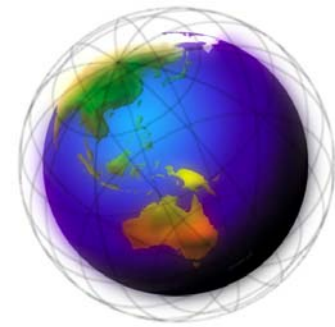


Managing the AGD to GDA Datum Change in Australian Business

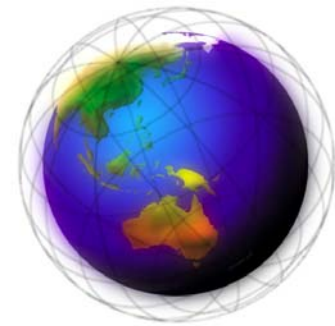




Paper Authored & Presented by
Hayden Foley



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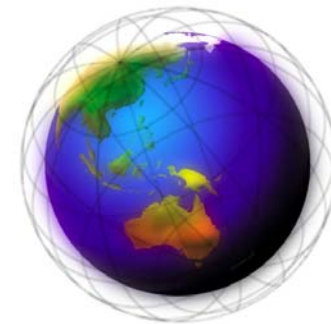
Abstract

This paper describes required policy, systems and processes needed to internally manage the ongoing business risks imposed by Australia's national datum change. Hydro Tasmania has adopted a phased introduction of the Geocentric Datum of Australia (GDA). GDA is Australia's new national mapping and coordinate system and replaces the Australian Geodetic Datum (AGD).

Addressing the findings of an internal spatial data audit, the business has developed an AGD to GDA implementation strategy supported by a 30-point action plan. The action plan seeks to ultimately achieve full datum compliance whilst managing the ongoing business risks imposed by a datum change which will result in every map coordinate changing by approx. 200 metres.

Central to implementing the action plan has been the creation of a GIS System that can handle a dual coordinate system environment and impose strict datum quarantine on individual Hydro Tasmania projects, thus providing confidence in spatially related decisions.





Managing the AGD to GDA Datum Change in Australian Business

Hydro Tasmania Case Study

‘Managing the National Datum Change
Within an Australian business is not simply a matter of
transforming coordinates to achieve compliance.
It is about managing significant risk imposed on business’



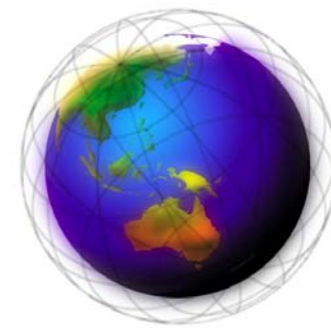
Artwork ICSM, 1999

Paper Presented by **Hayden Foley**
Survey and Geographic Information Services

Hydro Tasmania is an Australian ESRI Business Partner



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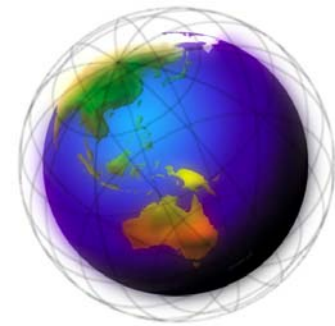


Contents

-
- Hydro Tasmania Case Study
 - Australia's National Datum Change
 - What are the Risks to Business?
 - Hydro Tasmania's Datum Policy
 - GIS Support Infrastructure
 - AGD to GDA Management Phases
 - Spatial Datum Audit
 - Audit Findings
 - Assessment of Risk
 - The AGD to GDA Action Plan
 - AGD to GDA Strategy
 - The Strategy Objectives
 - Action Plan Implementation
 - Spatial Data Retriever
 - Online Datum Toolkit
 - Datum Toolkit Contents
 - Post Implementation
 - Acknowledgments
 - End Notes
 - References
 - Author Information



Hydro Tasmania – Case Study

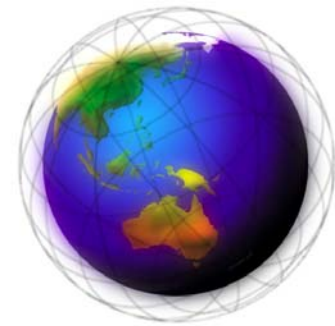


Hydro Tasmania the company profile:

- A renewable energy business
- Australia's pre-eminent generator of electricity from renewable energy sources, contributing over 60 percent of Australia's renewable energy
- Hydro Tasmania takes in the functions of electricity generation and consulting services-it has a workforce of about 680 and custody of 27 hydro, one thermal and two diesel power stations and a wind farm. It has electricity generating assets worth about \$3 billion with a total generating capacity of 2262 MW. With over 50 large dams, Hydro Tasmania is the largest dam owner in Australia.
- Forefront of the development of renewable energy options with a Consulting business committed to exporting our skills and expertise across Australia and around the world



Australia's National Datum Change AGD to GDA



Definitions:

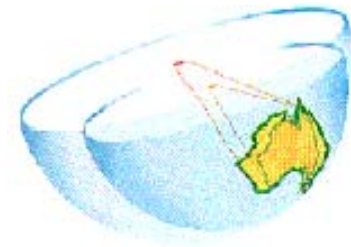
- AGD is an acronym for the Australian Geodetic Datum (AGD)
- AGD is the name of the existing datum used in Tasmania that is now to be phased out.
- GDA is an acronym for Geocentric Datum of Australia (GDA)
- *GDA is the new national mapping and co-ordinate datum* being implemented across Australia.
- The GDA has now been adopted nationally because is the most effective datum for spatial data users.

The new GDA datum provides:

- Compatibility with satellite navigation systems
- Local, regional, state, national and international compatibility through one consistent reference frame for all users.
- The reference frame on which the Australian Spatial Data Infrastructure (ASDI) is to be based and
- Infrastructure to support international agreements.

