GRAPHIC* WEB BASED MAPPING: STRATEGIC PLAN

Strategic Plan

Developed for The Australian Primary Health Care Research Institute (APHCRI)

Version 2.1 (Abridged)

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About this Document

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</table>
Contents

Glossary .................................................................................................................................................. 5
Executive Summary ................................................................................................................................. 6
1. Introduction ....................................................................................................................................... 8
   1.1 Overview ....................................................................................................................................... 8
   1.2 This Document ............................................................................................................................. 8
   1.3 Related Documents .................................................................................................................... 8
2. Organisational Context ...................................................................................................................... 9
3. The GRAPHC Platform .................................................................................................................... 10
   3.1 The Vision ................................................................................................................................... 10
   3.2 Platform Overview ...................................................................................................................... 10
   3.3 System Description ..................................................................................................................... 11
      3.3.1 Data Tier ............................................................................................................................... 12
      3.3.2 Application Server Tier (ArcGIS Server) ............................................................................. 12
      3.3.3 Services Tier ......................................................................................................................... 12
      3.3.4 Applications Tier .................................................................................................................. 12
      3.3.5 Portal Tier ............................................................................................................................. 13
      3.3.6 User Tier ................................................................................................................................ 13
   3.4 Benefits ...................................................................................................................................... 14
   3.5 Risks ........................................................................................................................................... 15
   3.6 Key Performance Indicators ....................................................................................................... 15
4. Road Map .......................................................................................................................................... 16
   4.1 Short Term (Next 6 Months) ....................................................................................................... 16
      4.1.1 HealthLandscape Australia ................................................................................................... 16
      4.1.2 ArcGIS Online ....................................................................................................................... 17
      4.1.3 Short Term - Requirements Analysis ..................................................................................... 18
      4.1.4 Short Term - Benefits ............................................................................................................ 19
      4.1.5 Short Term - Risks .................................................................................................................. 20
      4.1.6 Short Term - Costs ................................................................................................................ 21
   4.2 Medium Term (6-18 months) ....................................................................................................... 20
      4.2.1 Web Mapping Platform Infrastructure Options ....................................................................... 21
      4.2.2 Medium Term - Requirements Analysis ............................................................................... 22
      4.2.3 Medium Term - Benefits ....................................................................................................... 23
      4.2.4 Medium Term - Risks ............................................................................................................ 24
      4.2.5 Medium Term - Costs .......................................................................................................... 24
   4.3 Long Term (18 months and Beyond) ........................................................................................... 24
5. Implementation Plan .......................................................................................................................... 26
   5.1 Overview ..................................................................................................................................... 26
   5.2 Task Descriptions – Next Steps .................................................................................................. 28
   5.3 Estimated Budgetary and Resourcing Requirements .................................................................. 29
5.4 Project Risks.................................................................................................................. 30

List of Figures
Figure 1: GRAPHC Web Mapping Platform - Organisational Context........................................ 9
Figure 2: GRAPHC Web Mapping Platform .................................................................................. 11
Figure 3: GRAPHC Web Mapping Platform Users ......................................................................... 14
Figure 4: Short Term Web Mapping Platform ................................................................................ 16
Figure 5: Medium Term Platform .................................................................................................. 21
Figure 6: Conceptual Infrastructure Design ................................................................................... 22
Figure 7: Implementation Road Map.............................................................................................. 27
Figure 8: GRAPHC Team Structure .............................................................................................. 29

List of Tables
Table 1: Short Term Implementation - Functional Requirements Analysis......................................... 18
Table 2: Short Term Implementation Costs....................................................................................... Error! Bookmark not defined.
Table 3: Medium Term Implementation - Functional Requirements Notes...................................... 23
Table 4: Medium Term Implementation Costs................................................................................ Error! Bookmark not defined.
Table 5: Activities and Associated Objectives ................................................................................ 28
Table 6: GRAPHC Budgeting and Resourcing Plan........................................................................ Error! Bookmark not defined.
Table 7: GRAPHC Web Mapping Platform .................................................................................... 30
## Glossary

<table>
<thead>
<tr>
<th>Acronym/ Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flex</td>
<td>Proprietary API for providing rich interactive applications through a web browser. Flex requires an Adobe Flash plugin.</td>
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<tr>
<td>Android</td>
<td>A significant Mobile Operating System owned by Google</td>
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<tr>
<td>APHCRI</td>
<td>Australian Primary Health Care Research Institute.</td>
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<tr>
<td>ASGC</td>
<td>Australian Standard Geographical Classification.</td>
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<tr>
<td>BlueRaster</td>
<td>A private company in the US that provides specialist spatial software development expertise on a contract basis; provide custom code development to the Health Landscape Australia Applications.</td>
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<tr>
<td>CD</td>
<td>Census Collection Districts; a granular geographical unit; in 2006 Australia comprised of 38,704 CDs.</td>
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<tr>
<td>DoHA</td>
<td>Department of Health and Ageing; APHCRI sponsor, key project stakeholder and data custodian.</td>
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<tr>
<td>EFT</td>
<td>Equivalent full-time employee.</td>
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<td>EHR</td>
<td>Electronic Health Records.</td>
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<td>ESRI</td>
<td>Environmental Research Systems Institute; a leading GIS vendor based in the US; Developers of ArcGIS Server technology which underpins HealthLandscape.</td>
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<tr>
<td>Geocoding</td>
<td>A process where address information is converted into a set of x and y coordinates; an important requirement identified by a number of GRAPHC stakeholders.</td>
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<tr>
<td>GIS</td>
<td>Geographical Information System.</td>
</tr>
<tr>
<td>GRAPHC</td>
<td>National Centre for Geographic and Resource Analysis in Primary Health Care.</td>
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<tr>
<td>HTML5</td>
<td>Alternative to Flash (Flex) for rich interactive applications; however, does not require a browser plugin.</td>
</tr>
<tr>
<td>HWA</td>
<td>Health Workforce Australia; a major stakeholder and data custodian.</td>
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<tr>
<td>iOS</td>
<td>Apple’s mobile operating system; Underpins iPhones and iPADS.</td>
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<tr>
<td>JavaScript</td>
<td>Widely adopted programming language underpinning a broad range of web applications.</td>
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<td>KPIs</td>
<td>Key Performance Indicators.</td>
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<tr>
<td>LGA</td>
<td>Local Government Area; an ASGC geographical unit.</td>
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<tr>
<td>MOU</td>
<td>Memorandum of Understanding.</td>
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<td>MXD</td>
<td>Map file format used by ESRI mapping software; saved in a compound format that includes the map description, layout, and embedded objects saved in the map.</td>
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<td>NeCTAR</td>
<td>National eResearch Collaboration Tools and Resources; potential GRAPHC funding avenue.</td>
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<td>NHMRC</td>
<td>National Health and Medical Research Council; potential GRAPHC funding avenue.</td>
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<td>NHPA</td>
<td>National Health Performance Authority; a potential GRAPHC stakeholder.</td>
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<td>OGC</td>
<td>Open Geospatial Consortium; international consensus on standards interoperability.</td>
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<td>OpenLayers</td>
<td>An open source java script API for developing web mapping applications.</td>
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<td>OpenStreetMap</td>
<td>Open source base layer tile; alternative to proprietary services</td>
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<tr>
<td>PHCRED</td>
<td>Primary Health Care Research Evaluation and Development</td>
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<td>Python</td>
<td>An object oriented programming language natively integrated with ESRI software e.g. ArcGIS10.</td>
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<td>RGC</td>
<td>Robert Graham Centre.</td>
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<td>SDK</td>
<td>Software Development Kit.</td>
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<td>SLA</td>
<td>Statistical Local Areas; an ASGC geographical unit.</td>
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<td>WMS</td>
<td>Web Map Service.</td>
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Executive Summary

The Australian Primary Health Care Research Institute (APHCRI) provides national leadership in improving the quality and effectiveness of primary health care through the conduct of high quality priority-driven research and the support and promotion of best practice. The goals of APHCRI include strengthening the knowledge base of primary health care by conducting and supporting research and facilitating the uptake of research evidence in primary health care policy and practice.

