Economic Assessment of the Spencer Gulf Ecosystem & Development Initiative Phase II Proposal

A report to

Environment Institute

Prepared by

econsearch

15 August 2015

EconSearch Pty Ltd
214 Kensington Road
Marryatville SA 5068
Tel: (08) 8431 5533
Fax: (08) 8431 7710

www.econsearch.com.au

CONTENTS

TABLES

ACKNOWLEDGEMENTS

We are very grateful for the time and insights provided to this project from Gavin Begg (SARDI), Anita Crisp (Upper Spencer Gulf Common Purpose Group), Marty Deveney (SARDI), Simon Divecha (Environment Institute), Bronwyn Gillanders (University of Adelaide), Peter Gooday (ABARES), Steve Green (JBS&G Environmental Services), Jacqueline Griggs (SA Water), Greg Hill (BHP Billiton), Martin Reid (Department of State Development), Rob Thomas (Department of State Development) and Tim Ward (SARDI).

ABBREVIATIONS

ABS	Australian Bureau of Statistics
CBA	cost benefit analysis
EA	environmental approvals
EPBC Act	Environmental Protection and Bio diversity Act 1999
FRDC	Fisheries Research and Development Corporation
MISA	Marine Innovations South Australia
NPV	net present value
PIRSA	Primary Industries and Regions South Australia
SA	South Australia
SARDI	South Australian Research and Development Institute
SGEDI	Spencer Gulf Ecosystem and Development Initiative
TEPS	threatened, endangered and protected species

DOCUMENT HISTORY AND STATUS

Doc Ver	Doc Status	Issued To	Qty elec	Qty hard	Date	Reviewed	Approved
1	Draft	Simon Divecha	1	-	25/2/15	JBM	JBM
2	Draft	Simon Divecha	1 Word 1 PDF	-	27/2/15	JBM	JBM
3	Draft	Simon Divecha	1 Word 1 PDF	-	6/3/15	JBM	JBM
4	Draft	Simon Divecha	1 Word 1 PDF	-	6/3/15	JBM	JBM
5	Final	Simon Divecha	1 Word 1 PDF	-	31/3/15	JBM	JBM
6	Final	Simon Divecha	1 Word 1 PDF	-	14/4/15	JBM	JBM
7	Final	Simon Divecha	1 Word 1 PDF	-	15/4/15	JBM	JBM
8	Final	Simon Divecha	1 Word 1 PDF	-	11/8/15	JBM	JBM

Printed: 11/08/2015 4:43:00 PM

Last Saved: 11/08/2015 4:43:00 PM

File Name: S:\1_Projects\Current\1506_SGEDI CBA\Reports\SGEDI CBA_Final_150811.docx

Project Manager: Julian Morison

Authors: Heather Bailey, Julian Morison

Name of Client: Environment Institute

Name of Project: Economic Assessment of the Spencer Gulf Ecosystem and Development Initiative Phase II Proposal

Document Version: 8

Job Number: 1506

EXECUTIVE SUMMARY

The Spencer Gulf is currently the main economic development zone in South Australia. For commercial entities the Gulf provides access to water for desalination, a transport channel for bulk exports and an important fishing area. The Gulf is a rare inverse estuary where salt levels are lowest at its mouth. It provides a nursery for many of South Australia's fish species and is an area of high and unique biodiversity. It is the home of iconic species such as Australian sea lions, seals, giant Australian cuttlefish and seabirds. Consultation with industry and government suggests that considerable ongoing development of this region is likely and that the information needed to manage resultant cumulative impacts is inadequate.

The industry, people around the Gulf and the South Australian community at large are keen to see future developments carefully managed. The Spencer Gulf Ecosystem and Development Initiative (SGEDI) will support this by bringing together key stakeholders, investigating governance frameworks, gaining the necessary scientific understanding that underpins the potential environmental impacts and developing a world-class decision support system for future developments. Thus an integrated approach will be taken to marine management. The initiative is led by the University of Adelaide's Environment Institute and is a collaboration between research organisations (University of Adelaide, SARDI, Flinders University), industry, government and the community.

Phase I of SGEDI has identified existing environmental knowledge and information gaps for the Spencer Gulf, facilitated environmental data sharing between development proponents, and engaged a range of key stakeholders.

Phase II of the initiative is planned to be implemented in 2015/16 and the program will run for four years with an estimated budget of $15 million (funding sought).

The purpose of this study is to undertake a cost benefit analysis (CBA) of a selection of the expected outcomes of SGEDI to assist the Environment Institute and partners in developing a business case for government investment for Phase II of the initiative. Expected outcomes are:

1. Clearer approval pathways resulting in reduced costs and time delays
2. Knowledge and data sharing to reduce costs of environmental assessment
3. Development guided to lesser impacts, reducing risks of future liabilities for investors and government
4. Reducing avoidable environmental impact, e.g. from the introduction of marine pests, destruction of seagrass beds, etc.

This economic analysis examines two applications concerning development approval (points 1 and 2 above) and biosecurity (a small component of point 4).

The economic analysis of development approvals focussed on assessing the net benefits to Australia from the use of SGEDI Phase II models and data to undertake environmental planning and impact assessment required for development applications for major projects in an accurate and timely manner.

The biosecurity economic analysis focussed on assessing the net benefits to Australia from the use of knowledge gained through SGEDI Phase II biosecurity projects to allow more effective biosecurity surveillance of and response to potential marine pest introductions to the Spencer Gulf.

The CBA conducted for this project was undertaken according to the principles and method outlined in the Commonwealth Government's *Handbook of Cost-Benefit Analysis.*

The aggregate results of the CBA for the SGEDI Phase II initiative (reflecting a partial and minimum estimate of the benefits) are provided in Table ES1 below.

Table ES1 Aggregate results of the SGEDI Phase II initiative CBA

Components	NPV ($m) [a]
Environmental Approvals Application	107.9
Biosecurity Application	28.2
Total	**136.1**

[a] 2015 dollars

Source: EconSearch analysis

Based on the assumptions outlined in the report and relative to the base case, it is apparent that the SGEDI Phase II initiative will provide substantial benefits to the Australian community (i.e. an aggregate net present value (NPV) of $136.1 million over 30 years).

The results are premised on a very conservative base case that, in the absence of SGEDI, a similar initiative would commence in 10 years. The sensitivity analysis showed that a (perhaps more likely) 20-year lag would generate a project net benefit of $207 million and a base case that assumes no similar initiative in the future gives a project value of approximately $230 million.

In the case of the environmental approvals assessment (net benefits of $107.9 million), the three areas of quantified benefit were reduced data collection costs for proponents, reduced project timeframe for proponents and reduced project timeframe for government agencies. The two main costs valued were the SGEDI investment itself and the adoption and on-going maintenance costs of the datasets.

The biosecurity application was also shown to generate significant net benefits to the Australian community ($28.2 million). The analysis conservatively assumed that the benefits are in the form of avoided costs of managing marine pest incursions, avoided costs from lost aquaculture and wild catch fisheries production, avoided increased cost of maintenance of marine infrastructure, and the substantial benefits from avoided impacts on native marine biodiversity.

