Belize National Spatial Data Infrastructure

Supporting Sustainable and Resilient National Development

Strategic Plan

Draft V3

26th January 2018

GPC Group
A Global Network of Information Professionals

Belize National Spatial Data Infrastructure

Strategic Plan

DRAFT
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Prepared for

Government of Belize

Prepared by

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FORWARD

- An ambulance dispatcher trying to establish the location of a distraught caller
- A utility manager deciding where to optimize investment in system upgrades
- A police detective analyzing crime patterns
- A business owner choosing where to best locate a branch office to reach the most customers
- A visitor to Belize planning a well-deserved and relaxing vacation
- Regional planners identifying climate change risks and formulating contingency plans for responding to potential future catastrophes in order to save lives and protect property and the environment
- A courier staff attempting to find the location to deliver a package
- Planners, community leaders, and decision makers making projections into the future and deciding on where and how Belize's cities, towns and villages should develop in a rational and sustainable manner.

What do these scenarios all have in common? They all involve information and decisions about location. It has been said that over 85% of the most critical government decisions involve location-based, or geographic information in some way, and the same can be said about many other parts of our society. Geography is where we live, work, play and learn, and geographically based information gives us the means to better understand the world around us, plan effectively and comprehensively, make informed decisions, and carry out the results of those decisions in a coordinated and efficient way.

Geographic Information System (GIS) technology today provides a powerful variety of computerized tools to collect, manage, share, explore, analyze and visualize geographic data. Modern GIS is much more than computerized mapping - it provides an ***information infrastructure*** for bringing all manner of data together geographically to support integrated and multi-sector decision-making at many levels. In Belize, many government entities have invested significantly in GIS technology and databases to meet their own needs and in 2012 the Cabinet adopted a policy to initiate the development of the Belize Spatial Data Infrastructure (BNSDI). We are now in an excellent position to leverage our existing investment and build on the existing policy to develop and implement the detailed framework of policies, partnerships, standards, data, procedures, technology and institutional capabilities that are needed to formally institutionalize and operationalize more effective sharing and utilization of geospatial information in the country.

This Strategic Plan provides a high-level summary of the vision and guiding principles around which the BNSDI is being developed, the priorities and strategies that are driving initial implementation efforts and future plans, and the immediate activities that are underway to build the foundations for this initiative. This Strategic Plan is to be augmented with more detailed Programme Design and Implementation Plan documents that address the specific

form and function of each component of the BNSDI, including the NSDI Unit the unit responsible for the coordination, facilitation and support of the initiative. It also addresses the various roles and responsibilities of the key stakeholders and provides a detailed work programme for carrying out the specific provisions of the initiative over the next 3 years.

Looking ahead, we will continue to build on the excellent work being carried out by the government entities in Belize, and in expanding the BNSDI community over time to eventually include all segments of society in this important initiative. We can only accomplish this with the cooperation and assistance of our network of partners. Together we can ensure that the BNSDI is a success that will be an exemplary showcase in Belize, the Caribbean Region, and internationally.

(signed)

Signed by Chair of Executive Committee ??

EXECUTIVE SUMMARY

The Belize National Spatial Data Infrastructure (NSDI) Policy was approved at a meeting of the Government of Belize Cabinet held 21st August, 2012. This was one important milestone among several steps that have been moving the country in the direction of a fully developed NSDI programme. The most current of these activities is the present consultancy being undertaken within the Belize Climate Resilient Infrastructure Project (CRIP).

The objective of the current effort is to assist the Government of Belize (GoB) to review existing BNSDI policy and provide a roadmap for successful and sustainable implementation and governance of BNSDI with respect to investment programmes identified under the Climate Resilient Infrastructure Project (CRIP). The BNSDI is to provide an enabling environment for the CRIP Project Preparation Facility, providing critical information infrastructure to support more effective formulation, design, development, monitoring and evaluation of targeted retrofitting, rehabilitation and reconstruction activities that are needed to strengthen the resilience of critical infrastructure to natural hazards and the anticipated impacts of climate variability. Beyond the immediate CRIP programme requirements the study is also addressing a broader range of development concerns across all major sectors in Belize.

