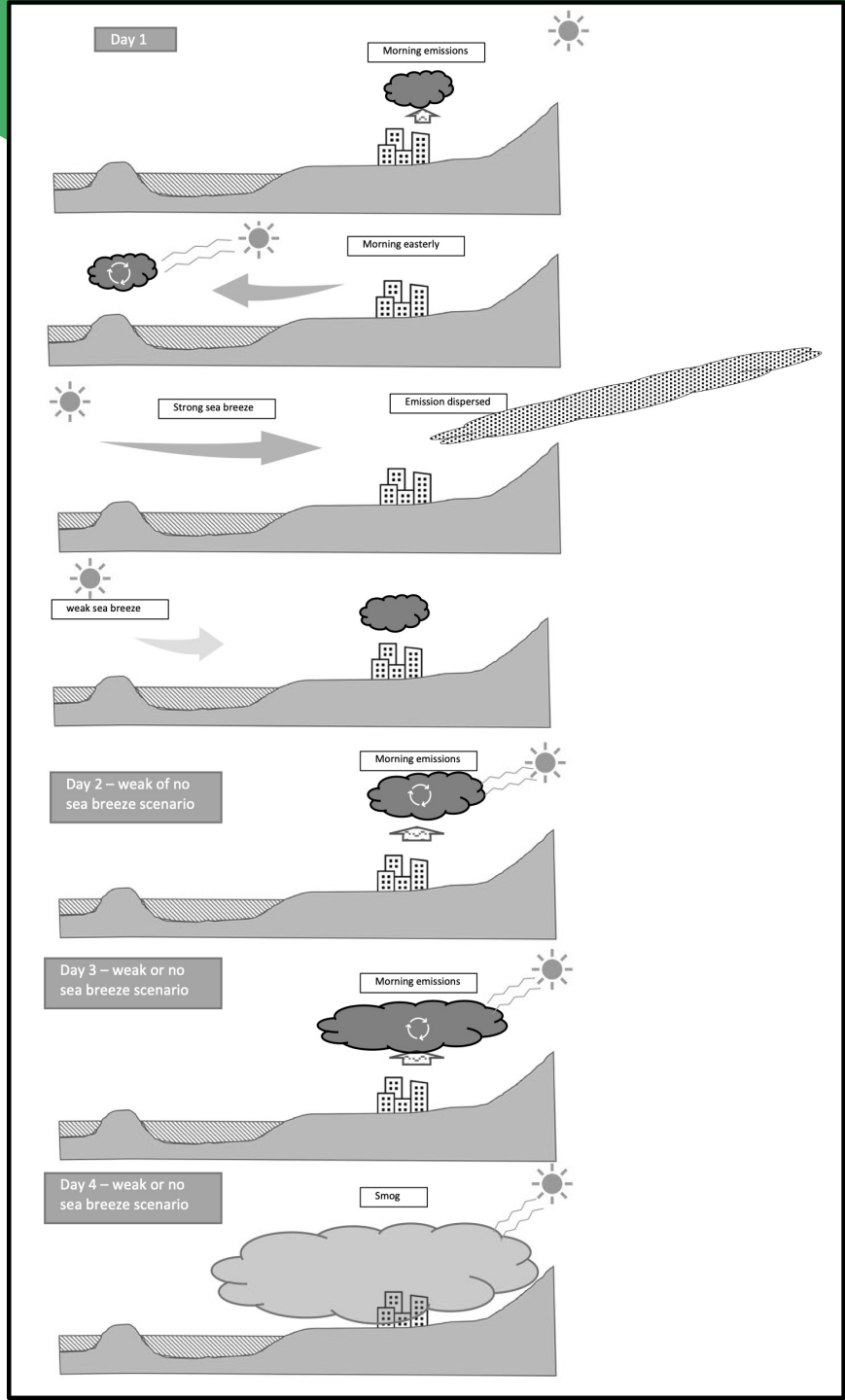
Photochemical smog

a ‘chemical cocktail’ of gases reacts in presence of light to form a visible, often brown, layer in the lower atmosphere

typically has high concentrations of ozone (O_3) at ground level.

Ozone is formed when oxides of nitrogen (NO_x) and volatile organic compounds (VOCs) react





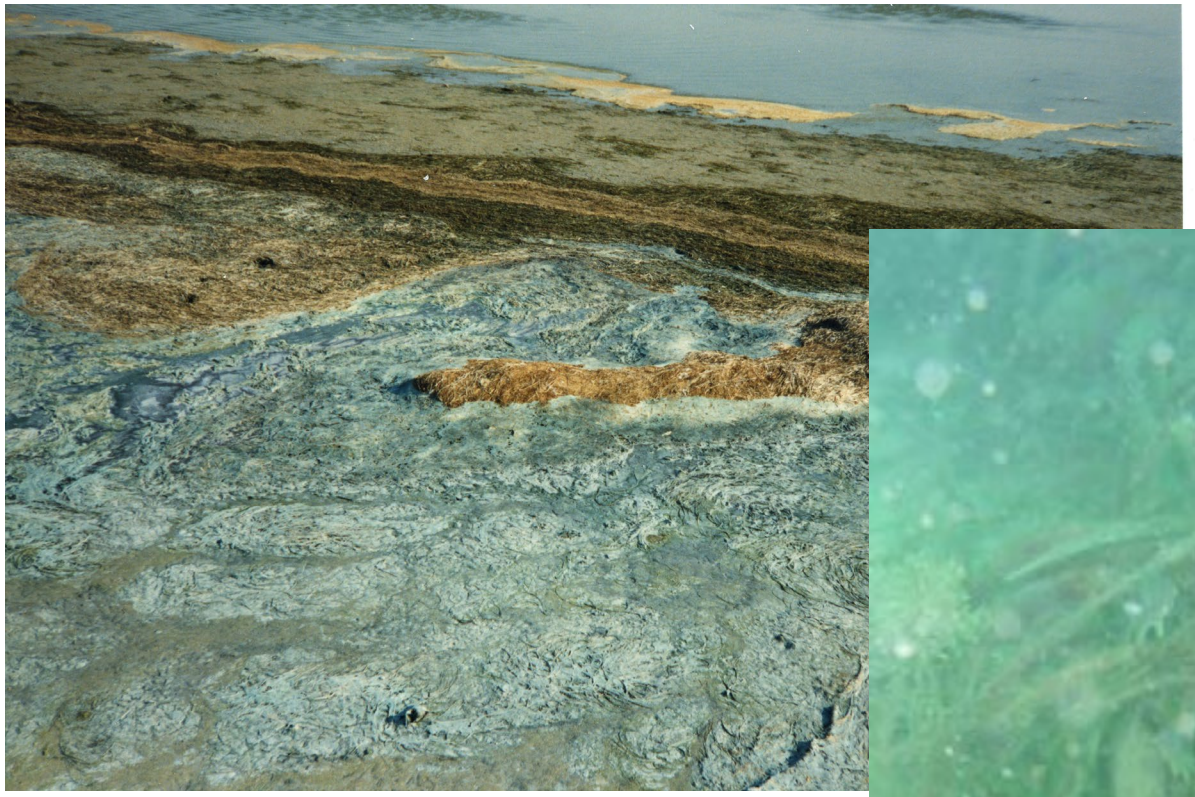
WATER POLLUTION

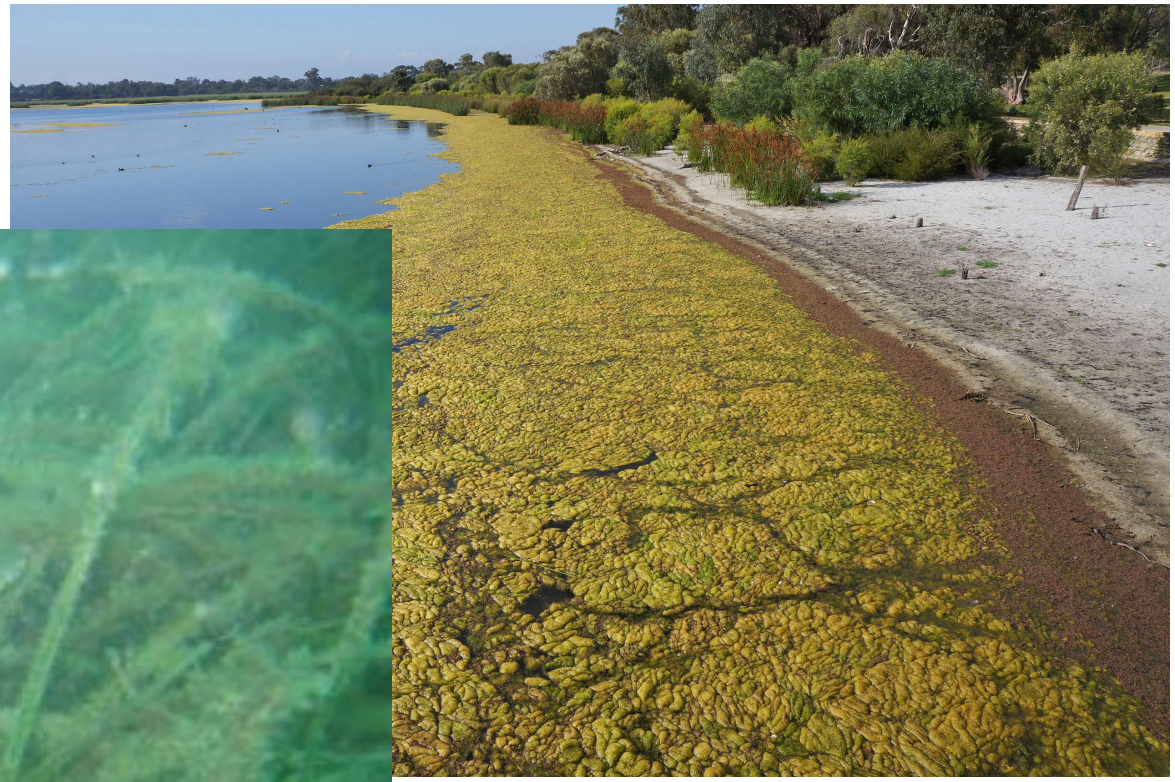
- Any physical or chemical change in water (including lakes, rivers, oceans, aquifers and groundwater) that adversely affects the health of humans and other organisms.
- Water …the universal solvent.

SOURCES AND EFFECTS OF WATER POLLUTION

Pollutant	*Source*	*Effects*
Bacteria and viruses (E. coli)	Sewage; Human and animal waste	Skin issues; illness/death from hepatitis, typhoid, and cholera if water is ingested
Oxygen demanding chemicals (Organic debris & waste + aerobic bacteria)	Sewage, feedlots, paper milling, food processing	Eutrophication; algal blooms; ecosystem degradation
Inorganic Contaminants (Heavy Metals, Ammonia, nitrogen, phosphorous)	Surface runoff, Industrial effluent, household cleansers	Illness; death; ecosystem degradation; Eutrophication; algal blooms
Nitrates, Phosphates	Sewage, manure, agricultural fertilizer and landscaping runoff	Eutrophication; algal blooms
Organic chemicals (Oil, Gasoline, Plastics, Pesticides, Solvents, detergents)	Industrial effluent; household cleansers, runoff from farms and yards	Oil smothering; ecosystem degradation
Sediment	Water (and wind) Erosion	Toxin transport to waterway; turbidity, suffocation, smothering.
Heat/Thermal	Power plants, industrial processes	Ecosystem degradation; Increased algal blooming – reducing oxygen
Solid waste	Anthropogenic (i.e. man)	Human and aquatic organism health; aesthetics

EUTROPHICATION





Phosphorus – salt water
Blue-green algae

Nitrogen - freshwater

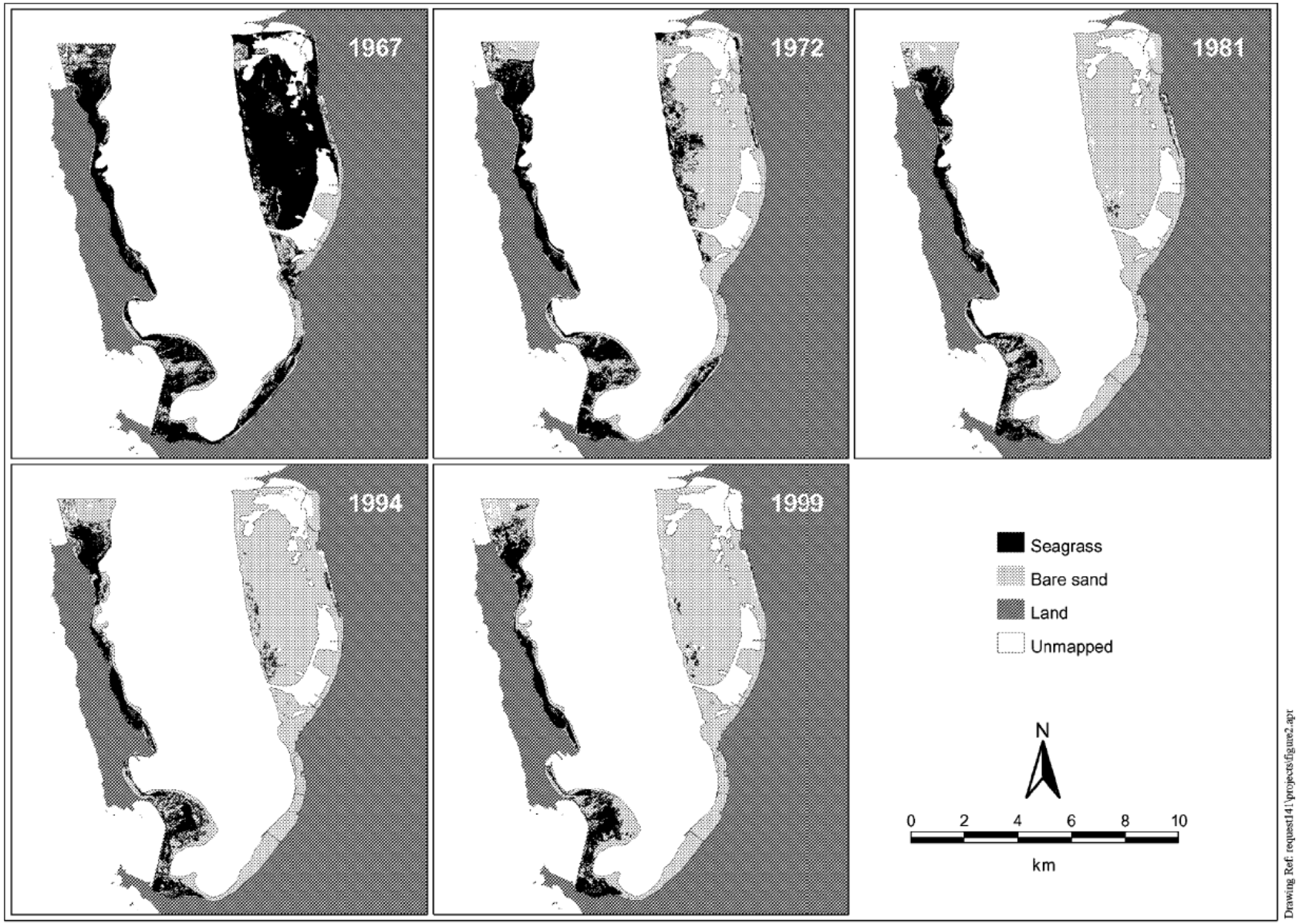
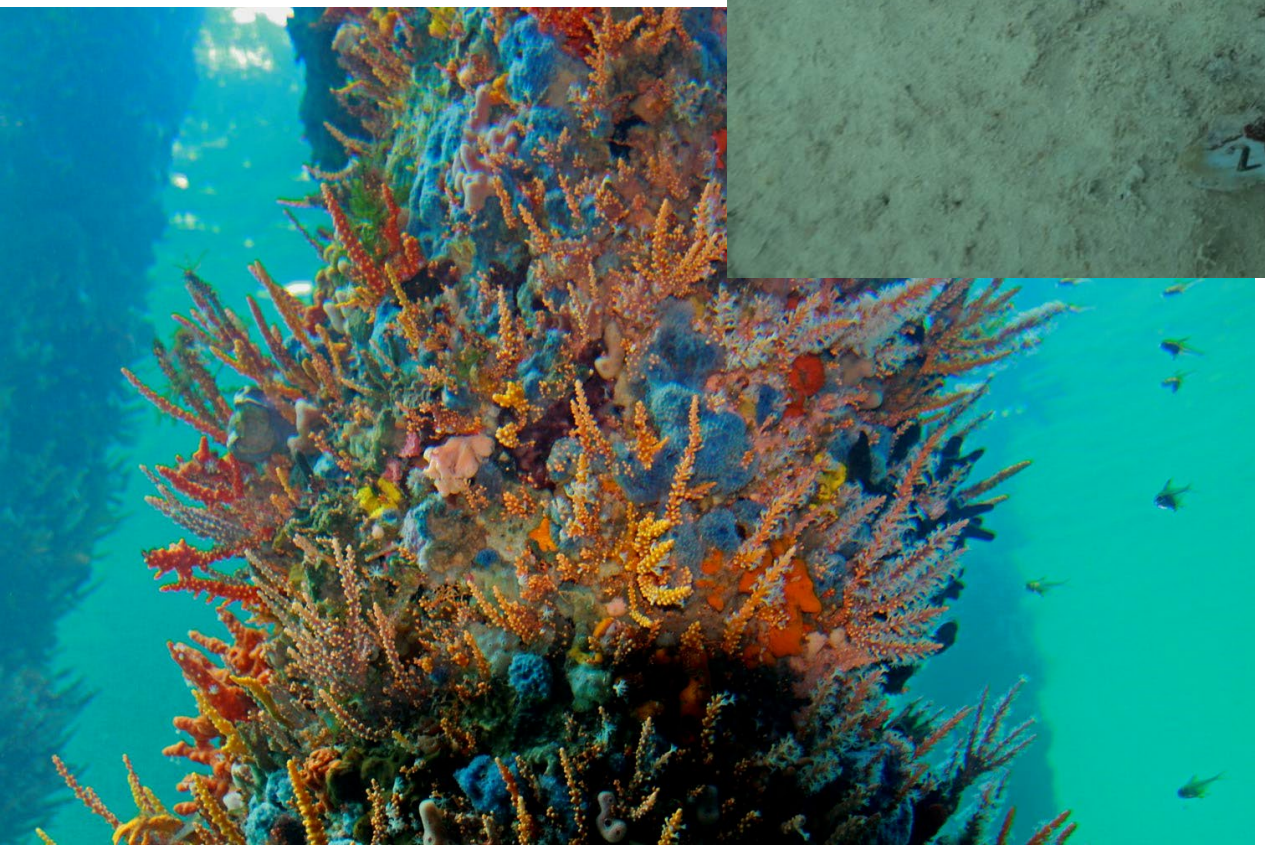


Fig. 2. Distribution of seagrasses in Cockburn Sound in 1967, 1972, 1981, 1994 and 1999.