Items affected by the AGD to GDA datum conversion include:

- Hard copy topographic maps
- Digital spatial data
- Engineering drawings
- Existing GPS units on AGD datum settings



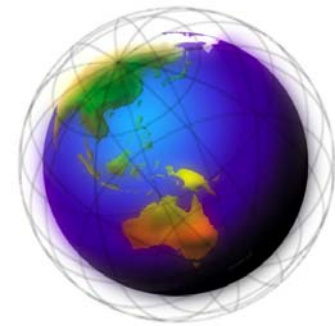
The datum shift concept is illustrated simply by this diagram above

Artwork ICSM, 1999



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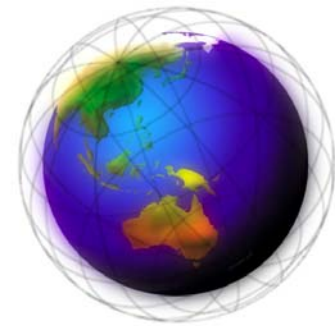
Why are there Risks Associated with the Datum Change?



- Incorrect co-ordinate datum in the decision making process could easily result in something being built in the wrong place or designed based on studies applicable to the ground 200m away from actual location.
- These risks relate to the fact that GDA datum shifts coordinate values approximately 200m from their current AGD coordinates.
- If the datum of a map or a GPS unit is not known or is misidentified serious error with cost consequence can occur.
- Any organisation that deals with spatial information needs to manage the business risks imposed by the national datum change.
- These risks are present within an organisation's internal activities and within its dealings with others, including contractors, service providers and the public.
- The state of Tasmania has only ever needed to deal with one active co-ordinate system at any one time due to it falling entirely within a single UTM zone. This has bred cultural complacency that has resulted in employees treating co-ordinates at face value without an in-built discipline to exercise due caution.
- The last major coordinate system change took place in 1972 upon the introduction TM to UTM. This move from imperial to metric measurement produced very apparent and obvious differences in relation to the respective co-ordinates assigned to the same geographic location.
- Imperial to metric datum change left little room for confusion between the two coordinate systems. The approx. 200m coordinate difference between AGD & GDA datum on the ground introduces potential confusion and misidentification of datum.



Hydro Tasmania's AGD to GDA Policy Document



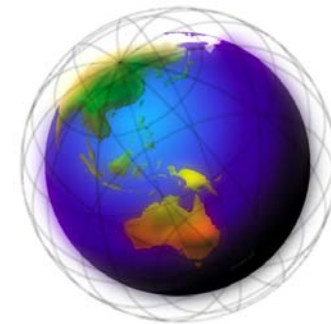
Prime Objectives:

- To implement measures needed to install confidence in spatially related decisions throughout the life of all Hydro Tasmania projects.
- To implement measures needed to eliminate risk of error occurring within all spatial handling and data exchange transactions.

Some Key Policy Ingredients:

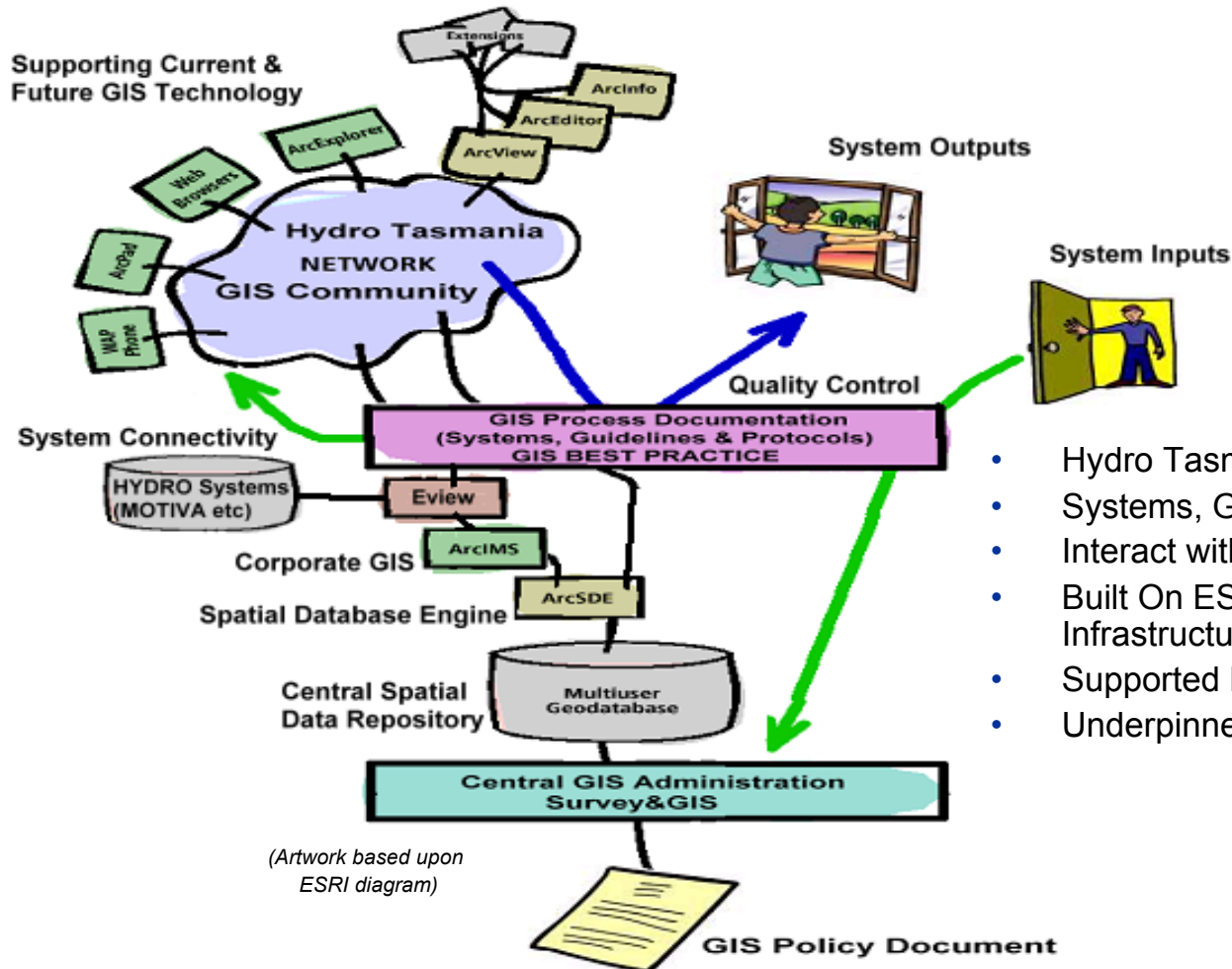
- All Hydro-Tasmania departments that provide spatial data to others, or who use spatial data that someone else has produced, need to be included in the GDA migration and risk minimisation strategy.
- Hydro-Tasmania needs to conduct a spatial data audit and include all forms of data, including an assessment of digital data, hardcopy map data and textual data.
- Hydro-Tasmania must ensure that spatial information used in Courts as evidence can survive legal cross-examination.
- Hydro-Tasmania has determined that the transition to GDA provides sufficient value, risk minimisation, and cost savings to justify a revision of our data and processes.
- Hydro-Tasmania must ensure that transformations used are appropriate for our datasets, and that our staff and contractors are competent in the use of transformations and survey reductions.
- Following adoption of GDA, Hydro-Tasmania will continue to support the old AGD datum, as necessary, for a reasonable transition period.
- Hydro-Tasmania needs to develop relevant procedures to implement this policy.