Part of the analysis drew on previous work aimed at valuing the marine environment in New Zealand and elsewhere (Skinner et al. (2009), Paterson and Cole (1999)) which was used to attribute a value of $1,023 million per annum to the Spencer Gulf (including both market and non-market values). The process of calculation downplayed the gulf's unique and high value characteristics and is therefore is likely to be a conservative estimate.

This attributed value compares with an estimated $314 million per annum in recreation and tourism revenues that the Spencer Gulf adds to the economies of the Yorke and Eyre peninsulas (TRA 2014) and commercial fishing and aquaculture in Spencer Gulf valued at approximately $189 million in 2013/14 (EconSearch 2015a-g). The non-market values referred to above are additional to these values.

The applications of SGEDI analysed in this report (environmental approvals and biosecurity) will involve a range of costs and benefits, including a number of benefits that cannot be easily or fully valued in monetary terms because of the absence of market signals. In this analysis un-priced benefits for each application have been identified and described qualitatively and are discussed below, but were not included in the environmental approvals valuation and were only partially included in the biosecurity valuation.

SGEDI will provide improved knowledge of Spencer Gulf ecosystems and oceanographic systems, which is a benefit in itself but will assist with better community awareness of the environmental values in their region, and assist with more effective planning for the future development and conservation in the region. It is likely to make other environmental modelling more accurate, e.g. SGEDI will be able to inform local-scale climate change modelling through providing more fine-scale oceanographic information and the effects of climate change on marine ecosystems will be more readily understood with a better knowledge of the habitats present, their condition and stressors.

With the creation of credible, third-party generated data and models and with the ability to consider cumulative impacts, it will lead to increased community confidence in the assessment of environmental impact, better project planning and better consideration of cumulative and flow-on impacts. This is expected to ease community tension around proposed and current developments in the region and reduce community/stakeholder conflict.

With more efficient development approval processes, it is possible to bring projects forward, bringing forward economic activity and the benefits that accrue to regional communities such as jobs and more business activity. It would also bring forward significant taxation revenues for government as projects come on stream earlier.

The knowledge gained through SGEDI Phase II biosecurity projects will allow more effective biosecurity surveillance of and response to potential marine pest introductions to the Spencer Gulf. These capabilities mean that there is less likelihood of marine pest introductions into the Spencer Gulf than exists at present. There are a number of benefits, from avoiding impacts. These include avoided impacts to native biodiversity. It is also important to recognise that biosecurity is a small component of the broader integrated program proposed as part of SGEDI phase II.

As noted above, this analysis is a partial one in the sense that not all aspects of SGEDI Phase II have been analysed and for those that have (e.g. reducing avoidable environmental impact) only a component of the expected outcomes have been assessed. Even so, clearly there are significant public and private benefits to be had, for example, from reducing costs and shortening timeframes in environmental approval processes. Additionally, the costs of collecting data and establishing the validity and independence of the data are important values relevant to both the industries that use the data and the broader community which depends on decisions being made in the public interest. These public interest decisions, in turn, depend on sound, reliable and independent data and knowledge of the sort that will be generated in Phase II of SGEDI.

1. INTRODUCTION

1.1 Background

The Spencer Gulf is currently the main economic development zone in South Australia. The Major Projects Directory[1] for South Australia highlights the large number of very significant mineral and energy resource and related infrastructure projects that will involve major developments around the Gulf and requirements for significant infrastructure. This infrastructure will support exports of mineral and energy products which is forecast to grow to 50 per cent of the State's merchandising exports within the next decade. Further to this, there is substantial activity in the energy, agriculture, fisheries and aquaculture sectors within this region.

The Gulf is a rare inverse estuary where salt levels are lowest at its mouth. It provides a nursery for many of South Australia's fish species and is an area of high and unique biodiversity. For commercial entities the Gulf provides access to water for desalination, a transport channel for bulk exports, an important fishing area and aquaculture production zone. It is the home of iconic species such as Australian sea lions, seals, giant Australian cuttlefish and seabirds.

Consultation with industry and government suggests that considerable ongoing development of this region is likely and that the information needed to manage resultant cumulative impacts is inadequate.

The industry, people around the Gulf and the South Australian community at large are keen to see future developments carefully managed. The Spencer Gulf Ecosystem and Development Initiative (SGEDI) will support this by bringing together key stakeholders, gaining the necessary scientific understanding that underpins the potential environmental impacts and developing a world-class decision support system for future developments.

SGEDI aims to provide stakeholders (the local community, governments and industry) in the Spencer Gulf region with access to independent and credible scientific information, so that opportunities for development can be optimised. By establishing an informed decision support system, effective tools will be developed to enable all stakeholders to consistently evaluate and respond to economic, environmental and social impacts.

The initiative is led by the University of Adelaide's Environment Institute and is a collaboration between research organisations (University of Adelaide, SARDI and Flinders University),

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[1] Source: Department of State Development Major Developments Directory, accessed 19/2/15: http://www.dmitre.sa.gov.au/directory/search_action?industry=0&organisation=&keyword=&region=9&size=

industry, government and the community. It forms part of the Marine Innovation Southern Australia (MISA) collaboration. Partners include Alinta Energy, Arrium Ltd, BHP Billiton Ltd, Centrex Metals Ltd, Fisheries Research and Development Corporation (FRDC), Flinders Ports, Flinders University, Nyrstar Santos Ltd and SA Department of State Development.

Phase I of the SGEDI initiative occurred over three years from the 2012/13 financial year to the 2014/15 financial year with funding from partners of $1.5 million. Phase I outcomes include:

- Publishing a report on scenario development, stakeholder workshops, existing knowledge and information gaps for the Spencer Gulf (Gillanders et al. 2013)
- Assisting developments that may be required to engage in expensive assessment around whale impacts for approval. The cost of this investigation can be greater than half a million dollars. Initiative members, such as Santos, have conducted millions of dollars of whale impact research that is now being utilised to understand environmental stressors and consequently assist development approval.
- Facilitating data sharing between BHP Billiton and Flinders Ports. This cut costs, time delays and duplication that are otherwise likely in conducting the necessary environmental investigations. This data sharing would not have occurred without the Initiative.
- Assisted Centrex Metals to gain federal environmental approval. Centrex's prior participation in the Initiative resulted in assurance around its responsible corporate citizenship. The company's EPBC Act approval contains a condition requiring it to continue its participation in the Initiative. It consequently helps to assure stakeholders that cumulative impacts are considered.

Phase II of the initiative is planned to be implemented from 2015/16 and the program will run for four years with an estimated budget of $15 million.

1.2 Objective

The purpose of this study is to undertake a cost benefit analysis of a selection of the expected outcomes of the SGEDI to assist in the development of a business case for government investment for Phase II of the initiative. Expected outcomes are:

1. Clearer approval pathways resulting in reduced costs and time delays
2. Knowledge and data sharing to reduce costs of environmental assessment
3. Development guided to less impactful pathways, reducing risks of future liabilities for investors and government
4. Reducing avoidable environmental impact.