TURBIDITY



https://mediad.publicbroadcasting.net/p/wlrn/files/styles/x_large/public/201906/buried_coral_dep.jpg

MINE WASTEWATER

- Water is essential for mining operations:
  - Processing — wet grinding, washing, flotation, leaching, etc.
  - Utilities — cooling water, pollution control, etc.
  - Dust suppression
  - Transportation — pumping tailings and products
  - Cleaning equipment, etc.
- In general, the lower the grade of ore, the more water intensive the mining process to extract the ore.

MINE WASTEWATER TREATMENT

Category	Examples	Application
Neutralization	lime or limestone addition	acid rock drainage
Passive treatment	wetland systems	polishing
Metals removal	sulfide precipitation, biological filters, fluidized bed reactor	metal recovery - saleable product
Metals removal	hydroxide precipitation (HDS process), coagulation-flocculation, clarification	metal removal; arsenic removal
Membranes	microfiltration, ion exchange, reverse osmosis	water reuse; metals removal
Biological treatment	Fixed film or suspended	Nitrogen removal, selenium removal, bioleaching
Evaporators and concentrators	brine concentrators, crystallizers	zero liquid discharge
Dewatering	clarifiers, dissolved air flotation	volume reduction of tailings
Filtration and thickening	pressure filters, paste thickeners	volume reduction of tailings
Cyanide treatment	alkaline chlorination, hydrogen peroxide process	gold mine effluent

SOUND v NOISE

- ‘Noise’ is unwanted sound judged to be unpleasant, loud or disruptive to hearing, or a particular activity.
- Natural sounds like bird noises may well be more acceptable than traffic noise
- noise can cause disturbance to people’s rest or recreational activities, and especially effect the elderly or sick.
- Noise that occurs at night is more likely to cause a disturbance than noise that occurs during the day.
- Unacceptable noise disturb people’s sleep and can lead to significant health issues due to sleep deprivation

Noise types

- Noise can be
  - audible and inaudible (commonly called vibrations)
- Noise can be
  - chronic being constant and forms part of the overall background of noise (i.e. “humming”, “whining” and traffic noise), and can also involve modulation (i.e. regular changes in level or pitch, e.g. a siren
  - acute or impulsiveness (e.g. “hammering”, cars breaking, shouting etc.) – cause most problems

SOURCES OF NOISE

- Road traffic e.g. moving trucks, automobiles, buses, especially those with modified silencer system
- Industrial (power plants, stone crushing, metal workshops, cabinet making)
- Machinery (generator sets, compressors, air conditioning units, boilers, pumps, motors)
- Construction and roadworks
- Aircrafts and ship engines
- Community noise e.g. radio/TV, loudspeakers, pool houses and alarms
- Animals (birds)
- Places of entertainment, including night clubs, loud speaker, amplifier, musical instrument

NOISE EFFECTS

- Hearing Loss (Including Occupational Hearing Loss)
- Stress
- High Blood Pressure
- Sleep Loss
- Distraction
- Disorientation
- Productivity Loss
- Irritability
- Headache
- Annoyance
- Interference with Communications

Regulating noise

- Noise that is fixed in one location (industry, concerts etc.) are regulated with set standards through Regulations
- Noise from mobile sources - traffic, trains trucks etc. - are not covered by formal standards, although there are guidelines
- Regulated by DWER and Local Government
- Regulations - *Environmental Protection (Noise) Regulations 1997*
- Regulation 7 requires that noise emitted from any premises must comply with assigned noise levels when received at any other premises and be free of the intrusive characteristics of tonality, modulation and impulsiveness
- The assigned levels are specified under Regulation 8, according to the type of premises receiving the noise, the time of day and the presence of commercial and industrial land use zonings and major roads within a 450 metre radius of the receiver.

Regulating noise

- In general different standards apply at different time during the day as follows:
  - 0700-1900 hours Monday to Saturday;
  - 1900-2200 hours Monday to Saturday and 0900-2200 hours on Sundays and public holidays; and
  - 2200-0700 hours Monday to Saturday and 0900-2200 hours on Sundays and public holidays.
- Calculation of noise levels is a highly technical process involving on-site measurements, modelling to take into account different weather conditions, and the use of statistics.

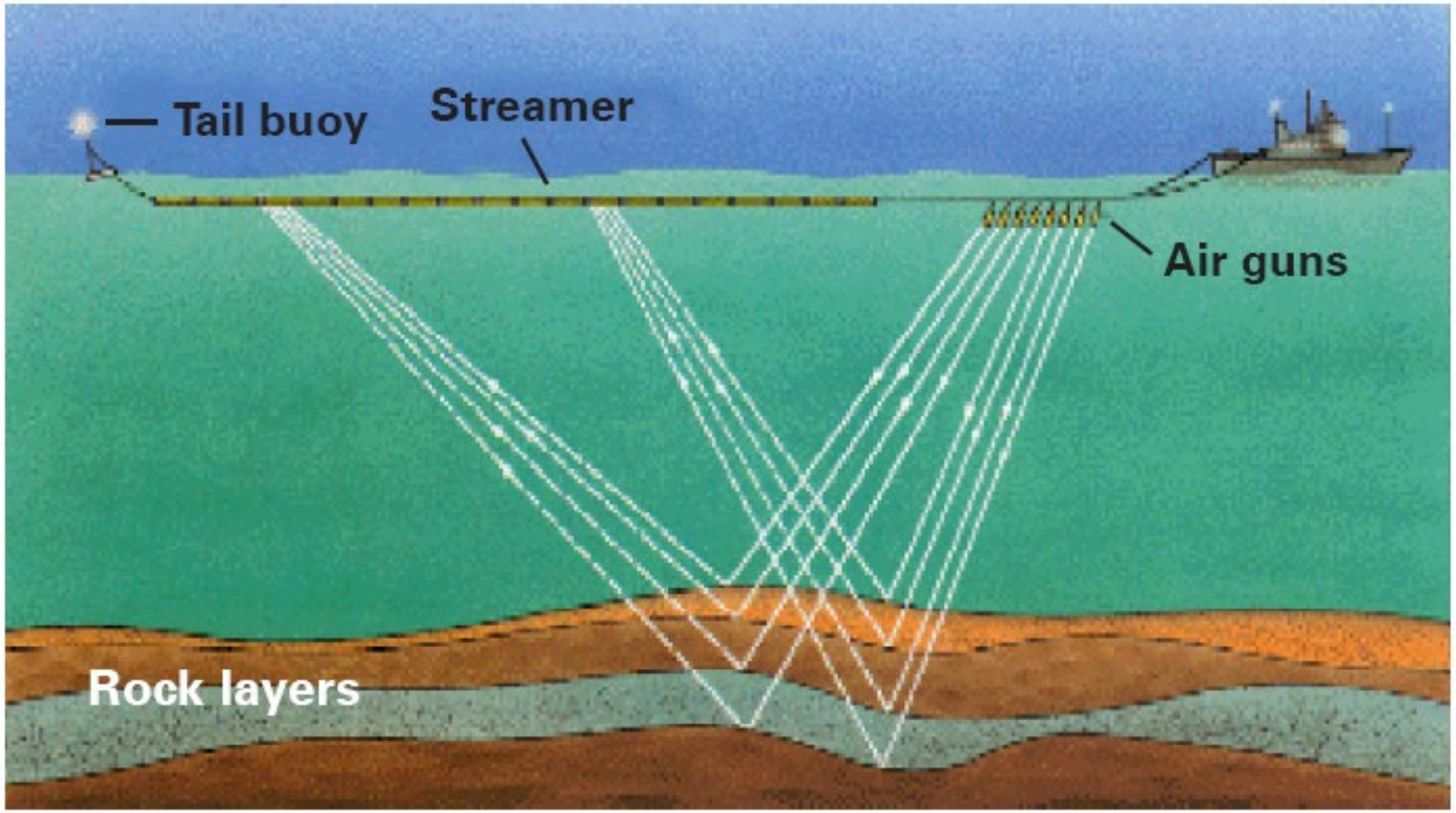
EXEMPTIONS

- Some farm vehicles
- Construction sites, at certain times of the day
- Equipment operated on residential premises (including musical instruments) at certain times of the day
- Bell-ringing and calls to worship at certain times of the day
- Community activities including: - spectators at organised sporting activities
- Public meetings and processions
- Religious activities
- Recreational and educational activities associated with schools and other premises used for educational purposes
- Agricultural shows, fairs, fetes, exhibitions and like events.

Exemptions – Reg 17

- Regulation 17 allows a proponent who believes they “cannot reasonably or practicably comply with a standard prescribed under these regulations” to apply to the Minister for approval to emit noise that exceeds or varies from the standard set in the Regulations
- Regulation 17 is aimed at large industrial premises
- 11 Reg 17 approvals
  - Wagerup Alumina Refinery;
  - Port of Esperance;
  - Fimiston Gold Mine in Kalgoorlie;
  - Australind Pigment Plant;
  - Pinjar Gas Turbine Station;
  - Talison Lithium Australia Greenbushes Operation;
  - Global Advanced Metals Greenbushes Operation;
  - Wesfarmers Premier Coal Mine in Collie;
  - Dardanup Pine Log Sawmill;
  - Western Power Transmission Substations (various locations); and
  - Western Power Electrical Distribution Transformer (various locations)

MARINE ANIMAL RECEPTORS



How seismic works. Source: http://www.glossary.oilfield.slb.com/default.cfm

Sensitive species

- **Table 6-10 Predictable occurrence periods for sensitive marine fauna in the Cape Lambert area**

Receptor	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Turtle nesting	■	▒	▒								▒	■
Emerging hatchlings	■	■	▒	▒								▒
Humpback whales							▒	■	■	▒		
Coral spawning		■	■	■							■	■
Legend	■	*Predicted occurrence*			▒	*Potential occurrence*				*Unlikely to occur*		

NOISE OFFENCE

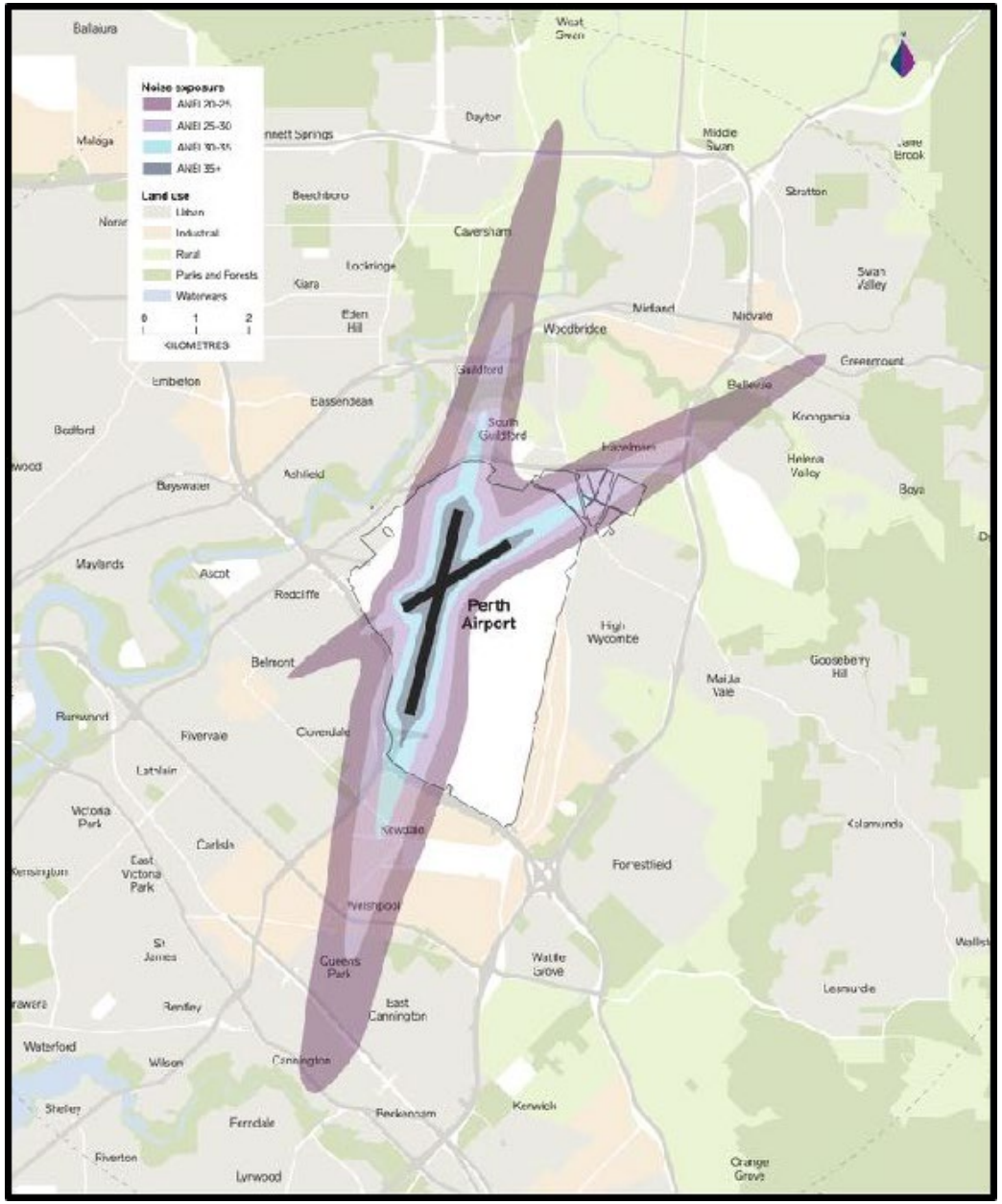
As per the EP Act it is an offence to:

- emit an *unreasonable* emission of noise
- cause pollution (including noise pollution)
- use equipment on any premises in such a way as to emit an unreasonable noise
- own or drive a vehicle or vessel that does not comply with the prescribed noise standard for that class of vehicle
- own or install any equipment that, when operated, can exceed the noise limit
- manufacture, sell, supply, assemble, distribute or store any equipment or vehicle which, when operated under prescribed test conditions, exceeds the relevant noise limit for that equipment or vehicle.

Aircraft noise

ANEFs

- Detailed computer modelling is carried out taking into account the number of flights, types of aircraft and meteorological conditions to produce these noise contours, called Australian Noise Exposure Forecast – or ANEFs.
- Four categories of ANEF that related to land use planning:
  - Less than 20 ANEF;
  - Between 20 and 25 ANEF
  - Between 25 and 30 ANEF; and
  - 30 to 35 ANEF.