The BNSDI Strategic Plan outlines the vision, defining principles and priorities for the initiative. It is one of three seminal documents that will together define the final form and function of the BNSDI. The other two documents are a Programme Design and an Implementation Plan. As described in this Strategic Plan, the BNSDI is to comprise a network of interoperable, entity nodes, and the standards, policies and procedures that together provide the enabling environment to support the coordinated development and sharing of commonly needed geographic information across the Belize stakeholder community. This programme will be promoted, facilitated, coordinated and supported by a BNSDI Coordination Team.

The initiative is based on a range of international sound practices and standards for all aspects of SDI that have been adapted to meet the special situation and needs of Belize. Major intended outcomes of the BNSDI programme include:

> ***Establish an Operational NSDI Coodination Unit***. Ensure the promotion, facilitation, coordination and support of the BNSDI through the NSDI Unit, including the management of a central node facility and provision of selected spatial analysis and decision support to executive leaders and others. The NSDI Unit will be directed by executive and technical oversight bodies, and will collaborate with topically focused, entity-driven working groups that will be formed as needed to address specific issues.

Establish data coordination and sharing arrangements among all the key entities. Ensure that all the technical, legal and administrative procedures are in place and carried out for sharing fundamental data among the stakeholder community.

Strengthen the BNSDI data clearinghouse, geospatial portals and website. Build, operate and maintain a central facility that will facilitate the data sharing network and various geospatial enabling services. For those entities that have the necessary capacity

Promote and adopt standards. Identify and adapt the appropriate data, technology and procedural standards that are needed to ensure interoperability across the stakeholder community.

Enhance policy, legal and administrative frameworks. In alignment with the e-Government and other related programmes, ensure that the legal and administrative measures are in place to support a modern knowledge economy.

Institutionalize the BNSDI as a permanent function of Belize government. Ensure that the mechanisms are in place to sustain and grow the BNSDI initiative into the future.

Essential to achieving the outputs listed above is the close cooperation between the stakeholder entities that are the true building blocks of this initiative. It is recognized that the BNSDI can only succeed through true partnership with the members of this community and that the programme will only be sustainable if it meets the needs of the individual entities, in addition to the community's collective needs and ultimately those of broader Belize society. It is important therefore that entity representatives participate directly in each step of BNSDI development and that their needs, opinions and suggestions provide the substantive input around which the final form and function of the BNSDI are shaped.

1.0 INTRODUCTION

1.1 Background

This BNSDI Requirements Analysis report provides a synthesis of requirements that need to be met by the Belize National Spatial Data Infrastructure (BNSDI) programme. This report is one component of a structured work programme for the planning, design, and implementation of the BNSDI. The position of this report relative to the entire work programme is illustrated in the Figure below.