This economic analysis examines two applications concerning development approval (points 1 and 2 above) and biosecurity (point 4). Consideration of point 3 and a fuller assessment of point

4 were not possible due to the limited time available to undertake the analysis and prepare this report.

1.3 Document Structure

An outline of the key characteristics of the CBA method employed in this study is provided in Section 2 of the report. The results of the CBA for the project in aggregate are presented in Section 3. In Sections 4 and 5 the scope of costs and benefits, data sources/assumptions and results of the CBA, including key indicators and sensitivity analysis, are detailed for each application within the project.

2. METHOD OF ANALYSIS

The CBA conducted for this project was undertaken according to the principles and method outlined in the Commonwealth Government's *Handbook of Cost-Benefit Analysis* (Department of Finance and Administration 2006).

The key characteristics of the CBA method employed in this study include the following.

- The CBA includes a base case or counterfactual scenario, that is, the benchmark against which the 'with SGEDI Phase II project' scenario was compared. The base case was defined as what would have occurred without the SGEDI Phase II project.
- The CBA was conducted over a 30 year time period and results were expressed in terms of net benefits, that is, the incremental benefits and costs of the 'with SGEDI Phase II project' scenarios relative to those generated by the base case scenario.
- Costs and benefits were specified in real terms (i.e. constant 2015 dollars). Past and future values were converted to present values by applying a discount rate of 6 per cent.
- In order to account for uncertainty, sensitivity analysis was undertaken using a range of values for key variables.
- The evaluation criterion employed in the analysis is net present value (NPV).
- For each CBA, costs and benefits for both the 'with' and 'without' SGEDI Phase II project scenarios have been listed in tabular form and include those that can be readily identified and valued in monetary terms as well as those which cannot be easily valued in monetary terms because of the absence of market signals. The tables provide an indication of the likely distribution of the costs and benefits between stakeholder groups and the source of the information.
- The 'without' SGEDI scenario (the base case) was premised on a very conservative assumption that, in the absence of SGEDI, a similar initiative would commence in 10 years. The sensitivity analysis examines an even more conservative 5-year lag, a perhaps more likely 20-year lag, as well as a base case that assumes no similar initiative at all in the future (i.e. outside the 30-year time frame of the analysis).

3. AGGREGATE RESULTS

The aggregate results of the CBA for the SGEDI Phase II initiative are provided in Table 3–1 below. The scope of costs and benefits, data sources/assumptions and results of the CBA for each application within the overall analysis, including key indicators and sensitivity analysis, are detailed in Sections 4 and 5.

Table 3–1 Aggregate results of the SGEDI Phase II initiative CBA

Components	NPV ($m) [a]
Environmental Approvals Application	107.9
Biosecurity Application	28.2
Total	**136.1**

[a] 2015 dollars

Source: EconSearch analysis

Based on the assumptions outlined in Sections 4 and 5 and relative to the base case, it is apparent that the SGEDI Phase II initiative will provide substantial benefits to the Australian community (i.e. the aggregate NPV of $136.1 million over 30 years). It should be noted that this is only a partial assessment of the benefits of the initiative (just two components analysed) and that the analysis was undertaken using very conservative assumptions.

In the case of the environmental approvals assessment (net benefits of $107.9 million), the three areas of quantified benefit were reduced data collection costs for proponents, reduced project timeframe for proponents and reduced project timeframe for government agencies. The two main costs valued were the SGEDI investment itself and the adoption and on-going maintenance costs of the datasets.

The biosecurity application was also shown to generate significant net benefits to the Australian community ($28.2 million). The analysis conservatively assumed that the benefits are in the form of avoided costs of managing marine pest incursions, avoided costs from lost aquaculture and wild catch fisheries production, avoided increased cost of maintenance of marine infrastructure, and the substantial benefits from avoided impacts on native marine biodiversity.

4. COST BENEFIT ANALYSIS OF SGEDI PHASE II'S CONTRIBUTION TO DEVELOPMENT APPROVALS

4.1 Description

This topic is about the SGEDI Phase II initiative's application in environmental planning and impact assessment in major development applications (abbreviated here as environmental approvals or EA).

As part of this application's outcomes it is intended that SGEDI will provide publically available, credible, comprehensive and independent environmental data, knowledge of the Spencer Gulf ecosystems and oceanographic systems and a decision support system for future developments, resulting in:

- Clearer approval pathways leading to reduced costs and time delays
- Knowledge and data sharing to reduce costs of environmental assessment.

This economic analysis focussed on assessing the net benefits to Australia from the use of SGEDI Phase II models and data to undertake environmental planning and impact assessment required for development applications for major projects in an accurate and timely manner.

4.2 Scenario Context

Environmental planning and impact assessment is required for all major projects. Special consideration is given to state Declared Rare and Priority Flora and Fauna and threatened species and communities listed under the Commonwealth *Environment Protection and Biodiversity Conservation (EPBC)* Act 1999.

Spencer Gulf is an area of high marine conservation significance and provides important foraging and breeding habitats for a range of iconic and threatened, endangered and protected species (TEPS), including those listed under the EPBC Act. For the Spencer Gulf region TEPS include all cetaceans (whales, dolphins and porpoises) found in the region, listed threatened species (e.g. southern right whale, Australian sea lion, white sharks), listed migratory species (migratory cetaceans and seabirds, white sharks and shortfin makos), listed conservation dependent species (school shark) and listed marine species (all seabirds, seals, marine turtles and syngnathids (seahorses, pipefish and sea dragons). Iconic species include apex predators or species with significant cultural or ecotourism significance such as the giant Australian cuttlefish (Gillanders et al 2013). In addition blue groper within the Gulf and cephalopods (cuttlefish, squid and octopus) within False Bay, Whyalla are protected under State legislation. It can be expected that many major projects relevant to the Spencer Gulf may be referred under the EPBC Act for further assessment of potential impacts towards TEPS.

Spencer Gulf has some of the largest seagrass meadows in the world, which form the foundation of diverse and highly productive ecosystems (Irving 2014 in Gillanders et al 2013). The seagrass meadows in Spencer Gulf have recently been listed as 'endangered' by the International Union for the Conservation of Nature (Gillanders et al 2013).

Currently there are six major projects that are in the development approval phase relevant to the Spencer Gulf, these are: Braemar Bulk Export and Razorback Iron Ore Projects, Port Spencer, Bungalow Joint Venture, Central Eyre Iron Project and Port Bonython. Collectively these projects are valued at more than $11.9 billion[2]. There are a further 17 major projects listed that can be expected to interact with the Spencer Gulf through the development of additional ports, marinas and other marine infrastructure, shipping, desalination and port-side industrial activities.

Typically the environmental impacts are assessed project by project, generally requiring elements of the same set of data and information, with little consideration of cumulative impacts. Consultation with industry and government suggests that considerable ongoing development of this region is likely and that there is general redundancy across applications for some of the information needed, whilst the data and information to manage resultant cumulative impacts is inadequate.