APHCRI has a number of research foci including an interest in the use of geographic information systems (GIS) in primary health care research. As a result of several years’ development, APHCRI’s National Centre for Geographic & Resource Analysis in Primary Health Care (GRAPHC) was established in November 2011. GRAPHC has three key goals in 3 years, 2 being research endeavours involving geographic aspects and the third being the development of geographic capabilities to support and service primary health care research community. To this end it has been determined that Web-based Mapping is a critical success factor in the use of GIS in primary healthcare research and as such it is important that GRAPHC engages with the technology in the most effective and efficient manner available and possible.

Web-based Mapping is an ideal tool to assist GRAPHC in achieving its goals of conducting and supporting research and facilitating the uptake of this research by providing:

- Access to primary health care and other related demographic data at varying levels of detail;
- Tools to visualise, interrogate, extract and analyse data; and;
- Mechanisms to share both data and research outcomes.

The use of Web Based Mapping is also facilitated by increasing use of the World Wide Web within the primary health care community, increased broadband availability and speeds and an overall shift towards electronic health records (EHR) and systems.

Vision:

The GRAPHC Web Mapping Platform will provide a data rich, interactive, highly functional suite of applications that will meet a diverse set of stakeholder requirements. Access to these applications will be via the GRAPHC Web portal which will also provide access to information on training, support, capacity development and spatial methodologies.

Requirements:

There are a broad range of primary health care stakeholders that will utilise Web Mapping including the research and academic community, service planning and delivery organisations and groups involved in policy and advocacy. In preparing this Strategy, most of the stakeholders were interviewed and a comprehensive picture of the needs and expectations was established.

The identified requirements covered a broad range of capabilities, ranging from simple map display through to complex visualisation and analysis. In general, the requirements identified aligned with capability delivered via web mapping platforms.

Due to the wide and diverse requirements of these groups, no “one single” product will meet the long term objectives of GRAPHC. The approach that will provide the greatest potential for success is one that takes advantage of a range of component products that deliver the most cost effective outcomes over the short, medium and long term.

Solutions

A number of potential approaches for the establishment of the Web Mapping Platform were reviewed, these included utilising existing platforms, off the shelf visualisation products, ESRI based products and open source solutions. These potential solutions were analysed with regard to the identified requirements. The recommended way forward is based on a considered evaluation of these solutions, requirements, resources, costs and risks.

Ways & means

1. Short term (next 6 months),

The existing relationship between APHCRI and the Robert Graham Centre, offers considerable benefits in that HealthLandscape Australia is an established capability; it has a substantial history and pedigree and is likely to be cost effective as the short term solution while a more substantial, flexible, targeted capability is being developed.

GRAPHC should focus on building on the existing interest and momentum in Web Mapping for primary health care, by rapidly expanding the amount of data available via HealthLandscape Australia combined with ArcGIS Online (via the GRAPHC Web portal). Increasing the amount of data available will act as a “data magnet” encouraging other stakeholders to contribute further data. In the short term, the most cost effective mechanism to rapidly publish additional primary health care data sets is via an updated instance of the current HealthLandscape Australia combined with use of the ArcGIS Online platform. This includes the establishment of GRAPHC ArcGIS Server infrastructure to publish map services that can be consumed and distributed via ArcGIS Online.
This short term approach reduces the costly and time consuming task of “developing” applications whilst delivering tangible short term benefits to stakeholders in the context of access to primary health care data.

2. Medium term (6-18 months),

GRAPHC should expand the capabilities of the Web Mapping Platform based on ESRI’s ArcGIS Server product. ArcGIS Server provides the most functionally complete and extensible platform on which to build Web Mapping Applications. GRAPHC have access to ArcGIS Server as part of the ANU site licence thus removing the significant upfront investment in licences that this product requires. In addition, as ArcGIS Server underpins HealthLandscape, GRAPHC will be able to take advantage of the some of the architecture and design aspects of this platform (based on intellectual property agreements).

Over this medium term, a number of Web Mapping applications should be delivered to users based on the underlying ArcGIS Server platform. These applications should be designed in a way that provides functionality and data to user groups based on their requirements.

3. Long term (18 months and beyond),

GRAPHC should continue to expand the capability of the Web Mapping Platform by taking advantage of technology advancements, improved data availability and increased user expectations and requirements. The potential to implement Open Source and mixed solution (Open Source mixed with ArcGIS Server) should also be investigated based on a “best tool for the job” approach.
1. Introduction

1.1 Overview

The Australian Primary Health Care Research Institute (APHCRI) is an initiative of the Federal Government and was established in 2003 as part of the Primary Health Care Research Evaluation and Development (PHCRE) Strategy of the Australian Government’s Department of Health and Ageing (DoHA). APHCRI’s mission is to provide primary health care research leadership within Australia and to foster research collaboration and promote evidence-based policy and service delivery that improves health outcomes.

The importance of the geographic aspects of primary health care research, policy and practice are well understood and this is demonstrated by the use of Geographical Information Systems (GIS), Web Mapping Systems and spatial analytical techniques within the broader health care sector. Cognisant of this fact, APHCRI established the National Centre for Geographic and Resource Analysis in Primary Health Care (GRAPHC) with the following core objective:

To enhance the capacity of primary health care, through collaboration between community, service providers, academia, and policy makers, to meet the needs of the community dynamically and innovatively using Geographic Information System (GIS) tools, spatial epidemiology, and web-based mapping platforms.

Web-based Mapping is a critical success factor in the use of GIS in primary health care research and as such it is important that APHCRI engages with the technology in the most effective and efficient manner. To that end, APHCRI engaged Spatial Vision to develop a Strategic Plan for the deployment of a primary health care focused Web Mapping platform.

1.2 This Document

The objectives of this document are to:

- Describe the organisational context for the GRAPHC Web Mapping Platform
- Outline the vision, structure, users and key performance indicators of the GRAPHC Web Mapping Platform
- Provide a road map which outlines the short, medium and long term recommendations, including costs, benefits and risks
- Outline the implementation plan

The document is divided into the following sections:

- Section 2: Organisational Context
- Section 3: The GRAPHC Web Mapping Platform
- Section 4: The Road Map
- Section 5: Implementation Plan

1.3 Related Documents

The following reference documents have been used in the preparation of this report.

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<td>21 March 2012</td>
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<td>Requirements Statement (Spatial Vision)</td>
<td>2.0</td>
<td>24 February 2012</td>
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<td>1.0</td>
<td>January 2008</td>
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<td>Stakeholder Workshop Report (Dr Danielle Butler)</td>
<td>1.0</td>
<td>15 December 2010</td>
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<td>Consultation and Expert Panel Report Research (Dr Danielle Butler)</td>
<td>1.0</td>
<td>15 December 2010</td>
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2. Organisational Context

Australian Primary Health Care Research Institute (APHCRI) was established at The Australian National University (ANU) in 2003 as part of the Primary Health Care Research Evaluation and Development (PHCRED) Strategy of the Australian Government Department of Health and Ageing (DoHA). APHCRI sits within the PHCRED strategy sharing the common overall aim of embedding a research culture in Australian general practice specifically, and primary health care more generally. APHCRI ANU comprises the Director and other academic and administrative staff based at ANU. The University is responsible for its governance and the Director reports to the Vice-Chancellor APHCRI.

APHCRI has a number of research foci including an interest in the geographic aspects of primary health care. As a result of several years of work, APHCRI’s National Centre for Geographic & Resource Analysis in Primary Health Care (GRAPHC) was established in November 2011.

GRAPHC has a number of key research planks. One of these planks is focussed on Capability Development. The establishment of a primary health care focussed Web Based Mapping capability is a key performance measure for Capability Development research plank. Figure 1 outlines where Web Mapping fits in the context of GRAPHC and APHCRI.

**Figure 1: GRAPHC Web Mapping Platform - Organisational Context**

The governance and management of the Web Mapping Platform will be undertaken by GRAPHC and may involve the establishment of a focussed technical reference group to provide stakeholder input into ongoing data and technical issues.
3. The GRAPHC Platform

3.1 The Vision

The GRAPHC Web Mapping Platform will be a national resource, not bound by jurisdictional, administrative or geographic boundaries. It will deliver access to data and analytical tools for a broad range of primary health care users across research, service delivery and policy areas. The Platform will be a resource for all stakeholders to use and will be funded at a national level.