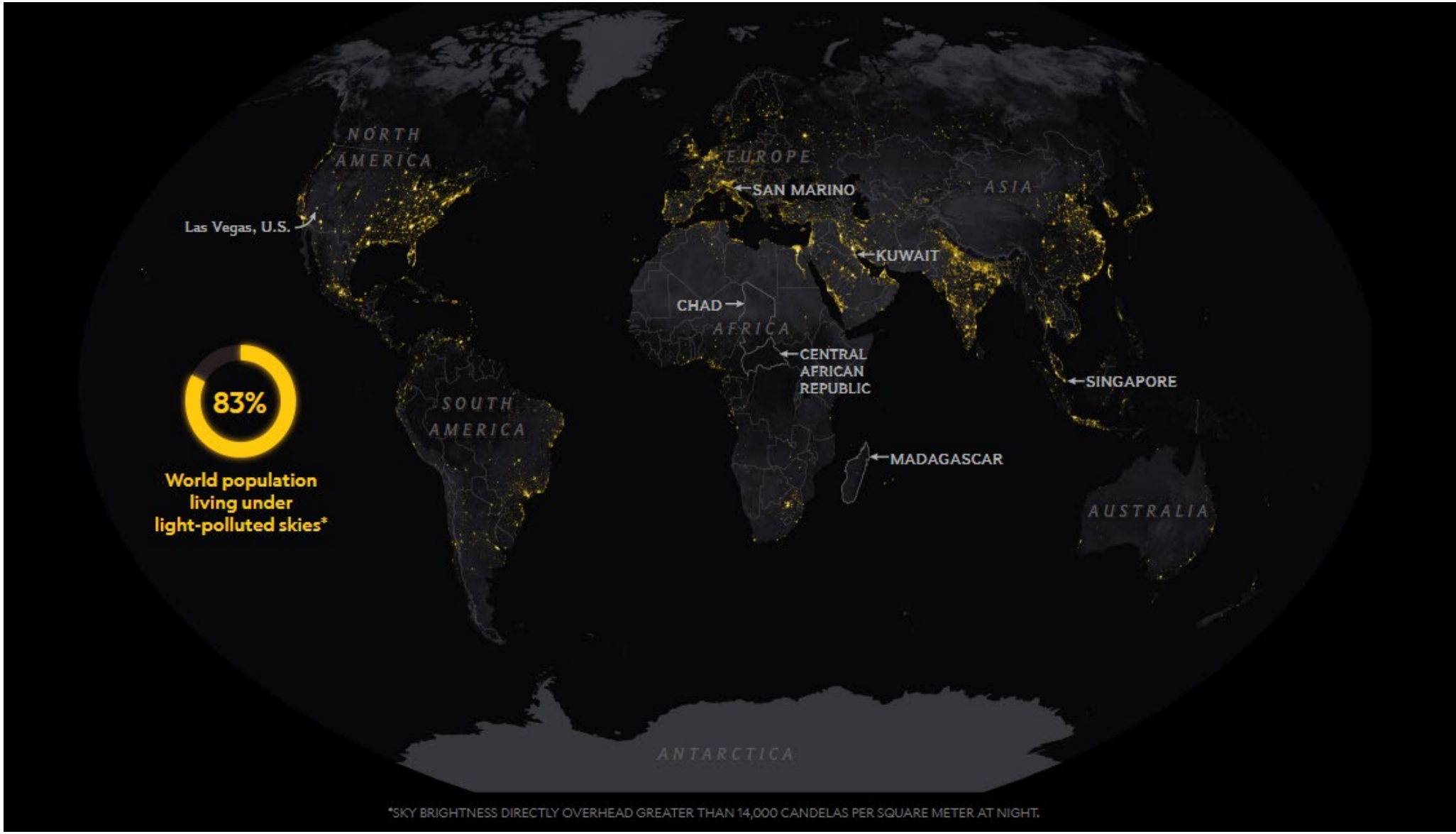
ANEFs

Building type	Forecast noise exposure level (ANEF)			
	less than 20 ANEF (Note 1)	20 to 25 ANEF (Note 2)	25 to 30 ANEF	30 to 35 ANEF
House, home unit, flat, caravan park	Acceptable	Conditionally Acceptable	Unacceptable (Note 4) (Note 5)	Unacceptable (Note 4) (Note 5)
School, university	Acceptable	Conditionally Acceptable	Unacceptable (Note 4) (Note 5)	Unacceptable (Note 4) (Note 5)
Hospital, nursing home	Acceptable	Conditionally Acceptable	Unacceptable (Note 4) (Note 5)	Unacceptable (Note 4) (Note 5)
Hotel, motel, hostel	Acceptable	Acceptable	Conditionally Acceptable	Unacceptable (Note 4) (Note 5)
Public building	Acceptable	Conditionally Acceptable	Conditionally Acceptable	Unacceptable (Note 4) (Note 5)
Commercial building	Acceptable	Acceptable	Conditionally Acceptable	Conditionally Acceptable
Light Industrial	Acceptable	Acceptable	Acceptable	Conditionally Acceptable
Other industrial	Acceptable	Acceptable	Acceptable	Acceptable

LIGHT POLLUTION

Definition

Light pollution is excessive, misdirected, or obtrusive artificial (usually outdoor) light.



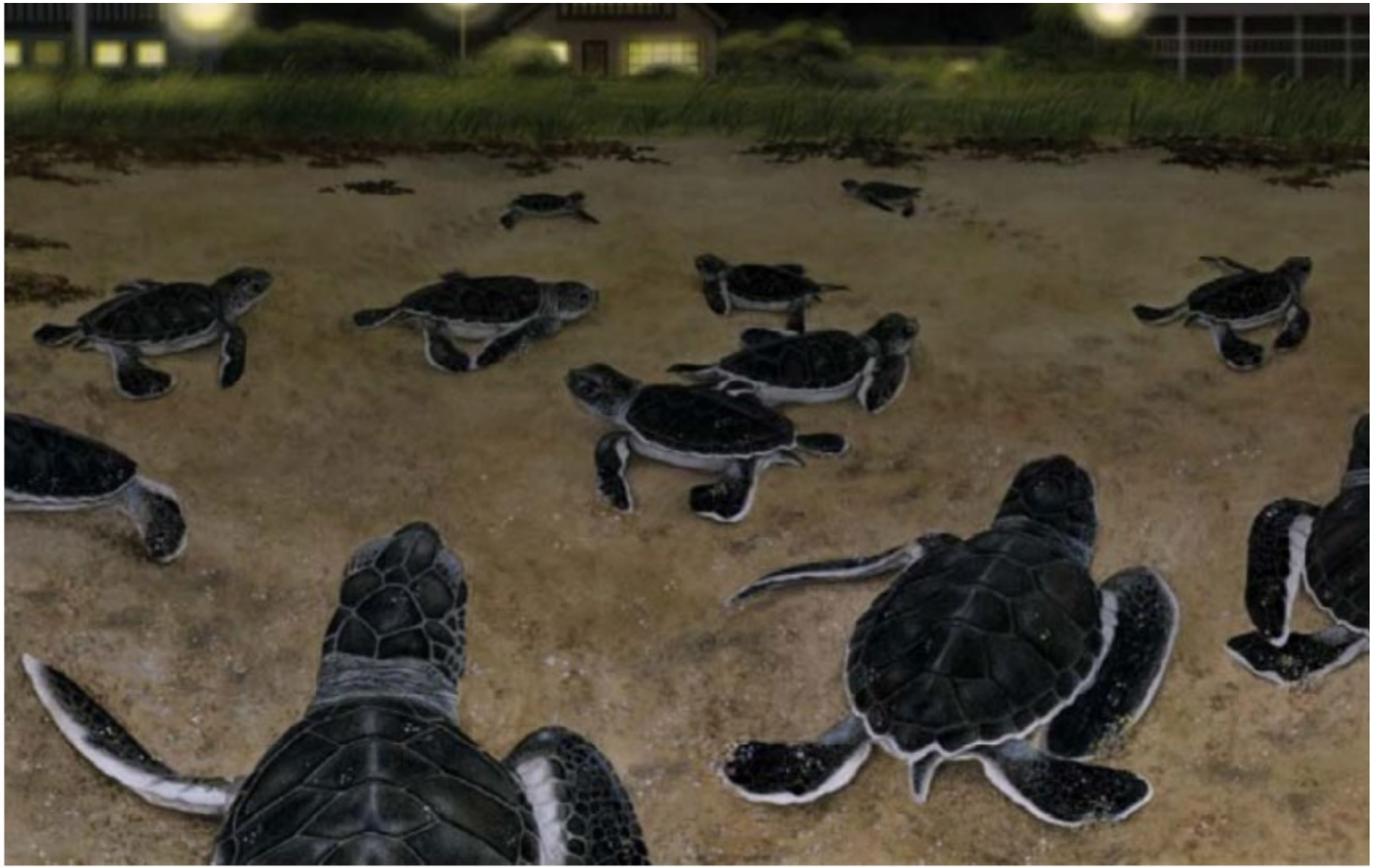
LIGHT POLLUTION EFFECTS

- Affects ecosystems
- Alteration of circadian rhythm
- Aesthetics of the night sky

LIGHT POLLUTION EFFECTS

- Researchers have already identified harmful impacts on an array of non-urban species including bats, insects, plants, fish, turtles, marine invertebrates including corals, and even primates
- The damaging effects of coastal light on threatened turtle species are perhaps the most commonly known
- *Commonwealth Government Light Pollution Guidelines for Marine Turtles, Seabirds and Migratory Shorebirds*

LIGHT IMPACTS ON TURTLES



credit: Dawn Witherington

[Light pollution - DCCEEW]

LIGHT POLLUTION MITIGATION AND MANAGEMENT

Light Emission Monitoring

- Demonstrate your lighting has not significantly increased ambient light levels over and above levels existing prior to development.
- Manage installed lighting to mitigate light spill on projects located in close proximity to species or ecosystems sensitive to ambient lighting.

Lighting Audit or Mitigation

- Demonstrate that installed lighting is appropriate and compliant with lighting commitments.
- Reduce lighting output and associated cost on your project effectively and without compromising stringent HES standards and employee safety.

Potential Light Emission Modelling

- Assess the ecological risk posed by project lighting in areas containing sensitive receptors.
- Assess the environmental risk posed by additional project lighting for existing projects which plan to expand, or add infrastructure, in areas containing sensitive receptors.

LIGHT POLLUTION MITIGATION AND MANAGEMENT

- Position Statement - Dark Sky and Astrotourism (www.wa.gov.au)

Department of Planning, Lands and Heritage

GOVERNMENT OF WESTERN AUSTRALIA

Western Australian Planning Commission

Position Statement:

Dark sky and astrotourism

January 2022

Published by the
Western Australian Planning Commission
Gordon Stephenson House
140 William Street
Perth WA 6000

Locked Bag 2506
Perth WA 6001

Published January 2022

website: www.dplh.wa.gov.au
email: info@dplh.wa.gov.au

tel: 08 6551 8002
fax: 08 6551 9001
National Relay Service: 13 36 77
This document is available in alternative formats on application to the Communications Branch.

5.6 Development

Development approval

In considering applications for development approval, decision-makers should ensure lighting and dust management is consistent with the dark sky principles. These measures may be demonstrated through a lighting management plan and dust/construction management plan approved as part of the application by the decision-maker, or as a condition of approval. For most proposals, a basic lighting management plan and/or dust/construction management plan will be sufficient. Lighting and dust management plans should be consistent with this policy, Australian standards, DWER Guidelines and include:

- a map/plan
- lighting selection, location and illuminance values
- potential light emission recipients, including the possible impact on any protected wildlife species
- mitigation measures
- maintenance/monitoring/reporting.

In considering lighting management for a proposal with light pollution that may adversely impact a listed species under the EPBC Act or State legislation, the Australian Government's *National Light Pollution Guidelines* should be followed.

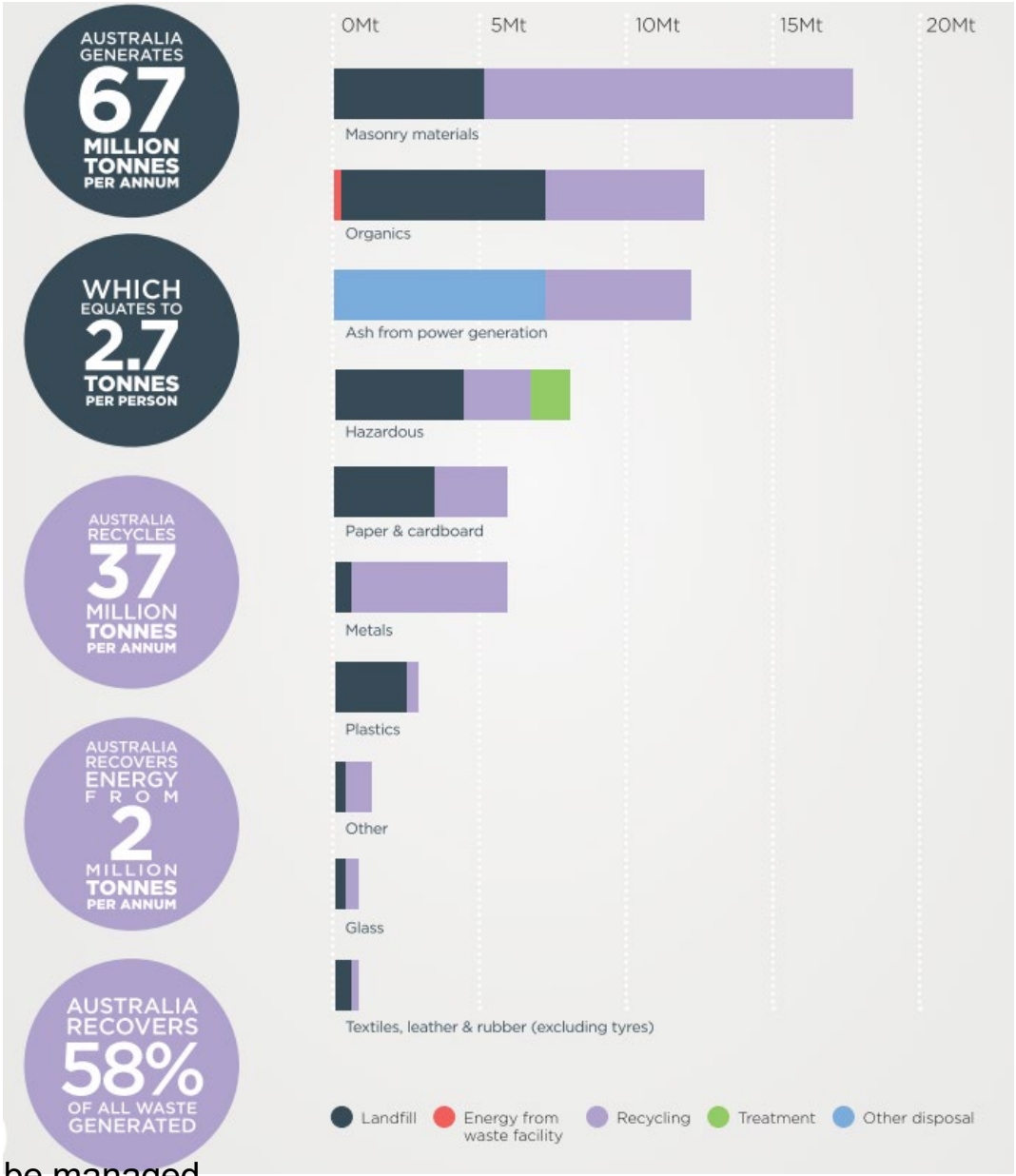
WHAT IS WASTE?

- Residual product that is not the primary goal of production
- A material, substance, or by-product) eliminated or discarded as no longer useful or required after the completion of a process
- Wastes may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities.
- If the residual product is reused or recycled or recovered in some way, the process will no longer be considered as waste.

WHY MANAGE WASTE?

- Conserves resources & energy
- Reduces water & air pollution
- Saves landfill space
- Waste = resource inputs

WASTE IN AUSTRALIA



Outcome 2: Understand why waste should be managed

WASTE CLASSIFICATION (origin and type)

Municipal Solid Wastes

- Solid wastes that include household garbage, rubbish, construction & demolition debris, sanitation residues, packaging materials, trade refuges etc. are managed by any municipality.

Bio-Medical Wastes

- Solid or liquid wastes including containers, intermediate or end products generated during diagnosis, treatment & research activities of medical sciences.

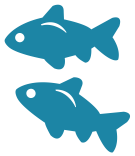
Industrial Wastes

- Liquid and solid wastes that are generated by manufacturing & processing units of various industries like chemical, petroleum, coal, metal gas, sanitary & paper etc.

Agricultural Wastes

- Wastes generated from farming activities. These substances are mostly biodegradable.

WASTE CLASSIFICATION (origin and type)



Fishery Wastes

- Wastes generated due to fishery activities. These are extensively found in coastal & estuarine areas.

Radioactive Wastes

- Waste containing radioactive materials. Usually these are byproducts of nuclear processes. Sometimes industries that are not directly involved in nuclear activities, may also produce some radioactive wastes, e.g. radio-isotopes, chemical sludge etc.

E-Wastes

- Electronic wastes generated from any modern establishments. They may be described as discarded electrical or electronic devices. Some electronic scrap components, such as CRTs, may contain contaminants such as Pb, Cd, Be or brominated flame retardants.

WASTE AVOIDANCE AND RESOURCE RECOVERY ACT 2007

An Act to –

- provide for waste avoidance and resource recovery; and
- establish the Waste Authority; and
- establish a container deposit scheme; and
- provide for waste services by local governments; and
- provide for levies on waste; and
- repeal the *Environmental Protection (Landfill) Levy Act 1998*
- provide for related and consequential matters.

Object of this Act

1) The primary objects of this Act are to contribute to sustainability, and the protection of human health and the environment, in Western Australia and the move towards a waste-free society by –
   a) promoting the most efficient use of resources, including resource recovery and waste avoidance; and
   b) reducing environmental harm, including pollution through waste; and
   c) the consideration of resource management options against the following hierarchy –
      i. avoidance of unnecessary resource consumption
      ii. resource recovery (including reuse, reprocessing, recycling and energy recovery);
      iii. disposal.

LANDFILL CLASSES

The *Waste Avoidance and Resource Recovery Act 2007* defines waste as matter whether useful or useless, which is discharged into the environment; or matter which is prescribed by the regulations to be waste.
Below are the criteria to be applied in determining classification of wastes for acceptance to landfills licensed or registered in Western Australia in accordance with Part V of the *Environmental Protection Act 1986*.