Required GIS Base Infrastructure

Supporting AGD to GDA Policy

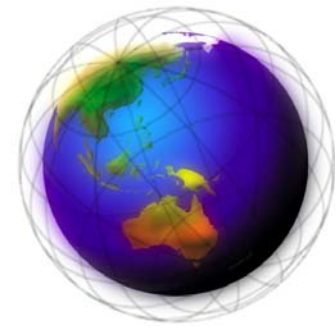


- Hydro Tasmania's GIS Community
- Systems, Guidelines & Protocols
- Interact with Ourselves & the World
- Built On ESRI ArcSDE / ArcIMS & Eview Infrastructure
- Supported by Central GIS Administration
- Underpinned by GIS Policy



AGD to GDA Management

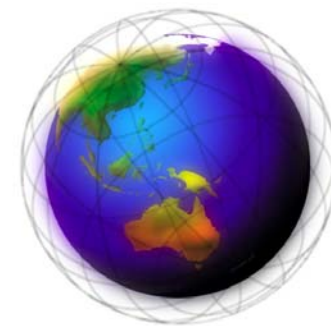
Project Management Phases



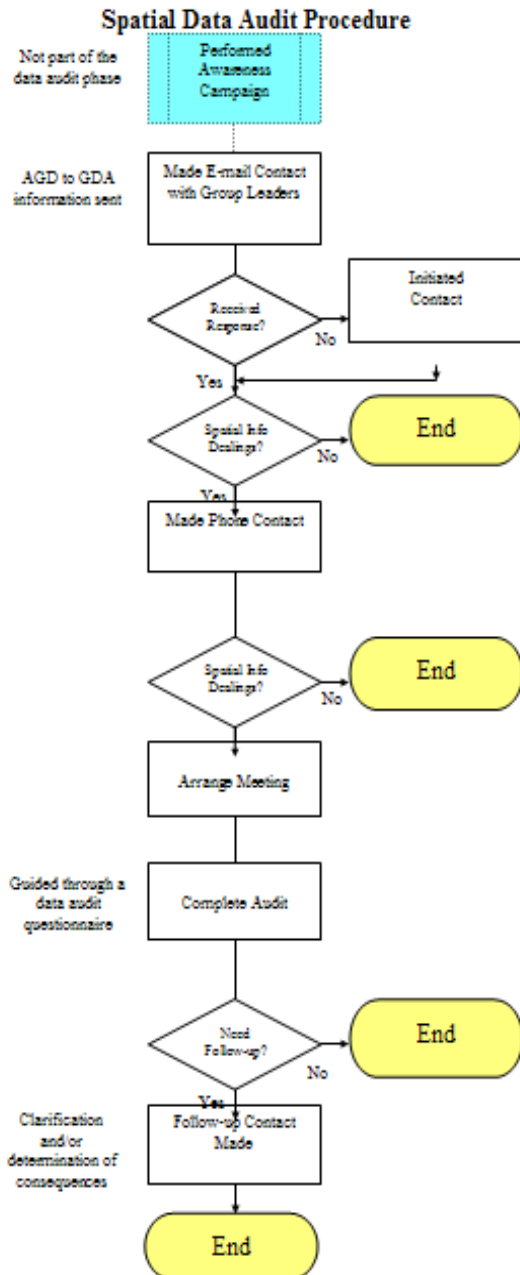
The Four Project Management Phases:

- PHASE 1 (Completed) involved conducting a GDA awareness campaign to inform Hydro Tasmania Employees of the impact of the datum change upon the workplace and conducting a Spatial Data Audit within Hydro Tasmania to better understand the volume and nature of spatial data usage.
- PHASE 2 (Completed) involved analysing the results of the spatial data audit conducted to measure the size and nature of Hydro Tasmania's spatial data asset. This phase also revealed the level of business risk & resulted in the formulation of an action plan to address GDA implementation that included 30 recommendations to management.
- PHASE 3 (Completed) involved the implementation of the recommended measures needed to forward manage the business risk associated with the datum change. It included development of a Project Spatial Datum Toolkit designed to provide employees with online resources needed to avoid datum misidentification.
- PHASE 4 (Ongoing) involves monitoring the effectiveness of implemented recommendations, maintaining the health of the centralised GIS System, recording datum related incidents and introducing new datum risk management measures as per required.