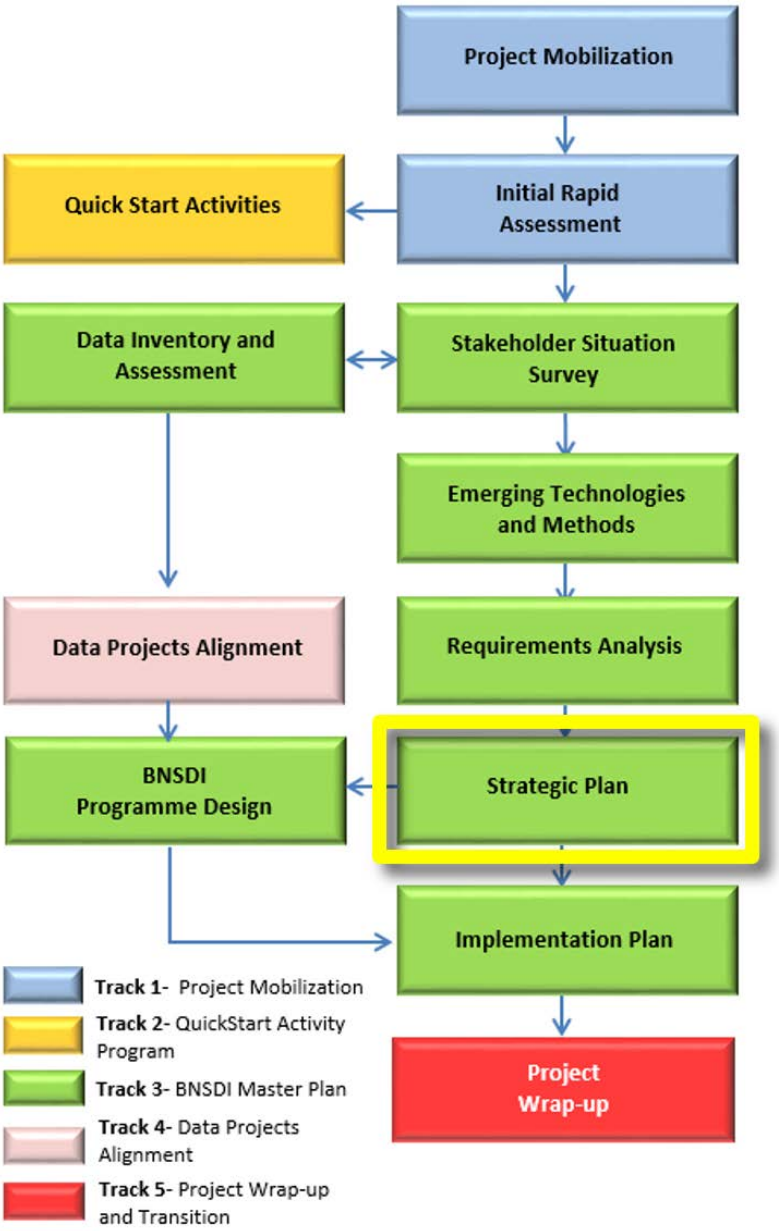

Figure 1 – Work Programme Illustration

The synthesis of requirements outlined in this report draws upon three contributing activities, including:

BNSDI Stakeholder Situation Update Survey. The BNSDI Stakeholder Survey involved over 60 units of government and other sectors and identified over 370 major functional areas that are or could benefit from GIS and the BNSDI. The study also outlined over 1700 specific applications of GIS and the BNSDI that would directly benefit and streamline those functional areas identified, as well as other information and findings.

Data Inventory and Assessment. The Data Inventory and Assessment provides a listing of the over geospatial data resources that were identified in the conduct of the BNSDI Stakeholder Situation Update Survey activity. This document provides a summary of the information available for over 35 data themes that are further broken down into over 140 specific geospatial data topics and then grouped to nearly 100 fundamental geospatial datasets that are needed in common among the BNSDI stakeholder community.

Emerging Technologies and Methods. This report outlines a wide range of emerging technologies and methods that have implications for the form and function of the BNSDI in the future. This report outlines a broad range of technologies, applications and enabling policies and methods, from new advanced space platforms for remote sensing, to unmanned aerial vehicle (UAV) survey techniques, to the many uses of social media and crowd sourcing, to the policies and incentives needed to catalyze innovations within the country, among many other areas. The results of that analysis have been incorporated to this report where appropriate.

BNSDI Strategic Issues and Scenarios Executive Briefing. An executive briefing was developed covering the purpose for the Strategic Plan, vision, mission, goals and objectives, the principles involved, key drivers, alternative governance approaches and alternative implementation approaches. This was presented to the BNSDI Executive Committee for review and comment. This Strategic Plan reflects the input and direction received from the Executive Committee.

1.2 Purpose of this document

This Strategic Plan provides a high-level summary of the vision and guiding principles around which the BNSDI is being developed, the priorities that are driving initial implementation efforts and future plans, and the approach that will be adopted for strengthening the programmeprogrammeme through the next stage of development. Once accepted, this document will provide the basic foundation understanding and “compass direction” for the development of the more detailed Programmeme Design and Implementation Plan documents.

1.3 Organization of this document

In researching this subject, it became clear that the incorporation of e-Merging technology within the context of the BNSDI would require consideration and alignment of several important factors. These factors have been used to structure the main content of this report as indicated below. This document has been organized accordingly, as follows:

Section 1 - Introduction. Provides the background, context and purpose for the current report.

Section 2 – Strategic Framework. This section outlines the vision, mission, objectives, opportunities and challenges that the BNSDI will need to address.

Section 3 – Strategic Goals and Objectives. This section outlines the series of major goals and objectives within these to be achieved.

Section 4 – Strategies and Work Plans. This section outlines the strategic positioning of the BNSDI and the approach to be taken for the incremental development of this initiative as a natural progression of interrelated activities..

The current document should be considered a “discussion draft” that will undergo further refinement with the help and advice of the BNSDI stakeholder community, through workshops and provision of further review and comments in regards to the information presented in this document.

2.0 STRATEGIC FRAMEWORK

Better information is needed to support more integrated, coordinated, and effective decision-making and operations across government, which in turn are key to better governance, climate-smart sustainable development planning and investment decision-making. Adding the geographic dimension to this equation will allow Belize to take advantage of location-based information and services and link communities together.

