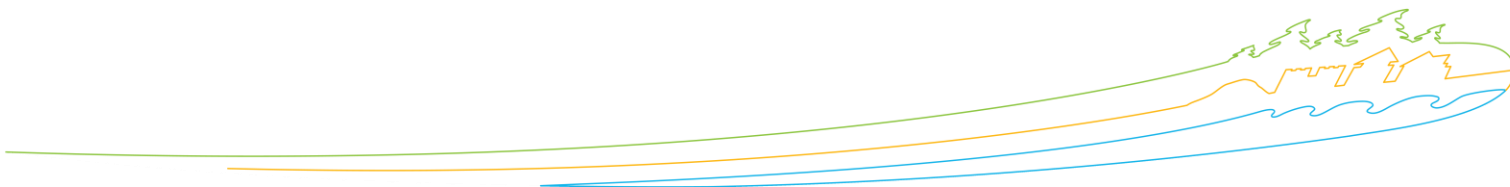




Parks
Canada

Parcs
Canada



Performance Audit of the Geographical Information System (GIS)

Final Report

July, 2012

Office of Internal Audit and Evaluation

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Her Majesty the Queen of Canada, represented by
the Chief Executive Officer of Parks Canada, 2012
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EXECUTIVE SUMMARY

Introduction

Several decades ago, Parks Canada began to use Geomatics or Geographic Information Systems to assist in fire mapping. Since then, Geomatics has been applied to more programs in support of the Parks Canada mandate. As the largest land-manager in the federal government, Parks Canada requires today more information that is geographically and location oriented to manage the conservation of resources and visitors' experience.

The Parks Canada Multi-Year Internal Audit Plan 2011-12 to 2013-14 identifies Geographic Information Systems (GIS) as a high audit priority in the Agency. To that effect, a national audit was conducted between April 2011 and February 2012.

The objective of the audit was to provide an independent opinion that: GIS activities in the Parks Canada Agency are aligned with and support the Agency's mandate; an appropriate GIS governance structure exists; and allocated funds are used with efficiency, effectiveness and economy.

The scope of the audit involved a combination of telephone interviews and site visits between July and October 2011.

Key Findings

During audit fieldwork, the audit team observed several examples of GIS use which resulted in positive findings including:

- Local GIS activities mainly support the corporate PCA mandate;
- A decentralized use of GIS has lead to a diversity of geomatic directions, outputs and processes; and
- GIS investments have produced effective results and a perception of good value among local managers and users.

The audit team also identified the following observations that highlight opportunities for improvement in the pursuit of the audit objectives:

Line of Inquiry	Rating	Observation
1. GIS activities effectively support the Agency's mandate.	YELLOW (Moderate improvements needed)	There is no central, Agency-wide alignment of GIS data content use and business decisions. At the moment, GIS capability is primarily seen as addressing FU requirements in a locally deployed service delivery model.

Line of Inquiry	Rating	Observation
2. An appropriate GIS governance structure is in place.	ORANGE (Significant improvements needed)	Governance elements are not rigorous enough to ensure efficient and effective achievement of Agency level GIS benefits. There is no GIS policy or directive in place and no executive sponsor for information content and business decisions. Planning and communication of GIS activities are fragmented across the Agency and ineffective at the Agency-wide level.
3. Management practices and tools exist to manage costs in an efficient manner.	ORANGE (Significant improvements needed)	Currently the financial system configuration does not permit tracking of GIS expenditures either by project or overall; and there is no evidence of monitoring and reporting done to assess efficiency of resources used for GIS activities. Therefore the audit was unable to measure the efficiency of GIS resource management.

Recommendation:

It is recommended that the Chief Administrative Officer:

1. In the near term develop a proposal for approval by EMC, on whether the Agency will adopt an Agency wide strategic direction and approach to the management of GIS information.
2. Ensures that a corporate management framework for GIS (governance, roles and responsibilities, communication, control and monitoring) is put in place and a senior manager be assigned responsibility and accountability to support programs in achieving the Agency's mandate if the Agency is to develop a strategic direction and approach to the management of GIS.
3. Ensures that measures are put in place to allow performance monitoring of GIS activities and resources.

1. BACKGROUND

The Complexity of Parks Canada's Reach

The Parks Canada Agency's (also termed PCA, Parks Canada or the Agency) mandate on behalf of the people of Canada is to "protect and present nationally significant examples of Canada's natural and cultural heritage and foster public understanding, appreciation and enjoyment in ways that ensure their ecological and commemorative integrity for present and future generations." In the large and diverse Canadian landscape the Agency manages 42 National Parks and National Park Reserves, 167 National Historic Sites and 4 National Marine Conservation Areas.