The Platform will take advantage of increased use of the Web within the primary health care sphere coupled with improvements in both fixed, wireless and mobile broadband speeds and access to provide increasing levels of functionality.

The Platform will make use of the latest Web Mapping technology and will provide a suite of highly functional, easy to use intuitive Web Applications. The Platform will meet the needs of stakeholders by providing:

- A single point of access for core primary health care related data including:
  - Socio economic data (including disadvantage and deprivation data)
  - Disease prevalence and treatment data (incidence, admissions etc)
  - Primary Health Care Usage Data
  - Primary Health Care Workforce data
  - Mortality and morbidity data
  - National Performance Indicators
  - Chronic Disease Indicators
- High quality thematic map display and visualisation tools
- Easy to use map navigation, search and query tools
- Access to analytical tools
- Self-serve tools for authorised users allowing them to extract data for subsequent use in desktop analytical systems
- Authorised users with the ability to upload research data, link to existing data and undertake geoprocessing activities.
- Authorised users with the ability to share (upload) research outcomes

Web Mapping applications developed with the Web Mapping Platform will be accessed via the GRAPHC Web Portal, which will also provide access to methodologies, technical documents and information about the broad range of capabilities and support provided by GRAPHC.

3.2 Platform Overview

Web-based mapping applications are being increasingly used as tools to support primary health care research, policy development and service delivery. There are numerous examples of web-mapping applications being used to communicate the geographic inequities of chronic disease prevalence, accessibility of health services, existence of workforce shortages and clinical placements for health professionals. As outlined in the Solution Assessment Report, these applications encompass a wide range of functionality and have been developed using a broad range of underlying technologies including commercial-off-the-shelf (COTS) products, vendor software solutions and Open Source solutions.

The Web Mapping Platform will support a range of identified requirements including:

- Data Security
- Data Analysis, Interpretation and Visualisation
- Map Navigation and Query
- Output (Reports and Maps)
- Input (Data Uploading etc)

A full list of requirements is outlined in the Business Requirements Statement report. A number of the requirements identified related to capabilities that are typically associated with desktop systems such as high quality map production, complex spatial analysis, temporal analysis and user controlled configuration. It is likely that GRAPHC will complement the capabilities delivered by the Web Mapping Platform with desktop tools and resources that GRAPHC could potentially make available to Health Researchers upon application.
Based on this analysis, ArcGIS Server was identified as the most appropriate underlying product for GRAPHC to deliver web Mapping Capability. This is based on:

- Functional and development limitations with “out of the box” products
- Mapping and symbology capability of ArcGIS Server and the ease of use of these capabilities, compared to Open Source approaches
- Relative ease in coding analytical processes compared with Open Source approaches
- Ability to take advantage of the significant amount of existing capability within ArcGIS Server, compared with Open Source approaches
- Access to ESRI software licences via the ANU ESRI site Licence
- Overall maturity of ArcGIS Server product

ArcGIS Server is the technology that underpins the HealthLandscape Platform developed by the Robert Graham Centre. This platform is currently used to host the HealthLandscape Australia application. GRAPHC has some exposure to ArcGIS Server though the establishment of HealthLandscape Australia and this will assist GRAPHC in establishing the Web Mapping Platform.

A more detailed discussion of the selection of ArcGIS Server is provided in Section 7 and 8 of the Solution Assessment Report.

### 3.3 System Description

The GRAPHC Web Mapping Platform will be based on ArcGIS Server and will be designed on a services based architecture. A services approach ensures GRAPHC is not constrained by any individual technology (e.g. Flex). As a result GRAPHC will be able to use the most appropriate development technology for a given application. GRAPHC will be positioned such that it can benefit from future technology developments as opposed to tying itself to a specific application programming approach.

As outlined in Figure 2, the GRAPHC Web Mapping Platform will be accessed via a series of Web Applications that provide focussed functionality coupled with appropriate data.

**Figure 2: GRAPHC Web Mapping Platform**

Using a services architecture approach, the GRAPHC Web Mapping Platform will separate “Web Applications” from server side logic. This will ensure that the technologies used to deliver Web Mapping Applications (e.g. Flex, HTML5 etc) can take advantage of underlying capabilities without the need for excessive code duplication or redevelopment. A services architecture will also allow the GRAPHC Web Mapping Platform to take advantage of non ESRI components such as reporting
via SQL Server Reporting Services and Web based graphing products, whilst ensuring that these components can utilise underlying spatial capabilities via ArcGIS Server services.

### 3.3.1 Data Tier

The data tier contains primary health care data stored in an RDBMS. The data tier will store textual descriptive data (tabular data), spatial data and document data (e.g. PDF documents etc). Data will be stored in an RDBMS which will provide backup, recovery, and data security. At a physical level, multiple servers may be used to store data depending on issues of data volume, system performance and data security. These servers may be hosted by GRAPHC or may reside in cloud or commercial hosting environments.

GRAPHC will need to develop a data model that caters for the various geographic levels used to represent health data. For example, Australian Bureau of Statistics (ABS) boundaries are often used to aggregate health data. The GRAPHC data model will need to support the various levels of ABS geography (and other geographies such as LGAs and Postcodes), and provide linkage mechanisms to tabular data contained health information.

Data security and confidentiality will be key features of the GRAPHC Web Mapping Platform. A data model will need to be established to ensure that data with varying levels of confidentiality can be appropriately managed. In addition to the technical implementation of this data model, GRAPHC will need to ensure appropriate documentation is available to communicate data security and confidentially provisions to stakeholders.

The GRAPHC Web Mapping Platform will be data rich and will contain hundreds (and possibly thousands) of layers of health related information. In order for this data to be fit for purpose, a rigorous set of metadata will be required. Typically, this metadata would be stored in tables within the database, and updated via both administration process and data loading interfaces. For example, the Platform would be designed in a way that ensures that data contributors would enter metadata for uploaded data (e.g. currency, source, usage restrictions, owner etc.).

### 3.3.2 Application Server Tier (ArcGIS Server)

The Application Server Tier sits at the “heart” of the GRAPHC Web Mapping Platform. As shown in Figure 2, ArcGIS Server is the main component of this tier and provides the following core components:

- **Web Mapping Services** – provides the core capability to publish spatial data in map form. In many cases, the Web Map Server product contains both the Spatial Server and Web Mapping API components (e.g. ArcGIS Server).
- **Geocoding Services** – services for geocoding
- **Geoprocessing Services** – analytical services. This includes out of the box analysis tools provided by ArcGIS Server (e.g. clip, buffer, overlay etc), as well as custom analysis tools built with python scripting.
- **Print Services** – map template based printed map services.

ArcGIS Desktop (ArcMap) is used within this tier to author map services (ArcMap MXD documents). The desktop product is used to add and configure layers to the map service and also provide all of the tools required to style the various map layers.

### 3.3.3 Services Tier

The services tier of the GRAPHC Web Mapping Platform will provide a series of services that can be consumed by the various Web Mapping Applications and direct to client systems where appropriate. Some of these services will be based around the underlying ArcGIS capabilities such as a “mapping service”, or built using ArcGIS Server such as a “medical service area definition” service (e.g. a geoprocessing tool).

Other services will be non-spatial in nature and will typically include security services which can be shared between the various Web Mapping Applications. In addition, some services may make use of some of the underlying ArcGIS Server capabilities, but may be built with non ESRI software components. An example of this could be a reporting service which integrates with ArcGIS Server.

The GRAPHC Web Mapping Platform will also be capable of using base map services (such as Google Maps, Bing Maps and Open Street Maps) which provide a “geographic backdrop” on which primary health care data can be overlaid. Utilising external basemap web map services can be a cost effective and simple way of accessing high quality basemap information compared to the effort and cost in sourcing basemap data directly from data suppliers (e.g. Geoscience Australia).

### 3.3.4 Applications Tier

The GRAPHC Web Mapping Platform will provide the capability to develop and deploy Web Mapping Applications using a number of different application development frameworks such as
Adobe Flex, JavaScript and HTML5 as well as targeted SDKs for Smartphones and Tablets (iOS, Android and Windows).