Several reports (Gillanders et al 2013, Gillanders et al 2015) highlight the limited environmental data available for the Gulf. Project proponents have had to collect substantial amounts of their own data and develop their own models to assess impacts. For example, an estimated $2 million was spent collecting data on bathymetry, tidal flows and a census of marine flora and fauna of the Upper Spencer Gulf for the Point Lowly desalination plant component of the Olympic Dam Expansion Project (Greg Hill, pers. comm. 11/8/15). The data were required to model the impact of discharge of concentrated seawater from the plant. The proponent experienced difficulty getting stakeholder acceptance of their data and modelling, and spent considerable resources on defending the credibility of their work.

In contrast, SGEDI through its MISA partners would provide an independent and credible source for these data and information.

[2] Source: Department of State Development Major Developments Directory, accessed 19/2/15: http://www.dmitre.sa.gov.au/directory/search_action?industry=0&organisation=&keyword=&region=9&size=

4.3 Scope of Costs and Benefits

Table 4–1 and Table 4–2 list, in qualitative terms, the costs and benefits associated with the 'with SGEDI Phase II' scenario and the base case ('without SGEDI Phase II') scenario. Note that there are several, potentially important benefits are not quantified in the subsequent analysis including reduced community conflict over developments, improved knowledge of the Spencer Gulf ecosystems and oceanographic systems, and bringing forward development in the region. As such the CBA reflects the partial benefits and provides a conservative (minimal) estimate of the benefits of SGEDI Phase II.

Table 4–1 The costs of the EA application

Scenario	Cost	Bearer of Cost	Monetary Valuation?	Source of Information
Base case (without SGEDI Phase II) scenario	Identical to the 'with SGEDI Phase II' scenario, but with a 10 year lag [a]	See below	See below	See below
With SGEDI Phase II scenario	SGEDI Phase II investment costs	Gov't, industry, research institutions	Yes	See text in Section 4.4.1
	Operating costs –maintaining and updating SGEDI Phase II datasets and models	Industry	Yes	See text in Section 4.4.1

[a] This implies that, in the absence of SGEDI, a similar initiative would commence in 10 years (there would be an incentive, given the benefits reported). The sensitivity analysis examines shorter and longer time lags (5 and 20 years), the longer term being perhaps more likely, as well as the scenario of there being no similar initiative established at any time in the future.

Table 4–2 The benefits of the EA application

Scenario	Benefit	Beneficiary	Monetary Valuation?	Source of Information
Base case (without SGEDI Phase II) scenario	Identical to the 'with SGEDI Phase II' scenario, but with a 10 year lag [a]	See below	See below	See below
With SGEDI Phase II scenario	Data collection cost savings	Industry	Yes	See text in Section 4.4.2
	Reduced project timeframe cost savings (proponents)	Industry	Yes	See text in Section 4.4.2
	Reduced project timeframe cost savings (government)	Government	Yes	See text in Section 4.4.2
	Reduced community conflict over developments	Society	No	See text in Section 4.4.2
	Improved knowledge of the Spencer Gulf ecosystems and oceanographic systems	Society	No	See text in Section 4.4.2
	Bringing forward development in the region	Society	No	See text in Section 4.4.2

[a] See footnote to Table 4.1.

4.4 Data and Assumptions used for Quantifying Costs and Benefits

This section of the report details the method, sources of information and assumptions used to estimate the costs and benefits listed in Table 4–1 and Table 4–2. For those costs and benefits which were difficult to estimate in monetary terms, some qualitative description is provided.

4.4.1 Costs

Investment costs

Estimates of the SGEDI Phase II investment costs attributed to this application ($13 million of the initiatives $15 million budget) were provided by the Environment Institute, and are described in Table 4–3.

Table 4–3 Investment costs in EA application

	Investment ($) [a]
2015/16	3,402,174
2016/17	3,054,348
2017/18	3,054,348
2018/19	3,489,130
Total	**13,000,000**

[a] 2015 dollars

Source: Environment Institute

Operating costs

Operating costs include maintaining and updating SGEDI Phase II datasets and models. A placeholder value of $1 million per year was assumed.

4.4.2 Benefits

Data collection cost savings

SGEDI will provide publically available, credible, comprehensive and independent environmental data, knowledge of the Spencer Gulf ecosystems and oceanographic systems, and a decision support system for future developments. This will mean that development proponents will be able to use the SGEDI data sets and system models and reduce their data collection costs.

It was conservatively assumed that SGEDI derived data and system models will provide the environmental data needs of proposed developments in 50 per cent of cases.

Based on an actual development approval case relevant to the Spencer Gulf, environmental data collection costs were assumed to be 0.33 per cent of total project value[3].

Based on an analysis of current major projects in the development approval phase relevant to the Spencer Gulf, the average project value is approximately $2.4 billion[4]. Currently there are 5 projects in the development approval phase. For this analysis it was assumed that the number of projects approved per year going forward would remain constant.

Analysis of major projects (state-wide) that have completed the development approval phase, indicates that the average time taken to achieve development approval is approximately 2.8 years[4]. On this basis, approximately 1.77 projects achieve development approval per year.

An estimated annual benefit of $7 million has been derived based on these assumptions.

Reduced project timeframe cost savings (proponents)

Because SGEDI will provide publically available, credible, comprehensive and independent environmental data, knowledge of the Spencer Gulf ecosystems and oceanographic systems and a world-class decision support system for future developments, it is expected that development approvals where SGEDI data and models are used will occur with less requests for further or revised assessments, and development approval times will be reduced.

As previously discussed, it was conservatively assumed that SGEDI derived data and system models will provide the environmental data needs of proposed developments in 50 per cent of cases. It has been assumed that on average the development approval phase will be reduced by 3 months per project for those projects using SGEDI data and models. It has been assumed that this development approval phase time-saving translates on average to a 45 day time-saving to the project overall.

Flyvbjerg et al (2003) in a global study of the project management of infrastructure development projects estimated that for every one year of delay in the completion of a project there was a 4.6 per cent increase in the total project cost. A smaller Australian study (Evans & Peck 2011) indicates figures of around 10 per cent. The more conservative figure of 4.6 per cent was used to assume that an equivalent time saving would lead to an equivalent cost saving.

An estimated annual benefit of $12.3 million has been derived based on these assumptions.

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3 Approximately $2 million was spent on environmental data collection (Greg Hill, pers. comm. 11/8/15) on a project worth $600 million (Department of State Development Major Developments Directory, accessed 19/2/15).

4 https://www.sa.gov.au/topics/housing-property-and-land/building-and-development/building-and-development-applications/major-development-applications-and-assessments , accessed 19/2/15)

Reduced project timeframe cost savings (regulatory authorities)

As discussed previously, it is expected that development approvals where SGEDI data and models are used will occur with less requests for further or revised assessments, and development approval times will be reduced. This will place less costs on the regulatory authorities because they will have less resubmitted assessments to review.

It has been assumed that for those projects that use SGEDI data and models, regulatory authorities will require 150 hours less review time per project. A rate of $88.29 per hour[5] (inclusive of on-costs and overheads) was assumed.

An estimated annual benefit of $11,720 has been derived based on these assumptions.