As the largest land-manager in the federal government, Parks Canada's managers and employees require information that is geographically and location oriented. The physical dispersion and remoteness of some of Parks Canada's locations raise management challenges for optimizing the visitor experience, for human resourcing, for information collection and management and for technology refreshment.

Geomatics and Geographic Information Systems in Parks Canada

Geomatics is generally viewed as the science of gathering, storing, processing, and delivering geographic information. Where as a "Geographic Information System" (GIS) is the merging of cartography, statistical analysis, and database technology. In this report the terms "GIS" and "Geomatics" - although not precise equivalents - will be used interchangeably for the convenience of the reader.

The world's first true operational geographic information system (GIS) was developed in Ottawa in 1962 by Dr. Roger Tomlinson for the Federal Department of Forestry and Rural Development.

At Parks Canada, the use of Geomatics has grown incrementally since the 1970's without centralized strategic planning. Today, it usually resides in the Resource Conservation Branch of most national parks across Canada. Between 2006 and 2010 several Geomatic needs analysis and pilot projects were conducted using Tomlinson's GIS Planning Methodology¹ and reports of these projects indicate that Geomatics resources could be effectively leveraged to address multiple business requirements in National Parks or National Historic Sites.

2. PURPOSE

In order to assess appropriateness of Parks Canada's GIS structure to efficiently deliver outputs aligned with corporate priorities, the Office of Internal Audit and Evaluation included a performance audit in its Multi-Year Internal Audit Plan 2011-12 to 2013-14. The plan was reviewed by the audit committee and approved by the CEO.

¹ *Thinking About GIS* by Dr. Roger Tomlinson, 2003

3. OBJECTIVES AND SCOPE

The preliminary objective of this internal audit is to provide an independent opinion that GIS activities in the Parks Canada Agency are conducted in a way that ensures allocated funds are used with efficiency, effectiveness and economy.

More specifically, the audit aims to:

1. determine whether GIS activity (as a geomatics component) is done in such a manner to effectively support the Agency's mandate, objectives and priorities – examining requirements and outputs;
2. confirm the existence of an appropriate Geomatics governance structure – examining processes and resources; and
3. assess the adequacy of management practices and tools in place to manage costs /resources in an efficient manner – examining efficiency and economic aspects².

The scope of this audit included an Agency-wide assessment of GIS activities for the period of April 2011 to February 2012.

4. METHODOLOGY

The audit methodology consisted of a review of relevant documents and interviews in various responsibility centres across the Agency. The following field visits took place from July 12 to August 18, 2011, with one team conducting audit work in Western Canada and the other one in Eastern Canada:

- Atlantic Service Centre;
- Mainland Nova Scotia Field Unit,
- Quebec Service Centre;
- Western Quebec Field Unit;
- Riding Mountain National Park Field Unit;
- Manitoba Field Unit;
- Western & Northern Service Centre;
- Banff National Park Field Unit; and
- Kootenay/Yoho/Lake Louise Field Unit.

Interviews encompassed 6 national office directorates and programs, four service centres, and 18 field units. Various representatives involved with GIS activities were met as shown in the table below.

GIS Specialists and Technicians	Resources Conservations Users	Other Users ³	Managers ⁴	Total
23	31	15	8	77

² Assessment of resource utilization in relation to the production of outputs and progress toward expected outcomes.

³ Users in: ERVE, Planning, Cultural Resources, Law Enforcement, Realty, Asset Management and the OCIO

⁴ Managers at the following levels: VP, Executive Director, Director, FUS, and CIO

Observations and recommendations have been made in accordance with the Audit Reporting Rating System described below:

<i>Audit reporting rating system</i>		
RED	Unsatisfactory	Controls are not functioning or are nonexistent. Immediate management actions need to be taken to correct the situation.
ORANGE	Significant Improvements Needed	Controls in place are weak. Several major issues were noted that could jeopardize the accomplishment of program/operational objectives. Immediate management actions need to be taken to address the control deficiencies noted.
YELLOW	Moderate Improvements Needed	Some controls are in place and functioning. However, important issues were noted and need to be addressed. These issues could impact on the achievement or not of program/operational objectives.
BLUE	Minor Improvements Needed	Many of the controls are functioning as intended. However, some minor changes are necessary to make the control environment more effective and efficient.
GREEN	Controlled	Controls are functioning as intended and no additional actions are necessary at this time.