GRAPHC will need to assess the benefits and limitations offered by the various application development frameworks as part of the medium term implementation. Each of the development frameworks (Silverlight, Adobe Flex, JavaScript, HTML5 etc) have their own benefits and limitations. ESRI offer different levels of support for each framework in terms of out of the box viewers, code samples and documentation. Each framework also differs in development effort.

An important consideration for GRAPHC will be; cross browser support and cross platform operating system support. In particular, the widespread use of Apple computing within the broad health community may influence the selection of an API which can be deployed to these environments.

GRAPHC will also be able to take advantage of enhancements to existing application development frameworks and new application development frameworks as these are added to the underlying ArcGIS Server product.

### 3.3.5 Portal Tier

Applications delivered by the GRAPHC Web Mapping Platform will be accessed by end users via the GRAPHC Portal. This Portal will be a central hub that will bring together the web mapping applications, best practice guides, contact information etc. At a technical level, the Portal Tier is represented by the current GRAPHC home page.

### 3.3.6 User Tier

The GRAPHC Web Mapping Platform will provide a suite of Web Mapping Applications targeted at different user groups. The consultation phase of this project identified four main user groups:

1. **Research and Academia**
   
   This group is focussed on primary health care research and includes doctoral students; post doctorate researchers, lecturers and other academics. The GRAPHC Web Mapping Platform will provide access to data, access to analytical tools as well as a mechanism by which research outcomes can be visualised and shared.

2. **Service Planning and Delivery**
   
   This group is focussed on planning and delivery of primary health care services and includes State and Federal Government Agencies, Medicare Locals, Local Hospital Networks, Aboriginal Health Services, General Practitioners and Practice Managers. These users are particularly interested in using the GRAPHC Web Mapping Platform to combine service delivery data (e.g. numbers of GPs etc) with socio economic data, disease prevalence and medical outcome data and visualising patterns and service delivery gaps.

3. **Policy and Advocacy**
   
   This group is focused on primary health care policy analysis and policy development and includes Not-For-Profit organisations, Health Promotion organisations, Professional Bodies and State and Federal Government Agencies.

4. **General Public**
   
   Members of the community who have an interest in primary health care. These users will range from those who want a simple “view of primary health care” at a National, State or local level, to those who have interests that align with the other user groups.

As shown in Figure 3, the functionality provided by the GRAPHC Web Mapping Platform will overlap between the different users groups. For example, a “service area definition tool” that defines services areas for primary health care providers based on a number of input parameters could be of interest to Policy, Service Planning and Research users. The requirement to meet diverse and overlapping user needs is an important driver behind the need for the GRAPHC Web Mapping Platform to be designed around services architecture, rather than building all the functionality for specific user groups at the Web Mapping Application Level.

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3.4 Benefits

There are a number of benefits that GRAPHC and its stakeholders will derive from the implementation of a Web Mapping Platform.

1. **Strengthen the knowledge base of primary health care**
   
   The Web Mapping Platform will support efforts to “strengthen the knowledge base of primary health care” by:
   
   - providing a piece of critical Australian PHC research infrastructure;
   - acting as a ‘data magnet’ drawing together disparate health-relevant data; and,
   - encouraging agencies to contribute their data making it available for other purposes.

2. **Facilitate the uptake of research evidence in primary health care policy and practice**
   
   The Web Mapping Platform will “facilitate the uptake of research evidence in primary health care policy and practice” by:
   
   - facilitating interagency awareness and sharing of data and making health data and research outcomes available to a distributed research community;
   - improving the availability and understanding of health information for a range of user groups and purposes;
   - providing a means for health data and research findings to be communicated in an interactive and visual format; and,
   - supporting the current Australian Health Reform initiative by aligning GRAPHC’s system with the requirements of stakeholders e.g. Medicare Locals and the National Health Performance Authority (NHPA).

3. **Enhance research capacity in primary**
   
   The Web Mapping Platform will “enhance research capacity in primary health care through strategic partnerships with other relevant national and international groups”. This will include
   
   - cementing informal relationships with extant stakeholders across Australia as they become system users;
   - formalising the web-mapping relationship with the Robert Graham Centre in the US;
   - positioning GRAPHC amongst global leaders in PHC web-mapping and enabling it to better collaborate with international research partners within this sphere; and,
   - advancing the use of spatial information and research capacities of those spanning research and academia, service delivery and policy and not for profit organisations across Australia.
3.5 Risks

Establishing the GRAPHC Web Mapping Platform does present a number of risks; these need to be reviewed, managed and mitigated.

An obvious and significant risk to the establishment of the Web Mapping Platform is the availability of funding. A significant investment will be required by GRAPHC to establish the platform over a period of several years. In addition, ongoing funding will be required to maintain and extend the Platform once it is established.

Another risk in establishing the Web Mapping Platform is the inherent risk associated with Information Technology projects. Part of this risk relates to the amount of "client" input (time) required which is often underestimated in project planning. Another element is the need for detailed requirements to be defined and agreed to in order to manage scope.

User expectations are also a risk in any IT project. In the case of the Web Mapping Platform, there will be some users who have unrealistic expectations around the functionality that will be delivered. These expectations will need to be managed by GRAPHC through clear and concise descriptions of "what will be delivered" by the Web Mapping Platform and articulation of the "non system" support offered by GRAPHC in terms of technical advice, desktop analytical capability and training.

Another risk to the overall success of the Web Mapping Platform is access to data. The sensitivity surrounding health data was the most recurrent theme throughout the consultation process. GRAPHC will need to have clear and transparent guidelines around the use of data in order to provide data custodians and contributors with the level of "comfort" required for them to provide data. Related to this will be the technical issues of log in, authentication and user registration protocols.

A risk to the long term success of the Web Mapping Platform is the amount of “succession planning” that is put in place. IT projects can initially be successful, but “fall away” when key staff leave. In the context of the Web Mapping Platform, this relates to establishing an internal human resource structure that minimises the impact of key staff departures.

3.6 Key Performance Indicators

In order to understand the success of the GRAPHC Web Mapping Platform, Key Performance Indicators (KPIs) will need to be defined and measured. These KPIs should be clear, concise and measurable. Importantly, KPIs will need to cover a number of aspects of the Platform including:

Data – KPIs will need to be established to measure how well the Platform is contributing to providing access to data. Examples of these include:

- Total data sets available;
- Number of contributing organisations;
- Data sets by thematic category;
- User survey results (based on user assessments of the value of the data available);

System – KPIs will need to be established that cover the performance of the Platform. These may include traditional measures such as system availability or system response times but could be extended to include other aspects (number of maps printed number of data downloads etc)

User Uptake - KPIs could be established to measure how well Applications delivered by the Platform are being adopted by various organisations or user groups. This could be based on metrics provided by the system (e.g. user statistics), or could be derived from a user survey.

Research - KPIs could also be established to measure how well the Platform is contributing towards the key research goals of GRAPHC (e.g. via survey of users etc)
4. Road Map

4.1 Short Term (Next 6 Months)

4.1.1 HealthLandscape Australia

Over the last 2 years APHCRI has generated a significant level of interest in the potential use of Web Mapping as a tool to support primary health care research, service delivery and policy development. In addition, the consultation process undertaken as part of the project has further encouraged stakeholders to "think" about how they might use Web Mapping tools to assist them in their activities. Given this progress, it is imperative that GRAPHC maintain and build on its momentum in the short term (next 6 months).

In the short term GRAPHC should focus on establishing a more substantial data rich on-line presence based on the HealthLandscape platform, complemented by the use of ArcGIS Online combined with the establishment and use of GRAPHC ArcGIS Server Infrastructure.

This short term approach will provide GRAPHC with an opportunity to establish the required ArcGIS Server infrastructure, whilst in parallel; continue to increase the availability, awareness and use of primary health care data. GRAPHC’s recommended Short Term Platform is illustrated below in Figure 4.