Un-priced benefits

The SGEDI will provide improved knowledge of Spencer Gulf ecosystems and oceanographic systems, which is a benefit in itself but will assist with better community awareness of the environmental values in their region and assist with more effective planning for the future development and conservation in the region. It is likely to make other environmental modelling more accurate, e.g. SGEDI will be able to inform local-scale climate change modelling through providing more fine-scale oceanographic information; and the effects of climate change on marine ecosystems will be more readily understood with a better knowledge of the habitats present, their condition and stressors.

With the creation of credible, third-party generated data and models and with the ability to consider cumulative impacts, it will lead to increased community confidence in the assessment of environmental impact, better project planning and better consideration of cumulative and flow-on impacts. This is expected to ease community tension around proposed and current developments in the region and reduce community conflict.

With more efficient development approval processes, it is possible to bring projects forward, bringing forward economic activity and the benefits that accrue to regional communities such as jobs and more business activity. This also has the potential to bring forward taxation revenue for government.

4.4.3 The base case

In the absence of the SGEDI Phase II initiative there would be an incentive, given the benefits reported, to develop such a capability. A conservative 10-year delay in the development of a capability has been modelled. The sensitivity analysis considers an extremely conservative 5-

5 Average hourly rate of a SA government professional officer level 3 (PO3) equivalent, plus on-costs of 25 per cent (superannuation, payroll tax, etc.) and overheads of 50 per cent.

year delay and perhaps a more realistic 20-year delay. The sensitivity analysis also examines the scenario of there being no similar initiative established at any time in the future.

4.5 Results of the Analysis

4.5.1 Net present value

The results of the CBA are provided in Table 4–4. These results are based on the expected values for key variables, as outlined in Section 4.4. The three areas of benefit are the reduced data collection costs for proponents, reduced project timeframe for proponents and reduced project timeframe for government agencies. The two main costs are the SGEDI investment itself and the adoption and on-going maintenance costs of the datasets.

Table 4–4 Net Present Value of the EA application

	$m [a]
Data collection cost savings (proponents)	43.5
Reduced project timeframe cost savings (proponents)	75.8
Reduced project timeframe cost savings (government)	0.1
SGEDI Phase II investment costs	-5.1
Adoption costs - maintaining Spencer Gulf datasets	-6.2
Environmental Approvals application Net Present Value[b]	**108.0**

[a] 2015 dollars

[b] Individual components may not sum to the total due to rounding

Source: EconSearch analysis

Relative to the base case, it is apparent that this application would generate substantial net benefits to the Australian community.

4.5.2 Sensitivity analysis

The results of the analysis were re-estimated using values for key variables that reflect the uncertainty of those variables. Sensitivity analyses were undertaken for different values of the following variables:

- Discount rate
- Adoption costs (maintaining Spencer Gulf data sets)
- Average project value
- Average development approval time per project
- Future increase in projects approved per year in comparison with current rates
- Adoption rate (SGEDI data and models)
- Environmental data collection costs as a proportion of total project costs

- Average reduction in development approval time
- Proportion of approval time saving resulting in project completion time-saving
- Per year time saving impact (decrease) in overall project costs
- Number of hours saved in assessment per project by regulatory authority
- Base case time-lag

Discount Rate

A key variable is the discount rate. In the analysis a discount rate of six per cent was used and sensitivity analysis on discount rates was undertaken using discount rates of four and eight per cent. The results are presented in Table 4–5.

Table 4–5 Results of the sensitivity analysis on the discount rate

Discount Rate	NPV ($m) [a]
4%	128.1
6% [b]	107.9
8%	91.3

[a] 2015 dollars

[b] Expected value

Source: EconSearch analysis

The results of the sensitivity analysis show moderate variation in the NPV, but the result is still substantially positive.

Adoption costs (maintaining Spencer Gulf data sets)

In the analysis an adoption cost of $1 million per year was assumed (beyond initial $15M investment). This is a placeholder value and as such is uncertain. A sensitivity analysis was undertaken using figures 50 per cent less and 50 per cent more. The results are presented in Table 4–6.

Table 4–6 Results of the sensitivity analysis on the adoption costs

Adoption costs - maintaining SG data sets ($)	NPV ($m) [a]
500,000	111.0
1,000,000 [b]	107.9
1,500,000	104.8

[a] 2015 dollars

[b] Expected value

Source: EconSearch analysis

The results of the sensitivity analysis show some variation in the NPV, but the result is still substantially positive.

Average project value

This variable was based on an average project value of projects currently in the development approval phase, and is dependent on the nature of the projects proposed which may change over time. A sensitivity analysis was undertaken using figures 50 per cent less and 50 per cent more. The results are presented in Table 4–7.

Table 4–7 Results of the sensitivity analysis on the average project value

Average project value ($m)	NPV ($m) [a]
1,194	48.3
2,388 [b]	107.9
3,583	167.6

[a] 2015 dollars

[b] Expected value

Source: EconSearch analysis

The results of the sensitivity analysis show significant variation in the NPV, but the result is still substantially positive.

Average development approval time per project

This variable was based on the average time taken to achieve development approval by major projects in South Australia, and is dependent on the nature and complexity of the projects proposed which may change over time. A sensitivity analysis was undertaken using figures 50 per cent less and 50 per cent more. The results are presented in Table 4–8.

Table 4–8 Results of the sensitivity analysis on the average development approval time per project

Average development approval time per project (yr)	NPV ($m) [a]
1.4	227.3
2.8 [b]	107.9
4.2	68.1

[a] 2015 dollars

[b] Expected value

Source: EconSearch analysis

The results of the sensitivity analysis show significant variation in the NPV, but the result is still substantially positive.

Future increase in projects approved per year in comparison with current rates

For this analysis it was assumed that the number of projects approved per year would remain constant. In practice, over time the number of projects is likely to fluctuate. A sensitivity analysis was undertaken using figures of 50 per cent less and 100 per cent more. The results are presented in Table 4–9.

Table 4–9 Results of the sensitivity analysis on the future increase in projects approved per year in comparison with current rates

Future increase in projects approved per year in comparison with current rates	NPV ($m) [a]
Half as many	48.2
No increase [b]	107.9
Twice as many	227.3

[a] 2015 dollars

[b] Expected value

Source: EconSearch analysis

The results of the sensitivity analysis show significant variation in the NPV, but the result is still substantially positive.

Adoption rate (SGEDI data and models)

In the analysis it was assumed that SGEDI data and models could be used by project proponents in their assessments in 50 per cent of cases. This is a placeholder value and as such is uncertain. A sensitivity analysis was undertaken using adoption rates of 25 per cent and 100 per cent. The results are presented in Table 4–10.

Table 4–10 Results of the sensitivity analysis on the adoption rate

Adoption rate (SGEDI data and models)	NPV ($m) [a]
25%	48.2
50% [b]	107.9
100%	227.3

[a] 2015 dollars

[b] Expected value

Source: EconSearch analysis

The results of the sensitivity analysis show significant variation in the NPV, but the result is still substantially positive.

Environmental data collection costs as a proportion of total project costs

This variable assumes environmental data collection costs of 0.33 per cent of total project costs and is based on an actual case. However there is not comprehensive evidence or a long history of precedence to confidently predict this value. A sensitivity analysis was undertaken using figures of 0.1 per cent and 1.0 per cent. The results are presented in Table 4–11.

