SEAF for the Pilbara, Western Australia

Report excerpt from:
A Shared Environmental Analytics Facility (SEAF) Feasibility Study
September 2023

The Western Australian Biodiversity Science Institute

Western Australian Marine Science Institution

Prepared by The Western Australian Biodiversity Science Institute (WABSI) and the Western Australian Marine Science Institution (WAMSI)

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SEAF for the Pilbara (Chapter 5) is an excerpt from a larger report and needs to be considered in the context of the full SEAF Feasibility Study published by WABSI and WAMSI.

The SEAF Feasibility Study is part of a suite of work in biodiversity data and information management undertaken by WABSI and WAMSI. More information at www.wabsi.org.au and www.wamsi.org.au

Funded by the Western Australian Government's Department of Jobs, Tourism, Science and Innovation and supported by WABSI and WAMSI partners.

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Foreword

A Shared Environmental Analytics Facility (SEAF) Feasibility Study progresses work in biodiversity data and information management undertaken by WABSI and WAMSI to demonstrate how co-ordinated and shared environmental analysis and reporting will support nature positive outcomes.

The study was developed over 8 months from August 2022 to April 2023 in consultation with more than 50 stakeholder groups, through funding from the Department of Jobs, Tourism, Science, and Innovation and with governance provided by a joint WABSI and WAMSI Board Sub-Committee.

Following the publication in 2021 of a high-level SEAF design and roadmap, the Feasibility Study progresses the work through:

1. Further refinement of the quantitative and qualitative value proposition;
2. Demonstration of the products, services and scientific application for SEAF customers;
3. Articulation of the further details for a suitable and scalable technology solution; and
4. Development of a high-level implementation roadmap for priority regions - Cockburn Sound, and the Pilbara, and the supporting SEAF Hub.

We acknowledge the contributions of Microsoft, AECOM and BMT in assistance with developing a creative approach to address the governance, economic, legal, environmental and technical challenges posed in developing a roadmap to progress shared environmental analytics from a project based ‘bespoke’ model, to a shared operational model that is ‘robust, repeatable and sustainable’.

Our thanks to Professor Matthew Tonts, Chair of the SEAF Advisory Committee and Chair of the Western Australian Environmental Protection Authority, and to members of the SEAF Advisory Committee for their continued advice.

Professor Owen T. Nevin, Chief Executive Officer, WABSI and Dr Luke Twomey, Chief Executive Officer, WAMSI

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SEAF for the Pilbara

An excerpt from the SEAF Feasibility Study: This document contains Chapter 5 and Chapter 6

5a. Executive summary

The Pilbara: A regional SEAF spoke supported by a central hub

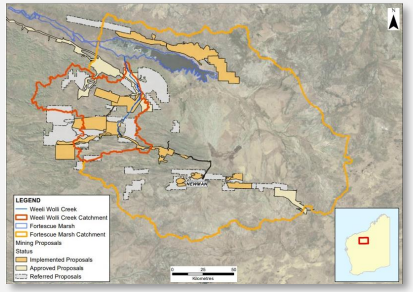
A SEAF regional spoke in the Pilbara will enhance environmental outcomes for the region and stakeholders and also generate significant value of quantifiable benefits

The *why*: Pilbara regional context

The Pilbara region is immensely important to the Australian both economically and culturally. It accounts for 78% of state and 32% of national export revenue (FY 20/21) and has extensive Native Title.

The region has a complex array of mines, processing plants, ports, and linear infrastructure with interdependency and cumulative impact on the landscape which threatens species.

Creating, assessing and approving environmental approvals for further Pilbara development are subsequently challenging due to the region's existing environmental impacts and significant cultural heritage value.

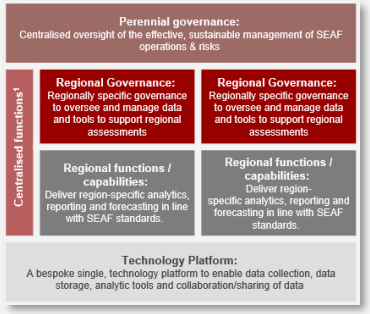


The *how*: The SEAF in action

The Shared Environmental Analytics Facility (SEAF) is an independent and objective entity with a lean operating model to support development of regional analytics and assessments.

The SEAF bridges the gap between existing open and shared environmental data sources and privately acquired data (e.g., proponent environmental data) through the introduction of a 'collaboration zone' on a bespoke and shared technology platform.

Development of user driven products and science needs to support Pilbara specific environmental challenges, e.g., Integrated Catchment Scale Groundwater Modelling.

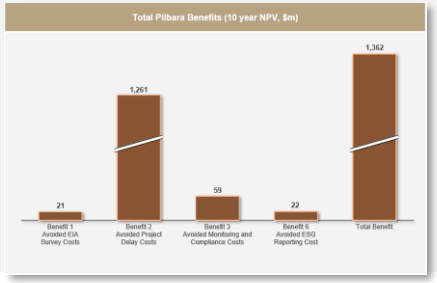


The *outcome*: Benefits for the Pilbara

The development of **regionally specific products and science** outcomes including:

- Regional Map of Flora, Vegetation, Fauna Habitat, and Fauna Distribution
- Regional Flora Species Habitat Suitability Model
- Regional Fauna Habitat Connectivity Map/Model
- Population Viability Model
- Integrated Groundwater Dataset
- Integrated Catchment Scale Groundwater Modelling

The above products and outputs are expected to realise **$1.4Bn Net Present Value (NPV)** in quantified benefits over 10 years, with significant additional environmental, social and commercial benefits.



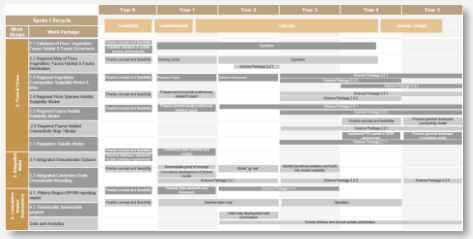
The *when*: Implementation timing and approach

An implementation plan has been established to appropriately sequence the development of the tailored regional products and science enhancements over a 6-year period.

Work have been co-developed and validated with stakeholders to ensure the outcomes and timing of each work package meets Pilbara stakeholder needs.

Indicative costings for the program components across the 6-year implementation plan are:

- Product : ~$16.3m
- Science : ~$17.5m
- **Total: ~$33.8m**



5b. Pilbara: Regional background and context

The Pilbara region is immensely important to Australia economically and culturally, which has resulted in a high cumulative impact to the environment

Why the Pilbara?

- The Pilbara region is immensely important to the Australian economy, accounting for 78% of state and 32% of national export revenue (FY 20/21)
- The region has significant iron ore and LNG production, with ongoing expansion in critical minerals and renewable energy, and modernisation of associated infrastructure.
- It has a complex array of mines, processing plants, ports and linear infrastructure with interdependency and cumulative impact on the landscape and on threatened species.
- The Pilbara has high cultural heritage value and extensive Native Title.
- Environmental approvals for further development in the Pilbara are challenging due to the region's existing environmental impacts and high cultural heritage value.

Pilbara investment pipeline

https://www.pdc.wa.gov.au/Profiles/pdc/Assets/ClientData/Documents/PDC_Investment_Snapshot_June_2021_Final_PDF.pdf

Ongoing mining developments place complex, cumulative pressures on the environment – an example being Weeli Wolli Creek

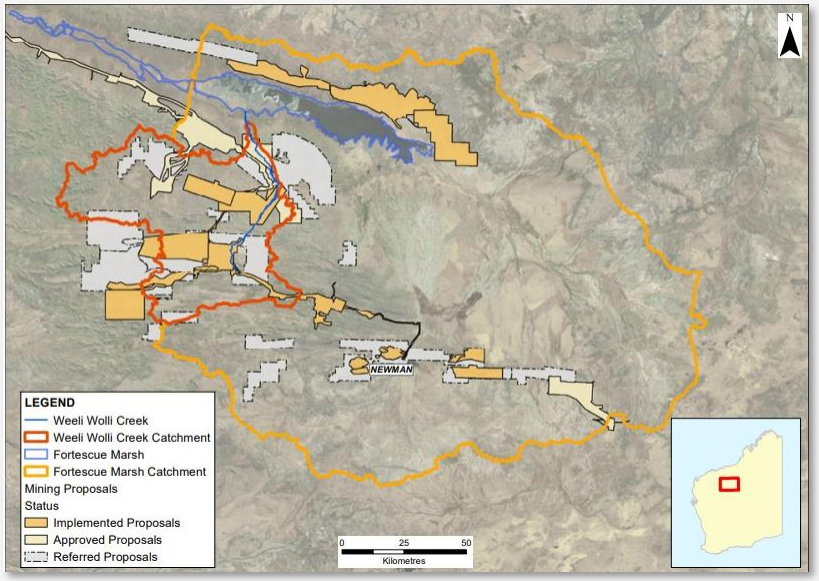
Complexity in one sector, one factor, one sub-region

New development pressure on an impacted system

- The Weeli Wolli Creek catchment contains extensive iron ore deposits with increasing development from multiple proponents as summarised by the Environmental Protection Authority (EPA).
- The wetland community is listed as a Priority 1 Ecological Community (DBCA) and has heritage significance with the area's permanent pools and large trees valued by its Traditional Owners - the Banyjima and Nyiyaparli peoples.
- Weeli Wolli Creek drains into Fortescue Marsh, a nationally important wetland.
- Before mining, groundwater flowed to the northeast, towards the spring; groundwater flow upstream of the spring is now towards the mine.
- Major infrastructure development proposed for the next decade will have complex and interdependent interactions with groundwater, creek flows and groundwater dependent ecosystems.

It is important to consider how future mining proposals may impact environmental values and interact with existing impacts to avoid risk to the ecosystem. (EPA 2018)

Pilbara mine development - Weeli Wolli Creek



https://www.epa.wa.gov.au/sites/default/files/Publications/Weeli%20Wolli%20evaluation%20report%2014-02-18c.pdf

Collective efforts are required to understand the contemporary state of Pilbara's environment and the pressures upon it to aid the environment and proponents alike

Why shared environmental analytics in the Pilbara?

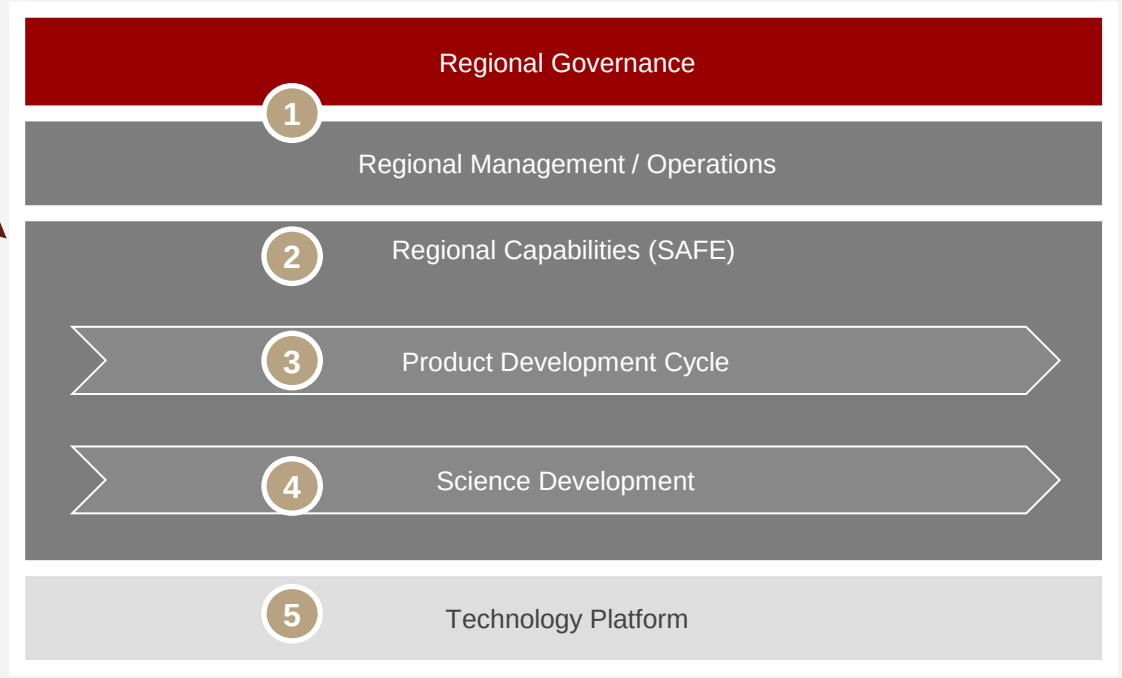
- Recent changes to the WA Environmental Protection Act require cumulative impact assessment for new developments, evaluating both historic and foreseeable impacts.
- Without collective efforts to maintain a contemporary evaluation of the state of the Pilbara's environment and the pressures upon it, the costs and timeframes for new development approvals will significantly increase.
- It is necessary to balance economic development with environmental and cultural heritage conservation to ensure sustainable growth in the Pilbara region.
- Complex land tenure and short-range endemism add to complexity; there are 15 native title claims, more than dozens of mining leases and dozens of protected areas in the Pilbara region.

SEAF Pilbara stakeholder feedback

- A Shared Environmental Analytics Facility would deliver real tangible benefits, delivering improved outcomes for environment, community and business.
- This could be enabled by establishing regional data sharing and predictive models (across various aspects, groundwater, biodiversity) solution to support catchment/regional scale planning and management for the Pilbara.
- This approach isn’t just “nice to have”, it is necessary for the future sustainability of the region.

The SEAF is an independent facility to deliver regional environmental reporting and decision support

SEAF: Regional spoke conceptual model



Overview of SEAF components

1. **Management and governance:** Customers, product delivery; policy, legislative standards and requirements; oversight

2. **Data and analytics:**
   - Data from diverse sources
   - Private/ collaborative/ constrained data and analytics
   - Validated analytic tools, improved over time – science feedback loop
   - Robust, repeatable and transparent

3. **Products:**
   - Reporting, decision support, prediction
   - For industry, government, community

4. **Science:**
   - Pipeline from science to operations and back
   - Science underpinning dependencies and impacts, enabling continuous improvement

5. **Platform**: Open source, cloud based, scalable, access controls for diverse users

A SEAF for the Pilbara is distinctive because it is:

Shared

- **Open** - to industry, regulators, Traditional Owners, researchers and the community
- **Inclusive** – not competitive – with other data and analytics capabilities
- **Linked** – to national research capability, ensuring ongoing continuous improvement

Operational

- Designed through **extensive, ongoing consultation** with industry, government, Indigenous and community groups and scientific experts
- Built to meet user needs - **secure, scalable, robust and sustainable**

Integrated

- Offering all the data and analytics - local, national and international – that users need **in one place**
- Supports decisions, forecasting and diverse reporting – on a **company footprint and regional scale**
- Offers **open, collaborative and private** data and analysis zones – and **dynamic interchange** between zones

Independent

- Includes – but **independent** from – industry, government and research
- It is **regional** – remaining close to stakeholders

SEAF builds on the culture of data sharing in WA

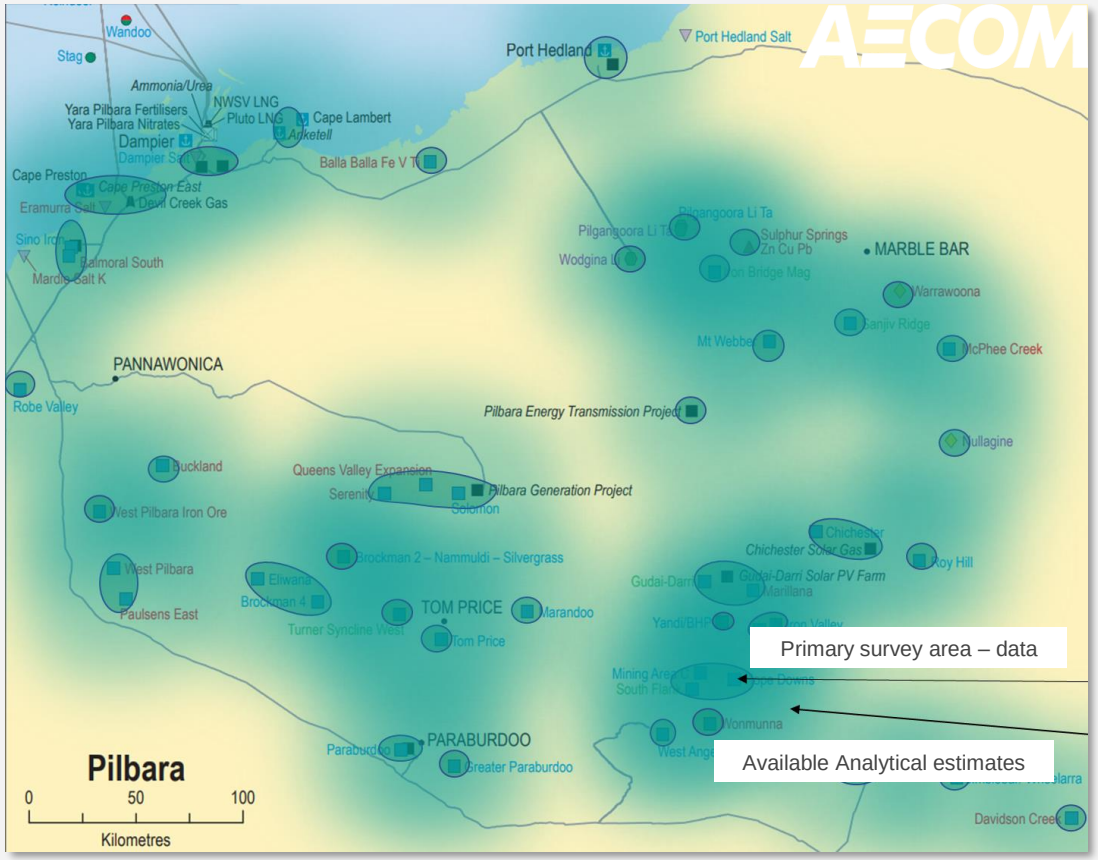
Historical data sharing

IBSA in the Pilbara

- $40M of Biodiversity survey effort captured by IBSA annually
- 25% – 50% of this effort is expended in the Pilbara region
- 90% of survey effort is expended by industry
- Data-richness is highly skewed towards development areas
- Limited knowledge and survey effort of the environmental values outside development areas and conservation estate
- Areas with high levels of uncertainty persist

Environmental data and knowledge is isolated to capital projects in the Pilbara, resulting in high levels of uncertainty in the region as a whole

Regional Data



Data richness and uncertainty

- Primary environmental surveys undertaken where economic mineralisation levels occur
- Knowledge of environmental values concentrated where major capital projects are located
- Very little knowledge of the environmental values of the spaces between
- Environmental analytics, including artificial intelligence and machine learning, can extend the area of inference (green shading)
- Areas with high levels of uncertainty persist
- Ground-truthing of the areas of inference and targeted infill can reduce uncertainty

Why shared analytics?

Data

The Pilbara is rich in knowledge in historic data

- **An estimated $10-$15M** of data per year is generated by proponents in support of the Environmental Impact Assessment Process
- This is captured through the Index of **Biodiversity Surveys and Assessments (IBSA)**
- Further data is collected for **monitoring and compliance**
- **Pilbara Region Biological Survey** (2002-2013) provides a baseline regional to underpin future planning and sustainable land-use
- Data-richness is highly skewed towards development areas

There are significant efficiencies to be gained in developing a coordinated multi-client approach to data monitoring in the Pilbara. This has been shown though the current approach to the Murujuga Airshed Model.

Analytics

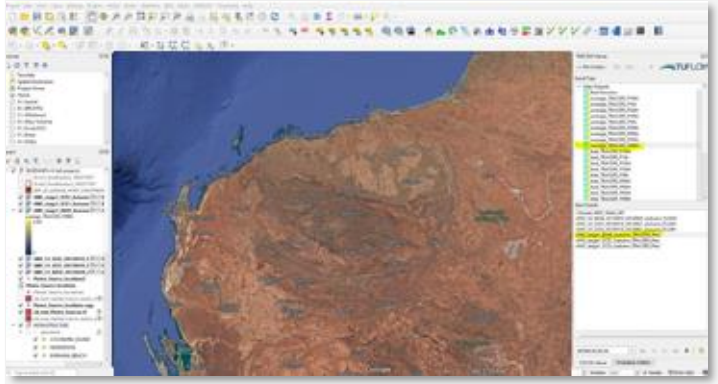
Through investment in science and data science, there are innovative analytics that can be used to forecast cumulative impacts in the Pilbara

- WABSI and its partners have developed a shared data and analytics platform to prove the concept and benefits of shared environmental analytics
- The goal of a cloud-based data framework is to allow compatibility, inter-operability between critical data assets and version control as is required for the development of a more comprehensive platform than what has been traditionally possible
- The platform provides access to secure computing resources – both commercial (Microsoft) and research (Pawsey Supercomputing Research Centre)

Secure data sharing, high-performance cloud computing and data and scientific modelling have resulted in 40x modelling speed increases (40 hours per model run to 1 hour) resulting in weeks or months of decision-maker time savings.

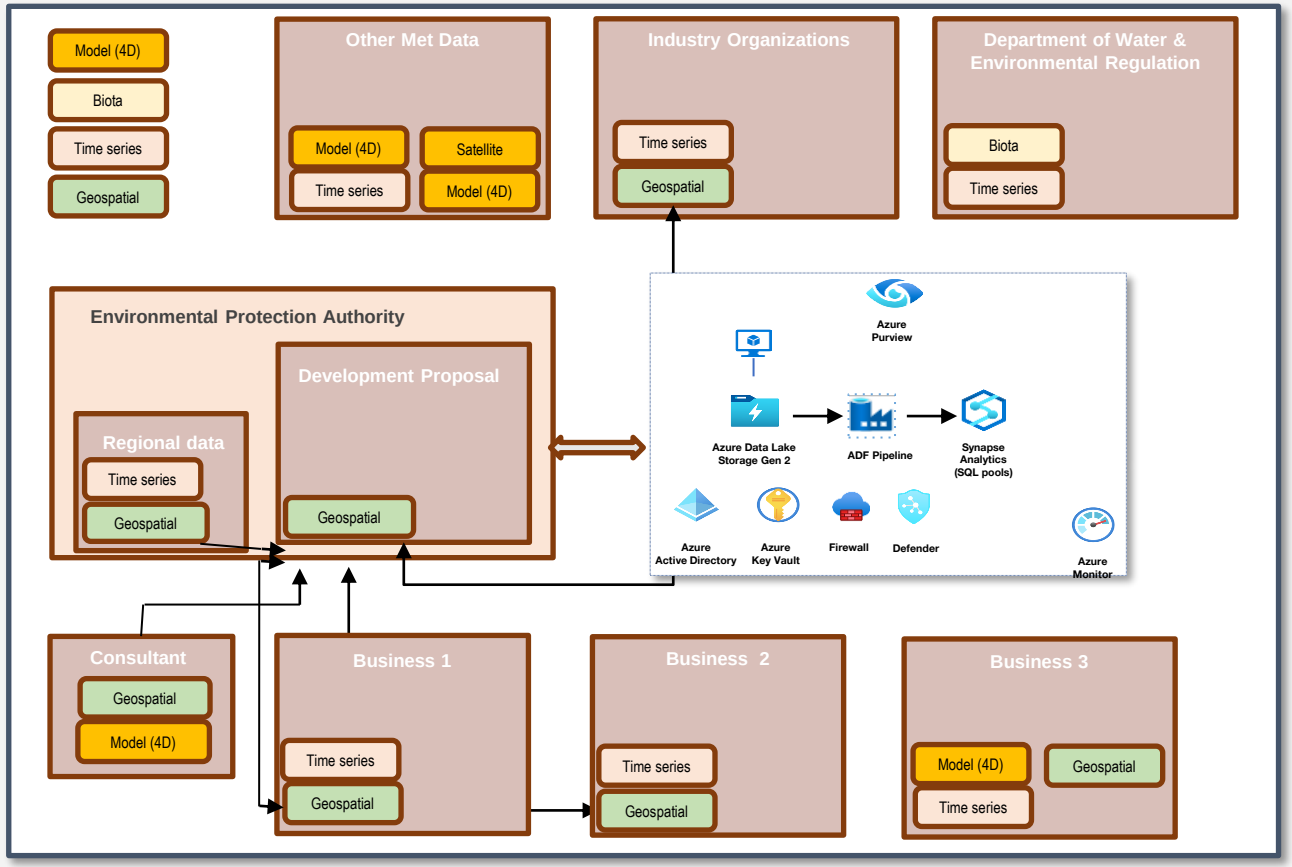
Data sharing model

SEAF data sharing model and platform provides a way to encourage and support access to data, while acknowledging the need for proponents and regulators to understand cumulative pressures in a collaborative environment while still in the project planning phases.



Pilbara: A cloud-based data approach

Cloud architecture overview



A scalable, extensible framework for the future of Pilbara science

The goal of a cloud-based data framework is to allow compatibility, inter-operability between critical data assets, and version control as is required for the development of a more comprehensive platform than what has been traditionally possible.

- Wide ranging cross-agency data ingestion
- Expandable, on-demand resources for data ingestion and compute
- Standardisation between disparate datasets
- Transferrable ingestion pipelines between different workgroups and agencies
- Standardisation of analytical workflows between cross-agency datasets
- Cost savings when compared to traditional on-premise data infrastructure

Products and science requirements introduction and overview

SEAF Pilbara

Products:
- Reporting, decision support, prediction
- For industry, government, community

Data and analytics:
- Data from diverse sources
- Private/ collaborative/ constrained data and analytics
- Validated analytic tools, improved over time – science feedback loop
- Robust, repeatable and transparent

Science:
- Pipeline from science to operations and back
- Science underpinning dependencies and impacts, enabling continuous improvement

Platform:
- Open source, cloud based, scalable across SEAFs; access controls for diverse users

Management and governance:
- Customers, product delivery; policy, legislative standards and requirements; oversight.