Spatial Data Audit



(Copyright Hydro Tasmania)

Audit Process

- All work areas within Hydro Tasmania participated in the audit
- Audit due process ensured that all groups/departments potentially affected were contacted and made aware of the change and its consequences
- In total, 77 people were involved in the audit process

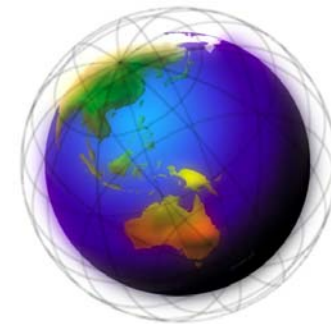
Questions Asked

- What data currently exists?
- Where did the data come from?
- What is the datum/spatial accuracy?
- How is the information utilised?
- What consequences could occur as a result of potential datum misidentification?
- Other comments?

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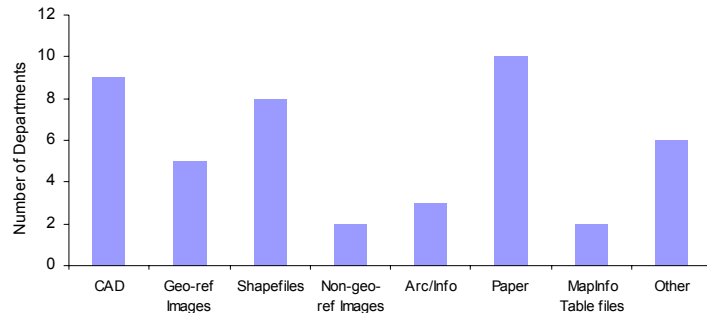


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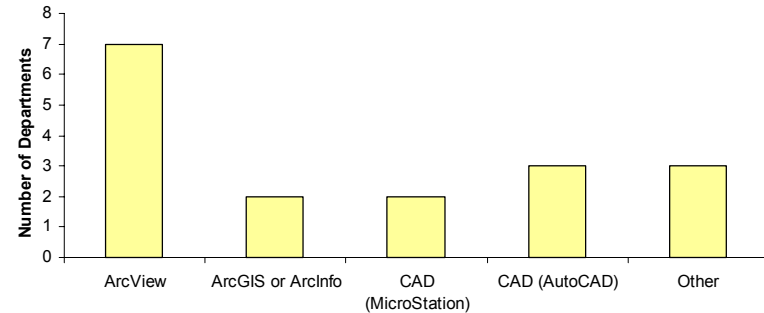


Spatial Data Audit Findings

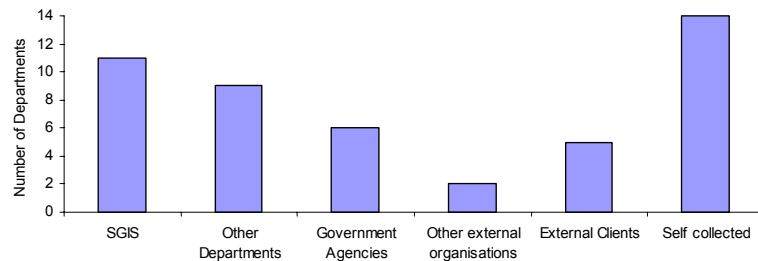
Number of Departments using various Spatial Formats



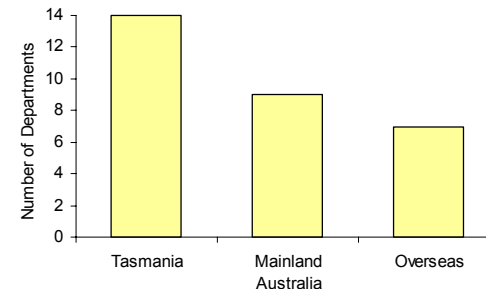
Software Primarily Used



Source of Spatial Data



Location of Projects Involving Spatial Information



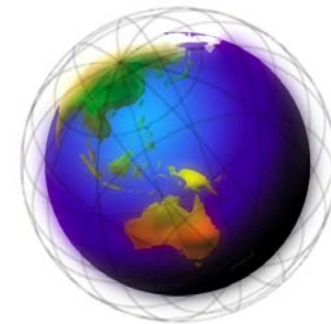
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Fourteen (14) departments were considered to be significant users of spatial information and required some form of assistance during the datum change process

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Assessment of Risk

- The Audit revealed that 14 Departments were high volume users of Spatial Data and were exposed to various levels of Datum related risk.
- The auditor based the probability, frequency and possible severity of incorrect datum considering factors such as: spatial information volumes, level of data transfer between departments and other groups, and the apparent level of datum awareness within each department.
- An interactive form was used to assess the risk and consequence associated with misidentifying the spatial datum within activities across the organisation.
- This assessment predicted a strong likelihood of a very serious incident occurring.
- AGD to GDA action plan was developed to address these risks and implement measures to avoid datum related incidents from occurring.

Please assess the risk level of this accident/incident/loss.