Landfill classes and waste types

Class I— Inert landfill	Class II— Putrescible landfill	Class III— Putrescible landfill	Class IV— Secure landfill	Class V— Intractable landfill
Clean Fill	Clean Fill	Clean Fill	Clean Fill	Intractable and other wastes in accordance with the approvals for the site
Type 1 Inert Waste	Type 1 Inert Waste	Type 1 Inert Waste	Type 1 Inert Waste	
Contaminated solid wastes meeting waste acceptance criteria specified for Class I landfills	Putrescible Wastes	Putrescible Wastes	Putrescible Wastes	
Type 2 Inert Waste	Contaminated solid wastes meeting waste acceptance criteria specified for Class II landfills	Contaminated solid wastes meeting waste acceptance criteria specified for Class II or Class III landfills	Contaminated solid wastes meeting waste acceptance criteria specified for Class II, Class III or Class IV landfills	
Type 3 Inert Waste	Type 2 Inert Waste	Type 2 Inert Waste	Type 2 Inert Waste	
Type 1 Special Waste	Type 1 and Type 2 Special Wastes	Type 1 and Type 2 Special Wastes	Type 1 and Type 2 Special Wastes	

TREATMENT - INCINERATION

- Works by burning wastes under heat
- Reduces waste substantially
- Waste must be segregated – what goes in comes out (Dioxins and furans)
- Ash is hazardous in most cases
- Emissions must be controlled
- Medical wastes are commonly incinerated

TREATMENT

- Composting
- Settling ponds
- Wastewater Treatment Facilities
- Resource Recovery (AKA Waste-to-Energy): Waste is burned to produce energy. Preferred to landfilling – reduces bulk of municipal waste to ash and provides energy. Strict regulatory restrictions and high economic costs and stringent environmental regulations:

WASTE LEGISLATION

- Waste Avoidance and Resource Recovery Act 2007
- Environmental Protection (Controlled Waste) Regulations 2004
- EP Act Part V Licence

BEST PRACTICE WASTE MANAGEMENT IN MINING

- Waste Management Plan:
  - Waste types and where waste is generated, stored, handled, treated or disposed
  - How will success be measured and monitored
- Ascertain the nature of the waste – and the correct classification
- Waste segregation
- Responsible disposal
- Sustainable procurement (recycled and recyclable materials)
- Recovering solvents, metals or oil and re-using them for a secondary purpose
- Recyclable construction wastes will be collected separately and reused or recycled
- Reverse logistics
- Vegetation wastes stockpiled safely to be used in on-site landscaping. Topsoil from disturbed areas will be stored for use in future rehabilitation activities on-site.

LandTrack Systems

Improved compliance performance, profit and productivity with our specialised training, tools and support

Broader issues – key policies, risk management and public engagement

Environmental Essentials WA

Public engagement

- What has been your experiences?

Decision making – a question of values?

- Eroding coastlines - What are the options here and what choice would you make?

Seabird WA

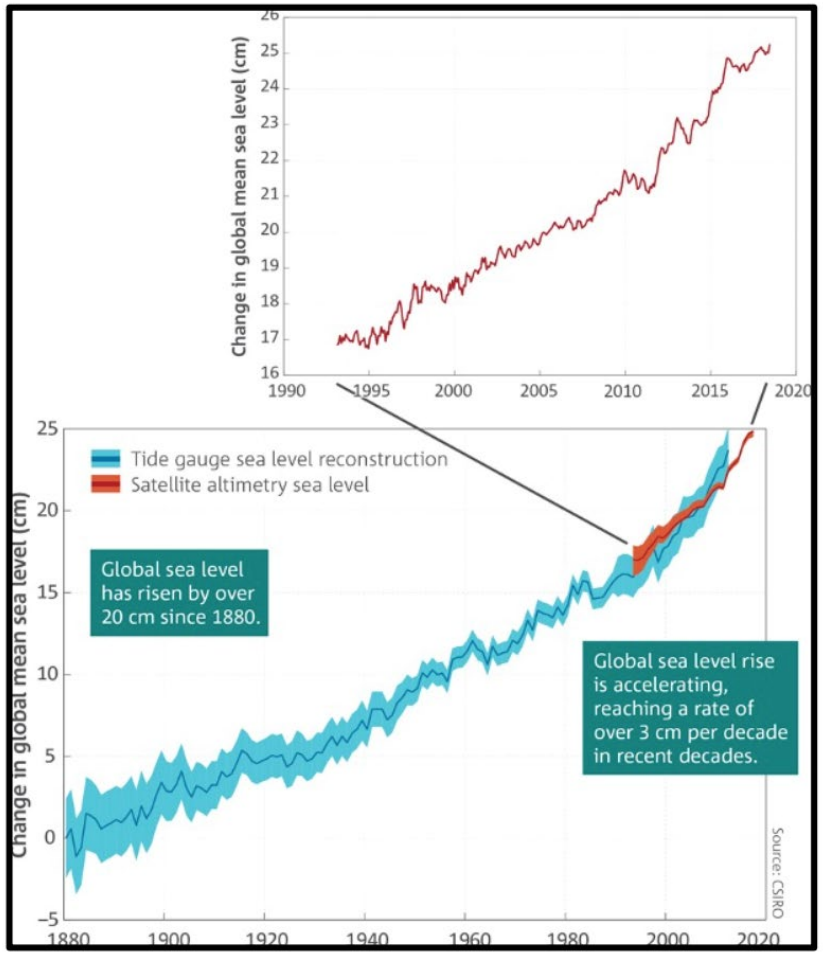
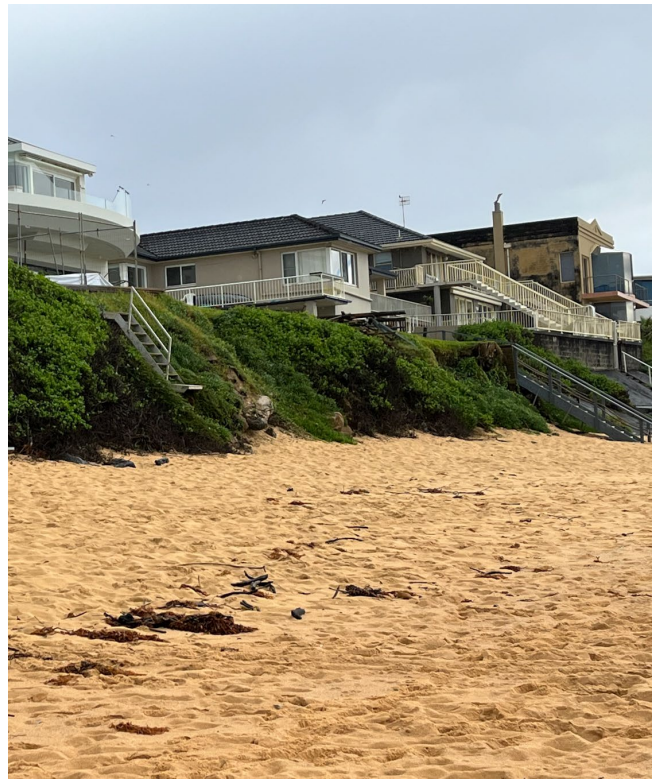


Figure 8.9: Global means sea level rise since 1880 (Source: CSIRO 2018)



Coast NSW

Key policies and approaches to decision making

Kwinana Environmental Protection Policy – command and control and market mechanism

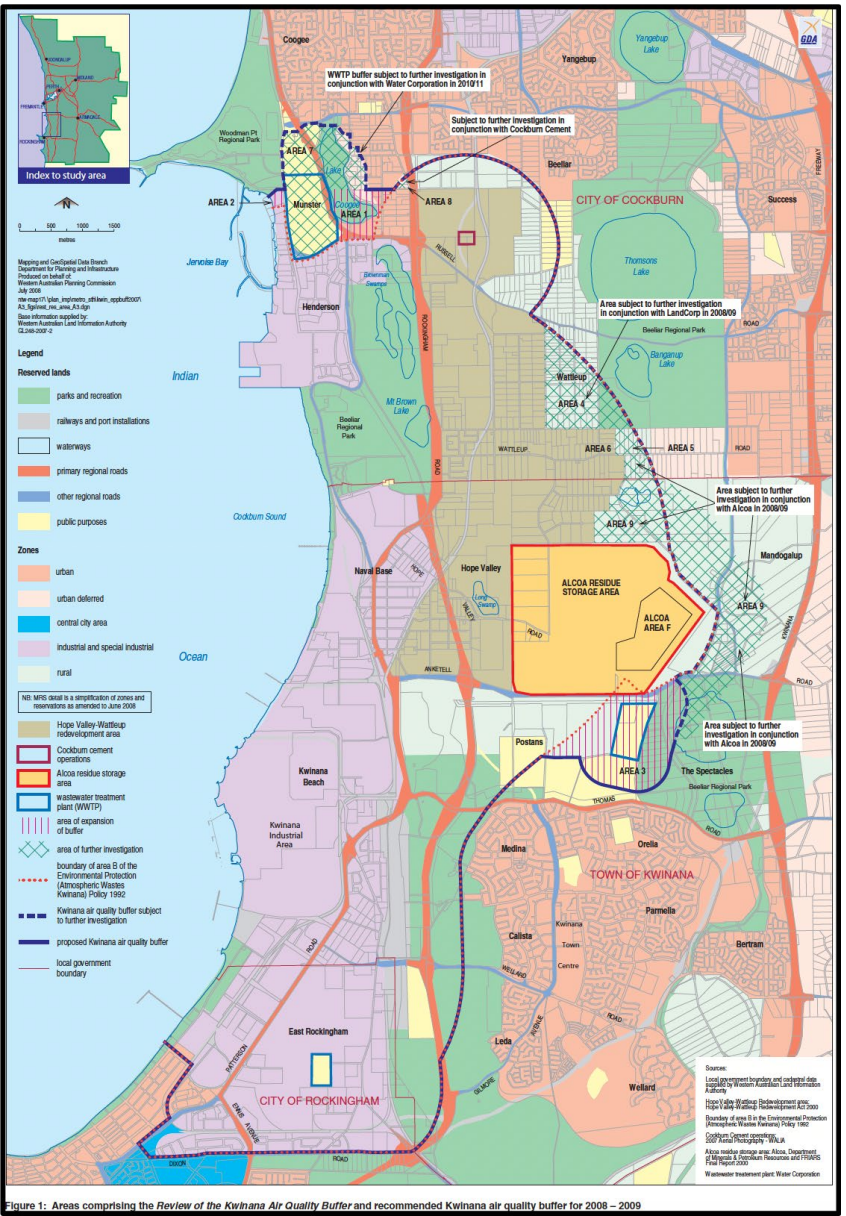


Figure 1: Areas comprising the *Review of the Kwinana Air Quality Buffer* and recommended Kwinana air quality buffer for 2008 – 2009

Averaging period		Concentration µg m^{-3}			
		Area A	Area B	Area C	NEPM
1 Hour	Standard	700	500	350	260
	Limit	1,400	1,000	700	
24 Hour	Standard	200	150	125	-
	Limit	365	200	200	-
Annual	Standard	60	50	50	52
	Limit	80	60	60	

Area	Standard µg m^{-3}	Limit µg m^{-3}	Averaging period
Policy area	-	1000	15 minutes
Area A	150	260	24 hours
Area B	90	260	24 hours
Area C	90	150	24 hours

Residential development

Figure 7.7: WAPC imposed dust buffer for the Alcoa mud-pits (Source: Taylor Burrell Barnett 2020).

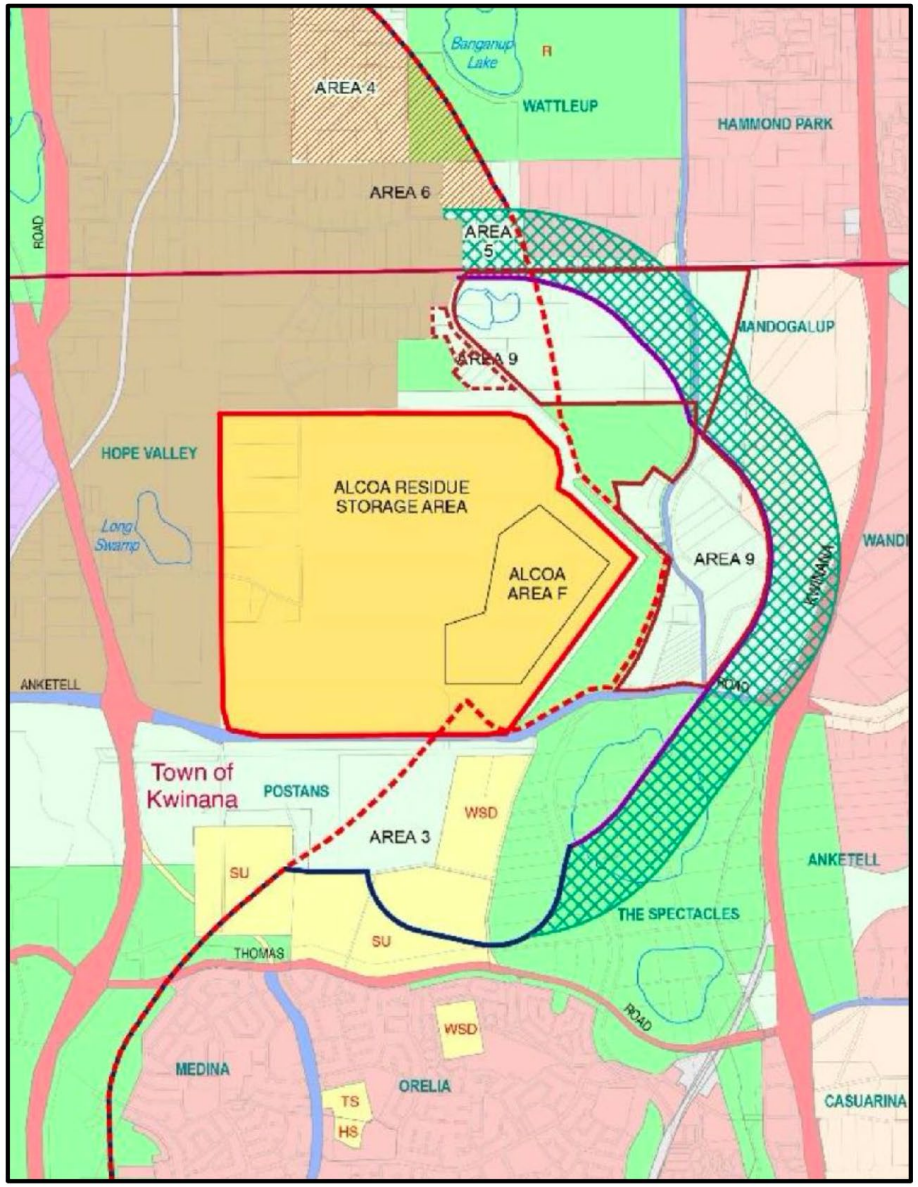
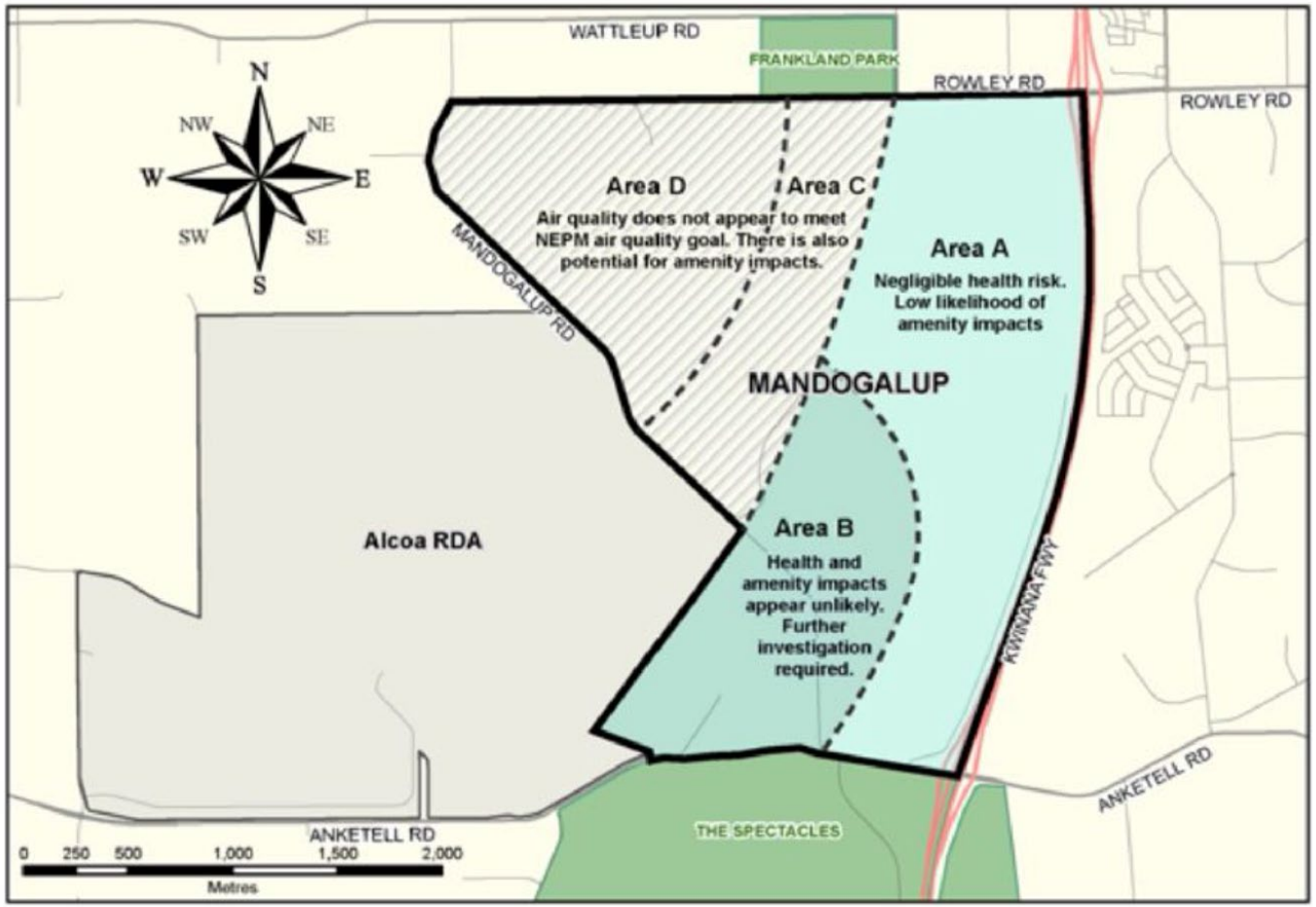


Figure 7.8: EPA recommended dust buffer around Alcoa's mud-lakes (Source: EPA 2017).