Pilbara product

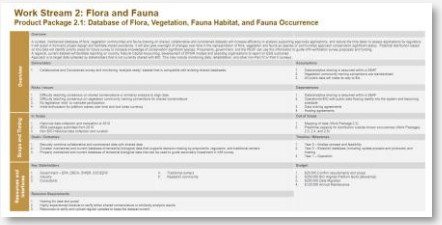
Flora and fauna
- Aggregated occurrence data
- Regional Vegetation Community, Flora and Fauna Habitat Mapping

Groundwater
- Aggregated datasets
- Catchment Scale Groundwater Modelling

Regional DPSIR
- Drivers, Pressures, States, Impacts and Responses (DPSIR) conceptual model

Reasonably foreseeable projects
- Regional map of developments including past, current and future project footprints

Survey infill
- Co-funding mechanism for survey implementation



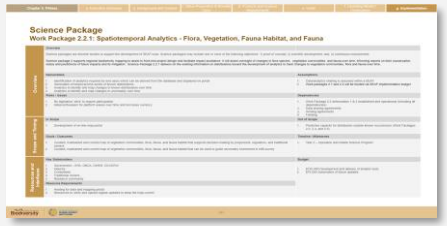
Science

Flora and fauna
- Regional Vegetation Community, Flora and Fauna Habitat Modelling
- Landscape/Habitat connectivity Modelling
- Population Viability Analysis

Groundwater
- Catchment Scale Groundwater Modelling

Regional DPSIR
- Trend identification and forecasting tools

Survey infill
- Prioritisation of survey areas and targeting based on Reasonably Foreseeable Project footprints



Proposed Pilbara flora and fauna SEAF products

Product	Benefits
Flora and Fauna • Aggregated occurrence data • Regional Vegetation Community, Flora and Fauna Habitat Mapping • Regional Vegetation Community, Flora and Fauna Habitat Suitability Modelling • Landscape/Habitat connectivity Modelling • Population Viability Analysis	**Flora and Fauna** ✓ Access to a larger data pool than currently available ✓ Increased efficiency in analysis and assessment for both proponent and regulator ✓ Spatial representation enables rapid visual assessment of potential risk and opportunity at project design stage ✓ Overview of change through time ✓ Identification of trend, risks and opportunities ✓ Capacity to quantitatively predict occurrence of vegetation communities and significant flora and fauna species ✓ Reduced uncertainty ✓ Informs infill survey priorities ✓ Enables future scenario analysis (e.g. climate impacts) ✓ Remote sensing and AI/Machine Learning approaches allow extension to areas where bio-geochemical data are unavailable ✓ Enables prioritisation of habitat conservation and restoration at a landscape scale ✓ Facilitate prediction of recovery in restoration areas ✓ Informs landscape-scale decision making

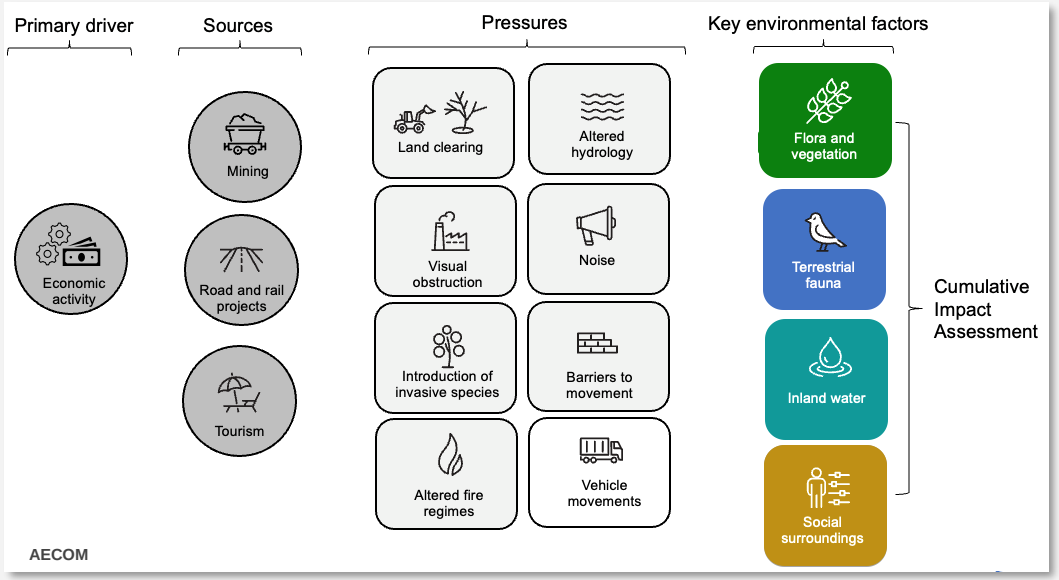
Proposed Pilbara groundwater SEAF products

Product	Benefits
Groundwater • Aggregated datasets • Catchment Scale Groundwater Modelling	**Groundwater** ✓ Access to groundwater data outside the proponent's lease boundary reduces the impact of estimated/assumed boundary conditions reducing uncertainty in model outputs ✓ Access to a larger data pool than currently available ✓ Increased efficiency in analysis and assessment for both proponent and regulator ✓ Establishes a shared baseline against which future assessments can be considered ✓ Reduced uncertainty ✓ Informs infill survey priorities ✓ Enables future scenario analysis (e.g. climate impacts) ✓ Ensures best practice is applied to decision making delivering sustainable environmental and business outcomes while maintaining social license

Proposed Pilbara 'management' SEAF products

Product	Benefits
Regional DPSIR • Drivers, Pressures, States, Impacts and Responses (DPSIR) conceptual model • Trend identification and forecasting tools **Reasonably foreseeable projects** • Regional map of developments including past, current and future project footprints **Survey infill** • Prioritisation of survey areas and targeting based on Reasonably Foreseeable Project footprints • Co-funding mechanism for survey implementation	**Regional DPSIR** • Provide insights into holistic environmental impacts and responses • Enables future scenario analysis (e.g. climate impacts) **Reasonably foreseeable projects** • Informs cumulative impacts **Survey infill** • Optimise future survey work • Prioritise knowledge gaps (unsurveyed areas) • Reduced uncertainty

Preliminary DPSIR Map



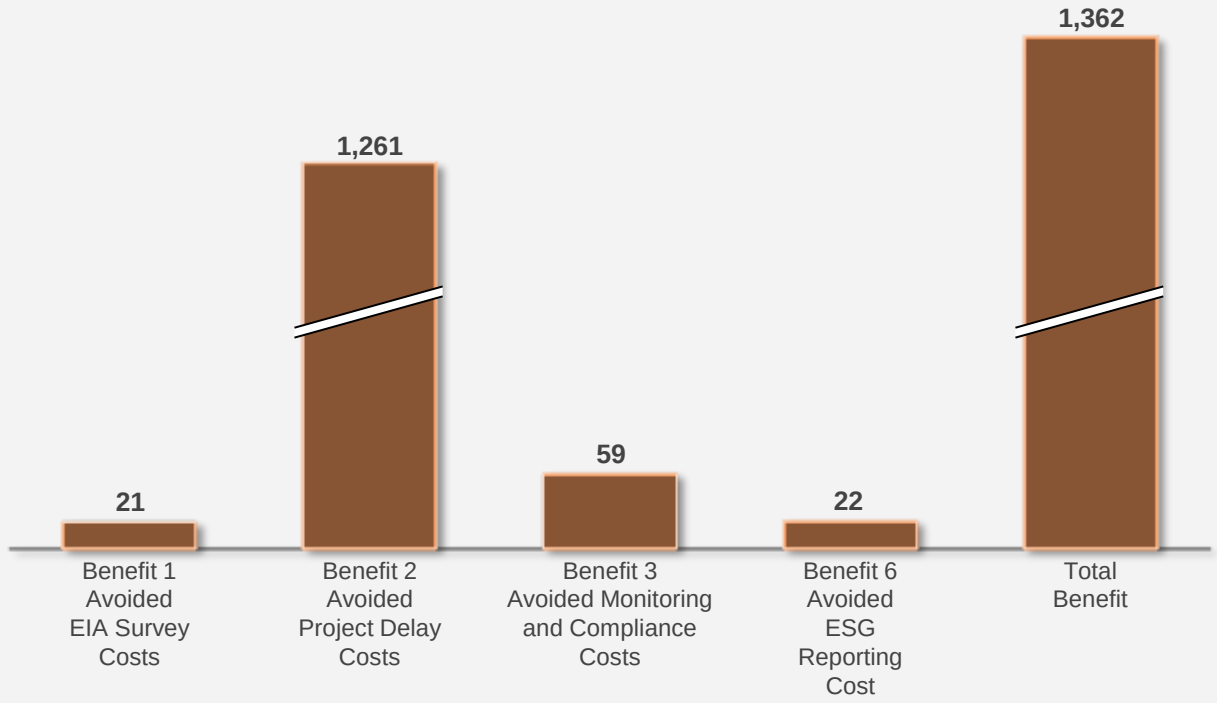
Preliminary Drivers, Pressures, States, Impacts and Responses (DPSIR)

- Analysis of 10 years of EPA Assessed Projects has been undertaken to develop a preliminary understanding of pressures and impacts in the Pilbara
- Combined with feedback from stakeholders this has been used to prioritise the requirements for shared analytics and prioritise data products

5c.
Pilbara: Value proposition and benefits case

A Pilbara regional spoke is expected to realise $1.4b NPV in quantified benefits over 10 years, with significant additional environmental, social and commercial benefits

Total Pilbara benefits (10 -year NPV, $M)



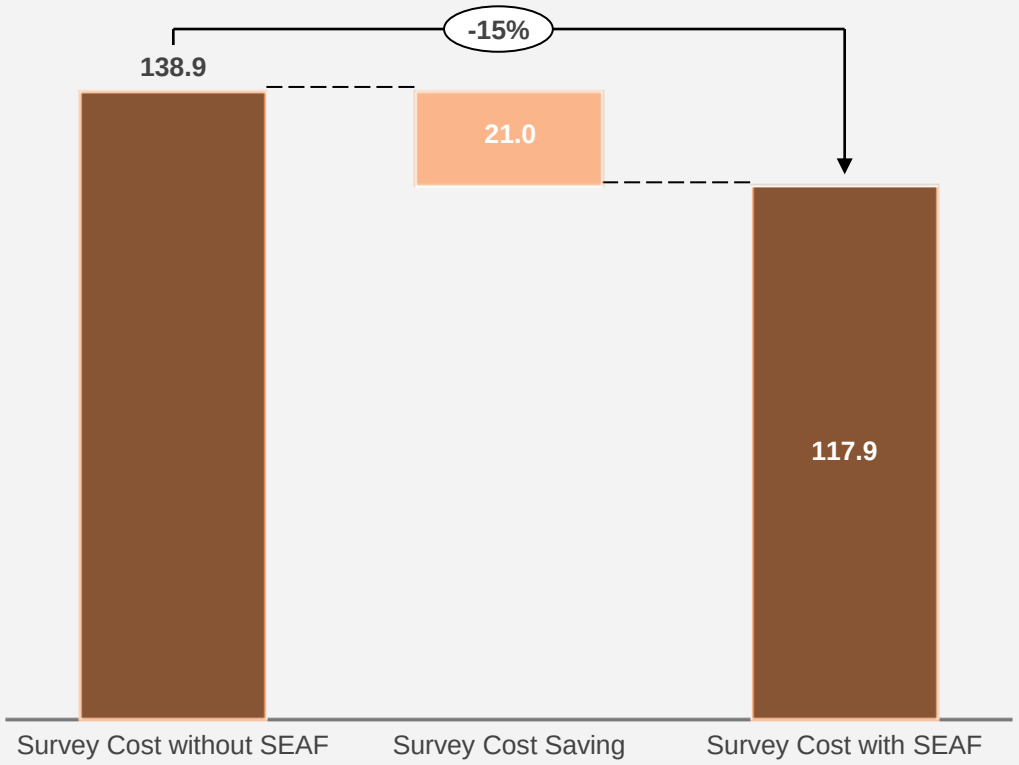
SEAF Benefits

- Pilbara's regional spoke is expected to contribute as much as $1.4b NPV in quantified benefits over the first 10 years, resulting from reduced costs of conducting surveys and analysis and avoided project delays
- The smaller three benefits (Benefits 1, 3 and 6) are considered direct offsetting benefits (i.e. the direct survey and analytics cost savings resulting from the central analytics capability held in the SEAF)
- These alone contribute $58m NPV in benefits over 5 years, approximately 113% higher than the estimated cost of the Pilbara spoke (this does not include the cost of the SEAF hub)
- This is in addition to a number of non-quantified benefits including critical environmental benefits that arise from enhanced data and a whole-of-environment view

Note: Net Present Values have been calculate using a 6% discount rate to Year 0.

Avoided survey costs are expected to contribute NPV $21m in benefits over the 10-year period, amounting to a 15% reduction in estimated costs compared to the base case

Survey cost breakdown – Pilbara (10-year NPV, $M)



Source: WABSI

Avoided Survey Cost

- Avoided survey cost in the Pilbara region is expected to amount to $21M NPV over the next 10 years
- This savings equates to a reduction in 15% of overall survey cost over the assessment period
- Savings are primarily driven by access to improved information, indicating a smaller saving for first projects and larger savings as the SEAF can collect more data
- The saving is driven by a mid-case average rate of 2.75 projects per year, broadly consistent with historic levels (e.g., nine assessments completed between 2019-21)

Avoided project delay cost is expected to be the most significant benefit, contributing $1.3B over 10 years

- Case studies of EPA WA reported completed assessments indicate an Environmental Review can take 42 months to complete, compared to a Referral Information, which can take 8 months
- The SEAF would reduce the time compiling surveys and data (which accounts almost entirely for the time difference)
- This leads to an **average assumed time reduction of 34 months**

- The *Digitally Transforming Environmental Assessment* report estimates delay costs at $6m/month for a large capital project ($1b) and $3m/month for a small capital project ($500m)
- This leads to an assumed blended **monthly delay cost of $5.7m/month**
- Further estimates indicate that delay costs can be significantly higher (from $100m-$1.3b per year),[1] however the above more conservative estimate has been used for this analysis

$1.3b NPV over 10 years

Estimated project delay costs avoided

- Per the EPA WA published figures, **nine Environmental Reviews** have been completed in the Pilbara region **in the last 3 years** – this compares to seven Referral Information assessments over the same period
- This figure has been used as the basis for this analysis and corresponds to additional data provided which estimates between 1 and 4 (mid-case 2.75) assessments per year over the next 5-10 years

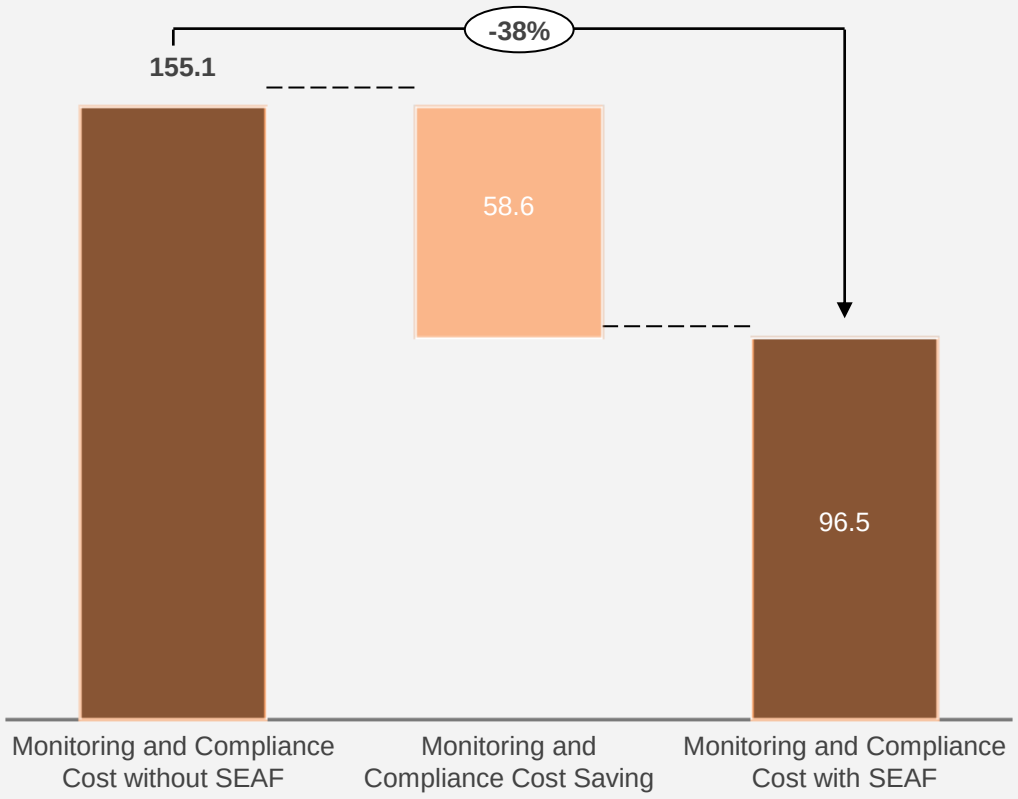
- While not all project assessments will necessarily be reduced (and certainly not all by 34 months), this analysis assumes **30% of projects will be able to be reduced on average**
- However, sensitivity analysis has been conducted, and is presented below:

1. The Productivity Commission (2013) found that cost of delaying by one year an average-sized Australian oil and gas extraction project, valued at $17 billion, could range from $300 million to $1.3 billion. An MCA submission (2020) on the review of the EPBC Act stated a one-year delay to a project can reduce the Net Present Value (NPV) by between 10 and 13 per cent.

Source: WABSI, EPA WA

Monitoring and compliance costs are expected to decline in similar fashion to avoided survey costs, contributing an additional $59M NPV in benefits over the 10-year period

Monitoring and compliance cost breakdown – Pilbara (10-year NPV, $M)



Avoided monitoring and compliance cost

- Monitoring and compliance costs are incurred regularly by majority of organisations with activity in the Pilbara region
- While the costs may be less on a per project basis than the original Environmental Impact Assessment (EIA) approval, given the breadth of organisations and the recurring annual cost, monitoring and compliance costs are higher than EIA costs
- Similar to EIA survey cost savings, these savings are primarily driven by access to improved information leading to a reduced need for duplication in survey efforts and efficiencies with collective surveying
- These efficiencies are expected to reduce the monitoring and compliance costs by 38%, leading to a benefit of $59 NPV over the next 10 years
- Costs for the Pilbara region have been estimated by reference to the provided Cockburn Sound estimates, with a scaling factor applied

Source: WABSI

Projects can incur significant relocation, redesign and delay costs where the proposal is rejected or modified by EPA – early access to robust data can avoid these costs

Case Study 1 – Mardi Salt	Case Study 2 – Subsea7 Learmonth Bundle Site	Case Study 3 – Greenbushes Lithium Mine
• **Mid-2018** – Proposal to produce salts from seawater was submitted to the EPA • **Assessment process** – Environmental investigations and analyses by the proponent prompted extensive redesigns resulting in assessment delays • **Mid-2021** – EPA conditions for approval included further changes to the design of some infrastructure and additional monitoring and further analysis of pond-wall integrity prior to full regulatory approval • **March 2022** – Mardi Salt came back to the EPA with a proposal to change (expand) the original project – this proposal remains under consideration by the EPA, who required additional information prior to making a determination	• **October 2017** – Proposal to build a subsea pipeline fabrication facility on the shores of Exmouth Gulf • **Assessment process** – Analyses of potential impacts and the need for further impact assessment and mitigation prompted proposal redesign • **February 2019** – Resubmission of the proposal – the EPA concluded that the changes were significant, and the review process would have to start afresh • **Second assessment process** – Minister for the Environment requested a strategic environmental assessment of the region and a pause on the consideration of further development • **August 2021** – By the time this regional assessment was completed, Subsea7 had decided to terminate the project proposal	• **Assessment process** – additional information was required by the EPA and it became clear that the potential offsetting would become onerous, even though only 350 ha of forest required clearing. • **Required offset** – To acquire and transfer to the conservation estate 1570 ha of high-quality jarrah forest, and only three potential properties were identified for potential availability • **Future projects** - Mining expansion proposals currently under development and consideration by the environmental regulators involve clearing of an additional 4399 ha (South32 Worsley Mine Expansion) and up to 6700 ha (Alcoa Huntley Expansion) – finding available offsets through land acquisition is exceedingly difficult even at relatively small scale
Outcome: At least **2.5 years** in lost productivity (calculated **$170M in project delay costs**) resulting from design and scope changes	**Outcome:** Almost **4 years** in lost productivity (calculated **$260M in project delay costs**), with additional opportunity cost resulting from the abandonment of the project	**Outcome:** Clearly the scale of future offsets in the region cannot be achieved through further conservation of existing private forest – a case will have to be made for **net-positive improvements on degraded sites**

Environmental, Social and Governance (ESG) reporting costs are expected to decline in similar fashion to avoided survey and monitoring and compliance costs, adding $22M NPV in benefits over the 10-year period

ESG Reporting analysis – Pilbara

Item	Value
Average Annual Cost of ESG Reporting	
Without SEAF	$1,000,000
With SEAF	$800,000
Average Annual Cost Saving (per reporting entity)	**$200,000**
Total ASX-listed gold mining companies	15
Pilbara Spoke Annual ESG Reporting Cost Saving	$3,000,000
Pilbara Spoke ESG Reporting Cost Saving (10y NPV)	**$21,685,090**

Avoided survey cost

- Given the wealth of data expected to be already available for reporting entities resulting from SEAF, significant savings (20%) are expected for ESG reporting
- There are at least 15 ASX-listed gold mining companies alone operating in the Pilbara region, with stakeholders counting at least 15 more companies supporting these activities – these numbers are expected to grow as ESG reporting becomes the norm
- An overall saving of $3M manually creates a net benefit of $22M NPV over 10 years

Source: WABSI

5d.
Pilbara: Products and science requirements

Pilbara products and science requirements overview

SEAF Pilbara

Products:
- Reporting, decision support, prediction
- For industry, government, community

Data and analytics:
- Data from diverse sources
- Private/ collaborative/ constrained data and analytics
- Validated analytic tools, improved over time – science feedback loop
- Robust, repeatable and transparent

Science:
- Pipeline from science to operations and back
- Science underpinning dependencies and impacts, enabling continuous improvement

Platform:
- Open source, cloud based, scalable across SEAFs; access controls for diverse users

Management and governance:
- Customers, product delivery; policy, legislative standards and requirements; oversight

Pilbara product packages

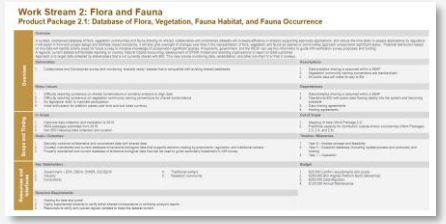
Flora and fauna
- Aggregated occurrence data
- Regional Vegetation Community, Flora and Fauna Habitat Mapping

Groundwater
- Aggregated datasets
- Catchment Scale Groundwater Modelling

Regional DPSIR
- Drivers, Pressures, States, Impacts and Responses (DPSIR) conceptual model

Reasonably foreseeable projects
- Regional map of developments including past, current and future project footprints

Survey infill
- Co-funding mechanism for survey implementation



Science Packages

Flora and fauna
- Regional Vegetation Community, Flora and Fauna Habitat Modelling
- Landscape/Habitat connectivity Modelling
- Population Viability Analysis

Groundwater
- Catchment Scale Groundwater Modelling

Regional DPSIR
- Trend identification and forecasting tools

Survey infill
- Prioritisation of survey areas and targeting based on Reasonably Foreseeable Project footprints

Approach to develop product and science

Stakeholder engagement objectives

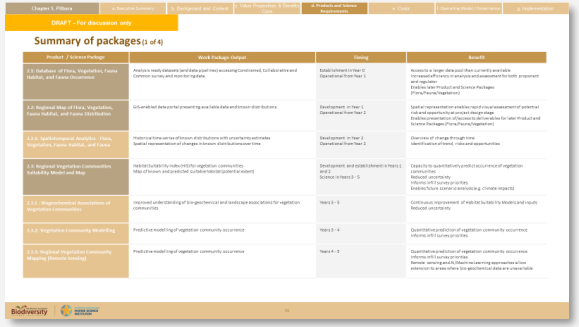
Seven stakeholder cohorts were engaged to capture the voice of all relevant stakeholder cohorts to:

(a) identify existing challenges and stakeholder perspectives of current state; and

(b) gain endorsement of the SEAF value proposition

Product and science package development

Iterative consultation with a key subset of end users across science, industry and government informed product and science package development.