Table 4–11 Results of the sensitivity analysis on environmental data collection costs as a proportion of total project costs

Environmental data collection costs as a proportion of total project costs	NPV ($m) [a]
0.1%	77.4
0.3% [b]	107.9
1.0%	195.0

[a] 2015 dollars

[b] Expected value

Source: EconSearch analysis

The results of the sensitivity analysis show significant variation in the NPV, but the result is still substantially positive.

Average reduction in development approval time

This variable assumes a three-month reduction in development approval per project as a result of using SGEDI datasets. This figure is based on a placeholder value and is therefore uncertain. A sensitivity analysis was undertaken using figures of 50 per cent less and 50 per cent more. The results are presented in Table 4–12.

Table 4–12 Results of the sensitivity analysis on the average reduction in development approval time

Average reduction in development approval (yrs)	NPV ($m) [a]
0.125	70.0
0.25 [b]	107.9
0.375	145.8

[a] 2015 dollars

[b] Expected value

Source: EconSearch analysis

The results of the sensitivity analysis show significant variation in the NPV, but the result is still substantially positive.

Proportion of approval time saving resulting in project completion time-saving

As discussed in Section 4.4.2, this variable assumes that the three-month time saving in development approval times translates to a one-and-a-half month time saving in the project completion. This figure is based on a placeholder value, and as such is uncertain. A sensitivity analysis was undertaken using figures of zero per cent (i.e. no project time-saving) and 100 per cent (i.e. project approval time-savings directly translate into project time savings). The results are presented in Table 4–13.

Table 4–13 Results of the sensitivity analysis on the proportion of approval time saving resulting in project completion time-saving

Proportion of approval time saving resulting in project completion time-saving	NPV ($m) [a]
0%	32.2
50% [b]	107.9
100%	183.7

[a] 2015 dollars

[b] Expected value

Source: EconSearch analysis

The results of the sensitivity analysis show significant variation in the NPV, but the result is still substantially positive.

Per year time saving impact (decrease) in overall project costs

This variable assumes that for every year of time-saving in a project there is a 4.6 per cent decrease in project costs. Based on a literature review this is a conservative figure, however there is some variation between types of projects and countries. A sensitivity analysis was undertaken using figures of 50 per cent less and 50 per cent more. The results are presented in Table 4–14.

Table 4–14 Results of the sensitivity analysis on the per year time saving impact in overall project costs

Per year time saving impact (decrease) in overall project costs	NPV ($m) [a]
2.32%	70.0
4.64% b	107.9
6.96%	145.8

[a] 2015 dollars

[b] Expected value

Source: EconSearch analysis

The results of the sensitivity analysis show significant variation in the NPV, but the result is still substantially positive.

Number of hours saved in assessment per project by regulatory authority

This variable assumes a time-saving for regulatory authorities of 150 hours per project in reviewing projects. This is based on a placeholder value, and as such is uncertain. A sensitivity analysis was undertaken using figures of nil hours and 1,500 hours. The results are presented in Table 4–15.

Table 4–15 Results of the sensitivity analysis on the number of hours saved in assessment per project by regulatory authority

No. hours saved in assessment per project by regulatory authority	NPV ($m) [a]
0	107.8
150	107.9
1,500	108.6

[a] 2015 dollars

[b] Expected value

Source: EconSearch analysis

Even with an extreme range of values of this variable the NPV varied relatively little and it therefore reasonable to assume that the results are not very sensitive to this variable.

Time lag variable used in the base case

In the base case it was assumed that without the investment in the SGEDI Phase II initiative at some point in the future an equivalent initiative would be invested in, and a delay of 10 years was assumed. There is uncertainty about how long the delay in investment in this capability would be. A sensitivity analysis was undertaken using a lower bound value of 5 years and an upper bound value of 20 years. The results are presented in Table 4–16.

Table 4–16 Results of the sensitivity analysis on the time lag variable used in the base case

Base case - timelag (years)	NPV ($m) [a]
5	61.8
10 [b]	107.9
20	168.2

[a] 2015 dollars

[b] Expected value

Source: EconSearch analysis

The results of the sensitivity analysis show significant variation in the NPV, but it is still strongly positive even when the shorter time lag is assumed. The analysis was also undertaken assuming that at no point in the future (i.e. within the 30 year timeframe of the analysis) would there be an equivalent investment made. The estimated NPV was higher than that for the 20 year time lag but not significantly so ($190.7 million).

5. COST BENEFIT ANALYSIS OF SGEDI PHASE II'S CONTRIBUTION TO BIOSECURITY

5.1 Description

This topic is about SGEDI Phase II's application in reducing avoidable environmental impact e.g. from the introduction of a marine pests, destruction of seagrass beds, etc.

In SGEDI Phase II researchers plan to:

- Undertake targeted risk identification and prioritisation of marine biosecurity threats for the Spencer Gulf
- Develop appropriate, targeted surveillance and risk management options
- Develop appropriate response options in the event of a marine pest incursion.

This economic analysis focussed on assessing the net benefits to Australia from the use of knowledge gained through SGEDI Phase II biosecurity projects to allow more effective biosecurity surveillance of and response to potential marine pest introductions to the Spencer Gulf.

5.2 Scenario Context

It is estimated that there are over 250 introduced marine species in Australia of which up to one in six have potential to be invasive (Crombie et al 2007). Marine invasive species pose a significant threat to Australia's marine industries and environment. An incursion of the exotic Black Striped mussel in Darwin Harbour in 1999 had the potential to decimate the local pearling industry – then valued at $225 million per year – and impose significant on-going costs on shipping and other industries. The Zebra mussel, a similar species, has become established in the Great Lakes in North America, and over the first 15 years from its discovery in 1989 has caused at least US$267 million in economic impact to drinking water treatment and electric power generation facilities (Connelly et al. 2007) alone, and this excludes consideration of its impact on native ecosystems by out-competing native species for food and by growing on top of and suffocating native clams and mussels, and on harbours, waterways, ships and boats from biofouling.

The Australian and state/territory governments, along with marine industries and marine scientists are implementing Australia's National System for the Prevention and Management of Marine Pest Incursions (the National System). The National System aims to prevent new marine pests arriving, guide responses when a new pest does arrive and minimise the spread and impact of pests already established in Australia.

The National System has the following measures in place to prevent the introduction of marine pests from known vector pathways:

- Ballast water: international shipping entering Australian waters must exchange ballast water at sea before entering Australian waters. Under the National System, the Australian and state/territory governments are working towards introducing ballast water management arrangements for vessels travelling between Australian ports.
- Biofouling: Under the National System, voluntary national biofouling management guidelines have been developed for a range of marine sectors. The Australian government is investigating new biofouling management options for international vessels arriving in Australian waters. Development and implementation of such controls, however, will require data such as those that will be produced by SGEDI Phase II.
- Aquarium trade: the Australian Government manages import restrictions in the trade in live marine animals, plants and rocks. There are no controls on domestic translocation of marine ornamental species.