Cockburn Sound – adaptive and collaborative

- Competing social, environmental and economic values

Historic environmental management

- Dump effluent into Cockburn Sound;
- Direct discharge to groundwater;
- Seawater used for cooling


BP

CSBP and direct discharge of fertilizer waste into Cockburn Sound

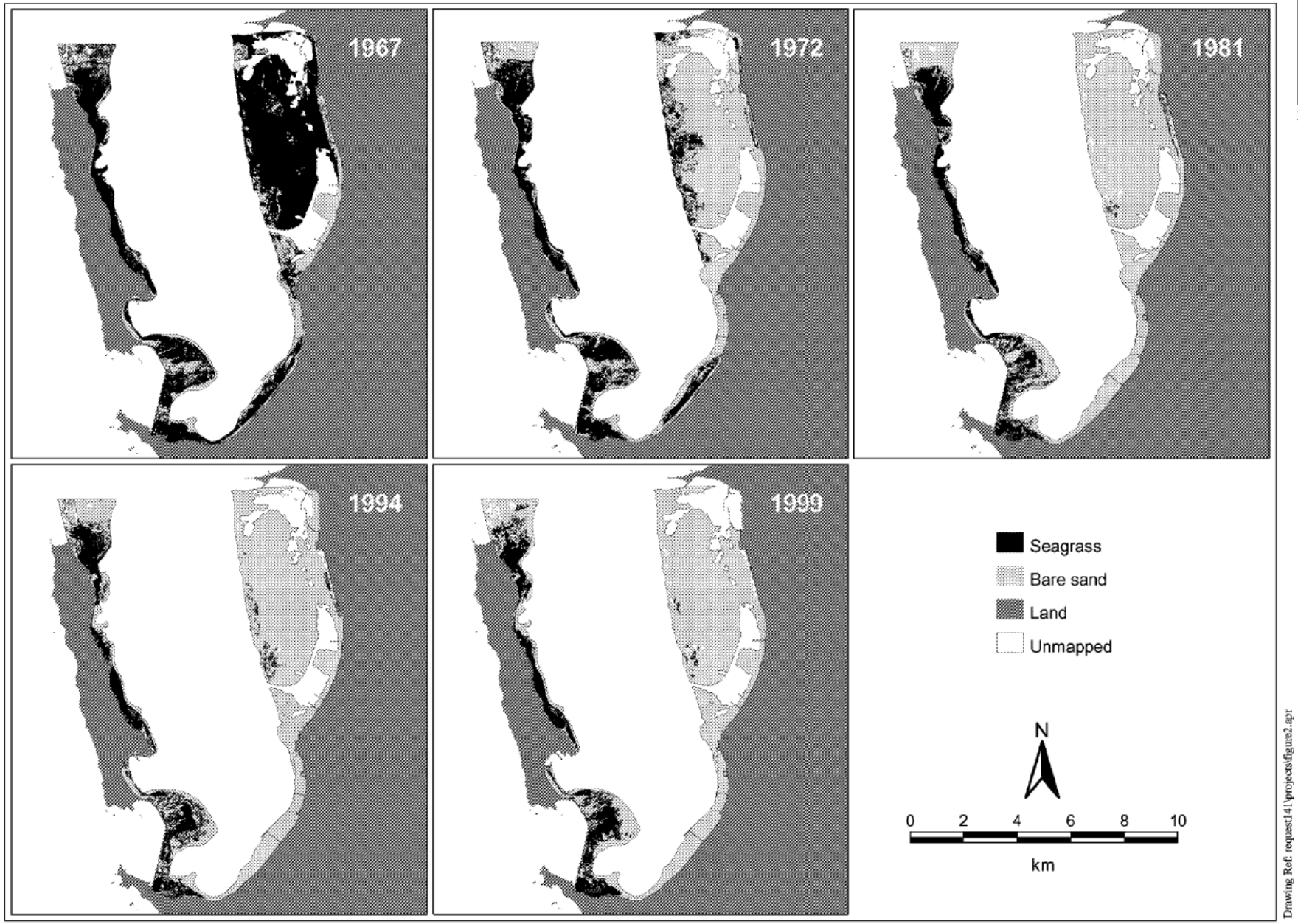


Fig. 2. Distribution of seagrasses in Cockburn Sound in 1967, 1972, 1981, 1994 and 1999.


Island Cafe
Restaurant
BREAKFAST
SCOTTISH
PANCAKES

Some data

- Commercial fishing worth $2 million a year;
- State's most important heavy industrial producing goods worth in excess of $8.7 billion a year;
- Rockingham population has grown from 2,500 to over 140,000 since 1966;
- Over 100 ships a year;
- State's main ship building area - Jervoise Bay
- Lime sands and dredging
- Westport

Protection of seagrass

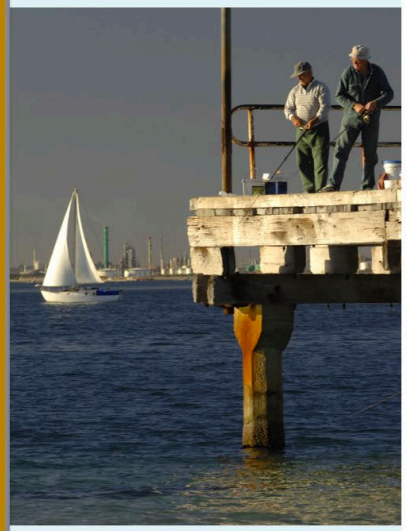
- Key driver of policy for Cockburn Sound
- Chlorophyll a standard needed
  - Controls algal levels

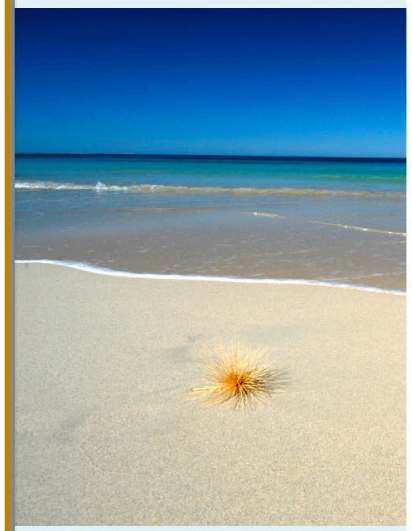
Key aspects of policy

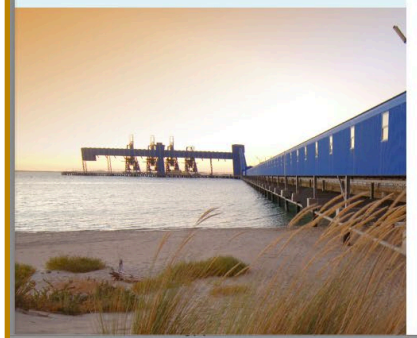
- Levels of protection – not uniform across whole Sound
  - Three levels of protection proposed
    - High
    - Moderate
    - Low
- What Chlorophyll a levels to apply to each level
- Where to apply the three levels

Chlorophyll a guidelines

- Originally proposed
  - High protection – 0.802; and
  - Moderate protection – 1.031.
- Industry argued
  - 1.2 to apply to both the High and Moderate
- Final
  - High protection – 0.8; and
  - Moderate protection – 1.3





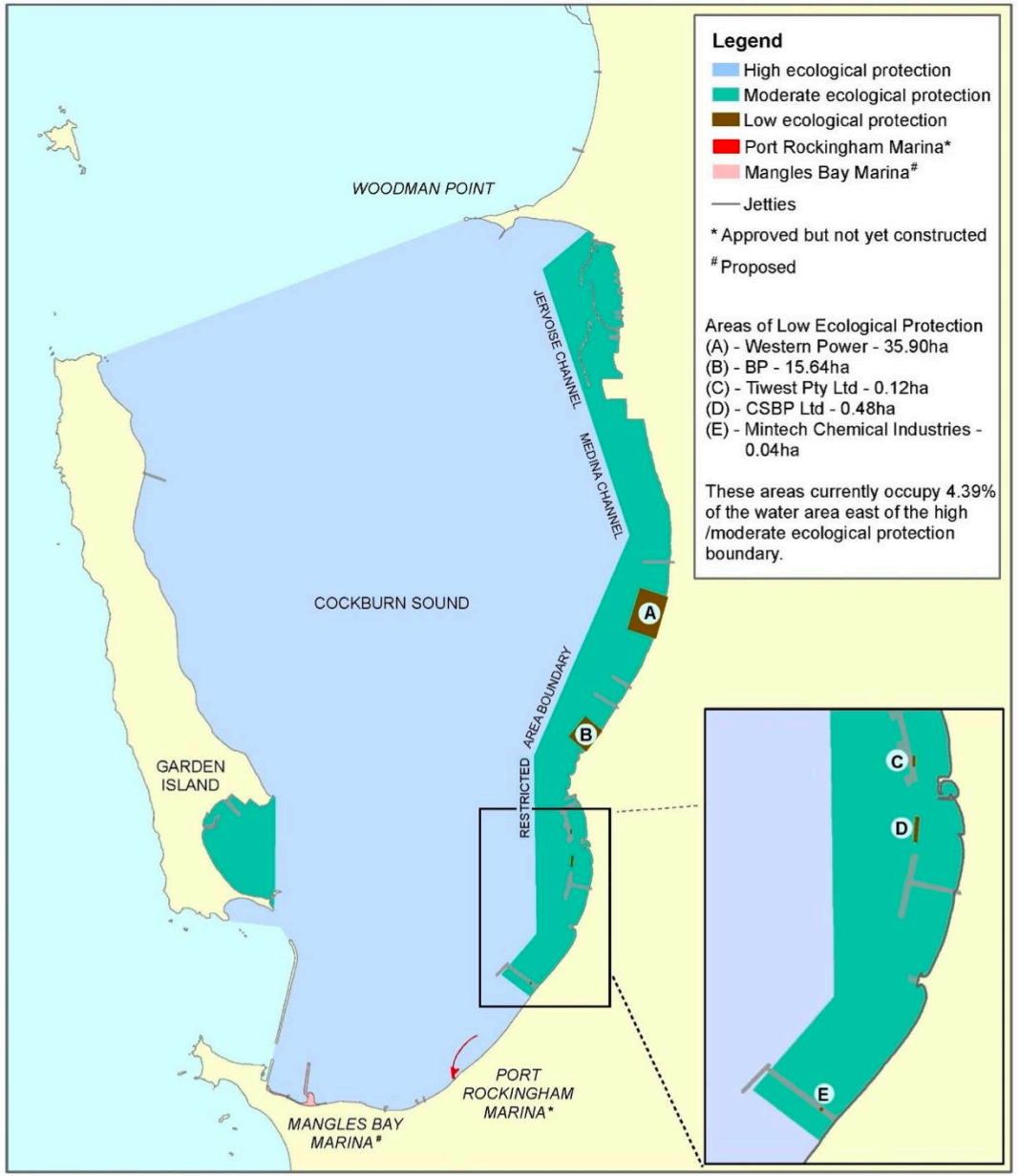


State Environmental (Cockburn Sound) Policy 2015

Perth, Western Australia

2015

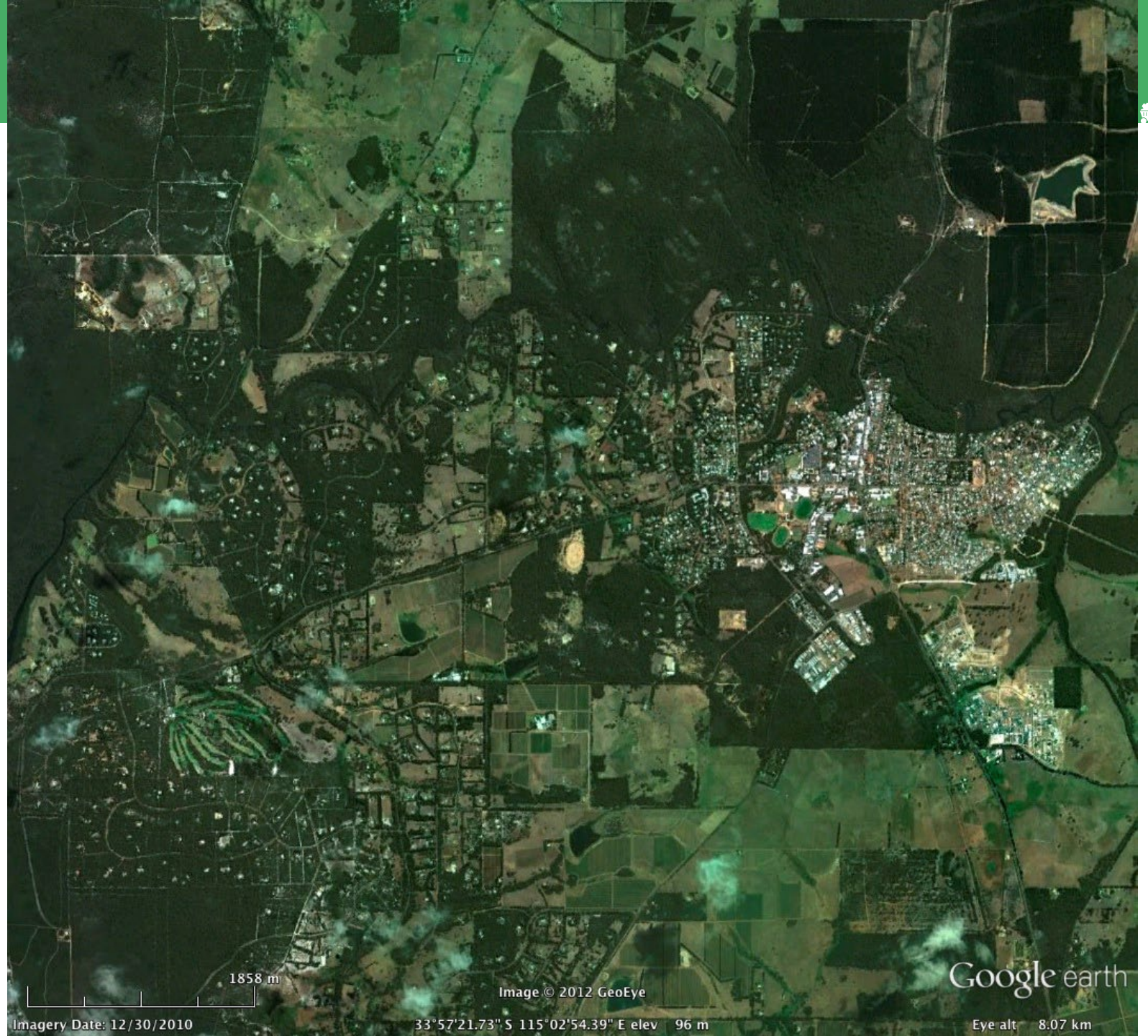
Schedule 2 – High, Moderate and Low Ecological Protection Areas in Cockburn Sound



Vasse coal mine and community protest


Vasse Hwy
104
10
Bussel Hwy
© 2012 Cnes / Spot Image
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2012 Whereis® Sensis Pty Ltd
14.0 km
Google earth
33°58'37.25" S 115°12'07.55" E elev 103 m
Eye alt 60.02 km


Woodlands Rd
Metricup Rd
Caves Rd
© 2012 Whereis® Sensis Pty Ltd
Image © 2012 GeoEye
536 m
Imagery Date: 12/30/2010
33°47'37.23" S 115°02'03.30" E elev 76 m
Eye alt 2.42 km
Google earth


1858 m
Image © 2012 GeoEye
Google earth
Imagery Date: 12/30/2010
33°57'21.73" S 115°02'54.39" E elev 96 m
Eye alt 8.07 km

Some data

- Population 14,000
- Shire growth rate 15%
- Town growth rate 20%
- 30% of population transient workers (seasonal)
- Huge influx of tourists in summer


268 m
Image © 2012 GeoEye
Google earth
Imagery Date: 2 Imagery Date: 12/30/2010
33°56'52.35" S 115°01'42.69" E elev 49 m
Eye alt 1.24 km