Feasibility and implementation plan

Implementation plan for the Pilbara SEAF presented for review

Science and products co-developed with key Pilbara stakeholders to meet end user needs (1 of 6)

Product / Science package	Work package output	Timing	Benefit
2.1: Database of Flora, Vegetation, Fauna Habitat, and Fauna Occurrence	Analysis ready datasets (and data pipelines) accessing Constrained, Collaborative and Common survey and monitoring data	Establishment in Year 0 Operational from Year 1	Access to a larger data pool than currently available Increased efficiency in analysis and assessment for both proponent and regulator Enables later Product and Science Packages (Flora/Fauna/Vegetation)
2.2: Regional Map of Flora, Vegetation, Fauna Habitat, and Fauna Distribution	GIS-enabled data portal presenting available data and known distributions	Development in Year 1 Operational from Year 2	Spatial representation enables rapid visual assessment of potential risk and opportunity at project design stage Enables presentation of/access to deliverables for later Product and Science Packages (Flora/Fauna/Vegetation)
2.2.1: Spatiotemporal Analytics - Flora, Vegetation, Fauna Habitat, and Fauna	Historical time-series of known distributions with uncertainty estimates Spatial representation of changes in known distributions over time	Development in Year 2 Operational from Year 2	Overview of change through time Identification of trend, risks and opportunities
2.3: Regional Vegetation Communities Suitability Model and Map	Habitat Suitability Index (HSI) for vegetation communities Map of known and predicted suitable habitat (potential extent)	Development and establishment in Years 1 and 2 Science in Years 3 - 5	Capacity to quantitatively predict occurrence of vegetation communities Reduced uncertainty Informs infill survey priorities Enables future scenario analysis (e.g. climate impacts)

Science and products co-developed with key Pilbara stakeholders to meet end user needs (2 of 6)

Product / Science package	Work package output	Timing	Benefit
2.3.1: Biogeochemical Associations of Vegetation Communities	Improved understanding of bio-geochemical and landscape associations for vegetation communities	Years 3 - 5	Continuous improvement of Habitat Suitability Models and inputs Reduced uncertainty
2.3.2: Vegetation Community Modelling	Predictive modelling of vegetation community occurrence	Years 3 - 4	Quantitative prediction of vegetation community occurrence Informs infill survey priorities
2.3.3: Regional Vegetation Community Mapping (Remote Sensing)	Predictive modelling of vegetation community occurrence	Years 4 - 5	Quantitative prediction of vegetation community occurrence Informs infill survey priorities Remote sensing and AI/Machine Learning approaches allow extension to areas where bio-geochemical data are unavailable
2.4: Regional Flora Species Habitat Suitability Model	Habitat Suitability Index (HSI) for significant flora species Map of known and predicted suitable habitat (potential extent)	Development and establishment in Years 1 and 2 Science in Years 2 - 5	Capacity to quantitatively predict occurrence of significant flora species Reduced uncertainty Informs infill survey priorities Enables future scenario analysis (e.g. climate impacts)
2.4.1: Biogeochemical Associations of Flora Species of Concern	Improved understanding of bio-geochemical and landscape associations for significant flora species	Years 2 - 5	Continuous improvement of Habitat Suitability Models and inputs Reduced uncertainty

Science and products co-developed with key Pilbara stakeholders to meet end user needs (3 of 6)

Product / Science Package	Work package output	Timing	Benefit
2.4.2: Species Distribution Modelling (Flora)	Predictive modelling of vegetation community occurrence	Years 2 - 4	Quantitative prediction of significant flora species Informs infill survey priorities
2.5: Regional Fauna Habitat Suitability Model	Habitat Suitability Index (HSI) for significant fauna species Map of known and predicted suitable habitat (potential extent)	Development and establishment in Year 1 Science delivery in Years 2 - 5	Capacity to quantitatively predict occurrence of significant flora species Reduced uncertainty Informs infill survey priorities Enables future scenario analysis (e.g. climate impacts)
2.5.1: Regional Fauna Habitat Suitability Model	Improved understanding of vegetation and landscape associations for significant fauna species Predictive modelling of significant fauna species occurrence	Years 2 - 5	Continuous improvement of Habitat Suitability Models and inputs Reduced uncertainty Quantitative prediction of significant fauna species Informs infill survey priorities
2.5.2: Species Distribution Mapping – Fauna (Remote Sensing)	Predictive modelling of significant fauna species occurrence	Years 4 - 5	Quantitative prediction of significant fauna species occurrence Informs infill survey priorities Remote sensing and AI/Machine Learning approaches allow extension to areas where bio-geochemical data are unavailable to inform vegetation models

Science and products co-developed with key Pilbara stakeholders to meet end user needs (4 of 6)

Product / Science package	Work package Output	Timing	Benefit
2.6: Regional Fauna Habitat Connectivity Map/Model	Habitat connectivity models (both general and species specific)	Develop and deliver Year 4 onwards	Enables prioritisation of habitat conservation and restoration at a landscape scale Facilitate prediction of recovery in restoration areas Informs infill survey priorities
2.6.1: Habitat Connectivity Model (Fauna)	General Landscape Connectivity Model Least cost dispersal models for MNES species	Scoping and development in year 3 Develop and deliver Year 4 onwards	Informs landscape-scale decision making Identifies cumulative impacts Informs infill survey priorities
2.7: Population Viability Model	Landscape-scale Population Viability Analysis (PVA) tools	Years 3 - 5	Enables prioritisation of habitat conservation at a landscape scale Identifies cumulative impacts
2.7.1: Population Viability Modelling (MNES)	Spatially-explicit Population Viability Analysis model Species-specific parameterisation	Years 3 - 5	Enables prioritisation of habitat conservation at a landscape scale Enables scenario analysis Identifies cumulative impacts
3.1: Integrated Groundwater Dataset	Analysis ready datasets (and data pipelines) accessing Constrained, Collaborative and Common groundwater data.	Establishment in Year 0 Operational from Year 1	Access to groundwater data outside the proponent's lease boundary reduces the impact of estimated/assumed boundary conditions reducing uncertainty in model outputs Access to a larger data pool than available Increased efficiency in analysis and assessment for both proponent and regulator Enables later Product and Science Packages (Integrated Catchment Ground water Modelling)

Science and products co-developed with key Pilbara stakeholders to meet end user needs (5 of 6)

Product / Science package	Work package output	Timing	Benefit
3.2: Integrated Catchment Scale Groundwater Modelling	Shared models/modelling environment at a catchment scale	Year 0 – Feasibility study Year 1 – Model development Year 2 – Model delivery Year 3 – 5 Continuous improvement cycle	Establishes a shared baseline against which future assessments can be considered Reduced uncertainty Informs infill survey priorities Enables future scenario analysis (e.g. climate impacts)
3.2.1: Integrated Catchment Groundwater Model Proof of Concept	Demonstration of proof-of-concept models/modelling environment	Year 1 – Model development Year 2 – demonstration of proof of concept	Reduced risk/uncertainty associated with further investment in shared ground water modelling
3.2.2: Integrated Catchment Scale Groundwater Model Development	Scalable shared models/modelling environment at a catchment level	Year 3 - Model development Year 4 – Model delivery	Establishes a shared baseline against which future assessments can be considered Reduced uncertainty Enables cumulative impact to be modelled and considered Informs infill survey priorities Enables future scenario analysis (e.g. climate impacts)
3.2.3: Enhancing knowledge and practice in Ground Water Modelling	Models/modelling environment which advance global best practice in ground water modelling	Year 5 – Analytics and continuous improvement cycle initiated	Ensures best practice is applied to decision making delivering sustainable environmental and business outcomes while maintaining social license
4.1: Pilbara Region DPSIR reporting model	Drivers, Pressures, States, Impacts and Responses (DPSIR) conceptual model	Concept development in Year 0 Data standards Year 1	Provide insights into holistic environmental impacts and responses Enables future scenario analysis (e.g. climate impacts)

Science and products co-developed with key Pilbara stakeholders to meet end user needs (6 of 6)

Product / Science package	Work package output	Timing	Benefit
4.1.1: Pilbara Region DPSIR Trends and Forecasting	AI / Machine Learning tools to identify trends and forecast of future changes in environmental factors based on extrinsic and reasonably foreseeable inputs	Analytic tool development in Year 2 Year 3 – 5 Continuous improvement cycle	Enables future scenario analysis (e.g. climate impacts)
4.2: Reasonably Foreseeable Projects	Regional map of developments including past, current and future project footprints	Basemap development in Year 1 Year 2 – 5 operations and continuous improvement cycle	
Data & Analytics **4.3: Survey Infill (BioSurvey Pilbara)**	A regional map which combines priority survey areas Prioritisation of survey areas and targeting based on Reasonably Foreseeable Project footprints Co-funding mechanism for survey implementation	Initiate in Year 2 Ongoing delivery years 2 - 5	Optimise future survey work Prioritise knowledge gaps (unsurveyed areas) Reduced uncertainty

5e.
Pilbara: Costs

Pilbara implementation: Indicative cost profile (1 of 2)

		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Total	NPV[1]
Work Packages & Science Packages	2.1: Database of Flora, Vegetation, Fauna Habitat, and Fauna Occurrence	$525,000	$125,000	$125,000	$125,000	$125,000	$125,000	$1,150,000	$1,051,545
	2.2: Regional Map of Flora, Vegetation, Fauna Habitat, and Fauna Distribution	-	$150,000	$50,000	$50,000	$50,000	$50,000	$350,000	$304,958
	2.2.1: Spatiotemporal Analytics - Flora, Vegetation, Fauna Habitat, and Fauna	-	-	$125,000	$75,000	-	-	$200,000	$174,221
	2.3: Regional Vegetation Communities Suitability Model and Map	-	$75,000	$350,000	$50,000	$50,000	$50,000	$575,000	$501,202
	2.3.1 : Biogeochemical Associations of Vegetation Communities	-	-	-	$200,000	$400,000	$400,000	$1,000,000	$783,665
	2.3.2: Vegetation Community Modelling	-	-	-	$200,000	-	-	$200,000	$167,924
	2.3.3: Regional Vegetation Community Mapping (Remote Sensing)	-	-	-	-	$250,000	-	$250,000	$198,023
	2.4: Regional Flora Species Habitat Suitability Model	-	$75,000	$250,000	$50,000	$50,000	$50,000	$475,000	$412,202
	2.4.1 : Biogeochemical Associations of Flora Species of Concern	-	-	-	$500,000	$500,000	$500,000	$1,500,000	$1,189,486
	2.4.2: Species Distribution Modelling (Flora)	-	-	-	$400,000	$50,000	-	$450,000	$375,452
	2.5: Regional Fauna Habitat Suitability Model	-	$75,000	$250,000	$50,000	$50,000	$50,000	$475,000	$412,202
	2.5.1: Regional Fauna Habitat Suitability Model	-	-	$50,000	$150,000	$400,000	$400,000	$1,000,000	$786,183
	2.5.2: Species Distribution Mapping – Fauna (Remote Sensing)	-	-	-	$500,000	$500,000	$500,000	$1,500,000	$1,189,486

1. Net Present Values have been calculated using a 6% discount rate to Year 0.

Pilbara implementation: Indicative cost profile (2 of 2)

		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Total	NPV[1]
Work Packages & Science Packages	2.6: Regional Fauna Habitat Connectivity Map/Model					$100,000	$250,000	$350,000	$266,024
	2.6.1: Habitat Connectivity Model (Fauna)				$50,000	$650,000	$500,000	$1,200,000	$930,471
	2.7: Population Viability Model					$50,000	$50,000	$100,000	$76,968
	2.7.1: Population Viability Modelling (MNES)				$50,000	$3,150,000	$3,000,000	$6,200,000	$4,778,851
	3.1: Integrated Groundwater Dataset	$75,000	$500,000	$250,000	$250,000	$250,000	$250,000	$1,575,000	$1,363,940
	3.2: Integrated Catchment Scale Groundwater Modelling	$350,000	$225,000	$225,000	$100,000	$100,000	$100,000	$1,100,000	$1,000,410
	3.2.1: Integrated Catchment Groundwater Model Proof of Concept		$175,000	$175,000				$350,000	$320,844
	3.2.2: Integrated Catchment Scale Groundwater Model Development				$600,000	$600,000		$1,200,000	$979,028
	3.2.3: Enhancing knowledge and practice in Ground Water Modelling				$500,000	$500,000	$500,000	$1,500,000	$1,189,486
	4.1: Pilbara Region DPSIR reporting model	$250,000	$50,000					$300,000	$297,170
	4.1.1: Pilbara Region DPSIR Trends and Forecasting			$350,000	$200,000	$200,000	$200,000	$950,000	$787,293
	4.2: Reasonably foreseeable projects	$50,000	$225,000	$225,000	$50,000	$50,000		$600,000	$544,099
	4.3: Data & Analytics Survey Infill (BioSurvey Pilbara)			$75,000	$3,050,000	$3,050,000	$3,050,000	$9,225,000	$7,322,612
	Product Packages Subtotal	$1,250,000	$1,500,000	$1,800,000	$3,775,000	$3,925,000	$4,025,000	$16,275,000	$13,553,332
	Science Packages Subtotal	$0	$175,000	$700,000	$3,425,000	$7,200,000	$6,000,000	$17,500,000	$13,850,411
Total Costs		$1,250,000	$1,675,000	$2,500,000	$7,200,000	$11,125,000	$10,025,000	$33,775,000	$27,403,744

1. Net Present Values have been calculated using a 6% discount rate to Year 0.

5f. Pilbara: Operating model and governance

The proposed operating model design for each spoke to effectively undertake regional assessments has considered the construct, legal structure, capability needs and key risks

Model construct

***Hub & spoke* model to balance consistency with regional flexibility**

Legal structure and considerations

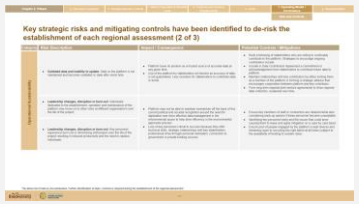
Regional Joint ventures / Joint developments established independently of SEAF entity

Governance and capabilities

Perennial governance overseeing operations & risks with Regionally specific governance to oversee and manage regional assessments

Key risks and controls

High level risks identified and categorised mitigation strategies articulated



Operating model highlights

- **Consistent and scalable platform**
- Consistent across independent spokes with **regional semi-autonomy to address unique needs**
- **Joint Venture (JV) / Joint Development (JD)** arrangement between key stakeholders in any particular region
- **Comprehensive range of attributes** tailor agreements during JV / JD development
- **Lean** centralised perennial governance **leveraging existing committees and forums**
- Independent Regional Governance leveraging **local expertise and networks**
- Capabilities **tailored for specific regional requirements and study objectives**
- **12 strategic risks identified across 4 high level categories**: (a) Data; (b) Legal liability; (c) Operational sustainability; (d) Stakeholder confidence

The SEAF will be an independently run and objectively managed entity, structured as a *hub and spoke* model

The *hub and spoke* construct enables the SEAF to manageably and consistently scale through the addition of prioritised regional assessments utilising a standardised model, a common platform and lean governance.

Hub and spoke model 1

Perennial governance & Centralised functions

Key responsibilities - 'Initial phase' (*e.g., 18-24 months*):

- Governance for pilot region(s) establishment e.g., Cockburn Sound and Pilbara
- Manage technology platform
- Share learnings and insights across regions
- Leverage existing governance forums (e.g., WABSI / WAMSI Joint Sub-Committee

Key responsibilities - 'End state' (*e.g., 24 months* +):

- Provide independent operational management for SEAF
- Establish / integrate / de-establish regional assessments as required
- Develop & maintain standards & consistency across regions

Benefits include:

- Regional capabilities tailored to bespoke needs
- Minimal capacity burden on core functions from regional assessments or on regional assessments from core functions
- Flexibility in the number of and timing of regional assessments
- Core functions able to evolve/scale as appropriate to support regional needs
- Consistent and scalable platform

SEAF construct

Perennial governance:
Centralised oversight of the effective, sustainable management of SEAF operations & risks

Centralised functions[1] (1)

Regional Governance[2]:
Regionally specific governance to oversee and manage data and tools to support regional assessments

Regional Governance[2]:
Regionally specific governance to oversee and manage data and tools to support regional assessments

Regional functions / capabilities[2]:
Deliver region-specific plans, assessment and advice in line with SEAF standards.

Regional functions / capabilities[2]:
Deliver region-specific plans, assessment and advice in line with SEAF standards.

(2)

Technology Platform:
A bespoke single, technology platform to enable data collection, data storage, analytic tools and collaboration/sharing of data

Spoke components 2

Regional Steering Committee & regional functions

Each spoke will:

- Leverage existing stakeholders and localised governance forums where appropriate (e.g., Pilbara: WABSI, Traditional Owners)
- Leverage and tailor the central technology platform to meet regional specific needs

Key responsibilities:

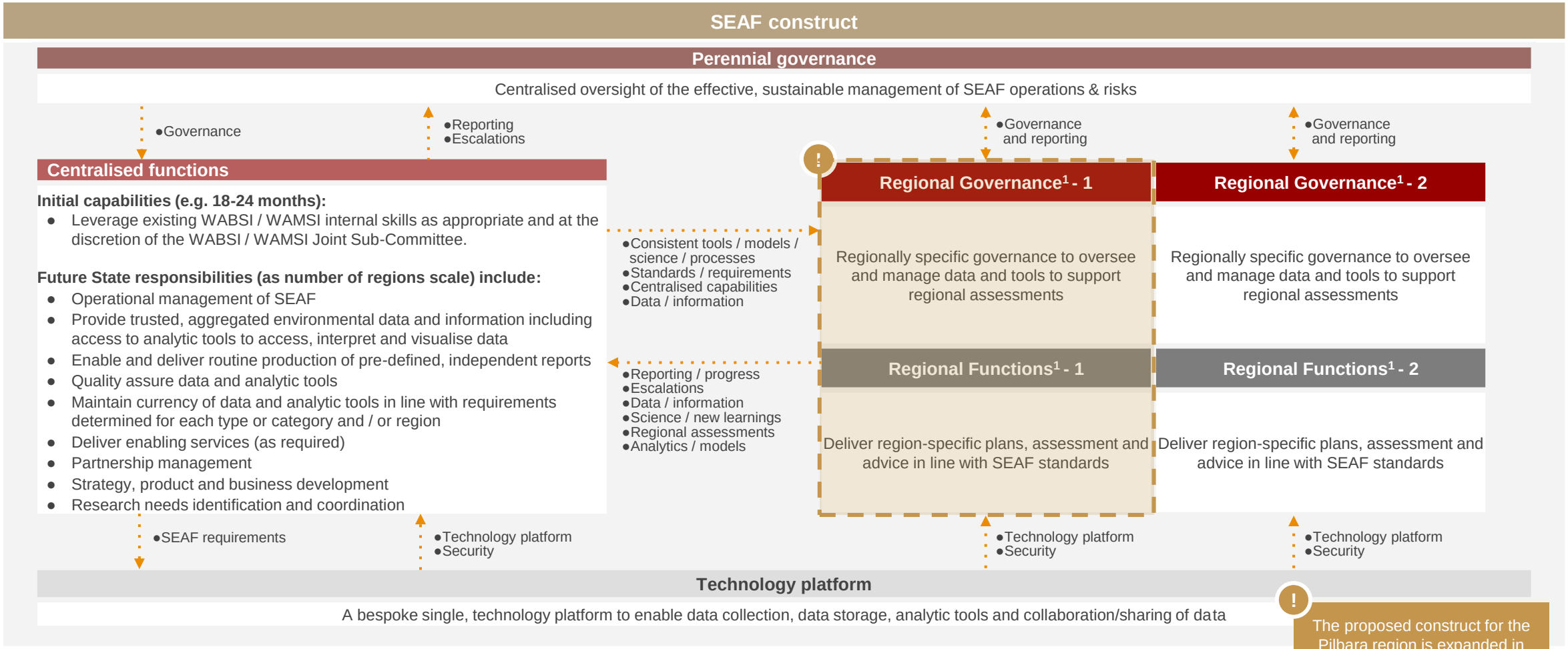
- Identify needs / requirements for regional assessment including update / maintenance and review cycles
- Regional plan science coordination and advisory
- Data collation and assessment in the development and production of regional assessments
- Maintaining and following SEAF standards

Benefits include:

- Localised data regionally specific
- Consistent across independent spokes with regional semi-autonomy to address unique needs
- Tailored governance representative of the region
- Flexible and reusable solution across spokes allowing for simple collaboration and data sharing
- Utilise and extend existing data and science

1. Centralised functions providing services to regions with consistency and quality assurance. Note: During initiation phase, central capabilities / capacity will be lean and where appropriate, will leverage existing inhouse capabilities from WABSI / WAMSI under direction of WABSI / WAMSI.
2. Spoke components include regional governance and regional functions / capabilities. Note while only two spokes have been depicted for clarity, there is no cap on the total number of regional spokes.

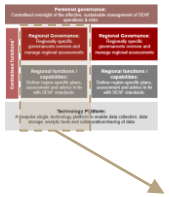
The high-level interaction model below outlines how each component of the model connects to produce tailored regional assessments



The proposed construct for the Pilbara region is expanded in subsequent slides

1. Note: While only two spokes have been depicted for clarity, there is no cap on the total number of regional spokes.

The conceptual model for the Pilbara regional spoke has the required capabilities to flexibility and independently operate to produce a regional assessment



Regional model construct

- Regional Governance
- Regional Management / Operations
- Regional Capabilities (SAFE)[1]
  - Product Development Cycle
  - Science Development
- Technology Platform

Conceptual Model Overview:

The above 'building blocks' are required to operationalise each SEAF spoke. This model provides a consistent structure for each newly established spoke promoting consistently and regional flexibility. Benefits include:

- ***Sustainability*** via regional governance in concert with SEAF governance
- ***Repeatability*** through dedicated processes and operational management
- ***Robustness*** built upon dedicated SAFE capabilities providing foundation for science and product development

Building blocks to 'operationalise' a regional spoke

Regional Governance		Regionally specific governance to oversee and manage data and tools to support regional assessments
Regional Functions / Capabilities[2]	Management / Operations	Overall management and falication of regional assessment operations including: • Product reporting • Data and analytics: SAFE capabilities • Science and data • Platform, Governance, Operations
	Regional Capabilities[1]	The capabilities at a regional level will be founded upon the Shared Analytic Framework for the Environment (SAFE) framework. SAFE depicts the capabilities which work together across the information and analytic supply chain to provide input decision-support and reporting tools for environmental assessments[2].
	Products[2]	Environment reporting, forecast and decision support • **Regulatory**: Cumulative environmental impacts assessments, monitoring and alerts • **Company**: TNFD, Paris climate goals & TCFD, green bonds, etc. • **National**: State of environment, state of country, sustainable development goals, other policy & program
	Science[2]	• Ability to extend on existing research and provide robust outcomes through: • Best available local and national science • Pipeline from research to operations • Proponent data available to researchers
Technology Platform[3]		The platform will enable data collection / storage, provide analytics / tools and enable collaboration and data sharing.

1. Refer to: SAFE - A guide to Shared Analytical Framework for the Environment: https://wabsi.org.au/wp-content/uploads/2023/05/SAFE-2.0_May-2023.pdf
2. Please refer to chapter *'4d. Products and science requirements'* for further details.
3. Please refer to chapter '*6. Technology'* for further details.

The regional capabilities required to enable regional assessments leverage the existing published SAFE framework*

Inputs

Inputs into the Pilbara spoke include:

- Industry contributions e.g., regional extractive firms
- Publicly available datasets - e.g., Biodiversity Information Office of Western Australia
- Leading research & development contributions through academia and other research organisations
- Bespoke technology platform from overarching SEAF

Pilbara conceptual model

Regional Governance:
Regionally specific governance to oversee and manage data and tools to support regional assessments

Regional Management / Operations:
Regionally specific management to oversee the day-to-day activities and operations for regional assessments. Management / operations capabilities can also leverage the SAFE Framework, specifically elements of the 'Culture' Tier.

Regional Capabilities - SAFE Framework

Culture	Collect	Curate	Integrate	Analyse	Use

Product Development Cycle

Science Development

Technology Platform:
A bespoke single, technology platform to enable data collection, data storage, analytic tools and collaboration / sharing of data.

Outputs and customers

Outputs from the Pilbara Region include[1]:

- Decision making tools (Dashboard, GIS, Thresholds and alerts)
- Forecast models
- Custom reports
- State of the Environment Reports etc.

Anticipated end users / customers of the above outputs include:

- Industry users e.g., extractive proponents
- Public State of Environment
- EPA
- Research organisations

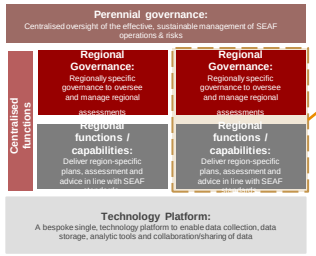
There will be varying levels of data accessibility depending the source / sensitivity of the data. These levels may include:

- ***Private:*** Secured to individuals / single companies
- ***Collaborative:*** Partially secured to nominated groups
- ***Constrained:*** Restricted access to one or more participants.