5. ASSURANCE STATEMENT

This audit was planned and conducted in accordance with Government of Canada Internal Audit Standards.

6. AUDIT OPINION

The audit observed that: GIS supports the corporate PCA mandate, but on an ad hoc basis. The current decentralized GIS structure has lead to a diversity of geomatic directions, products and processes; and GIS investments have produced effective results and a perception of good value at the local level.

Despite the recognition that a GIS investment represents good value locally, GIS is mainly seen as a set of tools rather than a function and therefore is lacking a clear corporate strategy to extract the potential benefits from a program-driven GIS architecture.

It is the auditor opinion that:

- There is no central, Agency-wide alignment for the use of GIS content in the pursuit of the Agency's mandate; although locally GIS is addressing ad hoc field unit requirements.
- Governance elements are not rigorous enough to ensure efficient and effective achievement of GIS benefits. There is no GIS policy or directive in place and no executive sponsor for information content and business decisions. Planning and communication of GIS activities are fragmented across the Agency and ineffective at the Agency-wide level; and
- The financial system configuration does not permit tracking of GIS expenditures either by project or overall; and no evidence of monitoring and reporting to assess efficiency and economy of GIS resources.

7. OBSERVATIONS AND RECOMMENDATIONS

7.1. Support of the Agency's Mandate

YELLOW	Moderate Improvements Needed	Some controls are in place and functioning. However, important issues were noted and need to be addressed. These issues could impact on the achievement or not of program/operational objectives.
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In attempting to determine whether the corporate approach to the use of GIS tools effectively supports PCA's mandate, objectives and priorities, the audit examined if

Criteria # 1: *senior management has established a corporate vision and approach to the use of GIS in the pursuit of the Agency's mandate.*

Observation

GIS tools originated in, and continue to significantly support, PCA's Resource Conservation (Res Con) program activities. Many examples were cited, including the use of GIS for wildlife monitoring to provide location analysis of collared animals and species at risk; for monitoring glaciers in national parks via monitoring protocols; and for the collection and storage of available Landsat and Radarsat images used to assist in fire mapping.

A growing awareness of the potential for GIS has led to an increasing demand for GIS services in other areas besides Res Con. In response, primarily through the Resource Conservation Renewal Initiative, an approach has been adopted for GIS services to be more widely available so as to address requirements across multiple functional areas such as: realty, digital images and coordination of assets, maps and information for law enforcement officers, internet maps and on-line campground reservations for visitors. Interviews revealed that, field level geomatic efforts are deployed approximately:

- 50% in Res Con;
- 20% in External Relations & Visitor Experience; and
- 30% in other areas.

As part of the Agency's national position, PCA has developed some relationships with other government departments on the use of GIS. While it may seem *de rigueur* that current fiscal constraints demand such increased collaboration all around, PCA's GIS infrastructure and replication work may be fairly unique among its peers, potentially allowing the Agency to offer expertise to other government departments such as Natural Resources Canada, Aboriginal Affairs and Northern Development Canada, etc.

Locally, the smaller scope and scale of management priority setting combined with the utility of GIS allows it to be more easily incorporated and aligned with the operations. Depth and capability of GIS support in field units exist and is based on a tight,

collaborative organizational framework. Overall, the acceptance of GIS is reflected in the level of satisfaction for the work of GIS staff among peer and field management personnel. For instance the use of cartographic rather than traditional data products to meet needs of the First Nations Liaison mapping was seen as a local geomatics achievement. The general consensus among interviewees is that the tool would be missed if it became unavailable.

The PCA GIS community has expressed the need for a corporate strategic direction in the use of GIS in support to program activities. To that effect, the OCIO undertook with the collaboration of several field units, User Needs Analysis (UNAs) initiatives between 2004 and 2007 to study where GIS could provide demonstrable benefits and savings across the organization. A report, commissioned by the OCIO was published that included a cost benefits analysis and recommendations to field management teams for funding, and to the CIO for strategic direction. Recommendations addressed to the management teams were followed to varying degrees.

In 2010, the Officer of the Chief Information Officer (OCIO) articulated the need for a national GIS infrastructure to standardize GIS tools and to respond efficiently to the global needs of the Agency. The Agency's approved IMST Strategic Plan 2010-11 to 2014-15 calls for such an infrastructure investment which the CIO has committed to fund within his budget.