The proposal

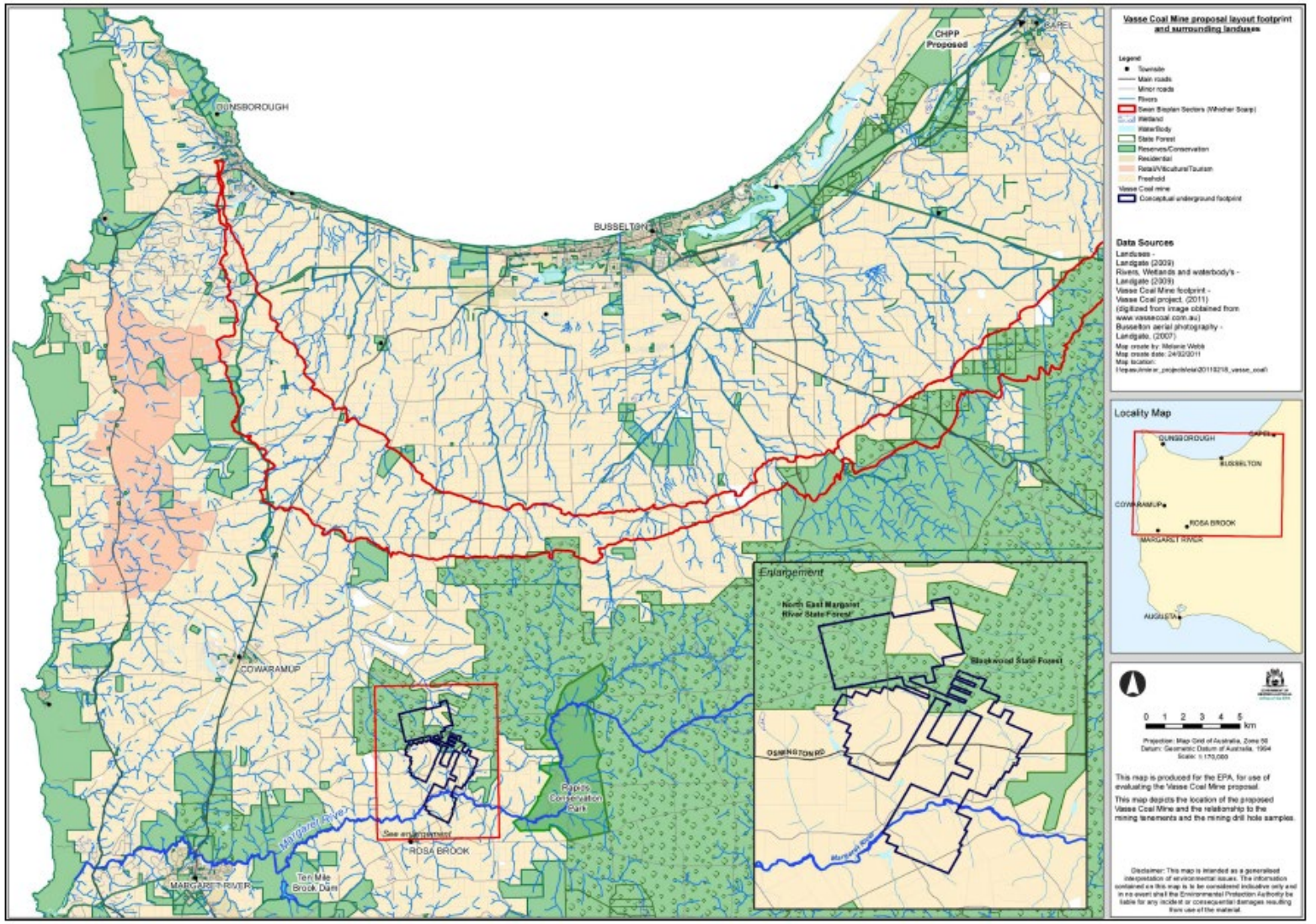


Figure 1: Regional location

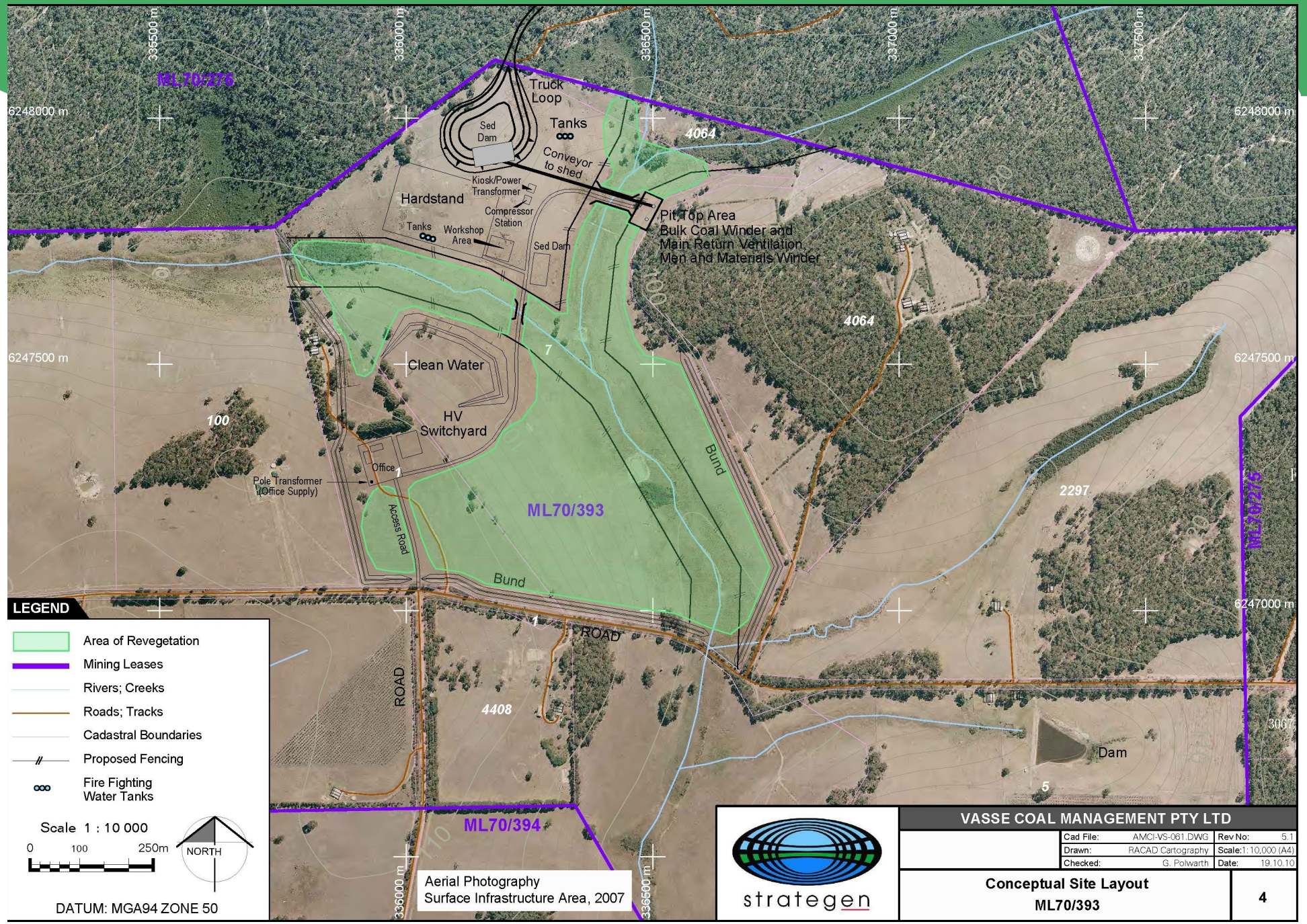

ML70/276
ML70/393
ML70/394
ML70/275
Truck Loop
Sed Dam
Tanks
Conveyor to shed
Kiosk/Power Transformer
Hardstand
Compressor Station
Tanks
Workshop Area
Sed Dam
Pit Top Area
Bulk Coal Winder and
Main Return Ventilation,
Men and Materials Winder
Clean Water
HV Switchyard
Office
Pole Transformer (Office Supply)
Access Road
Bund
Bund
ROAD
ROAD
Dam
4064
4064
2297
4408
100
7
1
5
6248000 m
6247500 m
6247000 m
336500 m
337000 m
337500 m
LEGEND
Area of Revegetation
Mining Leases
Rivers; Creeks
Roads; Tracks
Cadastral Boundaries
Proposed Fencing
Fire Fighting Water Tanks
Scale 1 : 10 000
0 100 250m
NORTH
DATUM: MGA94 ZONE 50
Aerial Photography
Surface Infrastructure Area, 2007
stategen
VASSE COAL MANAGEMENT PTY LTD
Cad File: AMCI-VS-061.DWG
Rev No: 5.1
Drawn: RACAD Cartography
Scale: 1:10,000 (A4)
Checked: G. Polwarth
Date: 19.10.10
Conceptual Site Layout
ML70/393
4

Table 1: Summary of key proposal characteristics

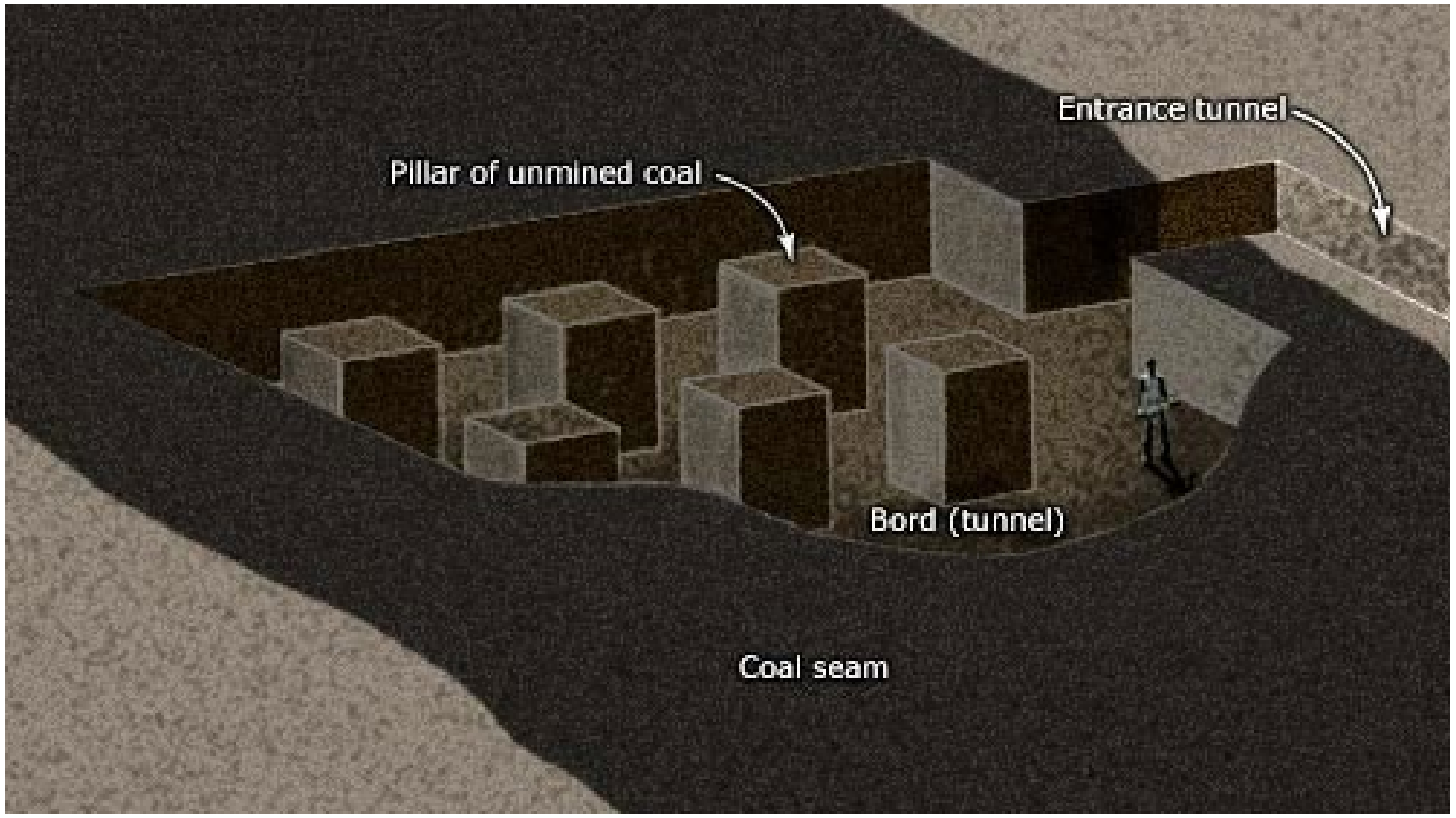
Element	Description
General	
Project Life	15 – 20 years
Area of disturbance	Disturbance required (including vegetation clearing): • Surface mine, 20 – 40 ha • Underground mine, approx. 1200 ha • Coal Handling and Preparation Plant (CHPP), area not specified • Transport route, 112 ha
Resource	Osmington Seam of the Sue Coal Measures, 160 – 500 m underground
Mining/Processing	
Type/rate	Underground bord and pillar mining of 1.0 – 1.5 Mt/a of ROM coal
Processing	ROM coal at the CHPP at Capel
Infrastructure	
Material transportation	Via truck from the mine site through State Forest to the CHPP at Capel, then via road/rail from the CHPP to the Port of Bunbury
Site access	Via Osmington Road
Supporting infrastructure	• Water bores • Water dams • Mine pump-out treatment facility • Enclosed conveyors • Truck loop • Land bridges • Workshop and hardstand • Surge bin

Abbreviations:

approx.	approximately	Mt/a	million tonnes per annum
ha	hectare	ROM	run of mine
m	metre		

Project details

- Employ 225 directly
- up to 800 additional jobs



http://www.teara.govt.nz/files/di7445enz.jpg

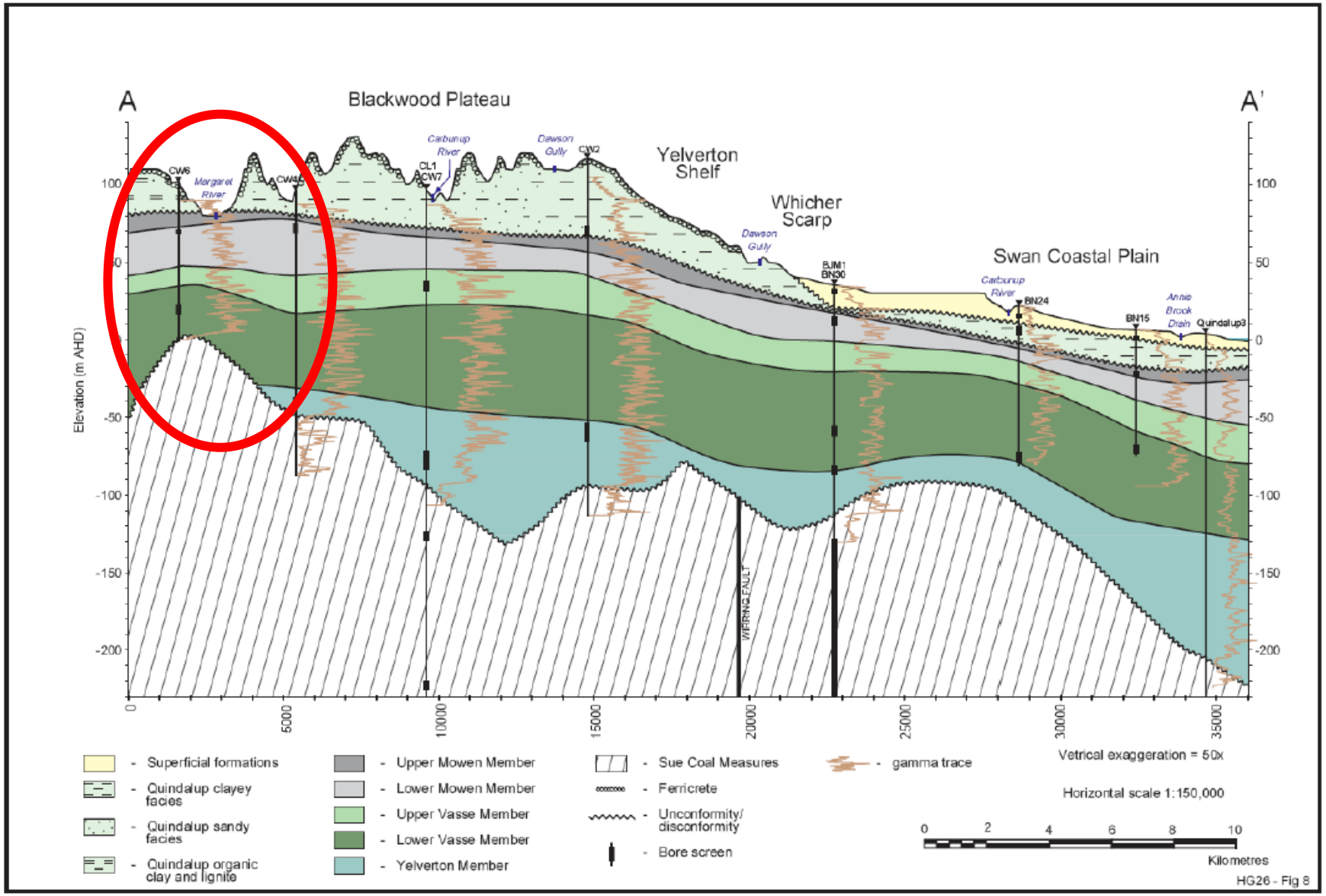


Figure 8 Stratigraphical cross-section A–A'

The No Coal!tion Margaret River

Opposing Coal Mining In Margaret River and Australia's far South West

MARGARET RIVER - TOO BEAUTIFUL TO UNDERMINE

About

Welcome

Please explore our site and help the NO COAL!tion campaign save the beautiful environment of Western Australia's South West Capes region from disruption and pollution by proposed coal mining.

Search

Pages

- About
- BLOG
- Coal Issues
  - Environmental
  - Facts about coal
  - Facts in brief
  - Health Concerns
  - Water used to process coal
- Contact Us
- Donate
- Events
- Fragile Hydrology
- Margaret River
  - Art & Craft Centre of Excellence
  - Surfing and Aquatic Playground
  - World Icon Tourism Region
  - World Ranked Wine Region
- News
- Proposed Mine
  - First Mine Site
  - Location and Resource
  - OWNERS

- Contact Us
- Clean South West Beaches


SAY
NO!
TO COAL MINES IN
MARGARET RIVER


NO


"THE ROAD
TO HELL
IS
PAVED
WITH COAL"


NO

API Category B

- Environmentally unacceptable
- Vasse Coal Management's Vasse Coal Proposal
- LoA set 21st March 2011

ENVIRONMENTAL PROTECTION AUTHORITY

Level of Assessment for Vasse Coal Management's Vasse Coal Proposal

EPA assessment

It is the EPA's opinion that the key environmental factor relevant to the proposal that requires evaluation is the surface and ground water and the environmental and social values that these water resources support.