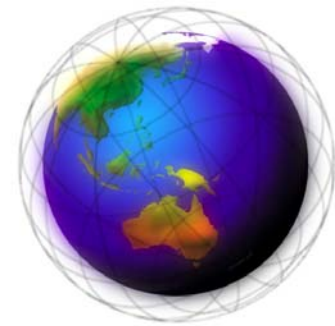
Select a button from each category:

PROBABILITY	FREQUENCY	TIE LINE	POSSIBLE SEVERITY	RISK LEVEL
<input checked="" type="radio"/> Might well be expected at some time	<input type="radio"/> Very rare (year or less)		<input type="radio"/> Catastrophe	High
<input type="radio"/> Quite possibly could happen	<input type="radio"/> Rare (a few per year)		<input type="radio"/> Disaster	Moderate
<input type="radio"/> Unusual, but possible	<input type="radio"/> Unusual (one per month)		<input checked="" type="radio"/> Very serious	Low
<input type="radio"/> Remotely possible	<input checked="" type="radio"/> Occasional (once per week)		<input type="radio"/> Serious	
<input type="radio"/> Conceivable, but very unlikely	<input type="radio"/> Frequent (daily)		<input type="radio"/> Important	
<input type="radio"/> Practically impossible	<input type="radio"/> Continuous		<input type="radio"/> Noticeable	

(Copyright Hydro Tasmania)

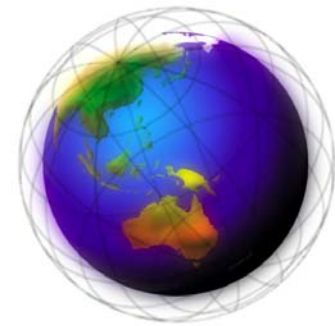


The AGD to GDA Action Plan

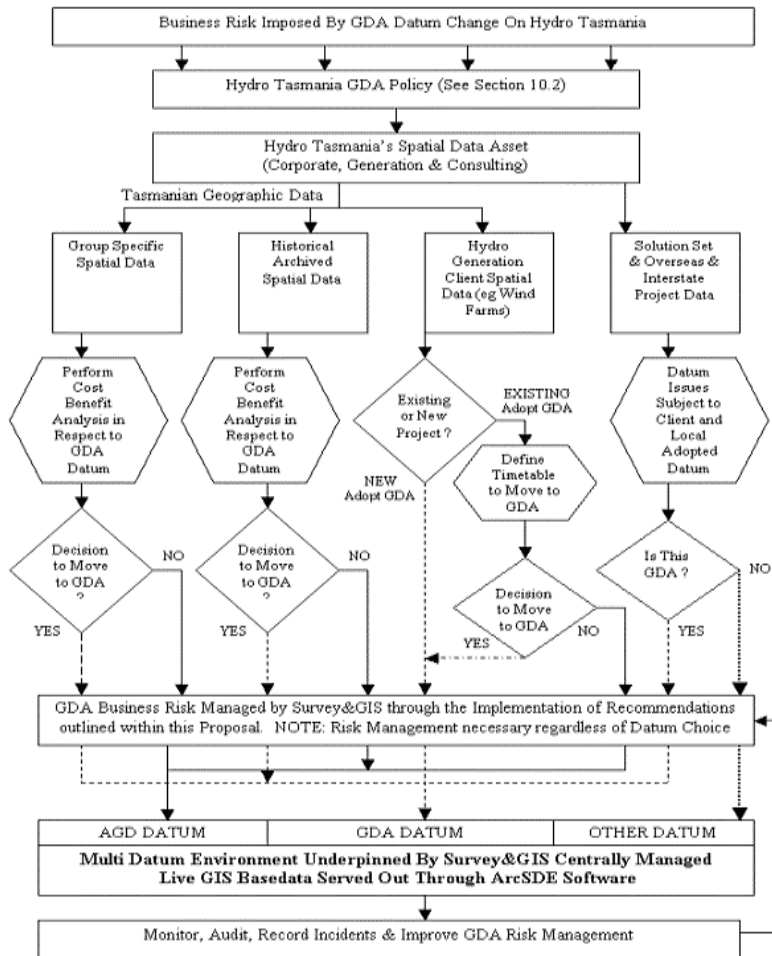


- Datum decisions to be based upon Cost Benefit Analysis with new projects adopting GDA datum by default.
- A staged migration of all historical and live AGD data onto GDA
- Ongoing risk managed through a 30 point Action Plan with recommendations flowing from findings of Spatial Data Audit.
- Requires the development of a “Datum Toolkit” to provide online help and datum management resources to project managers and employees
- Requires a spatial data coordinator to be assigned to all Hydro Tasmania’s large scale engineering projects.
- Requires development of auditable GIS and spatial data handling technical procedures and guidelines to be incorporated into Hydro Tasmania’s existing quality system.
- Requires ongoing monitoring, auditing and the recording of incidents through QMS systems (Corrective Action Process Records)
- Requires ongoing Improvement of GDA risk management
- The ultimate goal is for full GDA datum compliance for Tasmanian spatial data held by Hydro Tasmania.
- Supported by central GIS administration & ArcSDE infrastructure





The AGD to GDA Datum Migration Strategy



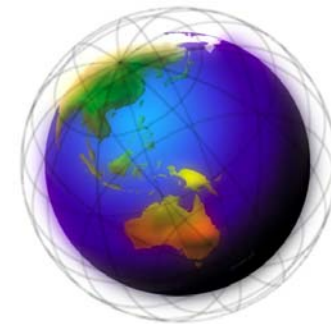
The Five Main Forms of Hydro Tasmania Spatial Data are:

- Historical Spatial Data – Spatial data locked away in either digital or hardcopy archive systems;
- Current Project Spatial Data – Spatial data in various forms, used on existing projects.
- Current Group Specific Spatial Data – Spatial data in various forms, used for group based activities;
- Corporate held GIS data – Spatial data stored within a central GIS served out live to Projects and Groups, administered by Survey&GIS Group; and
- Non-Tasmanian Spatial Data – Spatial data used on Interstate & Overseas Projects;

The diagram above shows the strategy adopted to handle the AGD to GDA datum change.