This has led the OCIO to undertake the initiative of defining seven key strategies, on which some work has been done on six of the seven items:

1. Coordinated GIS Planning at the National, Service Centre, and Field Levels.
2. Development of Corporate Geomatics Applications:
 - Applications for its realty, asset management, visitor experience, and ecological integrity clients.
3. Development of a GIS Infrastructure:
 - The development of a prototype GIS Infrastructure to replicates priority GIS data from data stewards in field units to consuming corporate applications.
4. Implementation of Geospatial Information Management Standards:
 - Common metadata and data models definition.
5. Provision of Tools, Training, and Best Practices:
 - Coordination of ESRI software licenses.
6. Increased Awareness by Managers of How Geomatics Contributes to Business Outcomes:
 - Publication of *Geomatics in Parks Canada*.
7. Development and Implementation of a Geomatics Accountability Framework.

Perhaps most importantly, the audit notes that although the OCIO is the sponsor for the IMIT infrastructure, there is no executive sponsor assigned to coordinate the GIS

information content for business decisions. However, it is clear that where GIS activities have been sponsored and supported at a senior management level, GIS projects have had success. PCA's execution of the National Geographic Guide project is one example where GIS effectively demonstrated the potential to support PCA's activities and mandate.

Conclusion

Despite an increase in the use of GIS, and a wide "grass roots" acceptance of the potential that GIS can provide, senior management has yet to confirm a clear vision for GIS services. At the moment, GIS capability is primarily seen as addressing FU requirements in a locally deployed service delivery model. This adversely affects the total benefit that is achievable for GIS. Consequently, GIS activities do support the Agency's mandate, but on an *ad hoc* basis.

Recommendation

1. The Chief Administrative Officer should, in the near term, develop a proposal for approval by EMC, on whether the Agency will adopt an Agency wide strategic direction to the management of GIS information.

Management response

Agree: The CAO will consult with stakeholders and will prepare and present to EMC an option analysis that describes the benefits, costs, and return on investment for an Agency-wide strategic direction for the management of GIS information in PCA.

Completion Date: September 2013.

7.2. Governance, Planning and Management Reporting

ORANGE	Significant Improvements Needed	Controls in place are weak. Several major issues were noted that could jeopardize the accomplishment of program / operational objectives. Immediate management actions need to be taken to address the control deficiencies noted.
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In determining whether the existing governance structure serves to support the efficient and effective use of GIS, the audit examined whether:

Criteria # 2: *a process is in place to plan, organize, direct and communicate the activities for the support of GIS implementation and use;*

Criteria # 3: *management has defined the roles and responsibilities of each major organizational component of the GIS operations structure, and applies sufficient resources to ensure services are appropriately supported; and*

Criteria # 4: *management has reliable information that supports decision-making and performance measurement.*

Observations

In assessing the relevant processes in place to plan, organize, communicate GIS activities, the audit found that essential pieces of a strong governance framework are missing.

Governance, Planning and Communication Processes:

The audit found no policy or directive governing GIS that would operationalize what is expected and provide guidance to the GIS community. Within the OCIO, plans are in place to support a national GIS infrastructure (hardware, software) and national projects requirements. However, there is no executive sponsor assigned to coordinate GIS information content and business decisions.

In field units GIS work is mainly done on a priority response basis, with few formal work plans and priorities for the year. Some field units generate an annual “wish-list” of GIS related activity, yet on a daily basis, the GIS specialists respond to the immediacies of operational management: fire and vegetation mapping, visitor and campground information maps, communications responses, etc.

Communication between field units is scarce and most GIS specialists and GIS users acknowledge not knowing what other field units’ specialists are doing or the status of national projects.

Organization of Roles and Responsibilities:

Across the Agency the organization of roles and responsibilities lies between: a National GIS Coordinator in the OCIO, GIS specialists & technicians, GIS users (scientists, fire crew, etc) and managers.

The role of the GIS Coordinator in the OCIO, is to manage GIS standards and a GIS infrastructure (network, licencing, database); whereas Geomatics Technicians and GIS Specialists roles are to orchestrate, develop and support GIS users. Formal job descriptions exist for these positions under the following HR classifications: Geomatics Coordinator (EG-05), Geomatics Technicians (EG-04) and Ecosystem Geomatics Specialist (PC-01/03).

There is no reporting relationship between the OCIO's National GIS Coordinator and the GIS specialists in field units. Consequently there is no horizontal planning and prioritization between these two levels with the exception of a few national initiatives (e.g.: the National Geographic Guide project where collaboration was required to assemble many dataset collections across national parks).