The National System includes a monitoring strategy that provides early detection of new pest arrivals. It will also provide information to assist in emergency response or pest management activities. The Australian marine pest monitoring manual has been developed which describes the processes and standards for marine pest monitoring in the Australian context.

Several diseases and pests are recorded in Spencer Gulf, but most records are incidental findings and few studies have integrated knowledge on these important organisms of relevance for the area. Primary Industries and Regions South Australia (PIRSA) coordinates passive surveillance of commercially important aquaculture and fisheries species, but no structured disease surveillance is currently in place for Spencer Gulf. No National Marine Pest Monitoring Manual compliant surveys have been undertaken in the Spencer Gulf (Gillanders et al. 2013).

High-risk pests such as Pacific seastars (*Asterias amurensis*) and wakame (*Undaria pinnatifida*), and pathogens such as abalone viral ganglioneuritis are established in Victoria and Tasmania. Proposed expansion in aquaculture production and mining in the Gulf, and the associated increases in shipping and development, are likely to drive increased propagule pressure. Pest and pathogen establishment is linked to propagule pressure (Lockwood et al. 2005 in Gillanders et al. 2013) and the changes in Spencer Gulf are likely to increase the incidence of incursions of pests and pathogens.

In summary, there are some measures in place to monitor and prevent the introduction of exotic marine pests, but with regard to the Spencer Gulf they are untargeted (i.e. not tailored to the specific stressors and conditions of the Gulf) and are not comprehensive.

5.3 Scope of Costs and Benefits

Table 5–1 and Table 5–2 list, in qualitative terms, the costs and benefits associated with the 'with SGEDI Phase II activity' scenario and the base case ('without SGEDI Phase II activity') scenario.

Table 5–1 The costs of the biosecurity application

Scenario	Cost	Bearer of Cost	Valued in Monetary Terms	Source of Information
Base case (without SGEDI Phase II) scenario	Identical to the 'with SGEDI Phase II' scenario, but with a 10 year lag	See below	See below	See below
With SGEDI Phase II scenario	SGEDI Phase II investment costs	Government	Yes	See text in Section 5.4.1
	Adoption costs – additional biosecurity surveillance and preventative measures using SGEDI Phase II knowledge	Government, industry	Yes	See text in Section 5.4.1

Table 5–2 The benefits of the biosecurity application

Scenario	Benefit	Beneficiary	Valued in Monetary Terms	Source of Information
Base case (without SGEDI Phase II) scenario	Identical to the 'with SGEDI Phase II' scenario, but with a 10 year lag	See below	See below	See below
With SGEDI Phase II scenario	Avoided cost of marine pest management activities	Government, industry, society	Yes	See text in Section 5.4.2
	Avoided impact on marine infrastructure	Government, industry, society	No	See text in Section 5.4.2
	Avoided impact on native biodiversity from predation, competition, alteration of habitat and local environmental condition by marine pests	Society	No	See text in Section 5.4.2

5.4 Data and Assumptions used for Quantifying Costs and Benefits

This section of the report details the method, sources of information and assumptions used to estimate the costs and benefits listed in Table 5–1 and Table 5–2. For those costs and benefits which were difficult to estimate in monetary terms, some qualitative description is provided.

5.4.1 Costs

Investment costs

Estimates of the SGEDI Phase II investment costs attributed to this application were provided by SARDI and the Environment Institute, and are described in Table 5–3.

Table 5–3 Investment costs in biosecurity application

	Investment ($) [a]
2016	347,826
2017	695,652
2018	695,652
2019	260,870
Total	**2,000,000**

[a] 2015 dollars

Source: SARDI and Environment Institute

Adoption costs

Adoption costs are expected to include additional biosecurity surveillance and preventative measures using SGEDI Phase II knowledge. A placeholder value of $0.5 million per year was assumed.

5.4.2 Benefits

The priced benefits of the SGEDI Phase II initiative are the avoided costs and diminished value of the marine resource associated with marine pest introductions.

This economic analysis focussed on assessing the net benefits to Australia from the use of knowledge gained through SGEDI Phase II biosecurity projects to allow more effective biosecurity surveillance of and response to potential marine pest introductions to the Spencer Gulf.

These capabilities mean that there is less likelihood of marine pest introductions into the Spencer Gulf than exists at present. There are a number of benefits, from avoiding impacts. These include:

- avoided cost of marine pest management activities
- avoided lost commercial fishing and aquaculture production
- avoided damage costs to marine infrastructure
- avoided impacts to native biodiversity.

As discussed earlier, an incursion of the exotic Black Striped mussel in Darwin Harbour in 1999 had the potential to decimate the local pearling industry. If introduced, the Northern Pacific seastar could threaten the local oyster industry which was worth $25.1 million in 2012/13 (Eyre Peninsula region in EconSearch 2014).

Marine pests can impact on native biodiversity by predation, competition and alteration of habitat. For example, the Northern Pacific seastar, established in Victoria and Tasmania, is a generalist predator of molluscs, ascidians (sea squirts), bryozoans, sponges, crustaceans, polychaetes, fish and other seastars. It has been implicated as a contributing factor to the decline of the endangered spotted handfish in the Derwent River Estuary. The Northern Pacific seastar have been observed feeding on a stalked ascidian commonly used as a spawning substrate (*Sycozoa sp*.) and it is possible that predatory loss of the ascidian may impact spotted handfish by reducing the available spawning substrate (Aquenal 2008). Another example is the Asian bag/date mussel (*Musculista senhousia*), established in Tasmania, a filter feeder that outcompetes other filter feeders and forms dense mats changing soft sediment ecology. In the northern hemisphere it has been implicated in the decline of eelgrass, and similar impacts could be expected with the highly productive and biodiverse seagrass meadows in Australian waters (Aquenal 2008b). The Asian bag mussel is established in Port Adelaide but not in Spencer Gulf (Wiltshire et al. 2010).

In this analysis estimates of the avoided costs and diminished value of the marine resource associated with marine pest introductions are based on the approach of Sinner et al (2009). That study involved the development of a method to value management actions that reduce marine biosecurity risk in the Fiordland in the southwest corner of New Zealand's South Island. The paper used a value of marine biodiversity from Patterson and Cole (1999) giving a conservative value of NZ$400 per hectare (current AUS$512), reflecting market values of fisheries, aquaculture and tourism as well as non-market values from biodiversity, carbon sequestration and amenity values.

Because of the unique biodiversity and special character of Fiordland's marine environment, Skinner et al. (2009) applied a 2.5 multiplier to the Paterson and Cole (1999) valuation. For this analysis a conservative approach has been taken and the base value ($512/ha) has been used, recognising, however, that there are unique and high value characteristics of the Spencer Gulf that would justify using a value above the base level. Given that the Spencer Gulf covers an area of approximately 2 million hectares, this suggests a value of $1,023 million per annum.

This compares with an estimated $314 million per annum in recreation and tourism revenues the Spencer Gulf adds to the economies of the Yorke and Eyre peninsulas (TRA 2014) and commercial fishing and aquaculture in Spencer Gulf valued at approximately $189 million in

2013/14 (EconSearch 2015a-g). The non-market values referred to above are additional to these values.