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The Strategy Objectives

Strategy Objectives :

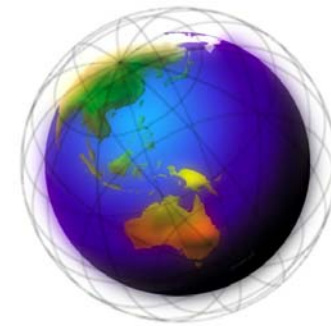
- GDA Risk Managed Historical Spatial Data – moved onto the GDA datum on an ‘as needed’ basis having satisfied a cost benefit analysis. Importantly, non-active spatial data in its archived state would be electronically stamped with its correct datum.
- GDA Risk Managed Current Project Spatial Data – captured on GDA datum for new projects and maintained in AGD datum for existing projects. The business risk in both instances to be managed appropriately.
- GDA Risk Managed Corporate Held GIS data – dual co-ordinate systems centrally maintained and administered to support AGD & GDA projects within Hydro Tasmania.
- GDA Risk Managed Non-Tasmanian Spatial Data – spatial data managed as per client requirements. They will adopt same business risk management measures introduced to manage the GDA datum change. These measures are just as applicable to safely managing data belonging to other states on a different spatial datum

*GDA compliance and datum migration is a complicated issue for **Live Projects**. Datum choice will have to be dealt with on an individual project-by-project basis. The decision to change the datum adopted for an existing project mid-stream (at short notice) will only serve to increase the risk of something being built in the wrong place or designed based on studies taken 200m away from its true location etc. On the other hand, the use of the old AGD datum on new Hydro Tasmania projects could prove costly should they have to be converted in the future.*

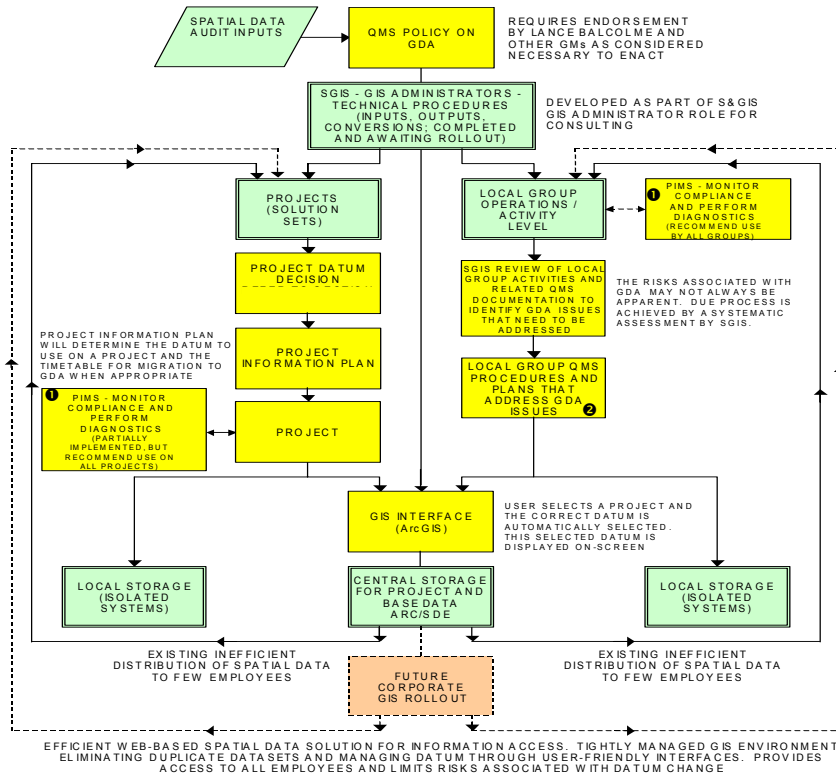


Action Plan Implementation

Spatial Information Flow & the Role of GIS



THE DIAGRAM BELOW SHOWS EXISTING PROCESSES AND SYSTEMS TOGETHER WITH THOSE THAT SGIS RECOMMENDS TO BE IMPLEMENTED TO MANAGE AGD TO GDA COMPLIANCE



1 ABOUT PIMS:
 Project information management involves determining how to ensure timely and appropriate generation, collection, dissemination, storage, and ultimate disposition of project information.
 PIMS is an internally developed software package providing a Hydro-wide application that includes a centralised Geographic Information System (GIS) to assist Project information management.
 PIMS implements a data model that creates consistent and structured information. This includes a facility to specify a project datum and provide real-time information about non-compliant entries.

2 LOCAL GROUP QMS PROCEDURES AND PLANS ENSURE THAT:

- PIMS is universally adopted.
- GDA issues are addressed.
- GIS and Spatial Data management guidelines and QMS procedures developed by SGIS are adopted.

NOTE: Project Information Plans and Group Procedures and Plans should also address information issues other than spatial data management. These other information issues are outside the scope of this report. PIMS provides a tool to manage these issues.

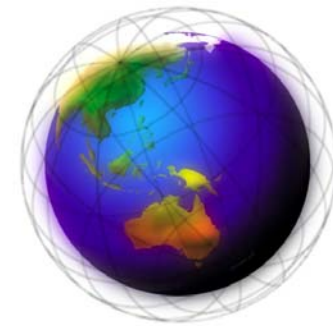
LEGEND

- EXISTING**
Those systems and processes already in operation
- NECESSARY**
Those additional systems and measures that need to be implemented to manage the datum change
- RECOMMENDED BUT OUT OF SCOPE**

- GIS System needed to help implement the AGD Migration Model and GDA Policy
- Required to micro manage datum on a continual project by project basis.
- Required a common central data repository (ArcSDE) for all Hydro Tasmania projects
- GIS interface to be customised for both Arcview 3.2 & ArcGIS involving creation of a Data Retriever tool.
- New Arcview GUI to enable user to select a project from drop down list, the datum of which is then resolved automatically behind the scenes.
- This correct datum automatically applied to map features with datum name displayed on-screen.
- Decisions made with confidence and certainty
- Future ArcIMS customisation to provide all employees with access to GIS technology and a managed datum environment.
- Reduce the need for any employee to source own spatial data from unknown sources and un-managed environments, thus restricting risk of introducing datum error.