GIS users make use of GIS tools and derived products to mainly collect, analyse and processed data. Outputs are used in research, to report on key information to management and to the general public.

Performance Reporting

The audit was expecting to find some form of GIS activity reporting in the field units and at the Agency level, at minimum, a list of GIS project / accomplishments and resources used.

Most field visits and interviews revealed that there is no standardized reporting of GIS activities; no breakdown of time and resources spent. However, managers and users interviewed were generally satisfied with the GIS tools, outputs and the support provided by specialists. The majority of those interviewed had the impression that GIS investments have produced effective results and a perception of good value.

Conclusion

The current decentralized GIS structure has facilitated the growth in diversity of geomatic directions, products and processes. However, governance controls are not rigorous enough to ensure efficient and effective achievement of GIS benefits. Planning and communication for GIS are fragmented across the Agency and ineffective at the Agency-wide level.

GIS is seen as a tool set that requires specific skills to deliver specific products. It is not a function within PCA, so does not have the governance structure normally afforded to a function (planning, controlling, and reporting). The impact is that the organization's ability to measure and monitor GIS activities is almost inexistent.

This area of assessment is crucial to the other areas of the audit scope as strong governance will impact management practices and how GIS supports the Agency's mandate.

Recommendation

2. It is recommended that the Chief Administrative Officer ensures that a corporate management framework for GIS (governance, roles and responsibilities, communication, control and monitoring) is put in place and a senior manager be assigned responsibility and accountability to support programs in achieving the Agency's mandate if the Agency is to develop a strategic direction and approach to the management of GIS.

Management response

Agree: Pending the outcome of Recommendation 1, the CAO will take the lead to consult with Executive Management and relevant stakeholders for the purpose of defining a corporate management structure for GIS that will require EMC approval in order to finalize. As part of that recommendation, EMC will be asked to assign responsibility and accountability to a senior manager for the purpose of supporting programs integral to the achievement of the Agency's mandate.

Completion Date: March 2014

7.3. Management Practices

ORANGE	Significant Improvements Needed	Controls in place are weak. Several major issues were noted that could jeopardize the accomplishment of program/operational objectives. Immediate management actions need to be taken to address the control deficiencies noted.
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An essential objective of this performance audit was to assess the adequacy of management practices and tools in place to manage costs and resources. The audit examined whether:

***Criteria # 5:** Management has defined a standard approach to operational control for GIS that includes overall costs, human resources and technology management.*

Observations

In assessing the management practices and tools in place to manage resources, the audit found there is no monitoring in place to measure the efficiency and economy of GIS activity.

Cost Management

The audit was looking to assess if GIS costs are known, tracked and managed over time.

Estimates provided by the OCIO establish the annual cost of GIS at \$8M⁵ which includes salaries, goods and services. In addition, a \$1M investment over the next three years is required for a new national GIS infrastructure (hardware, software and services). The investment was identified in the Agency's IMST Strategic Plan to support a national data repository. The CIO has committed to fund the new GIS infrastructure within his own budget.

The 2012 PCA's Deficit Reduction Action Plan and the repatriation of some IT services at Shared Services Canada may impact availability of funds and following the outcome of these actions, GIS plans will need to be reconfirmed by the OCIO.

The audit was unable to verify the reasonableness of GIS costs for both goods & services and salary expenditures for part-time GIS users, neither at the national level nor at the local level. There is no financial measure (such as an internal order) being used to track GIS-specific expenditures in the Agency's financial system and no internal cost recovery (i.e. service charge) for service centres providing GIS support within the field units.

Human Resource Management

The audit assessed if human resources levels and training were adequate to respond efficiently and with economy to GIS requirements.

⁵ \$8M is based on OCIO July 2011 estimates of: \$6.9M in GIS people's salaries (full-time 72 FTEs, plus a percentage of the part-time GIS users 150 FTEs x 0.10) and \$1.1M in Goods & Services.

At the time of this report, 58 Geomatics specialists or technicians positions located across 36 different locations were enumerated in a listing provided by Human Resources. Geomatics users are estimated at 150 + by the OCIO. Units that do not have GIS resources were supported by their service center.

Within the OCIO, the National GIS Coordinator; and the Geospatial Servers and Application Specialist, two key positions, coordinate and support GIS national developments and PCA's Geomatics infrastructure. ESRI products support is provided by Geomatic consultants on a contract basis.