1. Refer to chapter *'5d. Products and science requirements'* for further details.

* Shared Analytic Framework for the Environment (SAFE) https://wabsi.org.au/our-work/projects/safe-shared-analytic-framework-for-the-environment/

The appropriate legal structure has been considered for the establishment and operation of a regional assessment with other supporting legal considerations



Regional spoke legal considerations	
Challenge	How does a regional assessment operate, where different stakeholders would seek to be involved in each geographical area?
Recommendation	● Create regional joint ventures which are a contractual arrangement between the key stakeholders in any particular region who are prepared to be involved in a specific project, or series of projects, designed to generate data in relation to the region for scientific study and then for sharing on the SEAF platform. ● The arrangement between the parties will be a blend of a 'joint venture' concept and a 'joint development agreement' where the participants come together to share skills and resources for the development of a specific project.
Joint venture / Joint development overview	It is proposed the operations of the Pilbara spoke at the regional level will be through a bespoke Joint Venture (JV) / Joint Development (JD) agreement between key stakeholders. To undertake this, key stakeholders will enter into a contractual arrangement where information and data generated for a scientific project or series of projects specific to the region will be required to then be shared on the SEAF platform. **Products / outputs:** In this case the joint venture will be a little different to a typical joint venture as there may not be a product produced at the end of the project which all participants share in accordance with their participating interest share. Rather, the arrangement between the parties will be a blend of a 'joint venture' concept and a 'joint development agreement' where the participants come together to share skills and resources for the development of a specific project. **Features / benefits:** ● Utilise SEAF template joint venture / joint development agreement ● Separately negotiated terms with individual stakeholder involved ● WABSI / WAMSI's role in each project can be as big or as small as it would like / as is appropriate ● WABSI / WAMSI can take on strong project management type role: ○ Acting as key aggregator of the participants ○ Coordinating various stakeholder groups ○ Supporting SEAF to generate / receive the required information from the project

Several attributes need to be considered during the development of a Joint venture / Joint development agreement

Joint venture / Joint development agreement in action

Joint Venture/Joint Development Agreement

Governance	Governance considerations include: ● The JV is governed by the contractual terms of the JV / JD agreement. ● Operating committee acts as the decision -making body of the venture. ● Manager may be appointed to oversee day to day operations under guidance of committee. **Benefits:** Flexibility to tailor arrangement to the needs of each regional project.
Funding / Contribution	Each JV participant will contribute either in the form of: ● a specified amount of money; or ● providing services, technology or assets to the project. Project expenses will be set our in a work program and budget.
Liability of members	The liability of participants will be specified in the 'JV agreement' or 'JD agreement'. The manager is usually indemnified by the participants for any liability incurred by the manager when acting within their role as manager on behalf of the joint venture. The JV is not a separate legal entity (unless it is an incorporated JV) to the participants and therefore each participant will directly be liable for the actions of the venture.
Intellectual Property	The parties will negotiate their respective intellectual property rights with respect to the product of the joint venture. The SEAF will need to ensure it gains either ownership or a perpetual licence to use the IP generated from the project.
Number of Participants	No limit on the number of participants. This will vary from region to region. Not all contributors will need to be a party to the Joint Venture Agreement or Joint Development Agreement, only those key longer-term contributors. Other contributors may just be sub-contractors.
Types of Participants	Each joint venture can bring together the group of participants required for the particular region. Each participant's role in the venture will be expressed in the agreement and some participants may only be involved for a specified period of time and will cease participating in the project once it reaches a certain point.
Voting	Each party can have a voting right which will be set out in the joint venture agreement. The joint venture can allow for varied voting rights and voting thresholds across participants depending on the nature of the decision.

Regional governance will provide oversight and direction of each regional assessment

Regional governance

Purpose	Regional governance will provide regionally specific, independent and objective governance through representative members. A steering committee will be established or built on existing regional interest groups as appropriate, for each region.
Considerations	**Enabling structures:** Regional governance will have established Rules of Procedure, further elaborating on the provisions of the Memorandum of Understanding (MoU) regarding the structure of the board, meetings, requirements for participation and the establishment of subsidiary bodies. **Responsibilities:** The regional management board will be responsible for making collective decisions around and management of the regional assessment including ensuring the objectives are being met, stakeholders are being appropriately engaged, that any identified data or science gaps are being filled, and that the needs of the collective are being met through the work being undertaken. Those appointed to regional governance should ideally be well respected within the group they represent, have similar experience and have the capacity to be engaged throughout the duration of the regional assessment and beyond. **Potential skills and roles:** The composition of each regional governance will be tailored depending on the region and is expected to be participant representative and to recognise the diversity of needs and interests across the stakeholder spectrum.

What does success look like

- Regionally representative and independent governance
- Tailored governance procedures (i.e., regionally specific MoU) to ensure governance structure is ‘right sized’ for each region
- Deep knowledge of local pressures and expertise to support regional assessment development
- Well established local networks and relationships to support the development and advocation of regional assessment outcomes
- Alignment to broader SEAF standards to ensure consistency and quality of regional assessments is maintained across regions

Capabilities required will be tailored to Pilbara-specific regional needs and assessment objectives

Regional management and operations functions

Capabilities can be leveraged from i) participating members, ii) contracted / acquired, or iii) sourced through the Shared Sub-Committee.

Anticipated functions and capabilities required for Pilbara include:

Project management

Key responsibilities:

- Manage time, costs, quality and outcomes for regional assessments
- Report on progress
- Risk / issue identification and escalation

Relationship management

Key responsibilities:

- Manage existing relationships with regional stakeholders
- Seek out new relationships to strengthen regional capabilities and / or fill capability gaps
- Engage with regional users of the SEAF

Data integrity and integration management

Key responsibilities:

- Collation of data sources
- Data curation including quality checks and assurance
- Integration into single source of truth data repository
- Ensure alignment to SEAF data management frameworks / policies

Data science, modelling and reporting

Key responsibilities:

- Analyses and chooses the best models and parameters appropriate for a regional assessment in partnership with Science Coordination and Advisory
- Develop region specific models and reports
- Provide region specific data science and analytics

Communications

Key responsibilities:

- Provide relevant and timely communications on regional assessments to regional stakeholders
- Coordinating public presentations and publications local / regional assessment
- Collaborate with centralised SEAF Communications and Marketing team to maintain consistent messaging and branding

Science coordination and advisory

Key responsibilities:

- Liaise with the research communities
- Keep abreast of science developments across multiple industries including identification of research being undertaken
- Ensure the best science is being utilised for decision making
- Engage with research community to identify partner organisations as required
- Support grants liaison officer to seek state, federal, or other grants related to support research requirements

What does success look like

- Clearly defined capabilities to support operation of regional assessment
- Robust and repeatable processes to ensure consistency of outcomes
- Strong stakeholder management and relationships developed in regions to strengthen regional capabilities
- Regionally specific data, science, models and reports
- Consistent messaging and communications from spoke coordinated with other regional assessments

SAFE provides an existing structured framework on which the required capabilities to develop a robust regional assessment can be founded

SAFE capabilities[1]

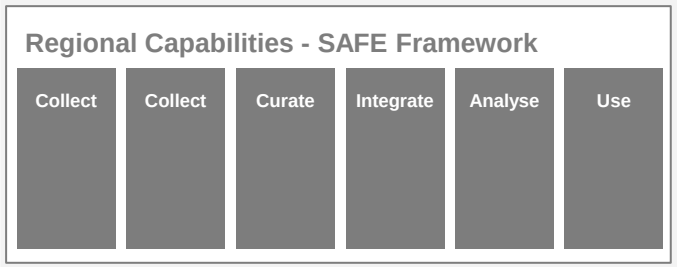
What is SAFE?

A Shared Analytic Framework for the Environment (SAFE) depicts the capabilities – the building blocks – which work together across the information and analytic supply chain to provide input decision-support and reporting tools for environmental assessments. It is a management tool, providing a framework and language to:

- Facilitate a consistent view of the capabilities and their interdependencies;
- Help align effort and prioritise investment across these capabilities.

Each 'Tier' of the framework outlines the required capabilities.

SAFE has been developed by WABSI, WAMSI and many others. It is based upon the Global Biodiversity Information (GBIO) Outlook[2].



Tier	Culture	Collect	Curate	Integrate	Analyse	Use
Tier Description	The Culture layer comprises the fundamental approaches and capabilities needed to enable all elements of SAFE to operate and to interact effectively.	The Collect tier includes the capabilities to generate multiple types of data, from existing sources to new fieldwork observations and automated sensors.	The Curate tier is the engine room where data are processed to make it fit for purpose, complete and FAIR. Data curation is an active and ongoing process that covers the full data lifecycle.	The Integration tier takes data and curated data products and links them to other data products in preparation for being used in analytic and modelling tools. It also identifies the key characteristics necessary to ensure their continued integrity, and the scientific basis for their integration.	The Analysis tier identifies the analytic and modelling capabilities that underpin research outcomes, reporting and decision support tools.	**Decision support tools**: Environmental Impact Assessment processes (including cumulative impacts), environment management, monitoring. **Reporting:** Regional and national: State of Environment reporting, environmental economic accounts, Sustainable Development Goals, etc Company level: Task Force on Nature-related Financial Disclosures. **Research:** Multi-disciplinary research, new analysis methods, input into and feedback from decision support and reporting tools
Capabilities	• Legal, policy and program incentives • Data governance and access • Culture of FAIR data and software • Indigenous Knowledge and CARE Principles • Communication and communities of practice	• Observations and measurements • Collection systems and protocols • Reference samples • Metadata and data standards • Data discovery and reuse	• Data quality and fitness for purpose • Vocabularies and conventions • Identifiers • Data and software publishing • Managed datasets, layers and products	• Trusted data on drivers, pressures, state, impacts and responses • Conceptual frameworks and methods for modelling • Standards and systems for data sharing and exchange • Provenance and lineage	• Explanatory and predictive modelling • Standards for models and model linkage • Model traceability, reproducibility and stewardship • Assurance and uncertainty methods	

1. Refer to: Shared Analytical Framework for the Environment (SAFE) https://wabsi.org.au/our-work/projects/safe-shared-analytic-framework-for-the-environment/
2. Based on the report Delivering Biodiversity Knowledge in the Information Age. Available at: https://doi.org/10.15468/6jxa-yb44.

Key strategic risks and mitigating controls have been identified to de-risk the establishment of each regional assessment (1 of 3)

Category	Risk description	Impact / consequence	Potential controls / mitigations
Data	• **Maintaining confidentiality of sensitive data:** Confidentiality breached when sensitive data is used to inform a wider set of data that is not confidential.	• Loss of trust in the platform as a safe repository for confidential data resulting in less contribution of data by stakeholders. • Claim for damages against SEAF for breach of contract - revocation of license.	• Policies and procedures are put in place to ensure staff involved in data upload are clearly informed of data confidentiality and security. • Strong data protection technology to protect platform from unauthorised access to confidential data. • Different layers of user access to quarantine unauthorised user groups.
	• **Initially sourcing data:** Data owners reluctant to share data that is not yet publicly available, without which full functionality of platform will be difficult to achieve.	• Without access to privately held data the platform will not be able to achieve full functionality and value to its users. • Inability to source data, current and future regional assessments will be significantly delayed. • Insufficient data can impact the operationality of the platform for public use.	• Include in proposals to stakeholders, a commitment from key data sources to provide data that will be used for Projects. • Ensure negotiation around terms of license includes agreement from stakeholder to receive and use data.
	• **Inaccurate data:** There is no internal resource to independently verify data accuracy. Data for the platform provided by Third Parties does not meet government standards, is inaccurate and / or no longer current.	• Reputational damage as platform cannot provide valuable and scientifically valid data. • Use of the platform by stakeholders will decline as accuracy of data is not guaranteed. Less incentive for stakeholders to contribute data or funds.	• Ensure the Data Contribution Agreement includes representation and warranty that data supplied is accurate, compete and to the standard required. • Include warnings on unverified data as submitted without guarantee of accuracy. • Ensure T&Cs include appropriate disclaimers from liability regarding any reliance on information provided on the platform.
Legal Liability	• **Third Party IP breach:** The platform obtains access to third party data which is subject to copyright and is then subject to a claim from the owner of that data and the intellectual property rights for damages.	• Platform may incur significant legal costs defending the claim. • Organisational time absorbed addressing the claim will drain resources from platforms' core functions.	• The platform (and wider SEAF) should operate as a separate legal entity from its members to help protect those involved. • Be rigorous in ensuring either: raw data is extracted out of materials received; or access to data is through a broad license which is not subject to narrow terms of use. • Where the platform is unsure, it should seek consent from data owner.
	• **Employee data breach:** Staff and contractors do not maintain confidentiality of information resulting in waiver of copyright of data or voiding ability to patent SEAF platform.	• Reputational damage causing reluctance of stakeholders to support SEAF. • Without the ability to patent or with IP breaches the financial standing of the platform is at risk.	• Create clear policies around confidentiality and protection of Intellectual Property so employees understand how to maintain it.

The above list of risks is non-exhaustive. Further identification of risks / controls is required during the establishment of the regional assessment.

Key strategic risks and mitigating controls have been identified to de-risk the establishment of each regional assessment (2 of 3)

Category	Risk description	Impact / consequence	Potential controls / mitigations
Operational Sustainability	• **Outdated data and inability to update**: Data on the platform is not maintained and becomes outdated or stale after some time.	• Platform loses its position as a trusted source of accurate data at any given time. • Use of the platform by stakeholders will decline as accuracy of data is not guaranteed. Less incentive for stakeholders to contribute data or funds.	• Build a following of stakeholders who are willing to continually contribute to the platform. Strategies to encourage ongoing contribution include: • Include in Data Contribution Agreement a commitment or acknowledgement from stakeholders to contribute future data to platform. • Maintain relationships with key contributors by either inviting them as a member of the platform or forming a strategic alliance that encourages cooperation between platform and key contributor. • Form long term regional joint venture agreements to drive regional data collection, sustained over time.
	• **Leadership changes, disruption or burn-out**: Individuals dedicated to the establishment, operation and maintenance of the platform may move on to other roles at different organisations over the life of the project.	• Platform may not be able to maintain momentum off the back of this current political and societal recognition around the need for digitisation and more effective data management in the environmental space to help drive efficiency in the environmental approvals process. • Loss of key personnel critical to success because they offer: technical skills, strategic relationships with key stakeholders, professional drive through personal motivation, connection to government or private funding sources.	• Ensure key members of staff or contractors are retained while also considering back up options if these personnel become unavailable. • Identifying key personnel early and the issues that could arise causing them to leave and apply mitigation on a case-by-case basis. • Ensure pool of people engaged by the platform is kept diverse and remains open to always recruiting the right talent (subject to the availability of funding to sustain roles).
	• **Leadership changes, disruption or burn-out**: Key personnel experience burn out or diminishing enthusiasm over the life of the project resulting in reduced productivity and the need to replace individuals.		

The above list of risks is non-exhaustive. Further identification of risks / controls is required during the establishment of the regional assessment.

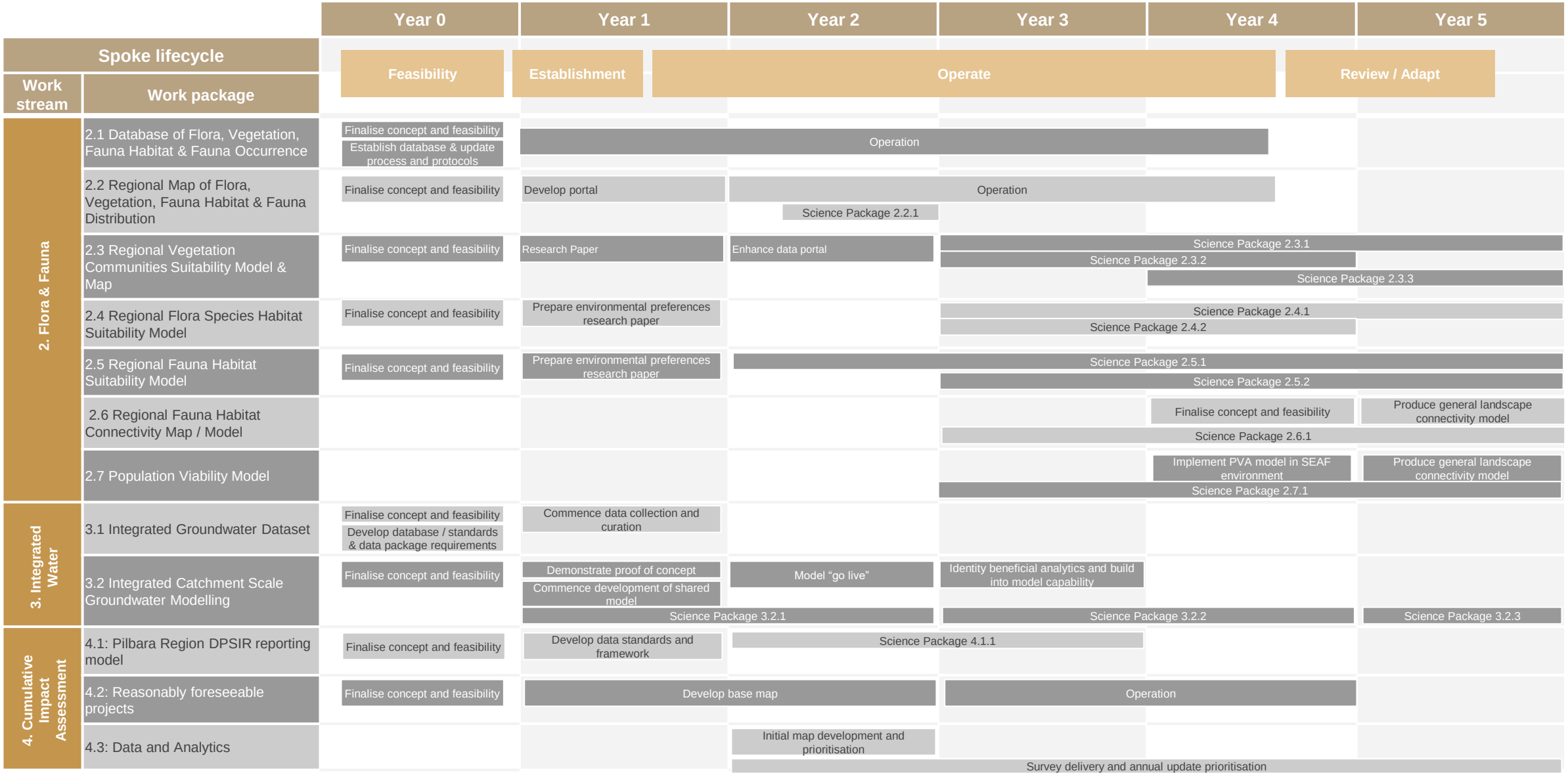
Key strategic risks and mitigating controls have been identified to de-risk the establishment of each regional assessment (3 of 3)

Category	Risk description	Impact / consequence	Potential controls / mitigations
Stakeholder confidence	• **Independence:** The SEAF and each region wishes to have, and maintain, a position as an independent provider of open-source data which is trusted by stakeholders to be objective and non-partisan about the manner in which it operates, curates and allows access to data on the SEAF platform.	• If seen to align with one particular group of stakeholders (nationally or regionally) or is politically tied to any side of politics in terms of its interaction with Government, then this could deter stakeholders from contributing data or funds to SEAF to help support the project. Once a reputation for being biased or too aligned with one particular group arises, it will take a lot of work to dispel that reputation whether it was justly acquired or not.	Ensure independence and objectivity is maintained across all aspects of its operations including in: • the manner it attains data (i.e. the consideration for acquiring such data should not result in having to show favour to that contributor); • the way the data is curated and presented on the platform; • the formation of its governance structures, including; membership base; the Board of Directors and its advisory groups; • strategic alliances or joint venture relationships; • the priorities it has when building out the platform. • Source and nature of funding sources.
	• **Misuse of Platform:** Third Parties accessing data in the platform and used for purposes not aligned to the platforms' objectives or the commercial interests of the parties who contributed data.	• Assertions made by third parties may or may not be an accurate interpretation of the data provided by the platform resulting in stakeholders affected by the assertions becoming reluctant to contribute data to the platform in the future.	• While limiting access to the platform or screening users will impact the platform's ability to appear independent, causing all users to log into the platform and verifying identity will allow for the restriction or termination of access by users who have misused the data. • Moving to a subscription model will also act as a 'gatekeeper' mechanism to prevent users misusing the data.
	• **Under delivery:** Platform becomes under resourced / underfunded and is therefore unable to deliver on its objectives or build confidence in the platform.	• Reputational damage impacting platform's ability to raise funds in the future, and likewise jeopardise future collaborative efforts from organisations.	• Ensure funding for each regional platform is in place prior to commitment to adding the regional project to the platform. • Ensure stakeholders the platform partners with are reputable, reliable and willing to invest either financially or in providing services or assistance to generate data required to maintain the platform. • Ensure legal advice is sought for every joint venture - that each participant is legally bound to deliver on their commitments.
	• **Lack of buy-in from Stakeholders:** Stakeholders do not have confidence in Platform being a long term and sustainable platform and therefore do not want to get involved.	• Unable to attract funding and strategic support from key stakeholders who have the skills or money to help support platform or the Regional Joint Venture.	• Secure support from strategic individuals within key stakeholders, such as high-profile board members whose public and / or private support can generate interest in the project from operational level stakeholders. • Develop a funding model which is sustainable and not reliant on any one particular source. • Government funding will still be critical to seed, scale and sustain however, maintaining independence from Government funding is crucial.

The above list of risks is non-exhaustive. Further identification of risks / controls is required during the establishment of the regional assessment.

5g.
Pilbara: Implementation plan

Implementation approach: Pilbara implementation plan and work



Work stream 2: Flora and fauna

Product package 2.1: Database of flora, vegetation, fauna habitat and fauna occurrence

Overview

Overview

A curated, maintained database of flora, vegetation communities and fauna drawing on private, collaborative and constrained datasets will increase efficiency in analysis supporting approvals applications, and reduce the time taken to assess applications by regulators. It will assist in front-end project design and facilitate impact avoidance. It will also give oversight of changes over time in the representation of flora, vegetation and fauna as species or communities approach conservation significant status. Potential distribution based on this data will identify priority areas for future survey to increase knowledge of conservation significant species. Proponents, government, and the PEOF can use this information to guide infill verification survey proposals and funding.
A regional, current dataset will facilitate reporting on country, Natural Capital Accounting, development of DPSIR models and assisting organisations to report on ESG outcomes.
Approach is to target data collected by stakeholders that is not currently shared with BIO. This may include monitoring data, rehabilitation, and other non-Part IV or Part V surveys.

Deliverables

1. Collaborative and Constrained survey and monitoring 'analysis ready' dataset that is compatible with existing shared databases.

Assumptions

1. Data/analytics sharing is assumed within a SEAF
2. Vegetation community naming conventions are standardised
3. All public data will make its way to Bio

Risks / Issues

1. Difficulty reaching consensus on shared nomenclature or similarity analysis to align data
2. Difficulty reaching consensus on vegetation community naming conventions for shared nomenclature
3. No legislative 'stick' to mandate participation
4. Initial enthusiasm for platform wanes over time and tool loses currency

Dependencies

1. Data/analytics sharing is assumed within a SEAF
2. Operational BIO with public data flowing readily into the system and becoming available
3. Data sharing agreements
4. Hosting agreements

Scope and Timing

In Scope

1. Historical data collection and translation to 2018
2. IBSA submitted from 2018
3. Non BIO Historical data collection and curation

Out of Scope

1. Mapping of data (Work Package 2.2)
2. Predictive capacity for distribution outside known occurrences (Work Packages 2.3, 2.4, and 2.5)

Goals / Outcomes

1. Securely combine collaborative and constrained data with private data
2. Curated, maintained and current database of terrestrial biological data that supports decision-making by proponents, regulators, and traditional owners
3. Properly maintained and current database of terrestrial biological data that can be used to guide secondary investment in infill survey

Timeline / Milestones

1. Year 0 – finalise concept and feasibility
2. Year 0 – Establish database (including update process and protocols) and hosting
3. Year 1 – Operation

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DBCA, DWER, DCCEEW
2. Industry
3. Consultants
4. Traditional owners
5. Research community

Budget

1. $25,000 Confirm requirements and scope
2. $250,000 BIO Aligned Platform Build (allowance)
3. $250,000 Data Migration
4. $125,000 Annual Maintenance

Resource Requirements

1. Hosting for data and portal
2. Highly experienced botanist to verify either shared nomenclature or similarity analysis results
3. Resources to verify and upload regular updates to keep the dataset current

Work stream 2: Flora and fauna

Product package 2.2: Regional map of flora, vegetation, fauna habitat and fauna distribution

Overview

Overview

A regional map will be displayed via a GIS based portal to biological data stored as a result of Work Package 2.1, which will provide a spatially represented visual aid to identify populations at risk of current and future development. The regional map will assist in front-end project design and facilitate impact avoidance. Predictions of future impacts that may push communities into higher conservation categories will be easier to make for both proponents and regulators.

Deliverables

1. Online SEAF data portal to spatially display data with ability to interrogate and import for further analysis
2. Operation – ongoing maintenance of map portal and linkages with SEAF and BIO
3. Identification of analytics that can be derived from the database and displayed on portal, such as ability to filter historical data by time and create mapped representations of changes in known distributions over time (Science package 2.2.1)

Assumptions

1. Data/analytics sharing is assumed within a SEAF
2. Science package will be funded via the Science budget

Risks / Issues

1. No legislative 'stick' to require participation
2. Initial enthusiasm for platform wanes over time and tool loses currency

Dependencies

1. Work Package 2.1 established and operational (including all dependencies)
2. Data sharing agreements
3. Hosting agreements
4. Funding

Scope and Timing

In Scope

1. Development of on-line map portal

Out of Scope

1. Predictive capacity for distribution outside known occurrences (Work Packages 2.3, 2.4, and 2.5)

Goals / Outcomes

1. Curated, maintained and current map of vegetation communities, flora, fauna, and fauna habitat that supports decision-making by proponents, regulators, and traditional owners.
2. Curated, maintained and current map of vegetation communities, flora, fauna, and fauna habitat that can be used to guide secondary investment in infill survey

Timeline / Milestones

1. Year 1 – Develop portal
2. Year 2 – Operation and initiate Science Program 2.2.1

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DBCA, DWER, DCCEEW
2. Industry
3. Consultants
4. Traditional owners
5. Research community

Budget

1. $150,000 Product Development
2. $50,000 Annual Maintenance

Resource Requirements

1. Hosting for data and mapping portal
2. Resources to verify and upload regular updates to keep the map current

Work stream 2: Flora and fauna

Science package 2.2.1: Spatiotemporal analytics - Flora, vegetation, fauna habitat, and fauna

Overview

Overview

Science are discrete studies to support the development of SEAF tools. Science may include one or more of the following objectives: 1) proof of concept; 2) scientific development; and, 3) continuous improvement

Science package 2 supports regional biodiversity mapping to assist in front-end project design and facilitate impact avoidance. It will assist oversight of changes in flora species, vegetation communities and fauna over time, informing reports on their conservation status and predictions of future impacts and its mitigation. Science Package 2.2.1 delivers on the existing information on distributions toward the development of analytics to track changes to vegetation communities, flora and fauna over time.