Figure 4: Short Term Web Mapping Platform

The existing HealthLandscape Australia application provides an ideal platform to rapidly “publish” health related data sourced via GRAPHC. Based on the analysis outlined in the Solution Assessment report, HealthLandscape provides the most cost effective, functionally complete and accessible platform that will enable progress to be made in the short term towards the objectives defined by GRAPHC.

As part of this activity, GRAPHC should seek to formalise the use of HealthLandscape via a Memorandum of Understanding (MOU) or other mechanism to ensure that agreed levels of service are in place. In particular this MOU should stipulate service agreements in relation to system performance, system availability and response times and in relation to the loading of new data.

The MOU should also stipulate levels of documentation and administrative training to ensure that HealthLandscape Australia can be administered efficiently and effectively. GRAPHC now have

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remote access to appropriate parts of the HealthLandscape platform that will enable them to
manage aspects of HealthLandscape Australia.

In the short term, it is advisable that GRAPHC utilise the HealthLandscape platform located in the
USA and focus attention (and resources) on obtaining and publishing data, together with ongoing
communication and promotion activities. This is due to the amount of effort, time and specialist
skills required to establish a “mirror” of the HealthLandscape platform on new GRAPHC ArcGIS
Server infrastructure, and the lack of tangible short term benefits that would be realised through “re-
locating” the HealthLandscape application. In addition, significant GRAPHC resources will be
required to focus on planning for the medium term implementation.

The issues that need to be addressed in the short term to ensure that HealthLandscape Australia
delivers the maximum value include:

1. Administration training
   a. GRAPHC to develop a user guide that describes the functionality and
      configuration of HealthLandscape Australia.
   b. GRAPHC to map the relationships between the Geodatabases and the
      application architecture.
   c. Develop a data dictionary and a configuration tag dictionary.

2. Data Management
   a. Develop data management processes and protocols to ensure the ongoing
      management and administration of myriad datasets (from different years) is
      appropriately stored, catalogued, backed-up and metadata is appropriate.

3. Interface Configuration
   a. Appropriate APHCRI branding of the HealthLandscape Australia application
      including banner image, “contact us”, disclaimer, copyright and data source
      information.

4. Additional Data Sets
   a. Obtain additional health related data sets that are in the public domain and
      publish these via HealthLandscape Australia. Where appropriate, data should be
      published at the smallest geographical unit available provided privacy
      requirements are met. For example, if data is available at Census Collection
      Districts (CD) and Statistical Local Areas (SLA) level, both should be published in
      the short term.
   b. Obtain and load additional base geographic data such as postcodes, General
      Practice Divisions, Local Government Areas (LGA) etc.

5. Search
   a. Update current “Welcome Zoom” dialog (currently not working). Should include
      Postcode, or State search.
   b. Potentially configure current spatial bookmarks from HealthLandscape (Alaska
      etc ) to reference Australian States (may require code change by BlueRaster)

6. Stability and Performance
   a. Ensure that known bugs are resolved (e.g. quick maps not working)
   b. Monitor map display performance and ensure that any performance issues are
      identified, communicated and resolved by the RGC.

7. Output
   a. Implement template map printing based on current Med School Mapper
      functionality (provided that this capability can be implemented with the
      HealthLandscape Australia application.

4.1.2 ArcGIS Online

As outlined in Section 6 of the Solution Assessment report, ArcGIS Online provides a simple
mechanism for rapidly publishing spatial data. In particular, ArcGIS Online provides access to a
simple online viewing application (without the need for any coding) as well as a more substantial
free desktop viewing application (ArcGIS Explorer). In addition, “simple” Web Apps can be
developed rapidly without the need for advanced programming skills.

Links to specific ArcGIS Online Maps (or groups) could be provided from the GRAPHC portal thus
“branding” these maps as part of the overall GRAPHC Web Mapping Platform.
ArcGIS Online could be used by GRAPHC to complement the data and capability that is delivered via HealthLandscape Australia. The potential use of ArcGIS Online may involve:

- Establishing a “Group” to provide simple access to a range of project specific data sets. The use of groups (either public or private) could also be used as a communication mechanism and promotion exercise.
- Provide browser independent access to data (HealthLandscape Australia will not be accessible from iPADS etc)
- Provide an effective way to group together “related data sets” as a project specific application (e.g. an Asthma Map, Diabetes Map, Health Workforce Map etc)

An additional potential use of ArcGIS Online involves the emerging ArcGIS Online for Organisations offering (scheduled for release in Q2 2012).

ArcGIS Online has limitations with regard to the data that can be uploaded (both in terms of numbers of features and file size), although these will change in Q2 2012 with the release of ArcGIS Online for organisations.

An alternative approach (as shown in Figure 4) is to publish ArcGIS Server map services from the GRAPHC ArcGIS Server and have these map services added to a GRAPHC ArcGIS Online web site. In order to do this, GRAPHC will need to establish an ArcGIS Server instance. Initially, this instance could be installed on server infrastructure provided by ANU (provided such hardware is readily available). Once the ArcGIS Server instance is available, GRAPHC can then commence publishing map services.

Establishing a GRAPHC instance of ArcGIS Server will also provide the opportunity for skills development in the context of both ArcGIS Server administration and map service publishing. Map services published via the GRAPHC ArcGIS Server will be authored in ArcMap and could be similar to the look and feel of the same data that is presented via HealthLandscape Australia.

### 4.1.3 Short Term - Requirements Analysis

The recommendations outlined in this section will deliver a cost effective, data rich suite of Web Mapping Applications, based on what can be realistically achieved in the short term (next 6 months).

In order to understand the level of capability provided by the recommended approach, functional requirements have been analysed in relation to this option and listed in Table 1.

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Category</th>
<th>Priority</th>
<th>Health Landscape</th>
<th>ArcGIS Online</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Login</td>
<td>Access &amp; Security</td>
<td>Critical</td>
<td>No</td>
<td>Yes (Q2 2012)</td>
<td>Only critical for data that is not public domain</td>
</tr>
<tr>
<td>System Administration</td>
<td>Access &amp; Security</td>
<td>Critical</td>
<td>Could be done by RGC, or shared with APHCRI</td>
<td>Limited skills required</td>
<td></td>
</tr>
<tr>
<td>Metadata</td>
<td>Data Interpretation</td>
<td>Critical</td>
<td>No</td>
<td>Limited</td>
<td>Short term requirement could be met via static HTML links from APHCRI portal.</td>
</tr>
<tr>
<td>Tabular Data Display</td>
<td>Data Interpretation</td>
<td>Critical</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Standard Map Navigation Tools</td>
<td>Navigation</td>
<td>Critical</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Map and Report Output</td>
<td>Output</td>
<td>Critical</td>
<td>Would need to be extended</td>
<td>Yes (Map Only)</td>
<td></td>
</tr>
<tr>
<td>Data Filtering</td>
<td>Querying</td>
<td>Critical</td>
<td>No</td>
<td>No</td>
<td>Could be partially achieved via publishing subsets of data</td>
</tr>
<tr>
<td>Intuitive User Interface(s)</td>
<td>Usability</td>
<td>Critical</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Standard Map Selection and Identification Tools</td>
<td>Usability</td>
<td>Critical</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Thematic Map</td>
<td>Visualisation</td>
<td>Critical</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Requirement</td>
<td>Category</td>
<td>Priority</td>
<td>Health Landscape</td>
<td>ArcGIS Online</td>
<td>Notes</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>------------------------</td>
<td>----------</td>
<td>------------------</td>
<td>---------------</td>
<td>------------------------------------------------------------</td>
</tr>
<tr>
<td>Data Security and Privacy</td>
<td>Access &amp; Security</td>
<td>Critical</td>
<td>No</td>
<td>Yes (Q2 2012)</td>
<td></td>
</tr>
<tr>
<td>Spatial Analysis</td>
<td>Analysis</td>
<td>Important</td>
<td>No</td>
<td>No</td>
<td>Short term solution may involve prepared data sets</td>
</tr>
<tr>
<td>Map Overlay</td>
<td>Analysis</td>
<td>Important</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Availability of Standard Base Maps</td>
<td>Data Interpretation</td>
<td>Important</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Upload Data</td>
<td>Data Management</td>
<td>Important</td>
<td>No</td>
<td>Limited</td>
<td></td>
</tr>
<tr>
<td>Data Extraction</td>
<td>Data Management</td>
<td>Important</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Search</td>
<td>Querying</td>
<td>Important</td>
<td>Would need to be extended</td>
<td>Limited</td>
<td></td>
</tr>
<tr>
<td>Themed / Grouped Layers User Control over “Table of Contents”</td>
<td>Usability</td>
<td>Important</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Graph/ Chart-based Data Display</td>
<td>Visualisation</td>
<td>Important</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Spatial Bookmarking</td>
<td>Navigation</td>
<td>Nice to Have</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Geocoding</td>
<td>Output</td>
<td>Nice to Have</td>
<td>No</td>
<td>No (basic address search)</td>
<td></td>
</tr>
<tr>
<td>User Controlled Map Elements</td>
<td>Output</td>
<td>Nice to Have</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Save Workspace/ Project</td>
<td>Output</td>
<td>Nice to Have</td>
<td>No</td>
<td>Yes (limited)</td>
<td></td>
</tr>
<tr>
<td>User Controlled Thematic Mapping</td>
<td>Visualisation</td>
<td>Nice to Have</td>
<td>No</td>
<td>Yes (limited)</td>
<td></td>
</tr>
<tr>
<td>Time Slider (Animation) Capability</td>
<td>Visualisation</td>
<td>Nice to Have</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