2.1 Vision, Mission, and Objectives

VISION STATEMENT

Belize government and society empowered with convenient, high quality and up-to-date geographic information and spatially enabled e-Government services.

MISSION

The mission of the BNSDI initiative is to promote, facilitate, coordinate and support the development of a dynamic, entrepreneurial and flexible geospatial enabling environment.

OBJECTIVES

The BNSDI should:

- provide for online access to a wide range of geographic information and services;
- enable integration of distributed geospatial and attribute information;
- support collaboration through multilateral information exchange and synchronization
- allow autonomous organizations to develop interdependent relationships in a distributed environment;
- maintain service orientation to the community of BNSDI stakeholders and the public
- actively connect data producers and users, especially in the areas of land, resource and community planning, and development investment;
- promote and support the adoption of policies and regulations that are needed for the BNSDI to operate effectively;
- facilitate and support the adoption of standards in key areas to ensure that government systems and databases are compatible and interoperable;
- promote, support and reward data coordination and sharing;
- promote government transparency and public rights to information access
- ensure financial equity between who pays and who benefits from GIS data and services;
- catalyze more coordinated and effective planning and operations within and among Belize's government entities, as well as all other segments of society;

- increase the value of e-Government services through spatial enabling;
- encourage and support private sector to use data to create new and diversified business opportunities and jobs, especially in the knowledge economy;
- promote public/private partnerships where substantial public benefit or cost recovery can be gained without adversely impacting other public uses;
- encourage and support research and educational institutions to leverage infrastructure to explore new ideas, concepts, and innovations and promote spatial awareness, thinking and problem solving;
- encourage and support non-profit organizations and other segments of civil society in using geographic information to build and promote communities of interest and support public benefits and social equity;
- safeguard intellectual property rights of data and application service owners;
- respect and protect information privacy, security and confidentiality;
- support organizations in the development of their internal technical capacity to be responsible contributors and users of the BNSDI;
- monitor BNSDI performance, and work with the stakeholder community to make as-needed adjustments;
- provide executive leadership in the country with decision support information access, analysis and visualization services;
- Promote innovation by laying the foundations for the integration of new technologies and practices into a common framework.

2.2 Guiding Principles

The development of BNSDI shall be based on the following key principles:

- Transform government into citizen-centric service oriented provider
- Safeguard privacy, security, and intellectual property
- Support coordinated and effective planning and operations
- Promote transparency
- Encourage and support private sector to use data to create new economic opportunities and jobs, especially in the knowledge economy
- Encourage and support research and educational institutions to explore new ideas, concepts and innovations and promote spatial awareness, problem solving, collaborative approaches, and information exchange
- Encourage and support civil society to build and promote communities of interest.

2.3 Building On Strengths and Opportunities

It is important that the BNSDI build on the extensive work already carried out by key entities, and other existing strengths and opportunities within and among the entities and the government at large, while also seeking to overcome or mitigate any obstacles or deficiencies. The following are identified as key strengths and opportunities that need to be supported and optimized by the BNSDI initiative:

Executive awareness and support. Executive leadership in Belize is aware of GIS technology in general and the theoretical potential of the BNSDI. There is an unprecedented level of support in principle for the initiative, but conversely there is a need to show practical and compelling results directly related to key national development priorities in order to sustain this support.

Scope of existing data and GIS capabilities of the key entities. There is a reasonable amount of existing data and at least rudimentary GIS capability within most of the participating entities. While these are not integrated or standardized, this nevertheless is a good starting point for building towards a more unified framework in the future. It will be critical that all the data custodian entities maintain their data at a level of accuracy and timeliness that is agreed with the rest of the BNSDI community. Ideally, such updating will be integrated to the day-to-day business transactions of each entity wherever appropriate.

CITO and SIB programme mandates. The CITO and SIB mandates and programmemes cover a broad spectrum of issues, projects and programmemes, many of which are complementary to and supportive of the BNSDI programmeme objectives. The BNSDI is logically one building block of a larger societal information infrastructure in Belize. While there are some issues that are particular to the geoprocessing field, most of the necessary framework of information and communications technology components, information-related policies, laws and regulations, and agreements for data sharing, and other associated issues are shared in common with other elements under the e-Government and national statistics umbrellas. There should continue to be close coordination, alignment and collaboration between the BNSDI, CITO and the SIB towards a coordinated societal information infrastructure in the country.