Deliverables

1. Identification of analytics required by end users which can be derived from the database and displayed on portal
2. Generation of historical time-series of known distributions
3. Analytics to Identify and map changes in known distributions over time
4. Analytics to identify and map changes in uncertainty over time

Assumptions

1. Data/analytics sharing is assumed within a SEAF
2. Work 2.1 and 2.2 will be funded via SEAF implementation budget

Risks / Issues

1. No legislative 'stick' to require participation
2. Initial enthusiasm for platform wanes over time and tool loses currency

Dependencies

1. Work Package 2.2 deliverables 1 & 2 established and operational (including all dependencies)
2. Data sharing agreements
3. Hosting agreements
4. Funding

Scope and Timing

In Scope

1. Development of on-line map portal

Out of Scope

1. Predictive capacity for distribution outside known occurrences (Work Packages 2.3, 2.4, and 2.5)

Goals / Outcomes

1. Curated, maintained and current map of vegetation communities, flora, fauna, and fauna habitat that supports decision-making by proponents, regulators, and traditional owners
2. Curated, maintained and current map of vegetation communities, flora, fauna, and fauna habitat that can be used to guide secondary investment in infill survey

Timeline / Milestones

1. Year 2 – Operation and initiate Science Program

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DBCA, DWER, DCCEEW
2. Industry
3. Consultants
4. Traditional owners
5. Research community

Budget

1. $125,000 Development and delivery of analytic tools
2. $75,000 Automation of future updates

Resource Requirements

1. Hosting for data and mapping portal
2. Resources to verify and upload regular updates to keep the map current

Work stream 2: Flora and fauna

Product package 2.3: Regional vegetation communities suitability model and map

Overview

Overview

Data portal developed under WP 2.2 will be expanded to draw in other biological, chemical, geological and landscape feature data, enabling fast visual assessment of landscape elements that define the distribution of vegetation communities. Research of known associations will be incorporated into the model assumptions to guide predictions of suitability for vegetation communities in areas that haven't been surveyed.
AI data analysis of these features along with known vegetation community distributions will give predictions of vegetation community occurrence outside known/surveyed areas with increasing confidence as the data sets grow and AI learns from ground truthing. Further analysis of data may help better define threatening processes, which may increase (or reduce) conservation significance of listed communities.
Proponents, government, and the PEOF can use these predictions to guide survey infill verification and planning to improve suitability and extent predictions over time.

Deliverables

1. Incorporation of relevant biological, chemical, geological and landscape data into data portal from Work package 2 .2
2. Analytics modelling the association between vegetation communities and these physio-chemical environmental properties (from Science package 2.3.1)
3. Expected occurrence and distribution of vegetation community occurrence based on known distribution and environmental preferences (from Science 2.3.2 and 2.3.3)

Assumptions

1. Science package will be funded via the Science budget

Risks / Issues

1. Currency of database and map from Work Packages 2.1 and 2.2 fall away and basis of maps becomes outdated

Dependencies

1. Work package 2.1 established and operational
2. Work package 2.2 established and operational

Scope and Timing

In Scope

1. Setting up workflows from established bio, chem, geo and landscape features
2. Research paper identifying known associations between vegetation communities, chem, geo and landscape features
3. Suitability model based on vegetation community environmental preferences
4. Map of predicted distribution based on the suitability model and known environmental features (incorporating levels of confidence)

Out of Scope

1. Investment in infill survey – that is a potential outcome of the Science Programs
2. Science

Goals / Outcomes

1. Increased knowledge of environmental preferences of vegetation communities
2. Predictive model of vegetation community occurrence based on known distributions of biological, chemical, geological and landscape features.
3. Predictive model map can be used to guide secondary investment in infill survey which in turn improves the accuracy of the model.

Timeline / Milestones

1. Year 1 – Research Paper
2. Year 2 – Enhance data portal
3. Year 3 – initiate Science Package 2.3.1
4. Year 3 – initiate Science Package 2.3.2
5. Year 4 – initiate Science Package 2.3.3

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DBCA, DWER, DCCEEW, DMIRS, Geological survey
2. Industry
3. Consultants
4. Traditional owners
5. Scientific research community

Budget

1. $75,000 Research Paper
2. $100,000 Enhance data portal
3. $250,000 Model Implementation
4. $50,000 Annual Maintenance

Resource Requirements

1. Researchers to compile environmental preferences of vegetation communities for biological, chemical, geological and landscape features
2. Resources to collate biological, chemical, geological and landscape feature data
3. AI/data processing to identify new environmental preferences and undertake predictive modelling and mapping

Work stream 2: Flora and fauna

Science package 2.3.1 : Biogeochemical associations of vegetation communities

Overview

Overview

Science are discrete studies to support the development of SEAF tools. Science may include one or more of the following objectives: 1) proof of concept; 2) scientific development; and, 3) continuous improvement

Science package 2.3 supports the development of a Suitability Model incorporating predictions of vegetation occurrence based on known biological, chemical, geological and landscape features. Science Package 2.3.1 acquires information on the current distribution and occurrences of vegetation communities across the region, and the physical and biogeochemical attributes known for those places. This information will then be used to develop an initial model of the potential distribution of vegetation communities including areas currently unsurveyed.

Deliverables

1. A comprehensive database of known occurrences and distributions of vegetation communities
2. A database of known biological, chemical, geological and landscape features associated with those occurrences
3. Review of existing knowledge of the relationship of vegetation communities to local factors
4. Identification and prioritisation of community-specific knowledge gaps needed to better define those relationships
5. A research program aimed at improving knowledge and filling knowledge gaps

Assumptions

1. Work 2.1 to 2.3 will be funded via SEAF implementation budget

Risks / Issues

1. Currency of database and map from Work Packages 2.1 and 2.2 fall away and basis of maps becomes outdated

Dependencies

1. Work Package 2.3 deliverables 1 established and operational (including all dependencies)

Scope and Timing

In Scope

1. Scoping the factors involved in a Suitability model based on vegetation community environmental preferences
2. Research informing model creation and improvement

Out of Scope

1. Investment in infill survey – that is a potential outcome of the Science Programs
2. Linkage to ground water models for GDE
3. Mapping of environmental features (biological, chemical, geological and landscape) combined with known vegetation community occurrence (Work Package 2.3)
4. Map of predicted distribution based on the suitability model and known environmental features (incorporating levels of confidence) (Science Package 2.3.2)

Goals / Outcomes

1. Increased knowledge of environmental preferences of vegetation communities

Timeline / Milestones

1. Year 3 – Knowledge gap analysis and model initiation
2. Year 4-5 – Research Program delivery

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DBCA, DWER, DCCEEW, DMIRS, Geological survey
2. Industry
3. Consultants
4. Traditional owners
5. Scientific research community

Budget

1. $50,000 Gap Analysis
2. $150,000 Model Development
3. $200,000 - $400,000 Research program delivery (Years 4)
4. $200,000 - $400,000 Research program delivery (Years 5)

Resource Requirements

1. Researchers to compile environmental preferences of vegetation communities for biological, chemical, geological and landscape features

Work stream 2: Flora and fauna

Science package 2.3.2: Vegetation community modelling

Overview

Overview

Science are discrete studies to support the development of SEAF tools. Science may include one or more of the following objectives: 1) proof of concept; 2) scientific development; and, 3) continuous improvement

Science package 2.3 supports the development of a Suitability Model incorporating predictions of vegetation occurrence and distribution across the region. Science Package 2.3.2 constructs a predictive model of vegetation occurrence based on information on the current distribution and occurrences of vegetation communities across the region, and the physical and biogeochemical attributes known for those places. This information will then be used to develop an initial model of the potential distribution of vegetation communities including areas currently unsurveyed. Model development will be based in part on AI interpretation of data taking these features into account alongside known vegetation community distribution and environmental preferences to predict of vegetation community occurrence with varying confidence outside known/surveyed areas.

Proponents, government, and the PEOF can use these predictions to guide infill verification survey proposals and funding, which will feed back into the science programs and increase accuracy of predictions over time.

Deliverables	Assumptions
1. Predictive modelling of vegetation community occurrence based on known distribution and environmental preferences 2. Identification of high priority survey sites (e.g. predicted occurrence of TEC with limited data availability)	1. Work 2.1 to 2.3 will be funded via SEAF implementation budget
Risks / Issues	**Dependencies**
1. Currency of database and map from Work Packages 2.1 and 2.2 fall away and basis of maps becomes outdated	1. Work Package 2.3 deliverables 1 established and operational (including all dependencies) 2. Science Package 2.3.1 initiated and delivering in parallel

Scope and Timing

In Scope	Out of Scope
1. Map of predicted distribution based on the suitability model and known environmental features (incorporating levels of confidence)	1. Investment in infill survey – that is a potential outcome of the Science Programs
Goals / Outcomes	**Timeline / Milestones**
1. Predictive model of vegetation community occurrence based on known distributions of biological, chemical, geological and landscape features. 2. Predictive model map can be used to guide secondary investment in infill survey which in turn improves the accuracy of the model.	1. Year 3 – Model Development 2. Year 4 – Infill survey prioritisation

Resources and Interfaces

Key Stakeholders	Budget
1. Government – EPA, DBCA, DWER, DCCEEW, DMIRS, Geological survey 2. Industry 3. Consultants 4. Traditional owners 5. Scientific research community	1. $200,000 Model Development
Resource Requirements	
1. Researchers to compile environmental preferences of vegetation communities for biological, chemical, geological and landscape features	

Work Stream 2: Flora and fauna

Science package 2.3.3: Regional vegetation community mapping (remote sensing)

Overview

Overview

Science are discrete studies to support the development of SEAF tools. Science may include one or more of the following objectives: 1) proof of concept; 2) scientific development; and, 3) continuous improvement

Science package 2.3 supports the development of a Suitability Model incorporating predictions of vegetation occurrence and distribution across the region. While Science Package 2.3.2 approaches this objective based on co-occurrence of vegetation communities with local site factors, and alternative approach is to use remote sensing of existing vegetation communities combined with broader GIS-based information to make a partially independent model of suitability.
This alternative, complementary approach will subsequently be compared with the performance and outputs of the Suitability Model from 2.3.2, toward the most robust approach to vegetation community prediction.

Proponents, government, and the PEOF can use these predictions to guide infill verification survey proposals and funding, which will feed back into the science programs and increase accuracy of predictions over time.

Deliverables	Assumptions
1. AI tools to analyse Landsat and other remote sensing data to predict occurrence and distribution of vegetation communities 2. Identification of high priority survey sites (e.g. predicted occurrence of TEC with limited data availability)	1. Work 2.1 to 2.3 will be funded via SEAF implementation budget 2. Compliments rather than duplicates the work of Science Package 2.3.2 3. Deliverable 2 of Science package 2.2.1 (Enable historical time-series of known distributions with uncertainty estimate) provides a suitable training set for AI/Machine Learning approaches
Risks / Issues	**Dependencies**
1. Currency of database and map from Work Packages 2.1 and 2.2 fall away and basis of maps becomes outdated	1. Work 2.1 and 2.2 established and operational

Scope and Timing

In Scope	Out of Scope
1. Map of predicted distribution based on remote sensing (incorporating levels of confidence)	1. Investment in infill survey – that is a potential outcome of the Science Programs
Goals / Outcomes	**Timeline / Milestones**
1. Predictive model and map of vegetation community occurrence based on remote sensing data. 2. Predictive model map can be used to guide secondary investment in infill survey which in turn improves the accuracy of the model.	1. Year 4 – Model development 2. Year 5 – Infill survey prioritisation Although scheduled in year 4; this science package can be initiated at any time after the completion of deliverable 2 of Science package 2.2.1 (Enable historical time-series of known distributions with uncertainty estimate)

Resources and Interfaces

Key Stakeholders	Budget
1. Government – EPA, DBCA, DWER, DCCEEW, DMIRS, Geological survey 2. Industry 3. Consultants 4. Traditional owners 5. Scientific research community	1. $250,000 Model development
Resource Requirements	
1. AI/data processing to identify new environmental preferences and undertake predictive modelling and mapping	

Work Stream 2: Flora and fauna

Product package 2.4: Regional flora species habitat suitability model

Overview

Overview

Data portal developed under WP 2.2 will be expanded to draw in predicted vegetation community distribution, enabling fast visual assessment of associations required for flora species to exist. Research of known associations will be incorporated into the model assumptions to guide predictions of suitability for flora species in areas that haven't been surveyed.
AI data analysis of these features along with known species distribution and environmental preferences will give predictions of species occurrence outside known/surveyed areas with increasing confidence as the data sets grow and AI learns from ground truthing.
Further analysis of data may help identify threatening processes not previously observed or quantified, which may increase (or reduce) conservation significance of listed species.
Proponents, government, and the PEOF can use these predictions to guide infill verification survey proposals and funding, which will feed back into the science programs and increase accuracy of predictions over time.

Deliverables

1. Modelled distribution (maps) of flora species based on their association with vegetation communities and their underlying physio-chemical and topographic determinants (supported by Science Packages 2.4.1, 2.4.2 and 2.4.3)

Assumptions

1. Science package will be funded via the Science budget

Risks / Issues

1. AI not developed enough to achieve the stated goals

Dependencies

1. Work package 2.1 established and operational
2. Work package 2.2 established and operational
3. Work package 2.3 established and operational

Scope and Timing

In Scope

1. Research paper identifying known associations between flora species and vegetation communities, chem, geo and landscape features
2. Suitability model based on flora species environmental preferences
3. Map of predicted distribution based on the suitability model and known environmental features (incorporating levels of confidence)

Out of Scope

1. Investment in infill survey – that is a potential outcome of the Science Programs
2. Science

Goals / Outcomes

1. Increased knowledge of environmental preferences of flora species
2. Predictive model of flora species occurrence based on known distributions of biological, chemical, geological and landscape features, and known and predicted vegetation community distribution.
3. Predictive model map can be used to guide secondary investment in infill survey which in turn improves the accuracy of the model.

Timeline / Milestones

1. Year 1 – Prepare environmental preferences research paper
2. Year 2 – initiate Science Package 2.4.1
3. Year 2 – initiate Science Package 2.4.2
4. Year 3 – initiate Science Package 2.4.3

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DBCA, DWER, DCCEEW, DMIRS, Geological survey
2. Industry
3. Consultants
4. Traditional owners
5. Scientific research community

Budget

1. $75,000 Research Paper
2. $250,000 Model Implementation
3. $50,000 Annual Maintenance

Resource Requirements

1. Researchers to compile environmental preferences of Conservation Significant flora species for vegetation communities, and biological, chemical, geological and landscape features
2. AI/data processing to identify new environmental preferences and undertake predictive modelling and mapping

Work stream 2: Flora and fauna

Science package 2.4.1 : Biogeochemical associations of flora species of concern

Overview

Overview

Science are discrete studies to support the development of SEAF tools. Science may include one or more of the following objectives: 1) proof of concept; 2) scientific development; 3) continuous improvement

Science package 2.4 supports flora species habitat suitability modelling to predict occurrence of flora species based on known (or predicted) association with vegetation communities, as well as biological, chemical, geological and landscape features. Science Package 2.4.1 will acquire existing data on the biogeochemical and landscape associations with flora species of concern, in support of modelling potential flora species occurrence with varying confidence outside known/surveyed areas. Further analysis of data may help identify threatening processes not previously observed, mapped or quantified, which may increase (or reduce) conservation significance of listed species.

Proponents, government, and the PEOF can use these predictions to guide infill verification survey proposals and funding, which will feed back into the science programs and increase accuracy of predictions over time.

Deliverables

1. Review of existing knowledge of bio-geochemical and landscape associations for flora species of concern.
2. Identification and prioritisation of species-specific knowledge gaps
3. Research program to improve knowledge and fill knowledge gaps

Assumptions

1. Work 2.1 to 2.3 will be funded via SEAF implementation budget
2. Species of concern projects embedded in vegetation community Science Package 2.3.X delivery
3. Cost for first species will be (relatively) high with a downward trend as knowledge is applied to additional species

Risks / Issues

1. Currency of database and map from Work packages 2.1 and 2.2 fall away and basis of maps becomes outdated

Dependencies

1. Work package 2.3 deliverables 1 established and operational (including all dependencies)

Scope and Timing

In Scope

1. Mapping of environmental features from Work package 2.3 combined with known Conservation Significant flora species occurrence
2. Suitability model based on flora species environmental preferences
3. Research enabling model creation and improvement

Out of Scope

1. Investment in infill survey – that is a potential outcome of the Science Programs
2. Science

Goals / Outcomes

1. Increased knowledge of environmental preferences of flora species

Timeline / Milestones

1. Year 3 – Knowledge gap analysis and model initiation
2. Year 4-5 – Research Program delivery

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DBCA, DWER, DCCEEW, DMIRS, Geological survey
2. Industry
3. Consultants
4. Traditional owners
5. Scientific research community

Budget

1. $50,000 - $75,000 per species (Allow $1,000,000 - $1,500,000 over 5 years)

Resource Requirements

1. Researchers to compile environmental preferences of Conservation Significant flora species for vegetation communities, and biological, chemical, geological and landscape features

Work stream 2: Flora and fauna

Science package 2.4.2: Species distribution modelling (flora)

Overview

Overview

Science are discrete studies to support the development of SEAF tools. Science may include one or more of the following objectives: 1) proof of concept; 2) scientific development; and, 3) continuous improvement

Science package 2.4 supports flora species habitat suitability modelling to predict occurrence of flora species based on known (or predicted) association with vegetation communities, as well as biological, chemical, geological and landscape features. Science Package 2.4.2 develop predictive modelling of potential flora species occurrence with estimates of confidence outside known/surveyed areas. Further analysis of data may help prioritise additional biological surveys.

Proponents, government, and the PEOF can use these predictions to guide infill verification survey proposals and funding, which will feed back into the science programs and increase accuracy of predictions over time.

Deliverables

1. Predictive modelling of species occurrence based on known distribution and environmental preferences
2. Identification of high priority survey sites (e.g., predicted occurrence of Threatened species with limited data availability)

Assumptions

1. Work packages 2.1 to 2.3 will be funded via SEAF implementation budget
2. Species of concern projects embedded in vegetation community Science Package 2.3.X delivery
3. Cost for first species will be (relatively) high with a downward trend as knowledge is applied to additional species

Risks / Issues

1. Currency of database and map from Work Packages 2.1 and 2.2 fall away and basis of maps becomes outdated

Dependencies

1. Work package 2.3 deliverables 1 established and operational (including all dependencies)
2. Science Packages 2.3.1 and 2.3.2 initiated and delivering in parallel

Scope and Timing

In Scope

1. Map of predicted distribution based on the suitability model and known environmental features (incorporating levels of confidence)

Out of Scope

1. Investment in infill survey – that is a potential outcome of the Science Programs

Goals / Outcomes

1. Predictive model of flora species occurrence based on known distributions of biological, chemical, geological and landscape features, and known and predicted vegetation community distribution.
2. Predictive model map can be used to guide secondary investment in infill survey which in turn improves the accuracy of the model.

Timeline / Milestones

1. Year 3 – Model Development
2. Year 4 – Infill survey prioritisation

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DBCA, DWER, DCCEEW, DMIRS, Geological survey
2. Industry
3. Consultants
4. Traditional owners
5. Scientific research community

Budget

1. $200,000 - $400,000 Model Development
2. $50,000 Infill survey Prioritisation

Resource Requirements

1. Researchers to compile environmental preferences of Conservation Significant flora species for vegetation communities, and biological, chemical, geological and landscape features
2. AI/data processing to identify new environmental preferences and undertake predictive modelling and mapping

Work stream 2: Flora and fauna

Product package 2.5: Regional fauna habitat suitability model

Overview

Overview

The predicted distribution of vegetation communities under Work Package 2.3, lays the basis for determining associations with fauna habitat suitability. Research of known associations will be incorporated into the model assumptions to guide predictions of suitability for fauna habitat in areas that haven't been surveyed.
AI data analysis of these features along with known species distribution and environmental preferences will give predictions of habitat occurrence outside known/surveyed areas with increasing confidence as the data sets grow and AI learns from ground truthing.
Further analysis of data may help identify threatening processes not previously observed or quantified, which may increase (or reduce) conservation significance of listed species.
Proponents, government, and the PEOF can use these predictions to guide infill verification survey proposals and funding, which will feed back into the science programs and increase accuracy of predictions over time.

Deliverables

1. Modelled potential fauna habitat distribution and occurrences based on associations with vegetation communities and underlying landscape features established in Work Package 2.3 (supported by Science Packages 2.5.1, 2.5.2 and 2.5.3)

Assumptions

1. Science package will be funded via the Science budget

Risks / Issues

1. AI not developed enough to achieve the stated goals

Dependencies

1. Work package 2.1 established and operational
2. Work package 2.2 established and operational
3. Work package 2.3 established and operational

Scope and Timing

In Scope

1. Research paper identifying known associations between fauna species and vegetation communities, chem, geo and landscape features
2. Suitability model based on fauna species environmental preferences
3. Map of predicted distribution based on the suitability model and known environmental features (incorporating levels of confidence)

Out of Scope

1. Investment in infill survey – that is a potential outcome of the Science Programs
2. Science

Goals / Outcomes

1. Increased knowledge of fauna habitat distribution
2. Predictive model of fauna habitat occurrence based on known distributions of biological, chemical, geological and landscape features, and known and predicted vegetation community distribution.
3. Predictive model map can be used to guide secondary investment in infill survey which in turn improves the accuracy of the model.

Timeline / Milestones

1. Year 1 – Prepare environmental preferences research paper
2. Year 2 – initiate Science Package 2.5.1
3. Year 2 – initiate Science Package 2.5.2
4. Year 3 – initiate Science Package 2.5.3

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DBCA, DWER, DCCEEW
2. Industry
3. Consultants
4. Traditional owners
5. Scientific research community

Budget

1. $75,000 Research paper
2. $250,000 Model Implementation
3. $50,000 Annual Maintenance

Resource Requirements

1. Researchers to compile environmental preferences of Conservation Significant flora species for vegetation communities, and biological, chemical, geological and landscape features
2. AI/data processing to identify new environmental preferences and undertake predictive modelling and mapping

Work stream 2: Flora and fauna

Science package 2.5.1: Regional fauna habitat suitability model

Overview

Overview

Science are discrete studies to support the development of SEAF tools. Science may include one or more of the following objectives: 1) proof of concept; 2) scientific development; and, 3) continuous improvement

Science package 2.5 supports fauna habitat suitability modelling to predict occurrence of fauna habitat. Science Package 2.5.1 approaches this objective based on known (or predicted) vegetation community on which fauna depend, and local biological, chemical, geological and landscape features. AI interpolation of data taking these features into account alongside environmental preferences will give predictions of potential fauna habitat occurrence with varying confidence outside known/surveyed areas. Further analysis of data may help identify threatening processes not previously observed, which may increase (or reduce) conservation significance of listed species, and assist prioritisation of subsequent fauna surveys.

Proponents, government, and the PEOF can use these predictions to guide infill verification survey proposals and funding, which will feed back into the science programs and increase accuracy of predictions over time.

Deliverables

1. A review of existing knowledge of vegetation community and landform associations for fauna species of interest.
2. Identification and prioritisation of species-specific knowledge gaps
3. A research program to improve knowledge and fill knowledge gaps
4. A habitat suitability model based on known distribution and environmental preferences
5. Identification of high priority survey sites (e.g. predicted occurrence of Threatened species with limited data availability)

Assumptions

1. Work 2.1 to 2.5 will be funded via SEAF implementation budget
2. Cost for first species will be (relatively) high with a downward trend as knowledge is applied to additional species
3. Models will be built to draw on the outputs of either Science Package 2.3.2 or 2.3.3 (i.e. agnostic to source of vegetation distribution data [observed/predicted/inferred from remote sensing]

Risks / Issues

1. AI not developed enough to achieve the stated goals

Dependencies

1. Work package 2.3 established and operational

Scope and Timing

In Scope

1. Mapping of environmental features from Work Package 2.3 combined with known fauna habitat occurrence
2. Suitability model based on aligning fauna habitats with vegetation communities and landscape features
3. Map of predicted distribution based on the suitability model and aligned environmental features (incorporating levels of confidence)

Out of Scope

1. Investment in infill survey – that is a potential outcome of the Science Programs

Goals / Outcomes

1. Increased knowledge of fauna habitat distribution
2. Predictive model of fauna habitat occurrence based on known distributions of biological, chemical, geological and landscape features, and known and predicted vegetation community distribution.
3. Predictive model map can be used to guide secondary investment in infill survey which in turn improves the accuracy of the model.

Timeline / Milestones

1. Year 2 – Literature review, model identification and gap analysis

Note: this will build on recent research prioritisation work for Pilbara MNES and the Pilbara Environmental Offset Fund fauna investment plan currently under development by DBCA

1. Year 3 – Model Development
2. Year 4-5 – Research Program delivery

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DBCA, DWER, DCCEEW
2. Industry
3. Consultants
4. Traditional owners
5. Scientific research community

Budget

1. $50,000 Gap Analysis
2. $150,000 Model Development
3. $200,000 - $400,000 Research program delivery (Years 4)
4. $200,000 - $400,000 Research program delivery (Years 5)

Resource Requirements

1. Researchers to compile environmental preferences of Conservation Significant fauna species for vegetation communities, and landform

Work stream 2: Flora and fauna

Science package 2.5.2: Species distribution mapping – Fauna (remote sensing)

Overview

Overview

Science are discrete studies to support the development of SEAF tools. Science may include one or more of the following objectives: 1) proof of concept; 2) scientific development; and, 3) continuous improvement

Science package 2.5 supports fauna habitat suitability modelling to predict occurrence of fauna habitat. While Science Package 2.5.2 approaches this objective based on the co-occurrence of fauna with vegetation communities and local site factors, an alternative approach in Science Package 2.5.2 is to use remote sensing of existing vegetation communities associated with specific fauna combined through AI with GIS-based information to make a partially independent model of habitat suitability and fauna distribution. The output and utility of these complementary approaches to predictive fauna distribution mapping will be evaluated toward the resolution of the most robust and useful approach.