### 4.1.4 Short Term - Benefits

The benefits of using the existing HealthLandscape Australia application as the short term solution for the GRAPHC Web Mapping platform are:

- Based on currently available system capabilities that do not require any substantial time or investment to extend or develop;
- Cost effective mechanism to publish primary health care data allowing stakeholders to rapidly share data;
- Builds on the existing relationship with the Robert Graham Centre; and,
- Based on ArcGIS Server which is the most logical solution for the medium term.

The benefits of using ArcGIS Online to complement HealthLandscape Australia as part of a short term solution are:

- Provides flexibility in terms of how health related data is provided to users. For example, GRAPHC can rapidly publish related data sets (e.g. as an Asthma Map) via ArcGIS Online, compared with potential user interface configuration changes within HealthLandscape Australia;
- Provides a no-cost mechanism to publish data available from GRAPHC via a simple to use interface;
- Provides browser independent access to GRAPHC data; and,
- Provides a no-cost mechanism to trial different presentation techniques and approaches for health related data.
### 4.1.5 Short Term - Risks

There are a number of risks associated with using the existing HealthLandscape Australia application as the short term solution for the APHCRI Web Mapping platform including:

- Delay in formalising the relationship between APHCRI and the RGC to ensure service level agreements etc are documented and agreed;
- Ability of RGC to meet APHCRI requirements in the desired timeframes; and,
- Potential issues with the provision of stakeholder data to third parties.
- Gap between GRAPHC investment expectations vs. cost of enhancements

Due to the nature of ArcGIS Online, there are few risks associated with the use of this option as part of the short term Web Mapping Platform implementation. This is due to the fact that:

- There is no upfront investment;
- There are no specific specialist skills required; and,
- There are no technology risks.

A risk that would need to be managed is the “perception” that is created by the use of ArcGIS Online in the context of it being a “simple” display capability. GRAPHC would need to ensure that stakeholders understand that this is part of a broader platform that will deliver the overall functionality identified.

### 4.2 Medium Term (6-18 months)

In the medium term, GRAPHC should focus on the transition from the interim platform (described in section 4.1) to the target Web Mapping Platform. This will include:

- Potential establishment of a ‘mirror’ instance of HealthLandscape Australia onto GRAPHC infrastructure; and,
- Web Mapping Application Development.

If GRAPHC establish an instance of HealthLandscape Australia locally, GRAPHC will need to decide if application and server enhancements are going to be carried out locally and independent to the core platform, or carried out within the core HealthLandscape platform in the USA.

In general, it would be beneficial from a technical viewpoint for enhancements to be added to the core platform in the USA, however, GRAPHC and the RGC would need to agree on development paths, costs etc. Key issues include:

- Appropriateness of the current Flex based environment as the application development framework;
- Status of current HealthLandscape viewer development; and,
- Cost of extending HealthLandscape by third parties compared to “starting again”.

An alternative is to build a new suite of web mapping applications based on the ArcGIS Server platform. These applications would provide GRAPHC with the flexibility to design user interfaces and functionality based on the identified requirements; however, this development would come with its costs and risks.

The medium term implementation of the GRAPHC Web Mapping Platform involves developing a suite of Web Mapping Applications that meet the diverse stakeholder requirements. Given the nature of the identified requirements, this process may involve a substantial system development process that will be undertaken over a 3 to 9 month period.

At this point in the implementation process, GRAPHC should review the costs and benefits of customising a third party viewer product (e.g. Geocortex, Dekho, Weave etc) vs. building Web Applications based on extending ArcGIS Server template viewers, or building Web Applications from the “ground up”. This decision relies on a more detailed analysis of user requirements and the development of a set of detailed functional requirements that can be used to compare approaches.
Figure 5: Medium Term Platform

Generally, Web Mapping Application development projects are delivered via an iterative approach that delivers logical groupings of functionality as “separate” project deliverables. This approach ensures that users have early access to the most critical functionality, and minimises the development risks by dividing the project into smaller more manageable units.

Based on an analysis of the requirements, it is logical to divide the medium term implementation into 3 software development iterations:

- **Iteration 1:** General Web Mapping Application (similar to the current functionality of HealthLandscape Australia, but with map template output);
- **Iteration 2:** Authentication and Data Upload; and,
- **Iteration 3:** Analytical Tools and Geocoding.

GRAPHC need to give due consideration to the software development approach in the context of either recruiting these skills in-house, or contracting out this development to third parties. Given the specialist nature of software development, it is often difficult to recruit staff with the full range of skills required. In addition, the “short term nature” of the engagement also presents a recruitment challenge. Contracting out development also has its challenges in the context of project management and the ability to maintain the solution in the long term without costly support contracts.

An ideal situation is one where GRAPHC have access to ArcGIS Server administration and support skills, combined with a reasonable level of software development within the organisation, combined with contracting out the software development tasks in a staged and well managed approach.

### 4.2.1 Web Mapping Platform Infrastructure Options

As part of the medium term implementation, APHCRI will require infrastructure on which to host the Web Mapping Platform. As shown in Figure 6, at a conceptual level, this includes an application server, a spatial server and a database server. At a physical level, all 3 “server roles” can be fulfilled by a single physical sever; however, it is common practice to separate the database server from the application and spatial servers due to performance issues.
There are 3 fundamental approaches that GRAPHC can take with regard to the provision of the infrastructure required for the Web Mapping Platform:

**Own and Host** – GRAPHC could procure the hardware required to build and host the Web Mapping Platform. This could either be new server infrastructure (purchased) or existing server infrastructure sourced from ANU. The own and host option assumes that the physical servers will be “hosted” by an existing ANU IT group. Core server administration (back-up, recovery, fail over etc) will be undertaken by ANU with GRAPHC administering the ArcGIS Server application.

**Standard Commercial Hosting** – GRAPHC could establish the Web Mapping Platform based on commercial hosting arrangements. This would involve utilising a commercial hosting company to provide the physical hosting and server administration (back-up, recovery, fail over etc). GRAPHC would be responsible for ArcGIS Server administration. Before committing to this option, GRAPHC would need to confirm if the current ANU ESRI site licence permits the use of an ArcGIS Server licence on infrastructure outside of the ANU organisation.

**Cloud Hosting** – GRAPHC could base the Web Mapping Platform on infrastructure hosted in the “cloud”. As outlined in the Solution Assessment Report, ESRI and Amazon have a service offering that provides an ArcGIS Server licence hosted on infrastructure provided by Amazon. Similar to the commercial hosting option, GRAPHC would administer ArcGIS Server (remotely via web services) while the core server administration is undertaken by Amazon. Before committing to this option, GRAPHC would need to confirm if the current ANU ESRI site licence would be valid to use with the Amazon Elastic Compute Cloud (EC2) solution.