Practical alignment of major ongoing data projects. There are several significant ongoing or planned data projects that will substantially benefit the BNSDI programmeprogrammeme, such as the capture of building points and polygons for the country being carried out by several organizations, 2020 population census, satellite imagery acquisition and others. These and other programmeprogrammemes are being developed around international standards and sound practices. Practical alignment of such activities will provide significant contribution to the efficiency, cost-effectiveness and future standardization and integration of GIS data in Belize by applying proven models that are then adapted to local needs.

General awareness of SDI and previous efforts. Most of the key stakeholders in Belize are very aware of the principles and practice of SDI, and the reasons and benefits for undertaking such an initiative. The past studies, seminars and meetings that have been held have been very instrumental in establishing the current level of awareness and initiating dialog regarding what form an SDI might take in Belize.

Policy and structural directions of the Belize government. In recent years the leadership of Belize has set new policy directions which favor modernization and progressive moves towards economic diversification, strategic planning, performance management, and an

entrepreneurial and transparent approach to governance. These and the ongoing rationalization and streamlining of government structure are all conducive to ICT in general, and the role of GIS and BNSDI in this specifically.

Technological advancements and spatial enabling. Global Positioning System (GPS) and other spatial enabling technologies are now opening up whole new frontiers for location based products and services. The position-enabling of field devices from portable laptops, PDA's, cell phones and other means is becoming commonplace, and this is being incorporated into everyday functions from car navigation to field utility maintenance. These advances in technology and their range of applications are set to increase dramatically in coming years. Data creation and consumption are becoming more economical and decentralized making a standards-driven approach even more imperative.

2.4 Overcoming Challenges

Despite the very significant strengths mentioned above, there are still several challenges that must be overcome for the BNSDI to be entirely effective and successful in achieving the stated vision and mission of the programme. These will need to be addressed throughout the programme and steps taken to overcome these issues to the extent possible as the BNSDI evolves.

Increase Awareness and Appreciation of the country's Existing Geospatial Resources. Many of the key participating entities have made significant investments and progress in implementing GIS technology within their own organizations and the CITO has negotiated an enterprise license agreement (ELA) that provides access to GIS software across government. While there is some recognition of this generally, the full extent of the data resources that have been developed and the remarkable potential breadth and power of this and other information when brought together in an integrated BNSDI environment is not yet fully appreciated. Since these existing geospatial data resources have been developed separately with little or no coordination or use of common standards, there are bound to be inconsistencies and integration challenges that will need to be overcome. This does not in any way lessen the value of the efforts that have been undertaken by the individual entities, but rather highlights the need for central coordination and support that can add practical integration and synergy to these efforts. It is certain that once the country's leaders, decision makers, and managers see the cumulative breadth and value of geospatial information and the power of being able to use that information together in an integrated environment, that the resulting level of support and cooperation will be more than enough to allow the community of stakeholders to solve these problems. This is an especially timely issue given the physical and economic development activities that are underway in Belize, the need for climate-smart sustainable development and investment and the level of cross-entity collaboration and information sharing that is critically needed to plan and carry out this development in a coordinated and sustainable manner.

Provide leadership towards an information sharing culture. There have been no comprehensive or sustained programmes in Belize for coordinating or sharing information among entities. In some cases there is still difficulty in sharing information among units within the same entity, much less with other organizations and the public. The reasons for this are varied including perceived lack of control on how data might be interpreted or used, claims of confidentiality, fear that the quality or accuracy of the data may be questioned or criticized, concern that others may take credit for work done by another or will be used for commercial purposes, and other issues. There is a need to dispel fears and build awareness and confidence, and it is likely that this sort of mindset and cultural change among individuals and organizations will take some time and positive experiences for this to happen. This can only be accomplished with strong and persistent leadership attention.

Compile information about the availability and quality of existing spatial data. Most organizations have not adequately documented their data, and have not required their contractors to do so. As a result the compilation methods used and other information that would give some indication of the data quality and accuracy is missing and must be interpreted or further researched to understand the legacy and qualities of the information. A complete inventory and assessment of existing commonly needed information is needed across government to better understand the existing information assets, and to use this knowledge as the basis for laying the groundwork for filling data gaps and ensuring sustainability of ongoing data maintenance and sharing.