Proponents, government, and the PEOF can use these predictions to guide infill verification survey proposals and funding, which will feed back into the science programs and increase accuracy of predictions over time.

Deliverables

1. AI tools to analyse Landsat and other remote sensing data to predict occurrence and distribution of suitable habitat
2. Identification of high priority survey sites (e.g. predicted occurrence of Threatened species with limited data availability)

Assumptions

1. Work 2.1 to 2.3 will be funded via SEAF implementation budget
2. Compliments rather than duplicates the work of Science Package 2.3.2
3. Deliverable 2 of Science package 2.2.1 (Enable historical time-series of known distributions with uncertainty estimate) provides a suitable training set for AI/Machine Learning approaches
4. Projects build on habitat suitability models Science Package 2.5.1 applying these to vegetation community predictions developed in Science Package 2.3.3
5. Cost for first species will be (relatively) high with a downward trend as knowledge is applied to additional species

Risks / Issues

1. Currency of database and map from Work Packages 2.1 and 2.2 fall away and basis of maps becomes outdated
2. AI not developed enough to achieve the stated goals

Dependencies

1. Work package 2.1 established and operational
2. Work package 2.2 established and operational
3. Work package 2.3 established and operational

Scope and Timing

In Scope

1. Map of predicted distribution based on the suitability model and known environmental features (incorporating levels of confidence)

Out of Scope

1. Investment in infill survey – that is a potential outcome of the Science Programs
2. Science

Goals / Outcomes

1. Predictive model of flora species occurrence based on remote sensing and known and predicted vegetation community distribution.
2. Predictive model map can be used to guide secondary investment in infill survey which in turn improves the accuracy of the model.

Timeline / Milestones

1. Year 4 – Model development
2. Year 5 – Infill survey prioritisation

Although scheduled in year 4; this science package can be initiated at any time after the completion of deliverable 2 of Science package 2.2.1 (Enable historical time-series of known distributions with uncertainty estimate)
Will be improved with the completion of Science package 2.3.2 (Vegetation Community Modelling)

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DBCA, DWER, DCCEEW, DMIRS, Geological survey
2. Industry
3. Consultants
4. Traditional owners
5. Scientific research community

Budget

1. $75,000 per species (Allow $500,000 - $1,500,000 depending on species selected and number considered)

Resource Requirements

1. AI/data processing to identify new environmental preferences and undertake predictive modelling and mapping

Work stream 2: Flora and fauna

Product package 2.6: Regional fauna habitat connectivity map/model

Overview

Overview

Habitat connectivity model and map will enable prioritisation of habitat conservation within a landscape scale model. It will assist in front-end project design and facilitate impact avoidance. It will also give oversight of changes over time in the availability of habitat for settlement and dispersal purposes.
Proponents, government, and the PEOF can use these predictions to guide infill verification survey proposals and funding.

Deliverables

1. Modelled and mapped local habitat resource patches and the value of habitat linkages, informing a General Landscape Connectivity Model and least-cost dispersal models for MNES species (supported by Science Packages 2.6.1, 2.6.2 and 2.6.3)

Assumptions

1. Science will be funded via the Science budget

Risks / Issues

1. Unavailability of sufficiently developed models and datasets for rare and threatened species

Dependencies

1. Work package 2.1 established and operational
2. Work package 2.2 established and operational
3. Work package 2.3 established and operational
4. Work package 2.5 established and operational

Scope and Timing

In Scope

1. Attach neighbourhood resource values and linkage values to habitat in the habitat suitability map
2. General Landscape Connectivity Model
3. Least cost path models development

Out of Scope

1. Population viability analysis

Goals / Outcomes

1. General Landscape Connectivity Model and dispersal modelling informing impact mitigation, offset opportunities and conservation planning

Timeline / Milestones

1. Year 4– finalise concept and feasibility
2. Year 5 – Produce General Landscape Connectivity Model and initiate Science Package 2.6.1
3. Year 6 – Implement Science Package 2.6.2
4. Year 6 – Implement Science Package 2.6.3

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DBCA, DWER, DCCEEW
2. Industry
3. Consultants

1. Traditional owners
2. Scientific research community

Budget

1. $100,000 Research Paper
2. $250,000 Model Implementation
3. $50,000 Annual Maintenance

Resource Requirements

1. Researchers to assign neighbourhood and linkage values
2. Researchers to establish General Landscape Connectivity Model

Work stream 2: Flora and fauna

Science package 2.6.1: Habitat connectivity model (fauna)

Overview

Overview

Science are discrete studies to support the development of SEAF tools. Science may include one or more of the following objectives: 1) proof of concept; 2) scientific development; and, 3) continuous improvement

Science package 2.6 supports habitat connectivity modelling and mapping to enable prioritisation of habitat conservation within a landscape scale model. It will assist in front-end project design and facilitate impact avoidance. It will also give oversight of changes over time in the availability of habitat for settlement and dispersal purposes.

Proponents, government, and the PEOF can use these predictions to guide infill verification survey proposals and funding.

Deliverables

1. A review of existing knowledge of species movement and landscape connectivity
2. A General Landscape Connectivity Model
3. Identification and prioritisation of species-specific knowledge gaps
4. A research program to improve knowledge and fill knowledge gaps
5. Species-specific models with higher confidence for species of interest
6. Least cost dispersal models for MNES species
7. Landscape scale measures of genetic distinctness for MNES

Assumptions

1. Work 2.1 to 2.5 will be funded via SEAF implementation budget
2. Cost for first species will be (relatively) high with a downward trend as knowledge is applied to additional species
3. Models will be built to draw on the outputs of either Science Package 2.3.2 or 2.3.3 (i.e. agnostic to source of vegetation distribution data [observed/predicted/inferred from remote sensing]

Risks / Issues

1. Unavailability of sufficiently developed models and datasets for rare and threatened species

Dependencies

1. Work package 2.3 established and operational

Scope and Timing

In Scope

1. Attach neighbourhood resource values and linkage values to habitat in the habitat suitability map
2. General Landscape Connectivity Model
3. Least cost path models development
4. Landscape scale genetic distinctness for MNES

Out of Scope

1. Population viability analysis

Goals / Outcomes

1. General Landscape Connectivity Model
2. Connectivity models for MNES Species

Timeline / Milestones

1. Year 3 – Scoping. Literature review and gap analysis
2. Year 4 – Produce General Landscape Connectivity Model
3. Year 4-5 – Research Program delivery
4. Year 5 – Species-specific modelling and least cost dispersal models

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DBCA, DWER, DCCEEW
2. Industry
3. Consultants
4. Traditional owners
5. Scientific research community

Budget

1. $50,000 Gap Analysis
2. $150,000 Model Development
3. $50,000 per species for model parametrisation
4. $350,000 - $500,000 Research program delivery (Years 4)
5. $350,000 - $500,000 Research program delivery (Years 5)

Resource Requirements

1. Researchers to assign neighbourhood and linkage values
2. Researchers to establish General Landscape Connectivity Model

Work stream 2: Flora and fauna

Product package 2.7: Population viability model

Overview

Overview

Spatially-explicit Population Viability Analysis models will enable prioritisation of habitat conservation within the landscape and allow scenario analysis for both habitat restoration and removal as well as reintroduction and enhancement initiatives. It will assist in front-end project design and facilitate impact avoidance. It will also give oversight of likely changes in population status over time.
Proponents, government, and the PEOF can use these predictions to guide restoration and offset strategies.

Deliverables

1. Deliver Population Viability Analysis tools and reports within the SEAF interface (supported by Science Package 2.7.1)

Assumptions

Science Package 2.7.1 funded via SEAF Science budget

Risks / Issues

1. Unavailability of sufficiently developed models and datasets for rare and threatened species

Dependencies

1. Work package 2.1 established and operational
2. Work package 2.2 established and operational
3. Work package 2.3 established and operational
4. Work package 2.4 established and operational
5. Work package 2.5 established and operational
6. Work package 2.6 established and operational

Scope and Timing

In Scope

1. Population viability analysis

Out of Scope

Goals / Outcomes

1. Improved means to consider, prioritise or protect key fauna species from potential, specific changes to the habitat, and the impact on the population as a whole

Timeline / Milestones

1. Year 3 – Initiate Science Package 2.7.1
2. Year 4-5 – Implement PVA model in SEAF Environment
3. Year 5 – Produce General Landscape Connectivity Model and initiate Science Program 2.6.1

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DBCA, DWER, DCCEEW
2. Industry
3. Consultants
4. Traditional owners
5. Scientific research community

Budget

1. $100,000 – Model Implementation

Resource Requirements

1. Researchers to PVA Model

Work stream 2: Flora and fauna

Science package 2.7.1: Population viability modelling - Matters of National Environmental Significance (MNES)

Overview

Overview

Science are discrete studies to support the development of SEAF tools. Science may include one or more of the following objectives: 1) proof of concept; 2) scientific development; and, 3) continuous improvement

Science package 2.7 supports spatially-explicit population viability modelling to enable prioritisation of habitat conservation within the landscape and allow scenario analysis for both habitat restoration and removal as well as reintroduction and enhancement initiatives. It will assist in front-end project design and facilitate impact avoidance. It will also give oversight of likely changes in population status over time.
Proponents, government, and the PEOF can use these predictions to guide restoration and offset strategies.

Deliverables

1. A review of existing knowledge of species movement and landscape connectivity
2. Identification and prioritisation of species-specific knowledge gaps
3. A research program to improve knowledge and fill knowledge gaps
4. Species-specific Population Viability analytics for MNES species

Assumptions

1. Work 2.1 to 2.6 will be funded via SEAF implementation budget
2. Cost for first species will be (relatively) high with a downward trend as knowledge is applied to additional species
3. Models will be built to draw on the outputs of either Science Package 2.3.2 or 2.3.3 (i.e. agnostic to source of vegetation distribution data [observed/predicted/inferred from remote sensing]
4. Models will be buid to draw on the outputs of Science Package 2.6.1 (Connectivity Model)

Risks / Issues

1. Unavailability of sufficiently developed models and datasets for rare and threatened species

Dependencies

1. Work 2.3 and 2.6 established and operational

Scope and Timing

In Scope

1. Population viability analysis

Out of Scope

Goals / Outcomes

1. Population Viability Analysis tools for MNES species

Timeline / Milestones

1. Year 3 – Scoping. Literature review and gap analysis
2. Year 4 – Produce PVA Model in SAEF
3. Year 4-5 – Research Program delivery
4. Year 5 – Species-specific modelling

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DBCA, DWER, DCCEEW
2. Industry
3. Consultants
4. Traditional owners
5. Scientific research community

Budget

1. $50,000 Gap Analysis and prioritisation
2. $150,000 Model Development
3. $3,000,000 - $6,000,000 Research program delivery (dependent on which species and how many addressed in this period)

Resource Requirements

1. Researchers to assign neighbourhood and linkage values
2. Researchers to establish General Landscape Connectivity Model

Work stream 3: Integrated water

Product package 3.1: Integrated groundwater dataset

Overview

Overview

An integrated groundwater dataset will provide industry wide access to groundwater data collected throughout the Pilbara region (or subregion as appropriate). By having access to groundwater data outside the proponent's lease boundary, the modelled boundary conditions will be based on more accurate conditions than would be assumed in the absence of neighbouring data. The database will operate similarly to BIO, and will have the ability to store private, collaborative and constrained data sets.
The approach is to establish a shared database as a priority, which will allow users to build their own groundwater models.

Deliverables

1. A private, collaborative and constrained groundwater database
2. Agreed data standards
3. Operational protocols to maintain currency and availability (supported by Science Package 3.2.1)

Assumptions

1. Users agree to provide data to the database
2. Data collection and reporting protocols are agreed and consistent

Risks / Issues

1. Reluctance to share baseline data
2. Reluctance to share post development monitoring data

Dependencies

1. Data/analytics sharing is assumed within a SEAF
2. Data sharing agreements

Scope and Timing

In Scope

1. Collection of historical data
2. Data package requirements

Out of Scope

1. Modelling

Goals / Outcomes

1. Establish a common dataset that is contributed to by all participants, and that can meet the requirements of the 'private/collaborative/constrained' data model

Timeline / Milestones

1. Year 0 – Develop database, data standards and data package requirements
2. Year 1 – commence data collection and curation

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DWER, DCCEEW
2. Industry
3. Consultants
4. Researchers

Budget

1. $75,000 Scope
2. $250,000 DWER Aligned Platform Build
3. $250,000 Data Migration (Allowance)
4. $250,000 Annual Maintenance (Allowance)

Resource Requirements

1. Hosted server
2. Data analyst to check / curate data

Work stream 3: Integrated water

Product package 3.2: Integrated catchment scale groundwater modelling

Overview

Overview

Shared catchment scale groundwater models for areas under development, integrating the data and understanding across stakeholders, will provide a baseline and a common, agreed tool for future assessments. The GW models will incorporate data supplied to the GW database and modelled developments as they are created. Model outputs for new projects will include consideration for adjacent projects, which will be able to provide a more robust cumulative impact assessment on groundwater values.

Deliverables

1. Identification of the groundwater catchments to be modelled
2. Agreed model platform and standards
3. Proof of concept for a catchment model conforming to the shared approach (supported by Science Package 3.2.1)
4. One or more constructed, operated and maintained catchment groundwater models (Science package 3.2.2)
5. Operation
6. Ongoing improvement and enhancement of models (supported through Science package 3.2.3)

Assumptions

1. A shared database exists and is in use
2. Participants are willing to upload project details
3. Science package 3.2.3 will be funded via the Science budget

Risks / Issues

1. Reluctance to share project models
2. Reluctance to share post development monitoring data
3. Reluctance to share post development models

Dependencies

1. Work Package 3.1
2. Shared water database

Scope and Timing

In Scope

1. Develop catchment model
2. Develop mechanism for new projects to be incorporated under the “Private/Collaborative/Constrained” model

Out of Scope

1. Subterranean fauna

Goals / Outcomes

1. Improved catchment scale understanding of groundwater movement
2. More accurate model outcomes
3. Improved understanding of cumulative effects on groundwater as a result of multiple developments within a catchment

Timeline / Milestones

1. Year 0 – Undertake feasibility study
2. Year 1 – Science package 3.2.1 – demonstrate proof of concept
3. Year 1 – Science package 3.2.2 – Commence development of shared model
4. Year 2 – Model ‘Go live’
5. Year 3 – Science package 3.2.3 – Identify beneficial analytics and build into model capability

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DWER, DCCEEW
2. Industry
3. Consultants
4. Scientific research community

Budget

1. $350,000 Feasibility & proof of concept
2. $450,000 Model development & Implementation
3. $100,000 Annual Maintenance

Resource Requirements

1. Groundwater modelling software package

Work stream 3: Integrated water

Science package 3.2.1: Integrated catchment groundwater model proof-of-concept

Overview

Overview

Science are discrete studies to support the development of SEAF tools. Science may include one or more of the following objectives: 1) proof of concept; 2) scientific development; and, 3) continuous improvement

Science package 3.2 supports integrated and shared catchment scale groundwater modelling to provide a common baseline and predictive basis for future proposals within the same groundwater catchment. These groundwater models will access the shared datasets available across the catchment and model the cumulative impacts of historic, proposed and foreseeable developments across the catchment. Science Package 3.2.1 will establish the protocols for accessing and maintaining shared data, agreement on model software choices, and ultimately demonstrate the proof of concept for a shared approach to groundwater modelling.

Deliverables

1. Demonstrate proof of concept.
2. Optimised software election.
3. Demonstrate that a SEAF GW Model can meet the “private/collaborative/constrained” approach

Assumptions

1. A shared database exists and is in use
2. Participants are willing to upload project details
3. Science package 3.2.3 will be funded via the Science budget

Risks / Issues

1. Reluctance to share project models
2. Reluctance to share post development monitoring data
3. Reluctance to share post development models

Dependencies

1. Work package 3.1
2. Shared water database

Scope and Timing

In Scope

1. Develop mechanism for new projects to be incorporated under the “Private/Collaborative/Constrained” model

Out of Scope

1. Subterranean fauna

Goals / Outcomes

1. Improved catchment scale understanding of groundwater movement
2. More accurate model outcomes
3. Improved understanding of cumulative effects on groundwater as a result of multiple developments within a catchment

Timeline / Milestones

1. Year 1 – Undertake feasibility study
2. Year 2 – Demonstrate proof of concept

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DWER, DCCEEW
2. Industry
3. Consultants
4. Scientific research community

Budget

1. $250,000 - $350,000 Scope & proof of concept

Resource Requirements

1. Groundwater modelling software package

Work stream 3: Integrated water

Science package 3.2.2: Integrated catchment scale groundwater model development

Overview

Overview

Science are discrete studies to support the development of SEAF tools. Science may include one or more of the following objectives: 1) proof of concept; 2) scientific development; and, 3) continuous improvement

Science package 3.2 supports integrated and shared catchment scale groundwater modelling to provide a common baseline and predictive basis for future proposals within the same groundwater catchment. These groundwater models will access the shared datasets available across the catchment and model the cumulative impacts of historic, proposed and foreseeable developments across the catchment. Science Package 3.2.2 will develop initial groundwater model(s) for priority catchments under development

Deliverables

1. Scalable shared model at a catchment level.

Assumptions

1. A shared database exists and is in use
2. Participants are willing to upload project details
3. Science package 3.2.3 will be funded via the Science budget

Risks / Issues

1. Reluctance to share project models
2. Reluctance to share post development monitoring data
3. Reluctance to share post development models

Dependencies

1. Work Package 3.1
2. Shared water database

Scope and Timing

In Scope

1. Develop catchment model

Out of Scope

1. Subterranean fauna

Goals / Outcomes

1. Improved catchment scale understanding of groundwater movement
2. More accurate model outcomes
3. Improved understanding of cumulative effects on groundwater as a result of multiple developments within a catchment

Timeline / Milestones

1. Year 3 – Development of shared model
2. Year 4 – Catchment scale integrated model delivered

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DWER, DCCEEW
2. Industry
3. Consultants
4. Scientific research community

Budget

1. $800,000 - $1,200,000 Model development

Resource Requirements

1. Groundwater modelling software package

Work stream 3: Integrated water

Science package 3.2.3: Enhancing knowledge and practice in groundwater modelling

Overview

Overview

Science are discrete studies to support the development of SEAF tools. Science may include one or more of the following objectives: 1) proof of concept; 2) scientific development; and, 3) continuous improvement

Science package 3.2 supports integrated and shared catchment scale groundwater modelling to provide a common baseline and predictive basis for future proposals within the same groundwater catchment. These groundwater models will access the shared datasets available across the catchment and model the cumulative impacts of historic, proposed and foreseeable developments across the catchment. Science Package 3.2.3 will test the utility and completeness of the initial model(s), identifying data and knowledge gaps and other opportunities to increase the models' robustness, utility and value

Deliverables

1. Knowledge gap analysis
2. Data gap analysis
3. Advances in global best practice in ground water modelling

Assumptions

1. A shared database exists and is in use
2. Participants are willing to upload project details
3. Science package 3.2.3 will be funded via the Science budget

Risks / Issues

1. Reluctance to share project models
2. Reluctance to share post development monitoring data
3. Reluctance to share post development models

Dependencies

1. Work Package 3.1
2. Shared water database

Scope and Timing

In Scope

1. Develop catchment model

Out of Scope

1. Subterranean fauna

Goals / Outcomes

1. Improved catchment scale understanding of groundwater movement
2. More accurate model outcomes
3. Improved understanding of cumulative effects on groundwater as a result of multiple developments within a catchment

Timeline / Milestones

1. Year 5+ – Identify beneficial analytics and build into model capability

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DWER, DCCEEW
2. Industry
3. Consultants
4. Scientific research community

Budget

1. $1,000,000 - $1,500,000 Model research and development over a 3-5 year time horizon

Resource Requirements

1. Groundwater modelling software package

Work stream 4: Cumulative Impact assessment

Product package 4.1: Pilbara region DPSIR reporting model

Overview

Overview

Drivers, Pressures, States, Impacts and Responses (DPSIR) conceptual model based on SEAF data to provide insights into holistic environmental impacts of changing drivers and pressures (contemporary and predictive State of the Environment Reporting). AI analysis used to make linkages between the DPSIR elements, and then to forecast what impacts might result from planned or emerging changes to drivers and pressures.

Deliverables

1. Agreement on the scale, definitions, structure, approach of the DPSIR framework
2. Initial scoping of Drivers/Sources, Pressures, and Environmental Factors (may change as the project progresses)
3. Production of a DIPSR conceptual model for the region
4. Data standards and framework to be used by SEAF in quantifying the reporting model
5. An AI approach to identify trends and to forecast changes in the environment (supported by Science Packages 4.1.1 and 4.1.2)

Assumptions

1. Data/analytics sharing is assumed within a SEAF
2. Cockburn DPSIR model concepts and principles are generally adaptable to Pilbara setting
3. Science will be funded via the Science budget

Risks / Issues

1. Reluctance to share post development monitoring data

Dependencies

1. Prior Work Packages are established and operational

Scope and Timing

In Scope

1. Regional conceptual DIPSR model
2. Data entry and reporting tools

Out of Scope

1. https://www.wa.gov.au/system/files/2022-03/Cockburn-Sound-Drivers-Pressures-State-Impacts-Responses-Assessment-2017-summary-report.pdf

Goals / Outcomes

1. Agreed DIPSR conceptual model
2. Increased understanding of environmental impacts from changes in drivers and pressures and how these have influenced historical trends
3. Increased ability to predict environmental impacts of future changes in drivers and pressures

Timeline / Milestones

1. Year 0 – finalise concept and feasibility - agree definitions, structure and approach; develop draft lists of DIPSR components; produce DIPSR conceptual model
2. Year 1 – Develop data standards and framework
3. Year 2 – Initiate Science Program 4.1.1
4. Year 3 – initiate Science Program 4.1.2

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DBCA, DWER, DCCEEW
2. Industry
1. Consultants
2. Traditional owners

Budget

1. Finalise concept etc - $250,000
2. Development of standards etc - $50,000

Resource Requirements

Work stream 4: Cumulative impact assessment

Product package 4.2: Reasonably foreseeable projects

Overview

Overview

Reasonable foresight of future development s fundamental to being able to fully consider cumulative impacts. A SEAF would enable all existing project footprints to be shared openly, with projects under assessment to be shared either openly or collaboratively and future projects to be constrained (or as determined by the proponent). This will provide proponents with a single point of reference for all reasonably foreseeable projects, which will significantly reduce the level of effort required to identify projects and calculate their footprints. The benefit of this to proponents is that can also upload management. It will also enable regulators to understand where gaps in the knowledge base of existing developments are (e.g., drawdown).

Deliverables

1. An agreed scope and protocol for historic and foreseeable developments to be included in scoping
2. A Regional map of historical and foreseeable developments
3. A method for uploading past, current and future project footprints into SEAF

Assumptions

1. SEAF can operate as a GIS platform for showing developments in 2D / 3D
2. Proponents are willing to share / upload actual footprints of existing projects
3. Science program will be funded via the Science budget

Risks / Issues

1. Lack of willingness to share current proposals
2. ASIC anti-competitive regulations

Dependencies

1. SEAF platform is in operation

Scope and Timing

In Scope

1. Feasibility study to determine method for reporting past, present and future projects in SEAF
2. Collation of spatial data for existing projects and future projects in public domain
3. Collation of spatial data for future projects

Out of Scope

1. Science Programs

Goals / Outcomes

1. To provide a single point of reference for all reasonably foreseeable projects

Timeline / Milestones

1. Year 0 – Feasibility Study
2. Year 1-2 – Develop base map
3. Year 4 - Operation

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DBCA, DWER, DCCEEW
2. Industry
3. Consultants

Budget

1. Agree scope - $50,000
2. Project map development - $450,000
3. Operation and Maintenance - $100,000

Resource Requirements

1. SEAF

Work stream 4: Cumulative impact assessment

Science package 4.1.1: Pilbara region DPSIR trends and forecasting

Overview

Overview

Science are discrete studies to support the development of SEAF tools. Science may include one or more of the following objectives: 1) proof of concept; 2) scientific development; and, 3) continuous improvement

Science package 4.1 supports a Drivers, Pressures, States, Impacts and Responses (DIPSR) conceptual model based on SEAF data to provide insights into holistic environmental impacts of changing drivers and pressures from historical and anticipated development, effectively an ongoing State of the Environment assessment and report for the region. AI analysis will be used to make linkages between the DIPSR elements, and then to forecast what impacts might result from planned or emerging changes to drivers and pressures.

Deliverables

1. An initial State of the Environment Report for the region based on SEAF and Bio databases
2. AI/Machine Learning tools for the identification of trends from SEAF and Bio data and relate to changes in drivers and/or pressures
3. Tools for forecast of future changes in environmental factors based on extrinsic and reasonably foreseeable inputs

Assumptions

1. Data/analytics sharing is assumed within a SEAF
2. Cockburn DPSIR model concepts and principles are generally adaptable to Pilbara setting
3. Science will be funded via the Science budget

Risks / Issues

1. Reluctance to share post development monitoring data
2. Failure to agree reasonably foreseeable scenarios

Dependencies

1. Prior Work Packages are established and operational

Scope and Timing

In Scope

1. Analytic, forecasting and reporting tools

Out of Scope

1. The initial DPSIR framework will not extend to some dimensions of Australia SOE reporting, including air quality and heritage

Goals / Outcomes

1. Increased understanding of environmental impacts from changes in drivers and pressures and how these have influenced historical trends
2. Increased ability to predict environmental impacts of future changes in drivers and pressures

Timeline / Milestones

1. Year 2 – Develop analytic tools for trend analysis and forecasting
2. Year 3 – Initiate research and continuous improvement cycle

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DBCA, DWER, DCCEEW
2. Industry
3. Consultants
4. Traditional owners
5. Research community

Budget

1. $350,000 – Development of models
2. $600,000 - $800,000 – Continuous improvement cycle (over 4 years)

Resource Requirements

Work stream 4: Cumulative impact assessment

Package 4.3: Data and analytics: Survey infill (BioSurvey Pilbara)

Overview

Overview

BioSurvey Pilbara is an end-user led strategy that aims to improve data inputs into the understanding and prediction of the cumulative impacts of development and restoration in Western Australia's Pilbara region. The initiative emphasizes the need for efforts to infill data gaps identified by regional analytics to address the lack of information in unsurveyed areas. To achieve this, a proactive survey plan is required, which involves prioritizing regions, assessing the current and future state, identifying data gaps, and conducting workshops with stakeholders. The program aims to optimize future survey work and is modelled on the Exploration Incentive Scheme (EIS)

Deliverables

1. A regional map which combines priority survey areas identified in Science Packages 2.3.2, 2.3.3, 2.4.2, 2.5.1, 2.5.2 and 3.2.3.
2. Prioritisation of survey areas and targeting based on Reasonably Foreseeable Project footprints (developed in Work Package 4.2).
3. Co-funding mechanism for survey implementation.