In conclusion, it is the EPA's judgement that should the proposal be implemented, the serious risks to important environmental values in the Margaret River region, especially surface and groundwater and the consequential impacts on the social surroundings, render this proposal environmentally unacceptable.

- ground water dependent ecosystems; and
- threatened fauna,

as well as other beneficial uses including:

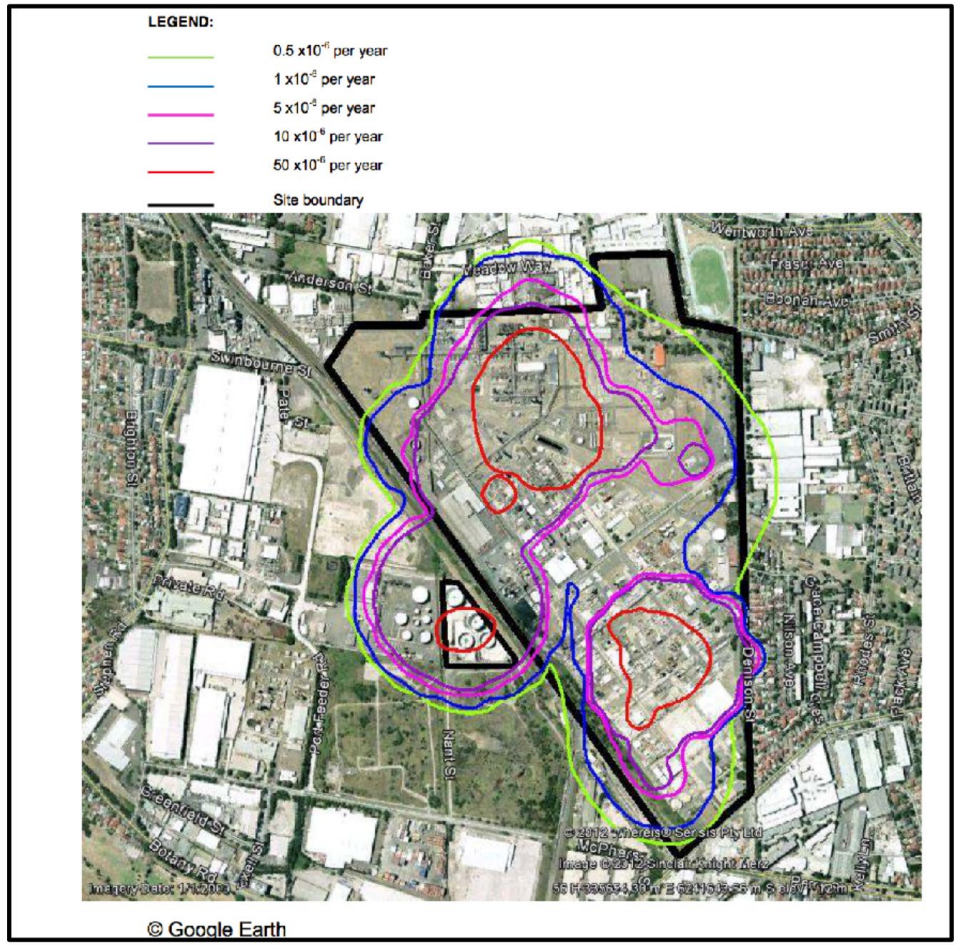
- potable water supply;
- water for stock and agri/viticulture; and
- social surrounds such as recreational activities and aesthetics.

Risk and risk assessment

- The questions
  - What impacts need to be addressed?
  - What are the consequences if they are not addressed?
  - How likely are those impacts?
- Focus on the impacts with greatest consequences and highest likelihood
  - Consequences and likelihood = risk

Quantitative Risk Assessment

Figure 10.1: Risk contours around the Botany Industrial Park, Matraville in NSW (Source: Sherpa Consulting 2012).



Qualitative Risk Assessment Matrix

		Consequence				
		Insignificant	*Minor*	*Moderate*	*Major*	*Catastrophic*
Likelihood	*Almost certain*	Medium	Medium	High	Extreme	Extreme
	Likely	Low	Medium	High	High	Extreme
	Possible	Low	Medium	Medium	High	High
	Unlikely	Low	Low	Medium	Medium	Medium
	Rare	Low	Low	Low	Low	Medium

WALGA

Public participation principles

Starting points

- We use the word ‘participation’ or ‘engagement’ not ‘consultation’.
- Participation has strong links to democracy and the democratic process
- Participation in decision making fine tunes the democratic process
- “Planners may also come to understand their roles in new ways: to see themselves as not unappreciated scapegoats, distrusted and resented by irate neighbors or developers, but as active facilitators and mediators of public voice; not just as narrow technicians but as technically competent professionals able to listen to conflicting views, mediate between interdependent parties, and negotiate to protect various public interests as well.” (Forester 1994:155)
- Comments?

Unintended consequences of participation

- As Philp (2001) notes:
  - “Power begats participation … participation in the pursuit of interest may lead to corrupt behaviour which suborns those holding office”

Stakeholders

Benefits of stakeholder engagement

- Several reasons (Philp, M. (2001). "Access, Accountability and Authority: Corruption and the democratic process." Crime, Law and Social Change 36(4): 357-377.) and The Environment and Natural Resources Foundation
- Part of democratic process – maybe a requirement;
- Accountability of decision-makers – avoids corruption;
- Provides access to information as part of decision making;
- Improves decision making – the public know stuff;
- Decisions should reflect community needs and values – engage them
- Community often important in implementation and enforcement – community 'ownership'
- Adds to political legitimacy
- Restores public trust
- Leads to social and technical learning which will help manage and reduce any conflict

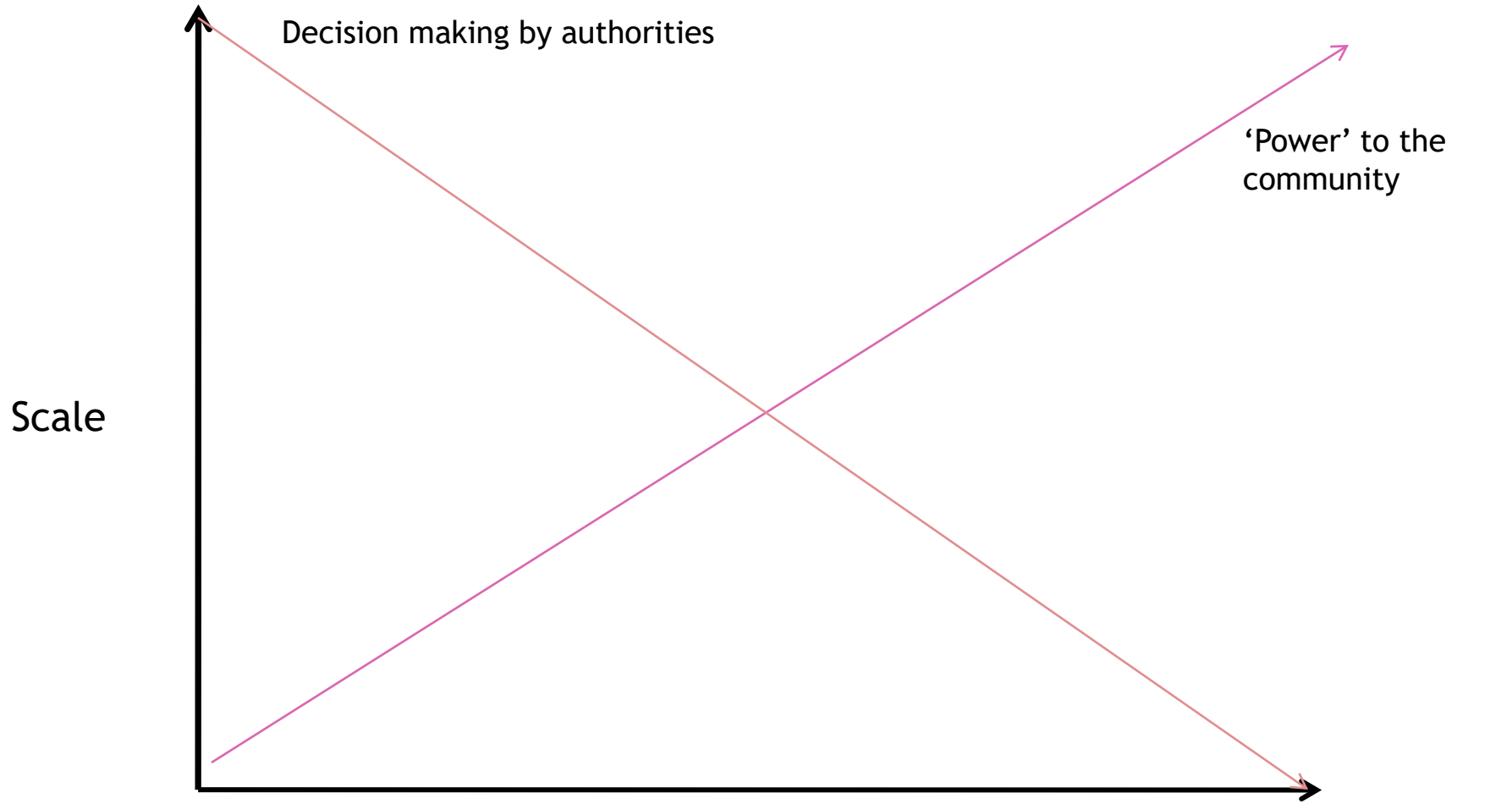
What do stakeholders want?

- Knowledge of the project/issue
- Clarity (timing and activities) on the proposed works
- How they might be affected by the proposed project
- Have their views acknowledged and taking into account
- Respect
- Truth

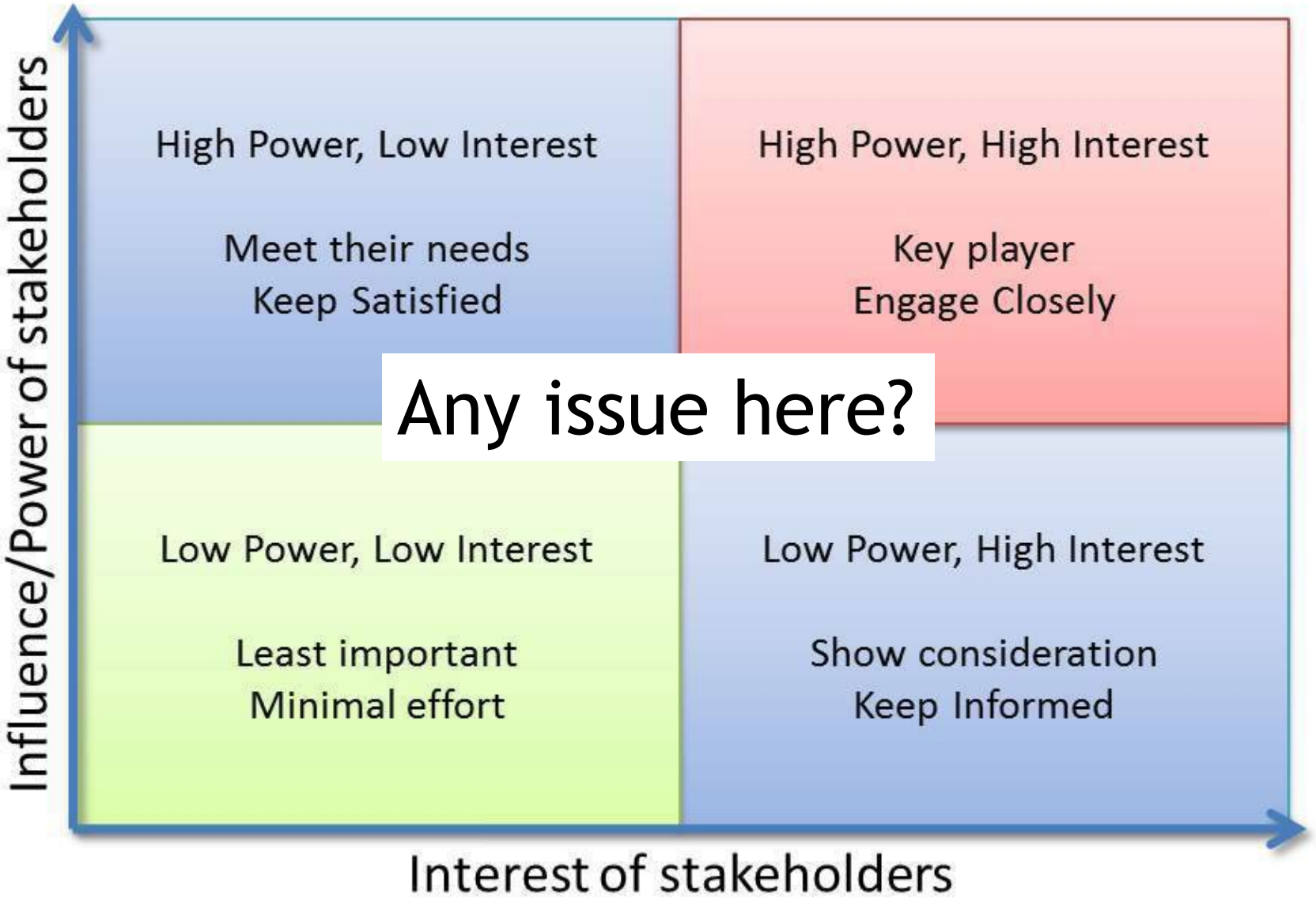
What are stakeholders concerns?

Changes or threats to:

- Livelihood
- Personal health
- Threats to cultural or racial identity
- Threats to community culture or history
- Recreational activity
- Property values
- Economic vitality
- Environmental degradation
- Inconvenience
- Restricted freedom


Decision making by authorities
‘Power’ to the community
Scale
Inform
listen to views
delegate decision making

Stakeholder classification

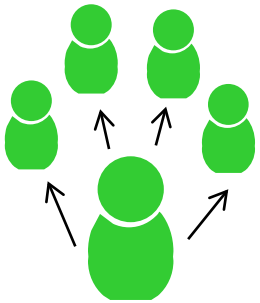


Any issue here?

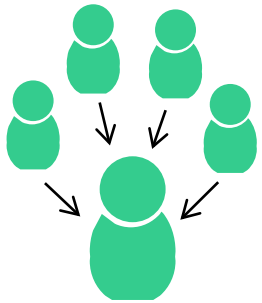
Engagement and influence

IAP2 Spectrum of Public Participation

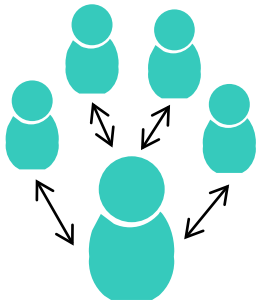
Inform



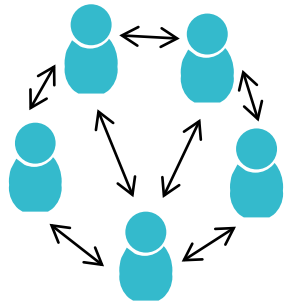
Consult



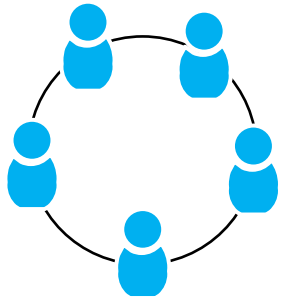
Involve



Collaborate



Empower



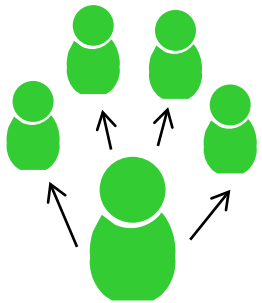
Outcome 7: Identify the principles of stakeholder engagement

Engagement and influence - inform

IAP2 Spectrum of Public Participation

Public Participation Goal	Promise to the Public	Example Techniques
To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions	We will keep you informed	• Fact sheets • Web sites • Open houses

Inform



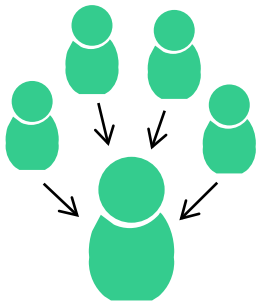
Outcome 7: Identify the principles of stakeholder engagement

Engagement and influence - consult

IAP2 Spectrum of Public Participation

Public Participation Goal	Promise to the Public	Example Techniques
To obtain public feedback on analysis, alternatives and/or decisions	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how public input influenced the decision	• Public comment • Focus groups • Surveys • Public meetings

Consult

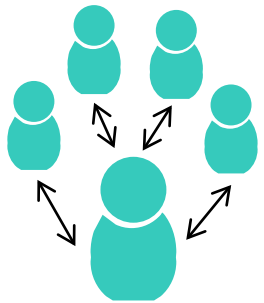


Engagement and influence - involve

IAP2 Spectrum of Public Participation

Public Participation Goal	Promise to the Public	Example Techniques
To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision	• Workshops • Deliberate polling

Involve

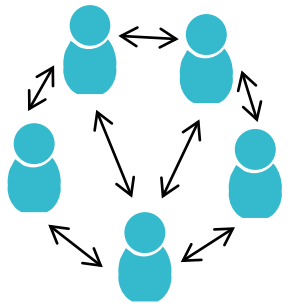


Engagement and influence - collaborate

IAP2 Spectrum of Public Participation

Public Participation Goal	Promise to the Public	Example Techniques
To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution	We will look to you for advice and innovation in formulating solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible	• Citizen advisory committees • Consensus building • Participatory decision-making

Collaborate

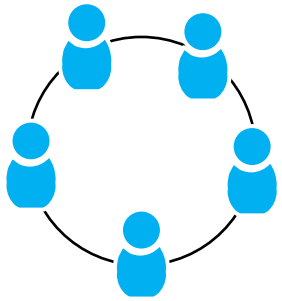


Engagement and influence - empower

IAP2 Spectrum of Public Participation

Public Participation Goal	Promise to the Public	Example Techniques
To place final decision-making in the hands of the public	We will implement what you decide	• Citizen juries • Ballots • Delegated decision

Empower



Healey's participative table

8	Citizen control	Degrees of citizen power	Control over decisions and agenda
7	Delegated Power		Delegated decision making
6	Partnership		Shared decision making
5	Placation	Degrees of tokenism	Consultation with on-going efforts made to deal with concerns
4	Consultation		Seeking input on proposals
3	Informing		Providing information on proposals
2	Therapy	Non participation	Dealing with concerns after decision making
1	Manipulation		Deliberately working to change the pubic view on a problem

Principles of Stakeholder Engagement

- Communication – must be open, accessible, clearly defined, two-way and appropriate
- Transparency – process and outcomes of community and stakeholder engagement should, wherever possible, be made open and transparent, agreed upon and documented
- Collaboration – a cooperative and collaborative approach to seek mutually beneficial outcomes
- Inclusiveness – identifying and involving communities and stakeholders early and throughout the process, in an appropriate manner
- Integrity – should establish and foster mutual trust and respect.