As part of the planning required for the Web Mapping Platform, GRAPHC should obtain cost estimates for these 3 options and base a decision around the cost, benefit and risk profile.

4.2.2 *Medium Term - Requirements Analysis*

The recommendations outlined in this section will deliver highly functional suite of Web Mapping Applications, dependent on the level of investment committed by GRAPHC. Table 3 lists the identified functional requirements and describes in broad terms, the nature of the development required to deliver this capability.
Table 2: Medium Term Implementation - Functional Requirements Notes

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Category</th>
<th>Priority</th>
<th>Development Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Login</td>
<td>Access &amp; Security</td>
<td>Critical</td>
<td>Security and user logins not inherently dependent on use of ArcGIS Server. Most likely solution implemented via standard web server security with roles, permissions etc managed at either the Web Server or database level. Potential to use ANU infrastructure to deliver this capability.</td>
</tr>
<tr>
<td>System Administration</td>
<td>Access &amp; Security</td>
<td>Critical</td>
<td>The majority of the administration tasks undertaken via remote access to ArcGIS Server Manager. Design of any software development should include the ability (where possible), to provide admin access via configuration files and/or tools.</td>
</tr>
<tr>
<td>Metadata</td>
<td>Data Interpretation</td>
<td>Critical</td>
<td>Most likely implemented via ArcGIS Server development linked with layer level metadata stored within the data repository. Custom code used to build user interface to manage metadata at the point of data loading. Level of sophistication dependent on the business process around user uploaded data.</td>
</tr>
<tr>
<td>Tabular Data Display</td>
<td>Data Interpretation</td>
<td>Critical</td>
<td>Implemented via custom code development.</td>
</tr>
<tr>
<td>Map and Report Output</td>
<td>Output</td>
<td>Critical</td>
<td>Built with ArcGIS Server.</td>
</tr>
<tr>
<td>Data Filtering</td>
<td>Querying</td>
<td>Critical</td>
<td>Built with ArcGIS Server. Cost dependent on complexity of filtering required.</td>
</tr>
<tr>
<td>Intuitive User Interface(s)</td>
<td>Usability</td>
<td>Critical</td>
<td>Delivered via screen layout and design, not dependent on the selection of a particular product.</td>
</tr>
<tr>
<td>Standard Map Selection and Identification Tools</td>
<td>Usability</td>
<td>Critical</td>
<td>Adapted from standard ArcGIS Server Templates.</td>
</tr>
<tr>
<td>Thematic Map Display</td>
<td>Visualisation</td>
<td>Critical</td>
<td>Inherent in ArcGIS Server.</td>
</tr>
<tr>
<td>Data Security and Privacy</td>
<td>Access &amp; Security</td>
<td>Critical</td>
<td>Security and user logins not inherently dependent on use of ArcGIS Server. Most likely solution implemented via standard web server security with roles, permissions etc managed at either the Web Server or database level. Potential to use ANU infrastructure to deliver this capability.</td>
</tr>
<tr>
<td>Spatial Analysis</td>
<td>Analysis</td>
<td>Important</td>
<td>Built with ArcGIS Server.</td>
</tr>
<tr>
<td>Map Overlay</td>
<td>Analysis</td>
<td>Important</td>
<td>Built with ArcGIS Server.</td>
</tr>
<tr>
<td>Availability of Standard Base Maps</td>
<td>Data Interpretation</td>
<td>Important</td>
<td>Inherent in ArcGIS Server.</td>
</tr>
<tr>
<td>Upload Data</td>
<td>Data Management</td>
<td>Important</td>
<td>Custom code development.</td>
</tr>
<tr>
<td>Data Extraction</td>
<td>Data Management</td>
<td>Important</td>
<td>Custom code development.</td>
</tr>
<tr>
<td>Search</td>
<td>Querying</td>
<td>Important</td>
<td>Adapted from standard ArcGIS Server Templates.</td>
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<tr>
<td>Themed / Grouped Layers User Control over “Table of Contents”</td>
<td>Usability</td>
<td>Important</td>
<td>Adapted from standard ArcGIS Server Templates.</td>
</tr>
<tr>
<td>Graph/ Chart-based Data Display</td>
<td>Visualisation</td>
<td>Important</td>
<td>Custom code development. Possible use of third party software components.</td>
</tr>
<tr>
<td>Spatial Bookmarking</td>
<td>Navigation</td>
<td>Nice to Have</td>
<td>Adapted from standard ArcGIS Server Templates.</td>
</tr>
<tr>
<td>Geocoding</td>
<td>Output</td>
<td>Nice to Have</td>
<td>Custom code development. Possible use of third party providers</td>
</tr>
<tr>
<td>User Controlled Map Elements</td>
<td>Output</td>
<td>Nice to Have</td>
<td>Adapted from standard ArcGIS Server Templates.</td>
</tr>
</tbody>
</table>
### 4.2.3 Medium Term - Benefits

The benefits of using the ArcGIS Server as the medium term solution for the GRAPHC Web Mapping platform are:

- Flexible Web Application development options including JavaScript, Silverlight, Flex, HTML5, in addition to support for direct access to user services via OGC and rest;
- Cost effective ability to implement analytical functions;
- Potential to build on HealthLandscape Australia developments;
- Access to both human resources (people with ArcGIS Skills) and developer community (development services from third party companies); and,
- Access to mature user community, forums, code examples etc.
- Relative ease in coding analytical processes

### 4.2.4 Medium Term - Risks

There are a number of risks associated with the use of ArcGIS Server as the medium term Web Mapping solution.

Application development is an inherently costly and time consuming exercise and there is a risk that the funding required to meet the identified functional requirements cannot be obtained. Although GRAPHC could prioritise functionality and implement capability in a staged approach (based on funding availability), the availability of funding in the medium term remains a risk to the successful implementation of the platform.

Another risk related to application development is the amount of GRAPHC staff resources and skills sets required to manage this development. There is a risk that the success of the Web Application development is impacted on the lack of resource availability to manage the project and provide timely technical input.

The administration of the various components of ArcGIS Server requires specialist skills. Lack of access to these skills may impact the stability, performance and overall capability of the Web Mapping Platform. This risk could be mitigated by ensuring that GRAPHC have access to these skills either via training of current staff or ensuring that these skills form part of any strategic appointment to support the Web Mapping Platform.

There is also a risk that future Web Applications built on ArcGIS Server is deemed to be outside of the terms and conditions of the ANU site licence. This may lead to GRAPHC needing to purchase additional ArcGIS Server licences to cover the use that is deemed to be outside of the site licence. In order to mitigate this risk, a thorough understanding of the licence usage limitations is required.

### 4.3 Long Term (18 months and Beyond)

By the end of 2013, GRAPHC will have a highly functional, data rich suite of Web Mapping Applications that will be used by a wide number of stakeholders. These applications will include both publicly available and secure applications.

Following the successful implementation of the medium term solution, GRAPHC will move into a longer term maintenance and enhancement phase. This will include ongoing maintenance to the underlying platform in the context of software updates, data loading and minor functionality changes. In addition, as both technology changes and user expectations mature, GRAPHC will continue to enhance the overall capability of the platform via the release of new Applications.

The technology associated with Web Mapping will continue to evolve and GRAPHC will need to maintain a level of understanding of the opportunities and risks presented by these developments.

Application development environments (Flex, Silverlight, HTML5 etc) will continue to develop, and as part of the long term plan for the Web Mapping Platform, GRAPHC will need to regularly review the impact of this and make decisions around continued development in a particular technology vs.
"re development" in a new technology. For example, a hypothetical situation is one where GRAPHC need to decide on continued development in a Flex environment, vs. building a new Web Application based on HTML5.

Another technology impact in the long term is the ongoing maturity of Open Source (or similar) products. GRAPHC should be open to the potential for either Open Source or mixed solutions forming part of the overall platform. For example, a mixed solution may involve the use of a Google Maps interface, Google compatible OpenSource based services together with Map Services served from the GRAPHC Web Mapping Platform.