Spatial Data Retriever

*Customised ArcSDE Interface
Developed by Hydro Tasmania*



GIS usage has evolved within Hydro Tasmania over a number of years. As a result numerous departments had created their own spatial data repositories, which quite often contained redundant data, thus wasting large amounts of disk space. Other issues encountered included version control in highly dynamic project based spatial data.

Survey & Geographic Information Services (S&GIS) provided the necessary expertise to assess the limitations of the existing infrastructure, then design, build and implement a new storage and retrieval system. The majority of Hydro Tasmania's spatial data has now been moved into ArcSDE.

This new system is named "*HydroGIS*" and is a central data repository for both base and project specific corporate spatial data. *HydroGIS* is built on top of ESRI's ArcSDE and ArcGIS, and utilises Microsoft SQL Server for its database repository technology.

The system has multiple components, which include:

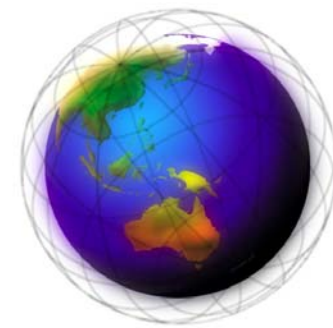
- A spatial data management database;
- The spatial data repositories; and
- A suite of tools for ArcGIS.

The ArcGIS end user is offered a number of tools including a data retriever, a locator and other Hydro Tasmania specific data query tools. The Data Retriever provides a mechanism for the ArcGIS user to easily search the spatial data within ArcSDE, then add these layers to the current ArcGIS map view.

The Data Retriever automatically New Arcview GUI to enable user to select a project from drop down list, the datum of which is then resolved automatically behind the scenes.

The *HydroGIS* interface has now been developed into a range of commercial products offered to industry through Hydro Tasmania's consultancy arm.





Spatial Data Retriever

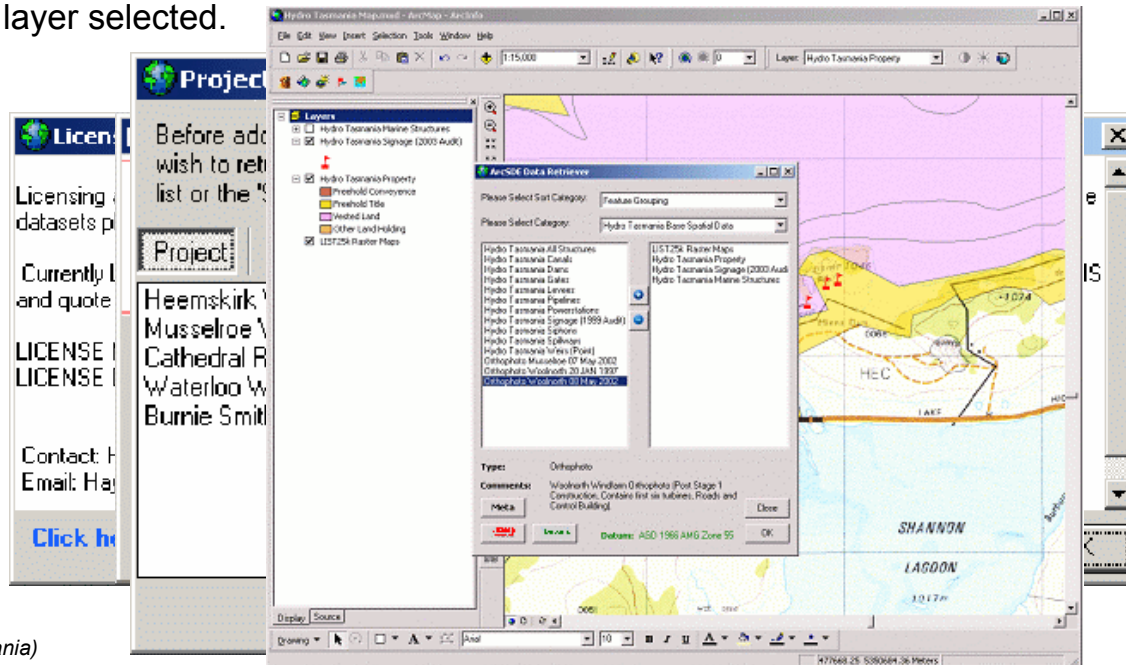
Customised ArcSDE Interface
Developed by Hydro Tasmania

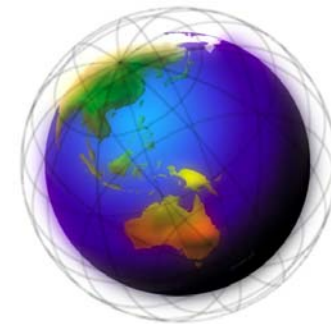
Datum Selection Screen; Displayed when the user clicks the data retriever button on the HydroGIS toolbar, is not displayed if the users project is already on a datum, can be displayed by the user when the click the "Datum" button on the "Main Form".

Updated Central Interface; This is the "Main Form" where the user selects the layers they wish to add to their arcmap project.

Warning Message Box; Displays if the user tries to load data belonging to a different datum to that the project is already on. The current datum details are displayed when the user clicks the "Datum" button on the "Main Form"

License Information; Displayed when the user click on the "License Information" button on the "Main Form", the user must have a layer selected.



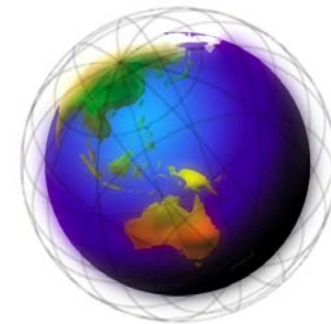


Online Datum Toolkit

The Project Datum Toolkit:

- Project Datum Toolkit was added to the GIS System web pages hosted on Hydro Tasmania's internal corporate website.
- Important datum change information is made accessible to all Hydro Tasmania employees via their web browser in a user friendly manner.
- The Project Spatial Datum Toolkit consists of a number of downloadable items and links to policy, systems, templates, examples and processes needed to raise awareness of datum related issues. These are needed to manage datum related risk within Hydro Tasmania projects.
- The toolkit was designed specifically to help ensure project teams have confidence in spatially related decisions throughout the life of any given project.