Clarify data ownership and custodianship information. In some cases, contractors have by default maintained ownership of information that was developed on behalf of a government project. The receiving entity may also not have the internal capability to maintain that information, and without proper maintenance the value of the information will diminish with time. There is a need to both clarify data ownership while also ensuring that responsible entities have the capacity to effectively manage such projects and assume permanent custodianship once they are complete.

Introduce standards in the existing spatial data. In the past, much of the geospatial data developed did not comply with any existing NSDI standards. It will therefore be necessary to increase awareness about the importance and use of standards as a general principle across the BNSDI stakeholder community, both in new data acquisition projects and during data updates when appropriate.

Strengthen the legal and institutional basis and enabling environment for effective information infrastructure. In addition to the lack of a well-articulated legal framework for data security, privacy, confidentiality and intellectual property, there is also minimal basis for establishing government transparency and the public's right to government information access. These are known to be prerequisites of a healthy knowledge economy, but will need to be crafted carefully to stay in alignment with local political and administrative realities.

Provide government orientation to profit-generating enterprise. Current government policy favors outsourcing and privatization of selected government functions. There is likewise a push for government entities to become more proactive and entrepreneurial as profit centers. SDI around the world is typically more focused on government efficiencies, cost avoidance, and public common benefit rather than direct commercial profitability, as outlined in the financial considerations described later. This will need to be fully vetted with decision makers and in subsequent alignment of policies, regulations and practices that will need to reflect decisions in this regard.

Leverage and Build On the e-Government Programme Framework. In some cases there are foundational issues that have not yet been addressed by the e-Government programme that are prerequisites for BNSDI, such as the legal and regulatory framework including a national data policy covering all data, information and media including geospatial data.

3.0 STRATEGIC GOALS AND OBJECTIVES

The overall goal of the BNSDI initiative is to accomplish the stated Mission by establishing an effective framework and enabling environment for the coordinated and effective development, sharing and use of geospatial information. Furthermore, geospatial technology is to be used to further enhance the provision of e-Government services through spatial enabling, and further the effective utilization of GIS technology across the stakeholder community by making a broad range of data more accessible and usable.

3.1 Goal 1 – Establish the BNSDI Foundation Elements

There are several foundational elements that are needed to establish the beginnings of an operational BNSDI. These provide the physical elements that will in part support many of the other goals.

Objective: Establish a dedicated, permanent function to promote, facilitate, coordinate and support BNSDI development

International experience shows that the development of a sustainable BNSDI initiative requires a dedicated team with the explicit mandate, full time and adequate resources needed to promote the concept with decision makers and entity management, and to promote, facilitate, coordinate and support development of all the different parts that need to come together. The key notion here is that the primary mission of this team is to "promote, facilitate, coordinate and support", the stakeholder community. The greatest investment in GIS technology and data development will be at the level of the individual organizations that need these tools and data for carrying out their work. The BNSDI seeks to leverage and align data development and application efforts to eliminate duplication and increase effective utilization of these important information resources for better policy, decision making and investments;

This team will need to comprise specialists with specific knowledge and experience with GIS federations and SDI. Its activities and priorities must be overseen by executive representation, and it must be responsive to the specific and collective needs of all the participating entities

In the future, the BNSDI coordination unit (NSDI Unit) will continue to be integrated within the ministry responsible for managing spatial data on behalf of the Government of Belize, and as a permanent function within central government. This NSDI Unit will be responsible for carrying out the functional responsibilities for supporting the BNSDI and this will work according to the priorities and direction of the BNSDI Executive Committee. The work of the NSDI Unit will also respond to issues raised by the Technical Committee, which comprises representatives from all the key participating entities.

Objective: Establish a spatial data clearinghouse

There is a need to establish a central data clearinghouse that will maintain a repository and archive of current and historic data from each of the contributing entities. This repository will protect the government's investment by providing an off-site, redundant storage of critical information. It can also be used as the basis for providing mapping services over the geospatial portal, to support decision support analysis on behalf of the Executive Committee and others, and for spatially enabling selected e-Government services, until such time that entities develop their own BNSDI node facilities that will allow for distributed access to this information. This clearinghouse will also serve as a test bed for data schema integration, the mechanics of data calls and collection, data storage and visualization best practices, and inter-entity responsiveness to requests for cooperation.