Assumptions

Survey delivery would be optimised through linkage to existing survey activities (e.g. Indigenous Rangers, DPIRD, DBCA, PEOF and industry).
Infill Survey budget separate from data acquisition activities costed in Science Packages

Risks / Issues

1. Lack of alignment between priority areas across in Science Packages
2. Lack of on-ground survey capacity

Dependencies

1. Work 2.X established and operational
2. Science 3.X established and operational

Scope and Timing

In Scope

1. Data acquisition through survey activity

Out of Scope

1. Survey activities which address regulatory requirements

Goals / Outcomes

1. Close survey gaps
2. Decrease uncertainty in model predictions

Timeline / Milestones

1. Year 2 – Initial map development and prioritisation
2. Year 2-5 – Survey delivery and annual update to prioritisation

Resources and Interfaces

Key Stakeholders

1. Government – EPA, DBCA, DWER, DCCEEW
2. Industry
3. Consultants
4. Traditional owners
5. Scientific research community

Budget

1. $75,000 – Map development and initial prioritisation
2. $50,000 – Annual prioritisation and administration of co-investment
3. $1,000,000 - $3,000,000 – Annual survey budget (attracting co-investment c.f. Exploration Incentive Scheme)

Resource Requirements

1. Field based survey crews
2. Taxonomic resources/expertise

6. Technology

What is the technical solution for the SEAF platform?

Technical solution design has been informed by stakeholder needs, SEAF guiding principles and target capabilities to enable it to deliver the value proposition. Design has been validated with Microsoft, based on requirements and the assumptions made. Further tailoring may occur during implementation to ensure the solution meets stakeholder requirements.

Platform summary

The SEAF technology platform will **bring together disparate environmental data sets** and components to a **shared point of access** and support their development and dissemination with the aim to become a **trusted** source of environmental data and analytics.

It will **transform** environmental planning, assessment and reporting to meet the multiple challenges driving environmental reforms by providing users with the necessary tools for analysis, modelling and interpretation of data of a given region through **integrated** modelling and analytics.

The technology solution provides:

- **Easy access** to historical and current data.
- Ability to **develop and apply** advanced analytics, interpretation and modelling of environmental data.
- Support for the development and articulation of cumulative environmental impacts for a region.
- Onboarding of data from **multiple sources** while providing **traceability and auditability** across of all data layers.
- Ability to **catalogue the data** and empower the data consumers to find **valuable and trustworthy** data.
- **Private zones** to work within to ensure data security and privacy.
- **Fully Scalable** for any number of zones

Private Zones

For participant teams to perform environmental impact assessments on a purpose built cloud infrastructure, including the ability to consume, process, and develop data models necessary to support proponents. There is an ability to consume data share data with (curated or modelled) with other zones.

Zone-specific capabilities

- Data Encryption (optional - prior to sharing)

Collaboration Zones

Collaboration Zones provide access for the participants that are providing data and working together. Operator has responsibility for provisioning and maintaining this zone, but access to internal services and data will be limited to participants.

Zone-specific capabilities

- Modelling on Encrypted data (where required)
- Data Sharing Agreements

Constrained Zones

Constrained Zones restrict access to one or more participants that are providing data - in cases where cumulative EIA is being generated with additional highly-sensitive data from certain participants. Operator has responsibility for provisioning and maintaining this zone, but access to internal services and data will be limited to participants

Zone-specific capabilities

- Modelling on Encrypted data (where required)
- Data Sharing Agreements

Common Zone Capabilities

● Identity & Access Control ● CI/CD ● Code Repository ● Data Ingestion ● Compute / Processing ● Governance & Cost Management ● Data Lake / Analytical Data Store ● Data Access - AI Model & Science Model ● Data Delivery – Reporting & Sharing

Shared Data Lake (Run by the Operator)

- Identity & Access Control
- Centralised curated datasets (i.e. BoM, DoT, DWER)
- Governance
- Admin reporting (model runs, data set usage))
- Data Delivery - Sharing

Designed to support a secure exchange of data and models between regional teams operating independently from Spokes based on access policies defined for content sharing.

Administration Platform (Run by the Operator)

- Platform Security (User management)
- Technology & Operational Resilience
- Infrastructure as a Code
- DevSecOps
- CI/CD

For the platform and technology operations team to have an ability to build, deploy and manage the ecosystem including an ability to support the platform, networks, applications on the platform, and access to application and data services on the platform.

A solution designed for flexibility and reusability

The proposed technology solution is cloud-first and aligns the reference architecture to the SAFE Framework. The included solution components are based on Microsoft Azure and designed to be open and extensible to enable collaboration with research institutions and relevant third parties. Together, they form a robust and scalable platform for SEAF data and analytics workloads that can evolve over time.

The requirements:

The requirements of the SEAF were used to help inform the technical solution design:

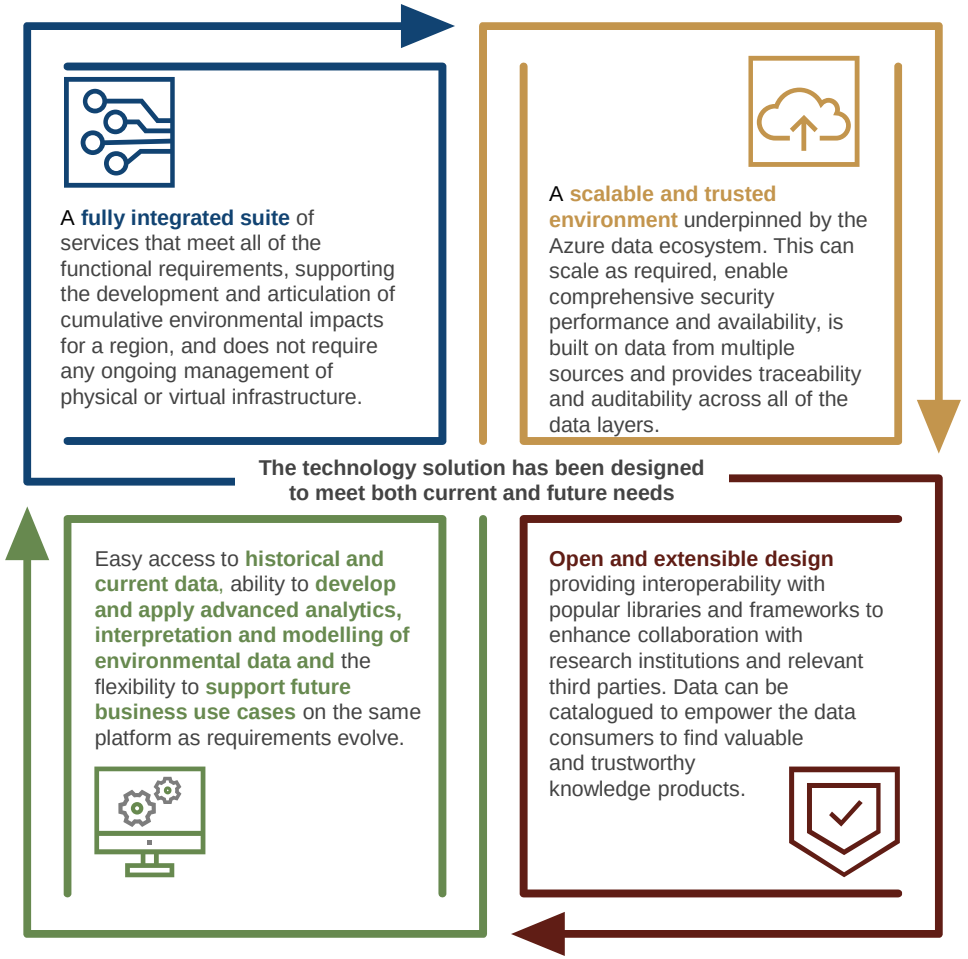
- The Operator Requirements: To support a **secure exchange of data and models** between zone based on access policies defined for content sharing.
- Zone Requirements - perform environmental impact assessments on a purpose built cloud infrastructure, including the **ability to consume, process, and develop data models** necessary to support proponents.

Key drivers for design:

- **Trust and Transparency:** Be a trusted source of curated environmental data, information and reporting, enabling confident decision making for regulators, proponents and the wider community in line with stakeholders expectations.
- **Scalability and Flexibility:** Provide the tools and capabilities for data modelling, analysis and forecasting to undertake and deliver cumulative environmental impact assessments.
- **Speed and Consistency:** Support streamlining and de-risking of the Environmental Impact Assessment process from both a proponent and regulator perspective, enable more efficient production of ESG and EEA reporting.

The high-level technology design has been developed in accordance with five core design principles:

- Ability to **integrate data** from a range of sources, including data hosted on organisations on premise platforms and external data from different cloud provides into the SEAF platform.
- Ability to **manage and protect data** from unauthorised third parties or vendors and ensure it is only used for the purpose it was intended.
- Data is protected and **complies** with Australian Government Information Security Manual (ISM) standards.
- Data can be **archived** and / or **deleted** without any traces after the retention period.
- Ability to **use or integrate data models or data products from other systems or organisations.**



1. https://wabsi.org.au/wp-content/uploads/2021/07/SAFE-Guide-V1.1P.pdf

The multiple benefits of building SEAF on a cloud platform

Trust and transparency

- Cloud governance and metadata management services provides the required capabilities to **make data FAIR** (Findable, Accessible, Interoperable and Reusable), thus **enabling trust and transparency** for the SEAF users
- Once data is in the cloud it can be discovered, catalogued and described making it **easier to know what data is available** and understand it and thereby providing opportunities for enhanced collaboration, sharing and reuse
- The wide variety of tools and capabilities available on cloud makes it possible to create **fit-for-purpose secure solutions**. It provides SEAF data / model producers and consumers the confidentiality, integrity, and availability of the data, while also enabling transparent accountability

Scalability and flexibility

- Cloud is flexible and can dynamically scale and adapt to meet **varied needs of different SEAF users**
- Compared to on-premise services, a cloud solution is able to be deployed on demand and has an economic advantage as it can be scaled up or down based on consumption patterns. On-premise services require an upfront CAPEX investment for hardware, however with cloud you only **pay for what is used**
- Operating in a single purpose built could environment makes the **experience seamless** thereby providing the flexibility for organisations and researchers to **work within their own area of expertise (zone)** and also **being able to collaborate and contribute to a larger effort** to support information and analytic supply chain

Speed and consistency

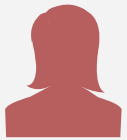
- Cloud is accessible and available on demand which **reduces lead time to provision new services**
- Cloud provides **better performance** compared to desktop computing and fills the gap between desktop computing and supercomputing - at a better price point. I.e. compute power on cloud is cheaper than on a supercomputer and cloud different storage tiers are available for cost optimisation
- A single cloud platform improves integration, reduces silos and enables reuse of analytical tools, thereby **increasing efficiencies, reducing cost, and enabling collective learning and continuous improvements**

SEAF platform high level design principles

Design principles have been based on stakeholder needs, including industry proponents, research organisations, State or Commonwealth Government, Environment Regulation Organisation and internal project teams conducting environmental impact assessments.

Design principles	How this is achieved on the SEAF platform	Outcomes
1 Ability to **integrate data from a range of sources,** including data hosted on organisations on premise platforms and external data from different cloud platforms into the SEAF platform.	**Microsoft's Interoperability Principles [1] -** Open Connections to Microsoft Products, Support for Standards, Data Portability and Open Engagement ensures interoperability between products from different vendors.	Organisations are able to access consolidated, current, consistent and trusted data to complete the assessment process.
2 Ability to **manage and protect data**, including Environmental Impact Assessment outcomes and approval decisions on the SEAF platform from unauthorised third parties or vendors and ensure it is only used for the purpose it was intended.	Microsoft's commitment to **Privacy [4]** ensures that the data will secured at rest and in transit and defended. It enables SEAF to choose the services and data location that is right for their stakeholder needs.	Organisations have comfort that the SEAF will manage and protect their data and ensure it is not used for purposes beyond the intended objectives.
3 Data is protected and **complies** with Australian Government Information Security Manual (ISM) standards.	Azure has been assessed by **Information Security Registered Assessors Program (IRAP) [3]** a standard similar to the Australian Government Information Security Manual (ISM).	The **IRAP assessment [3]** of Microsoft's cloud services provides assurance to public sector customers in government and their partners that Microsoft has appropriate and **effective security controls in place** for the processing, storage, and transmission of data at the PROTECTED level and below.
4 Data can be **archived** and / or **deleted** without any traces after the retention period.	Microsoft Azure Cloud Services are governed by strict **Data Management Standards [2]**. Microsoft removes cloud customer data from systems under its control, by overwriting the storage resources before reuse, and purging, and destroying decommissioned hardware before Microsoft returns it to the manufacturer for replacement or repair.	Guarantees the data is completely deleted without any trace after the retention period.
5 Ability to **use or integrate data models or data products from and to other systems or organisations.**	Microsoft's Interoperability Principle, **"Data Portability" [1]** enables the SEAF Platform to meet the varied needs of its stakeholders. Microsoft supports many data formats promulgated by standards bodies in its products today. Microsoft's "Open Format and Import/Export" methods helps to achieve the same, when data is not in Industry Standard Formats.	Data, models or knowledge products from other systems can be readily used through the SEAF platform to overcome limitations in the fragmented information landscape. Similarly data and model can be exported to other platforms if needed.

"We need to integrate our company information (data and models) with other external data sets from governments, research organisations and other business to undertake an environmental assessment to gain approval for major new development."



"I am a Research organisation providing data and models to SEAF towards the the development and assessment of EIA submissions and for a sustained regional cumulative impact assessment. I need to know SEAF will manage and protect my data and how it ensures that it is not used for any other purpose?"

"It is important to me that the Australian State and Government Environment Impact Assessment (EIA) data and its outcomes are PROTECTED and the data management requires complies to Australian Government ISM (Information Security Manual) standards"

"It is critical that the Environmental Impact Assessment outcomes and approval decisions are protected and managed on the SEAF platform and not mined by the cloud vendor and its sub-contractors for other purposes."

"It is important that the project team is able to bring in data models or knowledge products from other system and can also be readily exported / used by external system and people. It is critical to integrate elements from a range of sources seamlessly, in Australia's current fragmented information landscape"

References

1. Microsoft Interoperability Principles 2. Microsoft Data Management Procedures 3. Australia IRAP Compliance 4. Microsoft Trust Center

The solution components of a zone

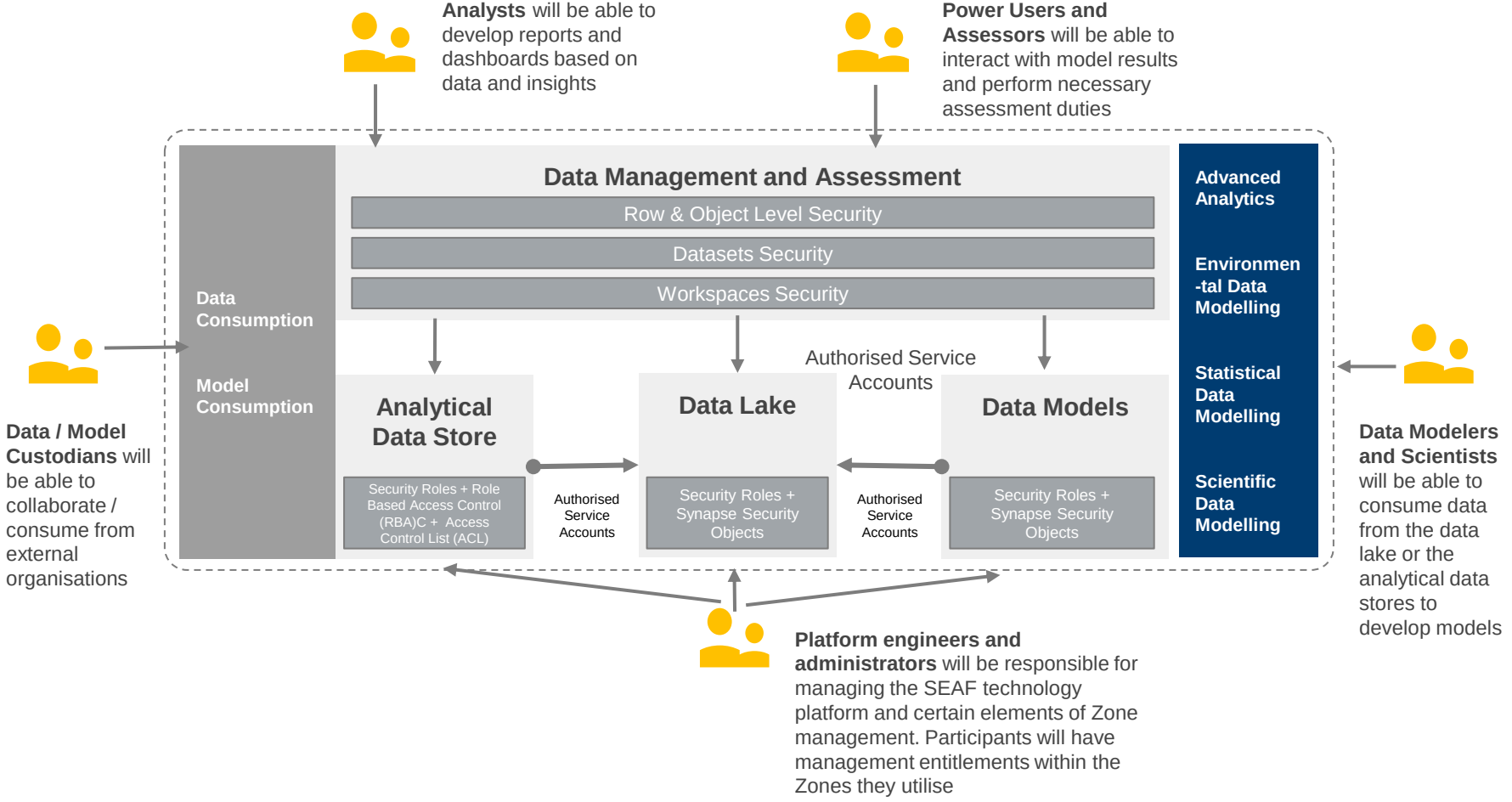
SEAF comprises a single cloud platform supporting multiple analytics zones. These zones differ depending on the scope of use - providing the necessary boundaries to support multiple participants working in isolation (private zones), but also facilitating collaborative analytics between participants.

The solution components of a zone are deployed using Microsoft's ADS Go Fast framework, which provides, Infrastructure as code (IAC) deployment of Azure Data Platform, "Out of the box" Continuous Integration and Continuous Deployment framework, Enterprise grade security and monitoring with full support for Key Vault, VNETS, Private Endpoints and Managed Service Identities, Codeless Ingestion from commonly used enterprise source systems into an enterprise data lake and users can interact with capabilities through a webpage and embedded dashboards.

Zone summary

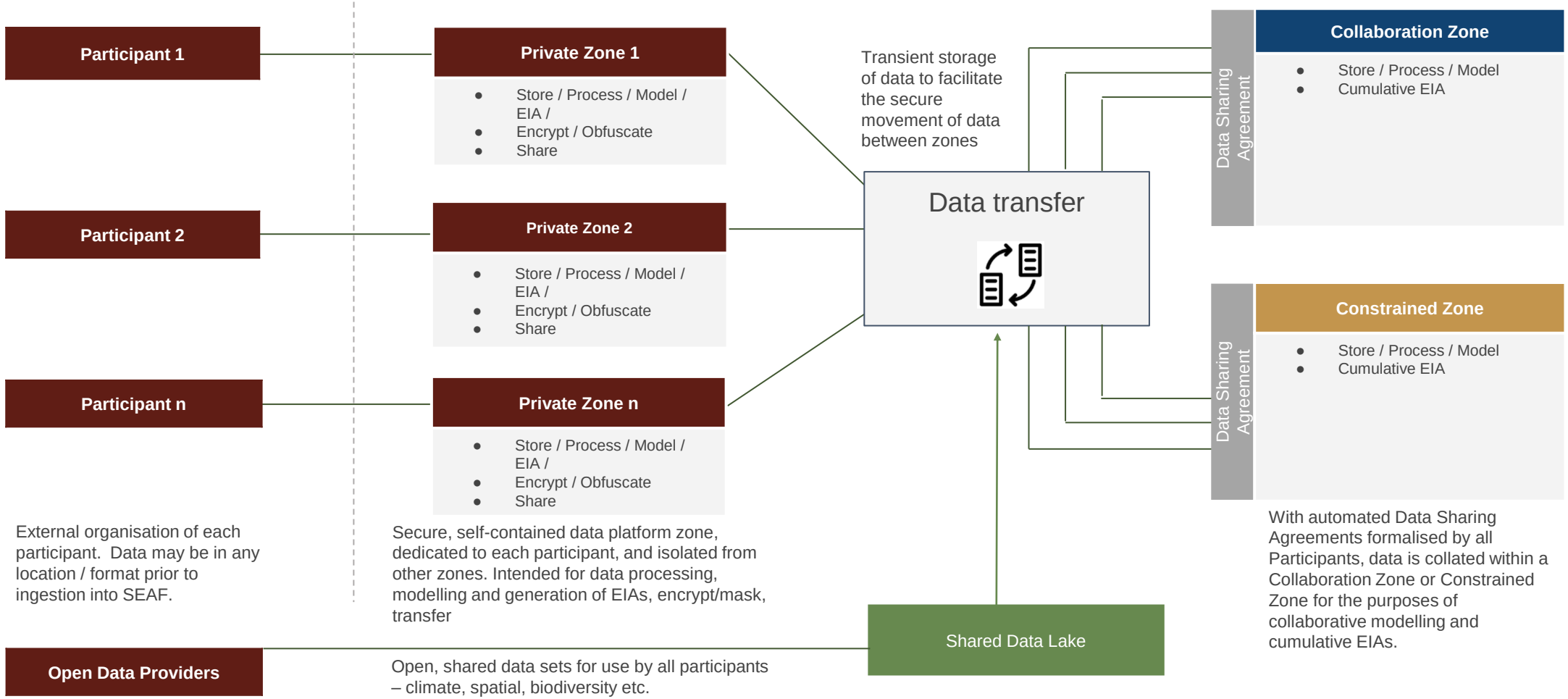
Each zone will contain a complete data/analytics stack, following reference architecture patterns, with:

- Consistent data ingestion (inbound) and sharing (outbound) mechanisms
- Optional modelling components where required
- Appropriate access control based on zone type
- Per-user/persona privileges dependent on the zone type
- Homorphoic data encryption / obfuscation / data sharing agreements
- Research users (non-commercial) will have access to resources at Pawsey Supercomputing Centre for data processing and model execution
- The 'default' zone configuration includes Azure data services for ingestion, processing, and storage
- Zones can be customised to include other Azure data services, for specific data processing and analytics requirements
- Platform evolution – as the SEAF platform is utilised its capabilities will evolve through new services and/or architectural changes. This will keep the platform current and in alignment with participant requirements.



How will the data flow through the SEAF platform?

The structure of the SEAF platform allows all participants to operate independently and then also work together to share data for the purposes of a cumulative EIA. The Collaboration Zone allows for access to all participants that are providing data. A Constrained Zone restricts access to one or more participants that are providing data – in cases where cumulative EIA is being generated with additional highly-sensitive data from certain participants. NDA/Data Sharing Agreements are essential as part of this process.



What is the technical operating model for the platform?

The SEAF prototype implemented (detail over page) a central Azure tenancy and framework that serves as an administration platform. The technical operating model proposed for the SEAF utilises an administration platform for the Operator and Zone model for Participant(s). The model is intended to be scalable from start up to full national roll out with key milestones and checkpoints.

Key definitions

- **Operator** – the foundational platform supports all zones and participants and requires a platform operator to manage and administer the overall environment.
- **Participants** – a SEAF participant is an organisation utilising the environment to import data, process, model, and generate EIA outputs. Participants may collaborate with each other through the Collaborative and Constrained Zone model.
- **Zone provisioning & participant specific requirements** – Zones are provisioned by the operator as required for each participant. Any Azure services required that are not provided in the default configuration can be deployed manually by the operator or participant.
- **Zone security & isolation** – All zones are isolated with both networking and identity controls to ensure access to services and data is only possible by zone participants. Operator will have administrative rights to the zone for monitoring and management, but no data or service access.
- **Data privacy & security** – data is encrypted in transit and at rest. Zone participants have access to clear text data by default. For scenarios requiring multiple participants operating on combined data sets, optional homomorphic encryption technology can protect sensitive data throughout the modelling process.
- **Non-Disclosure Agreements (NDA)** – to be established between SEAF and each participant prior to onboarding into the platform.
- **Data Sharing Agreements** – to be established between participants where requirements for data sharing and collaborative analytics exist. This agreement defines the data being shared, intended use cases and outputs, and data purging process.