In the field units, GIS specialists and technicians are still primarily resident within Resource Conservation at the exception of the Mountain Parks, where the resources are within Integrated Lands Uses Policy and Planning (ILUPP). Typically, there is usually one GIS specialist by site (e.g. Banff National Park) who has to respond to a series of requests from multiple GIS technicians and users. We were told by most GIS specialists that the requests and level of effort required was constant (full-time) but usually no backlog or overtime required for managing weekly workload.

In many sites visits the audit found that reporting on GIS activities is inexistent, no inventory of projects and level of efforts are kept. GIS activities are often cited as ad hoc, changeable and reactionary as nothing stays static at the operational level because of the nature of parks operations (fires, emergency response, wildlife control, etc).

GIS training varies across field units and is provided to specialists and staff in an inconsistent and ad hoc manner. We were told that retirements and accelerated attrition are affecting the availability of GIS expertise in some field units. No evidence of effort to manage this transition was found.

Infrastructure Management

The OCIO has orchestrated a series of key GIS strategies, as described in Section 7.1, which include the standardization of GIS Software tools to ESRI products. The responses from the field units were positive and most staff felt that the ESRI GIS software product was very efficient. The software is now used across the entire Agency.

Centralization at the OCIO of software licence acquisition has produced savings. The strategy used was to manage the optimum number of concurrent access by users across the Agency and reduce the number of individual license required.

Plans and pilot projects were conducted by the OCIO to establish requirements for an infrastructure to support a common data repository for national reporting and to ensure the safeguard of GIS data collections residing currently on many local servers;

Efficiency and Economy

Efficiency is defined as the relationship between inputs and output and economy the relationship between inputs and results.

In this case inputs are the salary and G&S costs to create and maintain GIS systems and collect and input data. The output is a set of geographic images and data in a system. The result is: better understanding of elements; and better decisions and interventions based on the information available.

The audit could not assess either because it could not identify the inputs and link them to outputs (i.e., lists of projects/activities or accomplishments during a given period) or results (impacts of the projects, activities).

Conclusion

The audit found many examples where GIS investments have produced effective results and a perception of good value at the local level. However, the current financial system configuration does not permit tracking of GIS expenditures by project or overall; and there is no evidence of monitoring in place to measure the efficiency of resources used to achieve these results. Therefore the audit was unable to measure the efficiency of GIS resource management.

Recommendation

3. it is recommended that the Chief Administrator Officer ensures that measures are put in place to allow performance monitoring of GIS activities and resources.

Management response

Agree: Pending the outcome of Recommendation 1, the CAO will lead the development a performance monitoring framework for GIS activities and resources and present it to EMC for approval.

Completion Date: September 2014

APPENDIX A: GLOSSARY

- GIS:** A **geographic information system (GIS)**, **geographical information system**, or **geospatial information system** is any system that captures, stores, analyzes, manages, and presents data that are linked to location(s). In the simplest terms, GIS is the merging of cartography, statistical analysis, and database technology. (Reference: http://en.wikipedia.org/wiki/Geographic_information_system)
- GIS Tools:** GIS tools refers to the hardware (e.g. plotters, GPS units, etc) and program/ applications/ systems software (3rd party software, PCA developed software, browser-enabled applications, standard operating system, etc) that support Parks personnel in the discharge of their duties.
- GIS Specialist:** A GIS Specialist is the individual providing specialized analysis and support to business areas (clients), either through National Office, Service Centres or Field Units, regardless of classification.
- GIS Technician:** GIS/Geomatics Technician is the individual working in a subordinate role to the GIS Specialist, directly or indirectly, primarily involved in technical support (printing, key-input, etc) to users (clients).
- GIS User:** A GIS user (including GIS super-user) is an individual working in an operational or program context that uses GIS output, GIS tools and GIS functional resources to increase the efficiency, economy or effectiveness of their program activity. In other words, it is a person who applies Geomatics outputs to the PCA mandate, and as a result, generates benefit for PCA. While a GIS user/ super-user may have vast technical or specialized GIS skills, the GIS user is considered the “client” of GIS services.
- Geomatics:** Geomatics is the science and technology of gathering, analyzing, interpreting, distributing and using geographic information.

Geomatics encompasses a broad range of disciplines that can be brought together to create a detailed but understandable picture of the physical world and our place in it.

These disciplines include Geographic Information Systems (GIS), Global Positioning Systems (GPS), Cartography, Remote Sensing, and Surveying.