Datum Toolkit Contents

Sample of Available Online Resources



The Hydro Tasmania GIS System Standard

1. Purpose

The purpose of these standards, guidelines and procedures is to promote the compatibility and interchange of digital spatial data among the GIS user community working within Hydro Tasmania.

Digital spatial data standards are important to promote the development of a high quality, robust and well-documented GIS system that aspires to industry best practice status.

These standards and procedures will provide valuable guidelines for Hydro Tasmania employees in acquiring, developing and processing spatial data. The standards will introduce the necessary filters, checks and balances to control the various GIS inputs and outputs that interface Hydro Tasmania with the outside world.

They will influence the way information is accessed, presented and used for Hydro Tasmania's own internal activities as well as for the many external projects it is involved with.

These procedures are not static documents but works in progress. They require ongoing review and updating to reflect the changes that occur within a healthy GIS environment that's committed to a continual program of system improvement.

The GIS process documentation supports the objectives of the Business Management System as well the "Knowledge Management" component of the Hydro Tasmania Business Excellence Program and is designed to improve business outcomes.

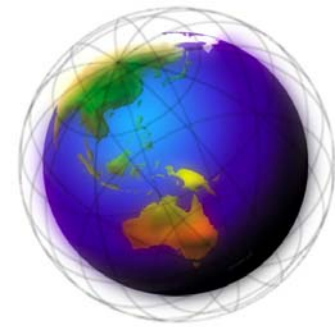
The GIS standards and procedures to be rolled out across the organisation, will introduce due process, consistency, completeness, certainty and accuracy to ensure a higher confidence level to managers and other stakeholders making decisions based on GIS data.

2. Scope

Geographic Information Systems (GIS) need to have processes in place that deal with the base components upon which a GIS is built. The preparation of following documentation has resulted from process mapping the core functions performed by GIS specialists working in the various aspects of GIS.

3. Definitions

GIS: Geographic Information System
BMS: Business management system
SGIS: Survey & Geographic Information Services
JM: Job manager



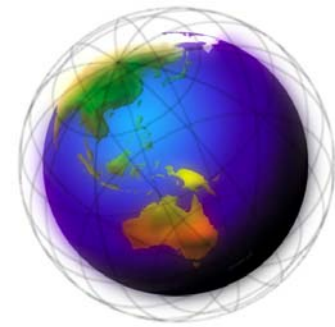
Post Action Plan Implementation

Ongoing Monitoring

Ongoing Monitoring will include:

- Monitoring AGD to GDA compliance and adherence to the Project Datum Toolkit within Hydro Tasmania.
- Monitoring compliance with related GIS standards and procedures that provide guidelines for Hydro Tasmania employees in acquiring, developing and processing spatial data. These standards introduce the necessary filters, checks and balances to control the various GIS inputs and outputs that interface Hydro Tasmania with the outside world and manage the risk imposed by the national datum change.
- Issue of corrective action process reports when datum related incidents (eg. error, client complaints, safety issues and quality management system nonconformities) arise and ensure that they are followed up with corrective and preventive action.
- Monitoring and maintaining Hydro Tasmania's online web pages dedicated to the AGD to GDA datum change to ensure these continue to provide accurate and up-to-date information and resources to Hydro Tasmania employees.





Acknowledgments

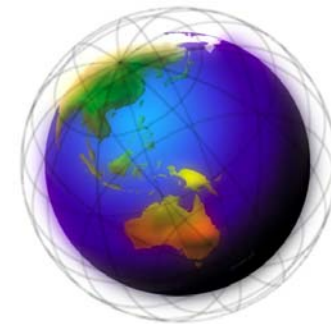
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End Notes

For more background information on how the AGD to GDA datum change was managed within Hydro Tasmania please feel free to contact the Survey & Geographic Information Services group.

Hydro Tasmania's Survey & Geographic Information Services Group

Hydro Tasmania's Survey & Geographic Information Services Group (Survey & GIS Group) is a group of talented, highly trained professional staff who have in-house access to an extensive array of the most modern and sophisticated equipment and facilities.

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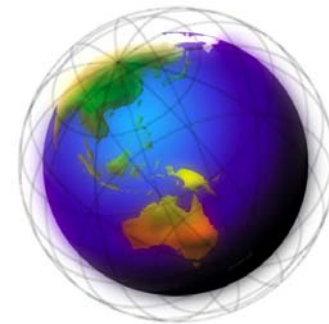
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- Precision Deformation Surveying.
- Aerial Photography

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References

Published Brochures prepared by Intergovernmental committee on Surveying & Mapping (ICSM)

"Know Where You Stand with GDA" ([PDF - Size 2921Kb](#))

"Get In Step With the Geocentric Datum - Discussing the Business Issues" ([PDF format - Size 185Kb](#))

Information Factsheets prepared by ICSM

"Maps and the GDA" ([PDF format - size 44kb](#))

"Transformation Options" ([PDF format - size 64kb](#))

"GDA Grid Transformation Using Distortion Modelling" ([PDF format - size 54kb](#))

"What is the difference between WGS84 and GDA94?" ([PDF format - size 30kb](#))

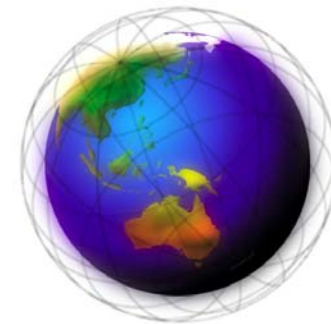
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