In Mining Proposal Guidelines 2016 – adapted from the Ministerial Council on Mineral and Petroleum Resources (MCMPR) Principles for Engagement with Communities and Stakeholders (2005)

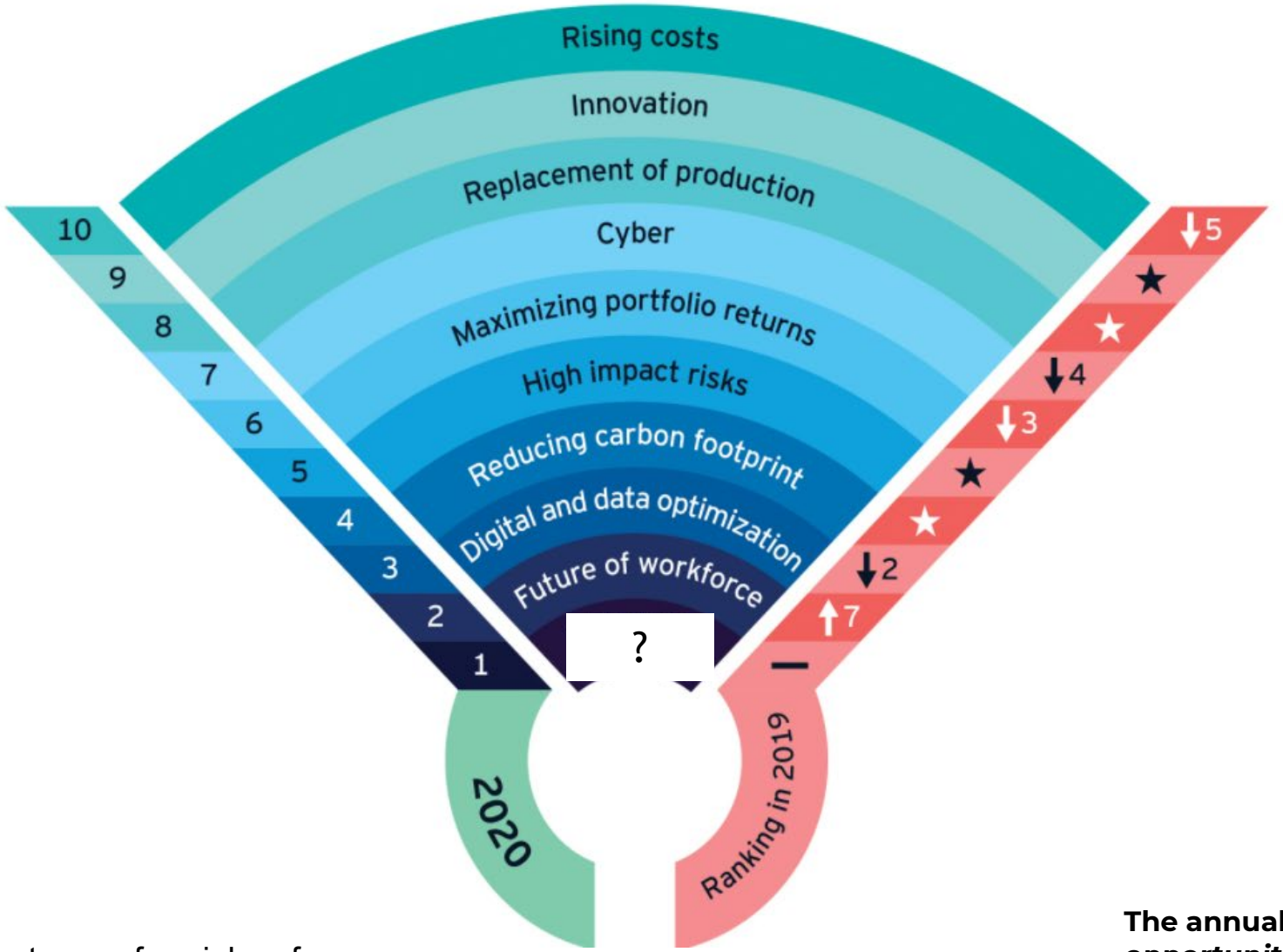
Barriers To Successful Engagement

- Contested or divided community (highly likely)
- Time
- Community may have limited literacy
- Cultural barriers
- ‘Hard to reach groups’ (youth, elderly or socially excluded groups)
- Cost
- Wrong level of engagement

Outcome of good community engagement

- Social licence to operate

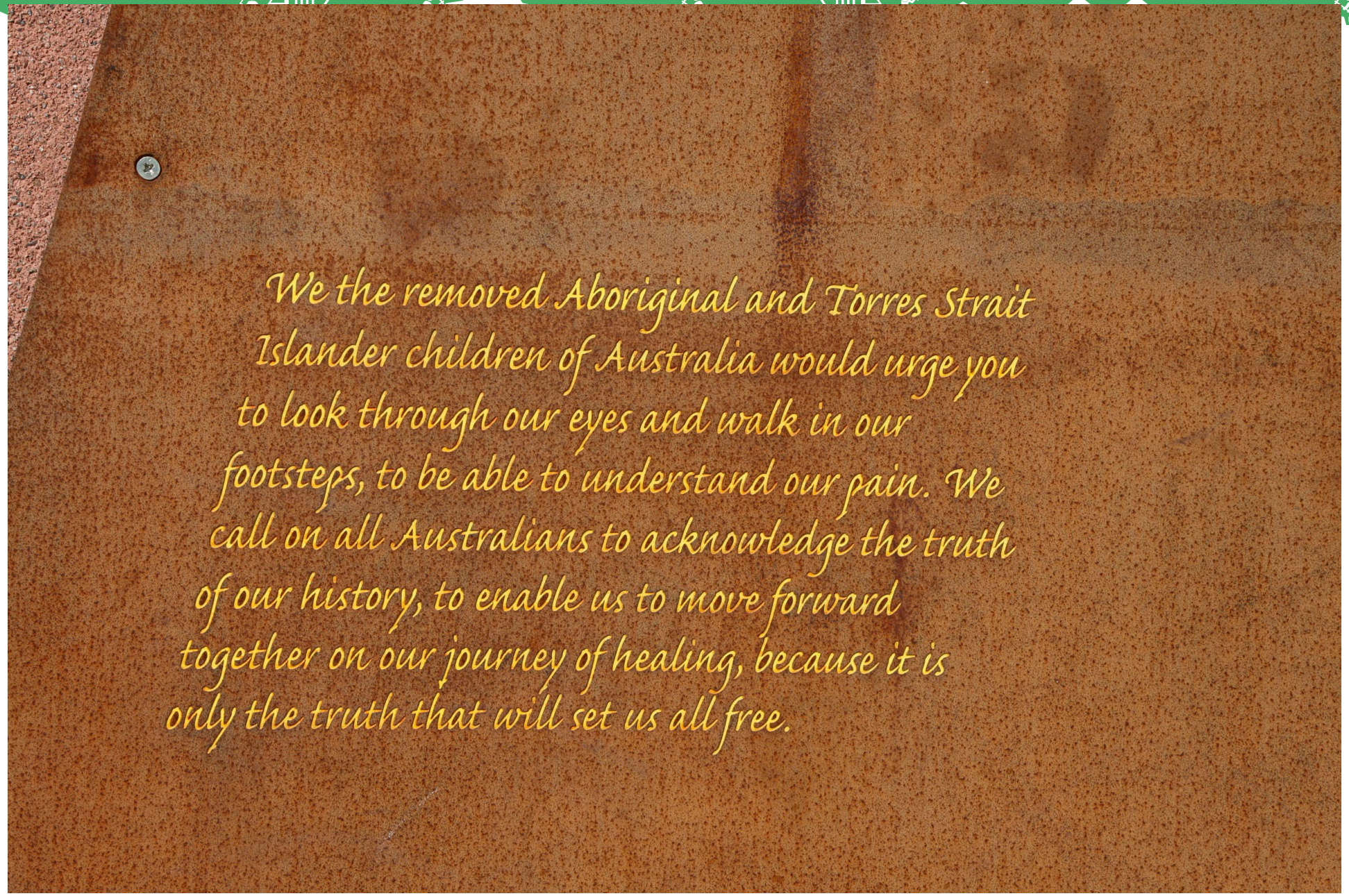
What is the number one risk facing mining and metals in 2020?



Outcome 8: Understand the importance of social performance

The annual EY *Top 10 business risks and opportunities — 2021*

Engaging with Traditional Owners



Traditional Owners back on Country – rangers' program

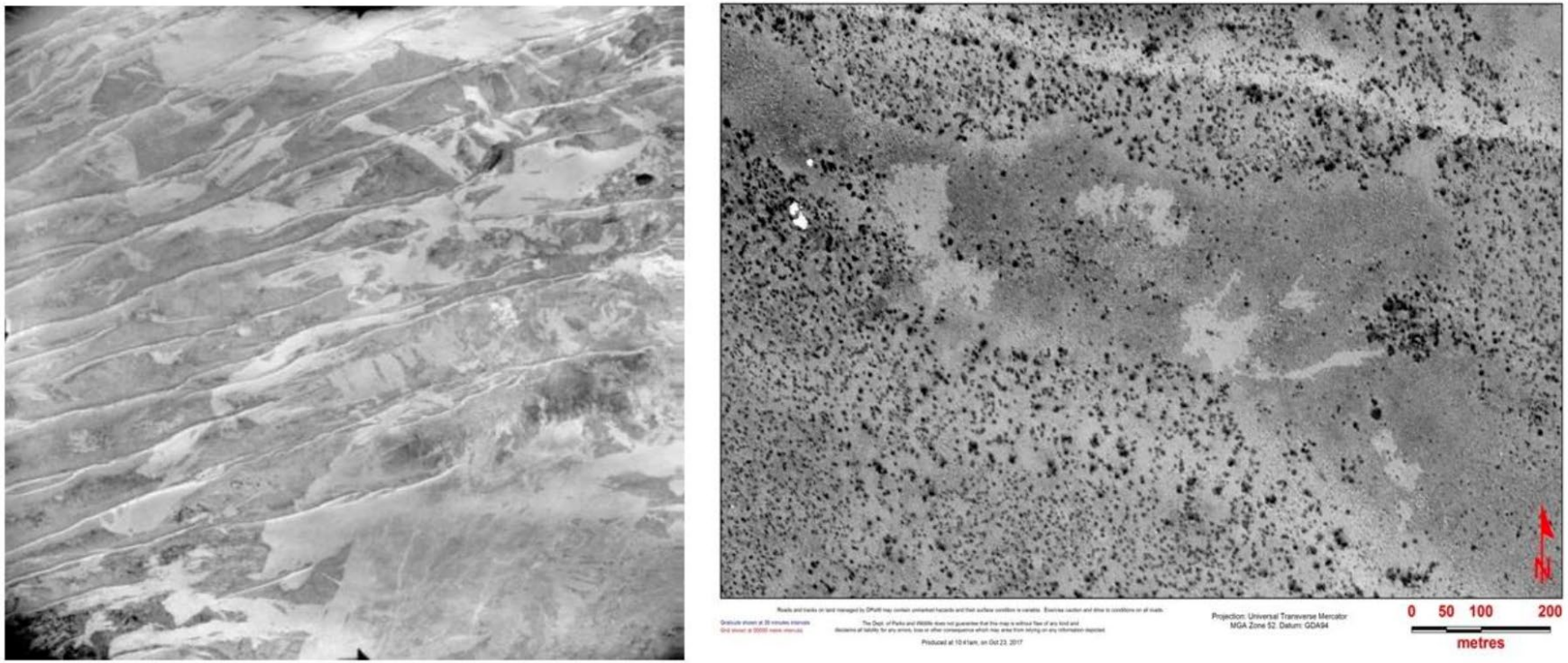
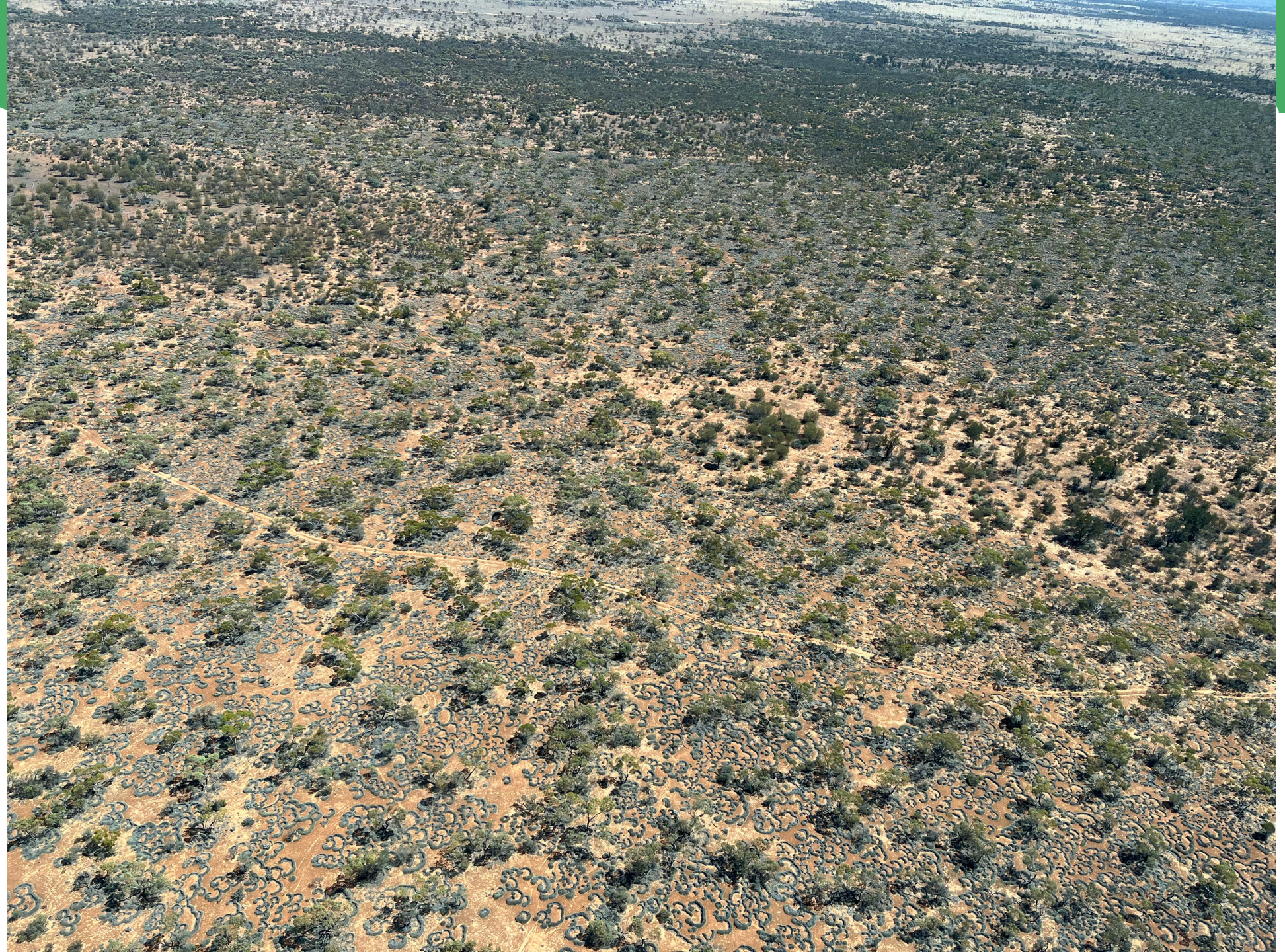


Plate 2: Early aerial photography over the Gibson Desert (1953) (L) and GVD (1960) (R) revealing fine-scale Aboriginal burning patterns (light areas).




Symbolic of poor participation??

The end ……