Role of the operator

- Provide the key foundational services to be utilised by each zone
- Shared access to trusted, aggregated and curated environmental data and information
- Provision of new zones based off template
- Reporting and allocation of costs per zone
- Establish/Integrate/De-establish zones
- Own and manages the overall Azure tenancy
- Govern and manage overall SEAF operations including the technology platform
- Manage controls & processes
  - Access/session controls
  - Activity auditing
  - Data purge/cleanse process
  - Zone creation/destruction
- Participant onboarding & enablement, and maintaining supporting SEAF collateral
- Establishing NDAs with platform Participants, and facilitating Data Sharing Agreements between Participants (for Collaborative/Constrained Zones)
  - Agreed intent / use cases
  - Use of collaborative data
  - Access to zone
  - Timeframes
  - Purging / destruction process

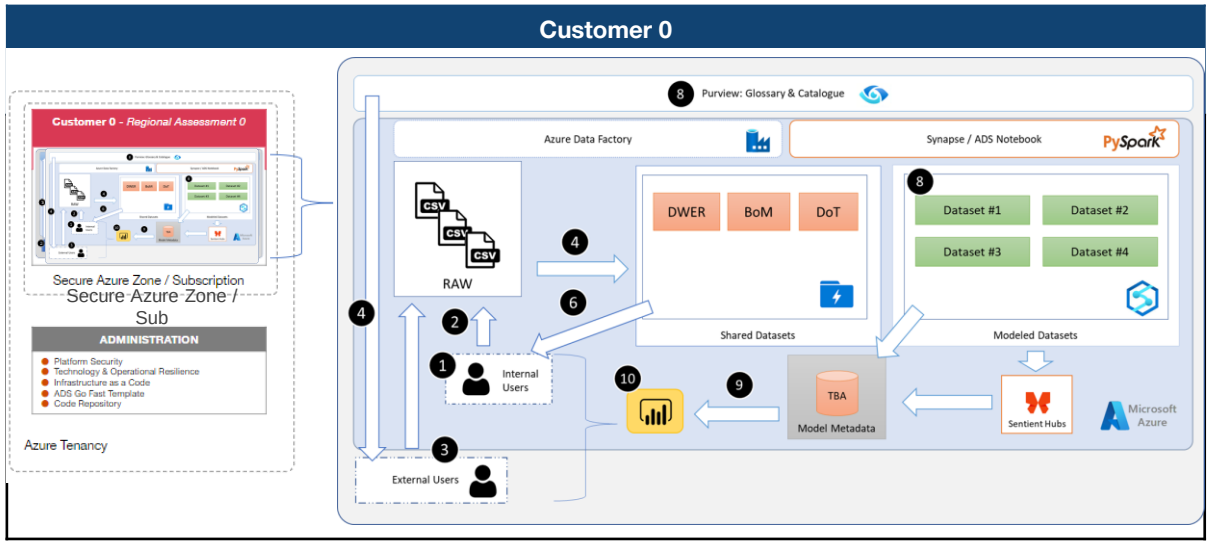
Role of participant(s)

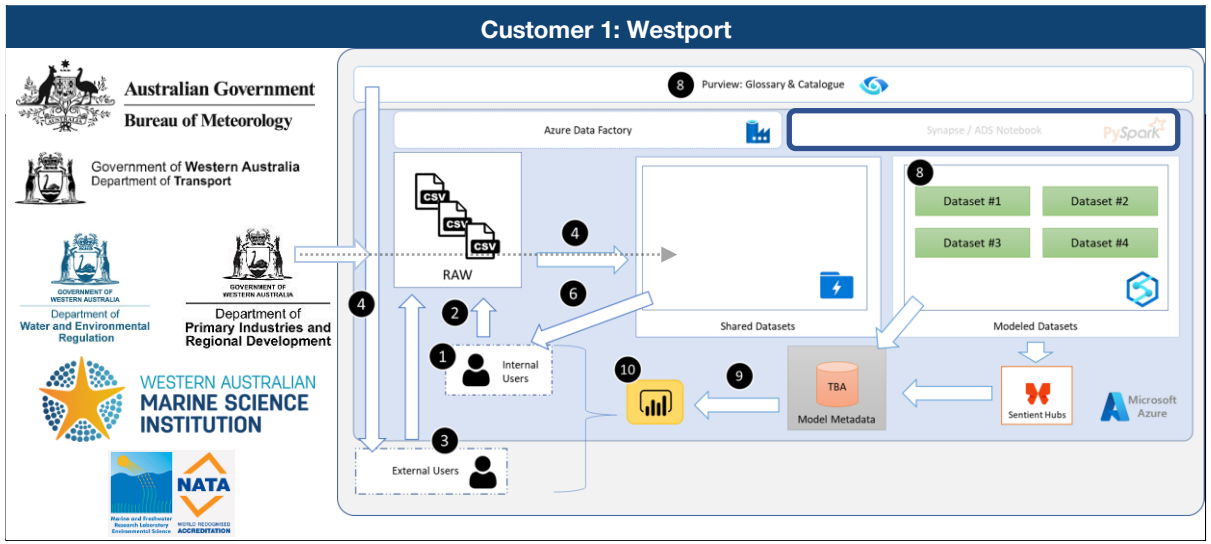
- Participant(s) have semi-autonomy to address unique needs whilst maintaining entity consistency within zones
- Participant(s) oversees and manages a specific assessment
- Functions and capabilities required to undertake and deliver a specific assessment are available within the zones. It is up to the Participant to identify what capabilities/components it requires.
- A participant is responsible to identify needs/requirements for a specific study, including update, maintenance and review cycles
- The Data collation and assessment in the development and production of specific assessments happens within a zone
- The participant is responsible for maintaining and following SEAF technical standards
- Zone is created at a subscription level and the participant(s) are responsible for costs for incurred in the zone

A prototype of the SEAF platform was established to develop the technical solution; a second zone was created to facilitate Westport cloud-based modelling

In the DWER Azure Tenancy, a protected cloud (enterprise grade security) zone was deployed using ADS go fast. This included deployment of all Azure Service using Infrastructure as Code.
We proved the concept of data ingestion into Synapse, transforming and visualizing research datasets (16 million rows of data). This was turned off to reduce costs while idle.

1. *Internal users log into Azure securely*
2. *Uploads Raw research files using **Azure Storage Explorer***
3. *User logs in with external identity using Azure Virtual Desktop. This will show the user experience for external user and will present same options in VM (including **Azure Data Explorer**)*
4. *Discovery of data assets via the data catalogue in Purview*
5. ***ADF Pipelines** loads files into processed layer of data lake*
6. *Validation of loaded data can be performed using Synapse notebooks (using **PySpark** or **SQL**)*
7. *Users can use language of choice (**PySpark/Scala/SQL**) to model data and validate. Final model output datasets will be created in Gold/curated layer of data lake*
8. *Purview add governance on data assets and including scans to get current datasets and lineage (table/file/detailed schema)*
9. *Model metadata extracted into a Power BI mode to surface summary information on datasets/research projects*
10. *Research coverage dashboard could allow data points to be show relevant coverage by location based on other search parameters. This can also use custom shapes to show boundaries and heat maps based coverage/# of data points. Researcher can also query the model metadata repository directly to gain understanding of research coverage.*





Leveraging off the workflows developed during the initial deployment, a second zone has been established to assist with the modelling demands of Westport. An expanded dataset from an array of Agencies was ingested onto the platform, as well as real-time access to the latest Cockburn Sound model configurations.

How can the SEAF prototype be made operational?

- The below table summarises the indicative implementation costs to make the SEAF Prototype operational.
- Pricing is indicative only and is a best estimate on current known information. Further analysis will need to be undertaken to improve the accuracy of the estimate detailed requirements are confirmed.

	Scope	Key capabilities	Number of days effort	Time (in weeks)	Cost (in AUD)
Productionise the prototype	Requirements & detailed design	Key capabilities to be design and implemented: ● Data sharing using ADF ● IXUP ● Automated deployment	300-360	12-14 weeks	~$750,000 - ~$900,000
	Foundational platform				
	Shared data lake				
	Testing Security testing				
	Prod / Hyper-care				

Technology costs: Indicative expenditure run for the platform - based on varying *sizes of usage and / complexity requirements*

The technology costs have been developed to indicate potential costs for varying usage sizes

Varying sizes have been utilised to provide pricing costs across various usage and implementation scenarios. Each size is based on a number of assumptions, if these assumptions change, there would be an impact on costing.

Small: Less than 10 consumers of the platform, typically less than 10TB of data storage required, simple modelling requirements.

Medium: Between 10-20 consumers of the platform, ~50 TB of data storage required. Some simple modelling requirements, in addition to custom science models with complex modelling requirements.
(note - used as basis of costing calculations)

Large: Between 20-50 consumers of the platform, ~ 100 TB of data storage required.

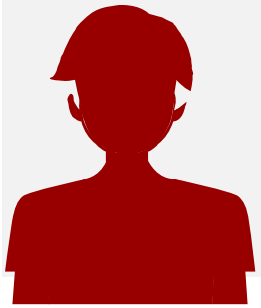
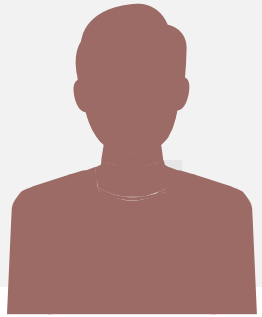
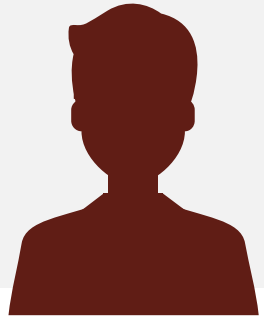
Extra Large: > 50 users of the platform ~ 200 TB of data storage required.

	OPERATOR COSTS (admin/shared zone)				Participant Costs (per ZONE)			
	S	M	L	XL	S	M	L	XL
Base Azure run costs (DevOps, Security)	$2,500	$2,500	$2,500	$2,500	$3,500	$3,500	$3,500	$3,500
Storage & Compute								
Storage Account	$2,700	$4,700	$8,700	$18,700	$400	$2,000	$6,000	$16,000
Managed Disk	-	-	-	-	$780	$3,900	$7,800	$15,600
VMs Modelling	-	-	-	-	$1,400	$2,800	$4,200	$5,600
VMs Software	$570	$570	$570	$570	$2,016	$2,016	$2,016	$2,016
Synapse Analytics	-	-	-	-	$2,250	$2,600	$2,900	$3,250
Modelling								
Sentient Hubs					$5,000	$10,000	$25,000	$50,000
Delivery								
Power BI Premium	$6,500	$6,500	$6,500	$6,500	$28	$55	$138	$275
Governance								
Azure Purview - Catalogue / Lineage	$785	$865	$1,239	$4,949	$785	$865	$1,239	$4,949
Encryption								
IXUP	$15,000	$15,000	$15,000	$15,000	$5,000	$5,000	$5,000	$5,000
Monthly Licensing Costs	**$28,055**	**$30,135**	**$34,509**	**$48,219**	**$21,159**	**$32,736**	**$57,793**	**$106,190**
Microsoft Licenses	$13,055	$15,135	$19,509	$33,219	$11,159	$17,736	$27,793	$51,190
3rd Party Software Licences	$15,000	$15,000	$15,000	$15,000	$10,000	$15,000	$30,000	$55,000
Yearly Licensing Costs	**$336,660**	**$361,620**	**$414,108**	**$578,628**	**$253,902**	**$392,832**	**$693,510**	**$1,274,280**
Application Managed Support (Yearly)	**$120,000**	**$240,000**	**$360,000**	**$480,000**	**$60,000**	**$90,000**	**$120,000**	**$150,000**

Pricing shown here is indicative only, based on several assumptions – accurate pricing for a specific participant would be done as part of their evaluation of the SEAF platform, based on their individual requirements.

User journeys developed for several personas - reflecting groups expected to interact with SEAF

The user journeys on the following pages are designed to illustrate how, at a high level, different users will interact with and utilise the SEAF based on the current thinking around the guiding principles, operating model and value proposition. The intent remains that SEAF will inform users, whatever their role in the EIA or other processes, not to make decisions, and support secure, transparent, interoperable sharing of data and information.

Participant	Regulator	Project team	Data or model provider	State and Commonwealth Government	Community or other interested group
					
Company undertaking decision making, assessment development and seeking approval for a major new development	Organisation responsive for assessment of EIA submissions, approvals and ongoing monitoring of environmental performance	Regional project team responsible for developing and maintaining the regional cumulative impact assessment	Research organisation or business providing data or models for use in the facility in the development and assessment of EIA submissions and a sustained regional cumulative impact assessment	State or Commonwealth Government department looking to ensure the proponents and state government are meeting their obligations in regard to matters of state and national environmental significance	Traditional Owner or Environmental Advocacy Group seeking to understand a proposed development in order to comment on it, and to understand the long term impact of operations in a region on the environment

User journey: Proponent

Proponent

Scenario
A mining company is assessing the potential for a major new site and is looking for information to inform its decision making around whether the site is viable, likely to receive approval having gone through the EIA process, and additional information to support development of an EIA submission in relation to the proposed development.

Expectations
- Data and information needed will be available, easily accessible, accurate and up-to-date
- We are able to review our proposed development in regard to the overall regional cumulative environmental impact utilising models trusted by decision makers in the government
- The information being available and trusted will assist us with gaining community support for the development

1 Stage	Identify the potential development site(s)	Gather data and information on the potential site	Assess feasibility of the site including potential environmental impact limitations	Make go/no go decision for the site	If decision is "go" - start preparation of EIA submission materials for referral to the EPA
2 Activity	Identify the sites shortlisted for consideration for the new site development	Collect existing information on the sites being considered and any desired additional information	Utilising the available information, including environmental reports, assess the pros and cons of each site being considered	Use the feasibility assessments to decide on which site is most likely to receive approval whilst best meeting the needs of the business	Use the regional environmental report to support development of EIA submission for the preferred development site
3 SEAF Touchpoint	No SEAF touchpoint at this stage	Identify relevant dynamic regional assessment and any other relevant environmental data, models and reports held	Utilise available environmental data, models and reports to support assessment of environmental impacts and therefore site feasibility	Utilising information from the SEAF on environmental and heritage impacts, alongside other data make go/no-go decision for each site	Utilise SEAF data, models and reports to develop EIA submission for the preferred site
4 Expectations	Research has been undertaken to identify and shortlist potential development sites	Information is easy to find, understandable, current and relevant	Ability to utilise models to support what-if / scenario modelling for each shortlisted site to inform decision making	SEAF outputs are able to be utilised as part of MCA comparing like with like for each shortlisted site	SEAF streamlines the EIA submission development process and allows EPA to quickly understand the basis of preparation
5 Experiences	Collection of data and information from within own company through central portal	Easily able to identify relevant information for identified shortlist of potential development sites	Able to simply access models or assistance to utilise models to support feasibility assessments	Outputs from the SEAF are simple to use and in a consistent format to support decision making	SEAF allows for a streamlined, transparent, collaborative approach to EIA submission development and EPA assessment

User journey: Regulator

Regulator

Scenario
The Western Australian EPA are looking to review the information, data and modelling used by a mining company in preparation of an EIA submission to inform their assessment report for the Minister including review of the current dynamic cumulative environmental impact assessment for the region including the impact of the proponents current activities.

Expectations
- Data and information we need will be available, easily accessible, accurate and up-to-date
- We are able to review the proposed development in regard to the overall regional cumulative environmental impact utilising trusted and agreed models
- The flow of data and information and model outcomes is transparent, and easily available to simplify our activities and streamline our processes.

1 Stage	Receive EIA submission from proponent	Review data utilised in development of the assessment	Review models utilised in development of the assessment	Review outputs from the models and their interpretation	Sensitivity testing on data and models utilised	Make a decision on recommendation to go to the Minister
2 Activity	EIA submission received from proponent via Environment Online	Review the source of the data utilised, including relevance, accuracy/assurance checks done and how current it is	Review the source of the models utilised, when they were last reviewed and updated and relevance	Assess the outputs from the models against expected results or outcomes and whether they can be accepted	Undertake, where possible, sensitivity testing on the data and model outputs and cumulative regional impact	Develop a recommendation to go to the Minister on the proposed development
3 SEAF Touchpoint	Access the SEAF and check if a relevant dynamic regional environmental assessment exists	Through the SEAF review the relevance and acceptability of the data utilised by the proponent	Through the SEAF review the relevant and acceptability of the models utilised by the proponent	Utilising the information and outputs in the SEAF review the model results against acceptance criteria	Using the SEAF review the sensitivity of the data and models utilised on cumulative impact in the region	Utilising the information and reporting from the SEAF as an input, develop a recommendation / decision
4 Expectations	Straightforward to see whether a relevant dynamic regional environmental assessment exists	Simple to review the data utilised by the proponent for source, relevance and currency	Simple to review the models utilised, their developer, when last updated and their accuracy	Clear and relevant reporting available to allow review of model outputs against standards and criteria	Functionality allows sensitive testing of data and models selected on outcomes	Information and reports are robust and enable decision making
5 Experiences	Simple to see that relevant dynamic regional assessment exists and is up to date	Transparency of process makes it simple to see data utilised and all relevant attributes	Transparency of process makes it simple to see models utilised and all relevant attributes	Model outputs and associated reports are easy to understand and align with assessment criteria	Full support from the SEAF to undertake desired sensitivity analysis to support decision making	Able to confidently make a recommendation to the Minister

User journey: Project team

Regional Project Team

Scenario
Regional project team responsible for supporting development and maintenance of the regional cumulative impact assessment though working with industries, researchers and others with data, information and models in the region that will support the overall goal.

Expectations
- Organisations will be able to simply share their data in accordance with data standards
- The tools are available to allow for data quality assurance and curation quickly to ensure this step is not a blocker in the process
- The team will be supported by experts able to identify any gaps in the data or science required to enable the regional assessment to be developed
- Organisations are happy to share their data confident that confidentiality requirements are being met and it is only being made available to appropriate users.

1 Stage	Agree project deliverables	Ascertain relevant key environmental values and factors and geographical scope	Identify key outputs and develop delivery plan	Bring together required capabilities	Conduct analysis	Develop report
2 Activity	Agree project deliverables with the project manager and the customer	Work collaboratively to ascertain relevant key factors and scope, apply DPSIR and gather initial data	Identify key outputs and develop plan to deliver them. Apply SAFE to understand existing capabilities and gaps	Bring together people, data, andmodels to form specialist team to deliver required outputs	Develop dynamic regional environmental assessment	Assemble information into report for the project team to utilise
3 SEAF Touchpoint	Review any existing data, models or assessments for the region	Provision of information to support determination of Key Environmental Values	Identification of data and analysis tools to support deliverables.	Development of data and analysis tools to meet required capabilities	Provision of data and analysis tools	Utilise standard report templates, model outputs and other standardised information formats
4 Expectations	Quick and easy to see what data and information is available for a geographical region	Information is available from the SEAF to support setting key values and scope	Able to simply assess available data and any gaps which need to be filled to deliver the assessment	SEAF supports connectivity required between data sources and models to meet the desired outcomes	Robust up to date data and models are available to support development of the regional assessment	Model results are available in standard formats and required reporting templates are also available for use
5 Experiences	SEAF is easily accessible and simple to use to find required information	The data required is available from the SEAF when needed, and it's easy to identify gaps or data issues	Application of SAFE through the SEAF is seamless and supports development of a realistic delivery plan	SEAF fully supports the development of the data and analysis tools needed in a timely manner	Outputs from the analysis tools are trusted and whole end to end is transparent so able to be easily verified	Templates are available, and meet the needs of the project

User journey: Model / data provider

Model / data provider

Scenario
Research organisation or business providing data or models for use in the facility to support the development and assessment of EIA submissions by proponents and regulators, and the development of a sustained regional cumulative impact assessment. They have been approached by the project team to help fill an identified data or science gap and are comfortable with the controls in place for use of their data so are happy for it to be included in the facility.

Expectations
- Robust contractual / legal processes and agreements are in place to ensure any necessary data confidentiality or data anonymisation requirements are met and data is only made available to appropriate users
- The process for sharing data or models to the facility is user friendly and support is available if any issues are encountered
- The project team will work collaboratively with us so we can be sure their needs are being met

1 Stage	Data or model provision agreement and standards	Develop / collate data package or model(s)	Submit data or models to the SEAF	Data package review	Address any identified issues and resubmit	Ongoing maintenance of data or models provided
2 Activity	Sign new or review existing data or model provision agreement and associated standards	Develop or collate data package or model(s) to be supplied to meet the identified need	Enter data package (data and / or models) via the submission process	Answer any questions the SEAF team have as a result of review of submission	If any deviation from required standards is identified, amend as per the advice received and resubmit	On regular basis, as per the agreement and standards, review and update the data and / or models as required
3 SEAF Touchpoint	Identified data or model requirement from the project team or SEAF	Clear definition of need	Portal for submission of data package for review, with notification of receipt	Review of data package contents by SEAF team and interaction with SEAF team	Resubmission of data package if required	Accessibility to support review and submission of updated data and / or models
4 Expectations	Requirements are clear and agreements and standards are straightforward	Able to see what data or models the information to be supplied will interact with and interoperability requirements	Simple process for submission of data or models	Updates on the data review package process	Issues identified are clearly articulated	Required access to support review of data and models and provide updates as needed
5 Experiences	No surprises in agreements and standards and clearly understand expectations of what is to be provided	Able to quickly understand what is required	Simple process for submission of data package with notification of successful submission	Regular notifications as the data package passess through the review process	Identified issues are spelled out clearly to allow for resolution without multiple loops through the process	Notified of when data or models are due for review

User journey: Government

Government

Scenario
State or Commonwealth government department looking to ensure that proponents and state government are meeting their obligations in regard to matters of state and national environmental significance through review of the dynamic cumulative environmental assessments and how what is happening in a region aligns with expected results from mitigations put in place as part of environmental approvals.

Expectations
- Dynamic regional cumulative environmental assessment utilises most recent information and models and there are no material gaps in the data provided to inform the models
- Information is available in a simple and understandable format that can be utilised by non-technical specialists to quickly and accurately assesses the impact of operations in a region and any unintended consequences, positive and negative, from the operations and the environmental impact mitigations in place
- Able to utilise information to inform the State of the Environment Report

1 Stage	Identify region to be assessed and available information	Access information to support review	Review current environmental performance	Report on outcomes of review
2 Activity	Confirm region to be assessed and what current reports and information exist including any regional dynamic environmental assessments	Access data and information, including dynamic cumulative environmental assessment, to support review of regional environmental performance	Utilising available information and standard reporting review current environmental performance against conditions applied to approvals for activities in the region	Assess any issues with current regional environmental performance, report on review outcomes and develop and implement an action plan if needed to address issues
3 SEAF Touchpoint	Review what data, information, models and assessments are available to support the selected regional review	Access to available information and reports	Utilise information and reporting to review current and forecast regional environmental performance	Reference relevant information to support review findings and recommendations
4 Expectations	Able to simply and clearly see what information is available for a region	Access information for a region with as few clicks as possible including relevant metadata	Information is up to date, quality checked and available in a format useable for review purposes	Standard reporting provides clear information to support review, including identification of issues and areas where action is required
5 Experiences	Simple interactive geographical based interface allows quick assessment of available information	Able to simply see when data and models were last updated, any data quality concerns and confidence in the assessment developed	Standard outputs and reporting are structured to meet what is needed for the review	Able to state with confidence what the current regional environmental performance is and where there are issues to be addressed and by who

User journey: Community

Community

Scenario
A Traditional Owner Group in a region are seeking to understand a proposed development in order to comment on it, including impact on native title rights, cultural heritage and the environment, and to understand the expected and experienced long term impacts of operations in a region.

Expectations
- Information is available in a simple and understandable format that can be utilised to quickly and accurately assesses the impact of operations in a region on cultural heritage and the environment
- Able to clearly see what information or data has been used, and who provided it
- Able to also share relevant cultural heritage information in a confidential manner to ensure it is only shared with appropriate people or organisations that will treat the information with respect and not misuse it

1 Stage	Become aware of EIA submission of interest	Access information on the proposal	Review data and information utilised in the assessment	Review forecast impact of the proposed development	Provide feedback / comment on the proposal
2 Activity	Received notification of an EIA submission of interest in a specific region for review and comment	Access information on the proposal and associated regional environmental assessment	Review data and information utilised in the assessment for relevance and gaps in what has been considered	Review the regional dynamic cumulative environmental assessment outcomes including impact of the proposed development	Provide feedback on any areas of concern including provision of supporting data or information as appropriate
3 SEAF Touchpoint	Notification received via Environment Online - no SEAF touchpoint at this stage	Access publicly available data and information for the region the proposed development lies within	Review the data and information utilised for relevance and any gaps	Review the available reporting to understand the impact of the proposed development on the environmental and cultural heritage	Provide feedback via Environment Online referencing SEAF outputs as appropriate
4 Expectations	Notifications are timely and relevant	Sufficient data and information is publicly available to allow for relevant groups to understand impacts on their region	Relevant and up to data information has been utilised in the assessment including consideration of native title rights and cultural heritage	The impact of the proposed development is reported in such a way that it can be understood by well informed members of the public	Able to provide robust and defensible feedback on proposed developments
5 Experiences	Notification received for relevant region with plenty of time to review and provide feedback	Reasonable amount of data and information appears to be available for the region and the proposed development	Reporting allows simple review of assessment undertaken, information and data utilised and any associated data gaps	Regional assessment outputs are clearly and simply displayed and allow layperson review and understanding	Able to provide factual feedback on the proposed development in a secure manner

More information

More information on the suite of work in biodiversity data and information management, undertaken by WABSI and WAMSI in Western Australia, can be accessed at www.wabsi.org.au and www.wamsi.org.au.

wabsi.org.au wamsi.org.au