Cloud based services will also continue to grow and mature, and GRAPHC should take advantage of these where appropriate. In particular, there may be potential to expand Geocoding capability via the use of third party cloud services.
5. Implementation Plan

5.1 Overview

The GRAPHC Implementation Plan is comprised of a series of activities which can be broadly grouped into five categories which underpin the establishment of the Web Mapping Platform; these are:

1. Strategy, Planning and Governance: These are the activities that contribute to defining GRAPHC’s vision, making strategic decisions around technology, capabilities, resourcing and delivering the project;

2. Communication and Promotion: These are the important activities that maintain the momentum GRAPHC has created. This is an important pillar particularly as a facilitator of objectives with respect to Data Agreements and Collation.

3. Data Agreements & Collation: The activities associated with putting in place data agreements, data collation and management together with data publication.


5. Platform Development: Tasks associated with developing the capability of the Web Mapping Platform.

These are illustrated in the Implementation Road Map, Figure 7, below.
Figure 7: Implementation Road Map

GRAPHC* Web Based Mapping Platform Implementation Plan

<table>
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<tr>
<td>G1 - Business Requirements</td>
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<td>G2 - Solutions Assessment</td>
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<td>G4 - Technical Reference Group</td>
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<tr>
<td>G5 - Formulate HLA relationship with RGC</td>
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<td>G6 - Recruitment GIS Resource</td>
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<td>G7 - Receive Current Issues with HLA</td>
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<td>G8 - Project Management</td>
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<td>C1 - Promote Strategic Plan</td>
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<td>C2 - GRAPHC ArcGIS Server</td>
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<td>C3 - Promote New System Capabilities</td>
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<td>C7 - Specification Development</td>
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<td>C8 - Tendering &amp; Contract</td>
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<td>1. Strategy, Planning &amp; Governance (G)</td>
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<td>2. Communication &amp; Promotion (C)</td>
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<tr>
<td>3. Data Agreements &amp; Collation (G)</td>
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<td>4. Systems Administration ($)</td>
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<tr>
<td>5. Platform Development (P)</td>
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## 5.2 Task Descriptions – Next Steps

### Table 3: Activities and Associated Objectives

<table>
<thead>
<tr>
<th>Activities</th>
<th>Timing</th>
<th>Description / Rationale / Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strategy, Planning &amp; Governance (G)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G4 - Technical Reference Group (engagement 1)</td>
<td>Short Term</td>
<td>Formation of a Technical Reference Group. Suggest group size of 6-8 people. Group will assist GRAPHC in refining requirements and contributing to supporting system development. Activities of the group continue to at least the end of the medium term. Assumption that this will require average ½ a day a week to coordinate and support. Includes regular web/phone hook ups, document review etc.</td>
</tr>
<tr>
<td>G5 - Formalise HLA relationship with RGC</td>
<td>Short Term</td>
<td>Establishment of service level agreements with RGC. Estimated ½ a day week in first 3 months.</td>
</tr>
<tr>
<td>G6 – Additional GIS Resources</td>
<td>Short Term</td>
<td>Recruitment of a GIS resource. New full time EFT. Increases to 2 EFTs early in 2013 once new Platform comes online. This is due to increase in workload. Define in appropriate detail the system requirements for development iteration one. Estimated at 20-25 days of work spread out over 2 time periods.</td>
</tr>
<tr>
<td>G7 - Specification Development</td>
<td>Short Term</td>
<td></td>
</tr>
<tr>
<td>G8 - Tendering &amp; Award of Contract</td>
<td>Short Term</td>
<td>Identification of appropriate third party to develop the required system capabilities. Note, this could involve collaboration with RGC. Intensive period of activity averages out to 0.4 EFT over 3 months (20-25 days).</td>
</tr>
<tr>
<td><strong>Communication &amp; Promotion (CP)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C1 - Promote the GRAPHC Strategic Plan</td>
<td>Short Term</td>
<td>Ensure momentum is maintained and that stakeholders are informed of plans and progress. This supports other objectives e.g. D1 through D3</td>
</tr>
<tr>
<td>C3 - Promote New Data</td>
<td>Short Term</td>
<td>Promotion of new data sets via the GRAPHC Web Portal. This will ramp up in Q3 2012 into early 2013. Will be replaced by general system promotion in 2013.</td>
</tr>
<tr>
<td>C3 - Promote New System Capabilities</td>
<td>Medium Term</td>
<td>Encourage stakeholders to use the system promote the added utility and ensure further buy-in.</td>
</tr>
<tr>
<td><strong>Data Agreements &amp; Collation (DAC)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D1 - Data Collation 1</td>
<td>Short Term</td>
<td>Attain quick wins with respect to data; secure all relevant public data sets for inclusion in HealthLandscape Australia. Estimated at 1 day a week.</td>
</tr>
<tr>
<td>D2 - Data Collation 2</td>
<td>Medium Term</td>
<td>Attain data major stakeholders e.g. AIHW, Medicare, Locals (at this time aggregated data but as granular as possible). Estimated at 1 day a week.</td>
</tr>
<tr>
<td>D3 - Data Collation 3</td>
<td>Medium Term</td>
<td>Attain additional data (e.g. unit record level data), in conjunction with security enhancements to Web Mapping Platform. Estimated at 1 day a week.</td>
</tr>
<tr>
<td><strong>Systems Administration (SA)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S1 - ArcGIS Server Administration</td>
<td>Short Term &amp; Medium Term</td>
<td>Ongoing ArcGIS Server administration. Estimated at 1 day a week.</td>
</tr>
<tr>
<td>S2 - Configuration and Technical Support</td>
<td>Short Term &amp; Medium Term</td>
<td>Ongoing minor configuration and user support. Estimated at 1 day a week. Also includes support contract with systems development vendor.</td>
</tr>
</tbody>
</table>
5.3 Estimated Budgetary and Resourcing Requirements

The activities set out in the Implementation Road Map all have costs and resource impacts. Table 6 provides a high level outline of these separated into "3 month" increments. In addition, the primary resource type for each activity is noted including Project Management (PM), Technical Specialist (TS) and GIS Analyst (GA).

Based on the high level estimates outlined in Table 6, in the short term, GRAPHC should consider recruiting a GIS analyst with skills covering:

- Map Production (using ArcGIS Desktop);
- ESRI Software skills (ideally ArcGIS Server Administration, although this could be optional); and,
- Basic programming skills in JavaScript (other languages optional).

Additional resources will also be required later in 2012 to manage the development of the Web Mapping Platform and other associated activities. Additional GIS resources have also been factored into the Roadmap in 2013 to manage the increased workload associated with data management and ArcGIS Server administration. Figure 8 provides an overview of a possible team structure that GRAPHC could put in place to support the Web Mapping Platform.

Figure 8: GRAPHC Team Structure
5.4 Project Risks

There are a range of potential risks to the successful implementation of this strategy. GRAPHC need to ensure that appropriate risk mitigation activities are put in place to manage these risks. Table 7 lists the identified risks and indicates the likelihood and impact. GRAPHC should deliver a risk management plan including risk mitigation as part of planning for the establishment of the Web Mapping Platform.

Table 4: GRAPHC Web Mapping Platform

<table>
<thead>
<tr>
<th>Risk Description</th>
<th>Likelihood/Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insufficient funding to design, build and deploy applications</td>
<td>M/H</td>
</tr>
<tr>
<td>Stakeholder resistance to adoption of GRAPHC systems over use of local databases and desktop software/status quo.</td>
<td>M/M</td>
</tr>
<tr>
<td>Inadequate ICT infrastructure and support arrangements to cater for high level dependency on systems</td>
<td>L/H</td>
</tr>
<tr>
<td>DoHA funded to develop systems that satisfy their web mapping requirements and those of other stakeholders</td>
<td>L/M</td>
</tr>
<tr>
<td>Stakeholders develop their own system solutions in isolation of each other</td>
<td>L/M</td>
</tr>
<tr>
<td>Amount of client input time required underestimated – project blowout and failure</td>
<td>M/M</td>
</tr>
<tr>
<td>System capabilities fail to meet stakeholder expectations or requirements</td>
<td>L/M</td>
</tr>
<tr>
<td>Inability to secure sufficient granular “fit for analysis” data that will differentiate GRAPHC’s system from existing system.</td>
<td>M/M</td>
</tr>
</tbody>
</table>