Based on the authors' indicative estimates, Sinner et al. (2009) and discussions with the project steering group, it was assumed that the impact of a marine pest incursion would be 1 per cent of the assigned value of Spencer Gulf and that the likelihood of marine pest incursions are as follows:

- With current measures to monitor for or prevent introduction of a marine pest (base case): one incursion in 20 years
- With SGEDI enabled measures to monitor for or prevent introduction of a marine pest: one incursion in 100 years.

Based on the above estimates, the annual cost of incursions in terms of reduced value of the marine resource is estimated to be:

- Current measures (base case): approximately $0.512 million per year
- With SGEDI enabled measures: approximately $0.102 million per year.

Therefore, the avoided cost of marine pest incursions (with SGEDI) is $0.410 million per year, i.e. the difference between the above estimates. Note that this is cumulative over time as the costs are annual and it is assumed that the marine pests are not eradicated.

5.4.3 The base case

In the absence of the SGEDI Phase II initiative there would be existing national programs which would in time develop such a capability. A conservative 10-year delay in the development of a capability has been modelled. The sensitivity analysis considers an extremely conservative 5-year delay and perhaps a more realistic 20-year delay. The sensitivity analysis also examines the scenario of there being no similar initiative established at any time in the future.

5.5 Results of the Analysis

5.5.1 Net present value

The results of the CBA are provided in Table 5–4. These results are based on the expected values for key variables, as outlined in Section 5.4.

Relative to the base case, it is apparent that this application would generate significant net benefits to the Australian community, estimated to have a net present value of $28.2 million. The analysis conservatively assumes that the benefits are in the form of avoided costs of managing marine pest incursions, avoided costs from lost aquaculture and wild catch fisheries production, avoided increased cost of maintenance of marine infrastructure, and the substantial benefits from avoided impacts on native marine biodiversity.

Table 5–4 Net Present Value of the biosecurity application

	$m [a]
Avoided loss of marine resource value	32.1
SGEDI investment costs	-0.8
Marginal adoption costs	-3.1
Biosecurity application Net Present Value	**28.2**

[a] 2015 dollars

Source: EconSearch analysis

5.5.2 Sensitivity analysis

The results of the analysis were re-estimated using values for key variables that reflect the uncertainty of those variables. Sensitivity analyses were undertaken for different values of the following variables:

- Discount rate
- Marginal adoption costs
- Probability of preventing introduction of pest (with SGEDI)
- Probability of preventing introduction of pest (with current measures)
- Value of the marine resource
- Time-lag variable used in the base case.

Discount rate

A key variable is the discount rate. In the analysis a discount rate of six per cent was used and sensitivity analysis on discount rates was undertaken using discount rates of four and eight per cent. The results are presented in Table 5–5.

Table 5–5 Results of the sensitivity analysis on the discount rate

Discount Rate	NPV ($m) [a]
4%	39.7
6% [b]	28.2
8%	20.3

[a] 2015 dollars

[b] Expected value

Source: EconSearch analysis

The results of the sensitivity analysis show significant variation in the NPV, but the result is still positive at the higher (8 per cent) discount rate.

Marginal adoption costs

This variable was based on a placeholder value of $500,000 and therefore has significant uncertainty attached to it. A sensitivity analysis was undertaken using values 50 per cent less and 50 per cent more. The results are presented in Table 5–6.

Table 5–6 Results of the sensitivity analysis on marginal adoption costs

Marginal adoption costs ($m/year)	NPV ($m) [a]
0.25	29.8
0.5 [b]	28.2
0.75	26.7

[a] 2015 dollars

[b] Expected value

Source: EconSearch analysis

The results of the sensitivity analysis show only a small variation in the NPV, and at the higher bound the NPV is still strongly positive, indicating that the results are insensitive to this variable.

Probability of preventing introduction of pest (with SGEDI)

This variable was based on a placeholder value of 90 per cent and therefore has significant uncertainty attached to it. A sensitivity analysis was undertaken using a figure of 99 per cent as the upper bound and 75 per cent as the lower bound. The results are presented in Table 5–7.

Table 5–7 Results of the sensitivity analysis on the probability of preventing introduction of pest (with SGEDI)

Probability of preventing introduction of pest (with SGEDI)	NPV ($m) [a]
99%	35.4
90% [b]	28.2
75%	16.2

[a] 2015 dollars

[b] Expected value

Source: EconSearch analysis

The results of the sensitivity analysis show significant variation in the NPV, but at the lower bound the NPV is still positive.

Probability of preventing introduction of pest (with current measures)

This variable was based on a placeholder value of 50 per cent and therefore has significant uncertainty attached to it. A sensitivity analysis was undertaken using an upper bound value of 75 per cent and a lower bound value of 25 per cent. The results are presented in Table 5–8.

Table 5–8 Results of the sensitivity analysis on the probability of preventing introduction of pest (with current measures)

Probability of preventing introduction of pest (with current measures)	NPV ($m) [a]
75%	8.1
50% [b]	28.2
25%	48.3

[a] 2015 dollars

[b] Expected value

Source: EconSearch analysis

The results of the sensitivity analysis show significant variation in the NPV. At the higher bound the NPV is still positive but $20.1 million less than the NPV at the expected value, indicating that the results are sensitive to this key variable.

Value of the marine resource

This variable was derived from a global study of the value of marine resources, which were estimated conservatively to have a base value of $512/ha (adjusted to 2015 Australian dollars). Due to the high level of uncertainty around this value, a sensitivity analysis was undertaken using 50 per cent less and 50 per cent more than the expected value. The results are presented in Table 5–9.

Table 5–9 Results of the sensitivity analysis on the value of the marine resource

Value of marine resource ($/ha/annum)	NPV ($m) [a]
256	12.2
512 [b]	28.2
768	44.3

[a] 2015 dollars

[b] Expected value

Source: EconSearch analysis

The results of the sensitivity analysis show significant variation in the NPV, but even when the marine resource is valued at the lower level (which is approximately equal to the current annual gross value of commercial fishing and aquaculture and tourism revenue in Spencer Gulf) the result is still positive.

Time-lag variable used in the base case

In the base case it was assumed that without the investment in the SGEDI Phase II initiative at some point in the future an equivalent initiative would be invested in, and a delay of 10 years was assumed. There is uncertainty about how long the delay in investment in this capability would be. A sensitivity analysis was undertaken using a lower bound value of 5 years and an upper bound value of 20 years. The results are presented in Table 5–10.

Table 5–10 Results of the sensitivity analysis on the time-lag variable used in the base case

Base case - time lag (years)	NPV ($m) [a]
5	17.1
10 [b]	28.2
20	38.4

[a] 2015 dollars

[b] Expected value

Source: EconSearch analysis

The results of the sensitivity analysis show significant variation in the NPV, but it is still strongly positive even when the shorter time lag is assumed. The analysis was also undertaken assuming that at no point in the future (i.e. within the 30 year timeframe of the analysis) would there be an equivalent investment made. The estimated NPV was higher than that for the 20 year time lag but only marginally so ($39.3 million).

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