Objective: Develop and maintain an BNSDI website

An BNSDI website within the e-Government web presence can provide information about the programme, highlight the excellent GIS and SDI-related work being carried out by the participating entities, and provide access to other information, relevant events, and learning resources. The website will need to be continuously updated with new information over time.

Objective: Develop and maintain a geospatial portal

A geospatial portal can be used to provide authorized stakeholders with access to BNSDI GIS resources through the website. This facility will need to provide a central metadata catalog where a user can search for information that they need. The catalog will also allow a user to search by various criteria, and/or by a location on the map. Once the user finds the information they are interested in, they should then be able to use the geospatial portal's map exploration tools for accessing, viewing and browsing the available information. Authentication and authorization to utilize geospatial portal resources will need to be structured according to levels of security that have been agreed with the executive oversight body and the entities.

Objective: Spatially enable e-government services

Many e-Government services can benefit from place-based information and spatial analysis tools. GIS technology will be used to provide a geoprocessing engine and access to data that can be used to add value to various e-Government services. This is expected to include both spatial enabling that is introduced by the custodians of services, as well as general purpose spatial application services that may be accessible through the NSDI Unit Portal.

Objective: Implement BNSDI facility and computing infrastructure

A limited facility equipped with a basic set of GIS hardware and software technology and appropriate staffing is needed for the NSDI Unit. This facility would process data coming to the data clearinghouse and support limited data integration and as-needed spatial analysis and decision support functions on behalf of the Executive Committee, Cabinet and others.

3.2 Goal 2 – Promote Standards and Interoperability

Standards are critical to ensuring compatibility and interoperability among the BNSDI stakeholder systems and databases. A variety of different standards are required to ensure that commonly needed data contains the information that everyone needs, are structured in an appropriate form, are cataloged according to the same standard, are updated and disseminated according to agreed procedures, and that stakeholder systems utilize open-system standards to ensure that they can talk to one another. Some of the more prevalent classes of geoprocessing related standards that are needed for the BNSDI include the following:

Objective: Establish Fundamental Data Standards and Procedures

Certain basic geospatial data themes are needed in common by a majority of stakeholders. These fundamental geospatial data sets (FGDS) often include cadastral information, orthoimagery, elevation data, transportation, hydrography, governmental administrative units, land cover/land use, demographics, soils, land ownership plots, utility networks, and other themes at various scales and levels of resolution as needed to support stakeholder applications. Identification of specific FGDS and subsequent development or refinement of standards for data content and format, as well as procedures for updating for each FGDS data theme, are being confirmed or refined through BNSDI Working Groups that are focusing on this issue.

Data custodians catalog their geographic information (including FGDS) in a standard manner as geospatial metadata and describe its data content, organization and quality. This metadata information is accessible to experts and non-experts alike. International geospatial metadata standards are in common usage in other SDI initiatives around the world, and these are being adapted to fit the needs in Belize.

There are a variety of common procedures that need to be agreed upon and codified into standard operating procedures. These include identifying new fundamental data sets, defining data format and content standards, establishing data custodianship, determining security classification level of each theme/attribute combination, conducting data updating and publishing of these updates for common access, and determining data access rights. These process standards will need to be developed, and once established, monitored to ensure that all partners are complying with agreed procedures over time.

Objective: Enhance Technology Standards

Additional technology standards that are specific to the geoprocessing field will be added as needed.

3.3 Goal 3 – Enhance Policy, Legal and Administrative Frameworks

It is widely recognized that the existing policy, legal and administrative measures in place in Belize today are not sufficient to promote an effective information society. It is necessary to

enhance the policy, legal and administrative frameworks for more effective geospatial data coordination and sharing. Specific areas requiring special attention include:

Objective: Enhance the Governance Framework

The establishment of the NSDI Unit and the Executive and Technical oversight bodies as permanent functions central government will require the institutionalization of these as legal entities under specific administrative assignment. It is expected, given the overlap and alignment of common issues and requirements that the NSDI Unit will remain integrated with the permanent body that will be responsible for managing spatial data for the Government of Belize. It is recognized also that to establish and sustain the BNSDI as an indispensable infrastructure relied on by the community, the stakeholder entities must have substantive input into the form, function and priorities of the BNSDI and therefore must be given sufficient powers to ensure that entity needs are adequately represented in how the BNSDI is developed.

Objective: Enhance the Legal and Regulatory Framework

In addition to legal matters associated with the above-mentioned Governance Framework, there is a need to strengthen and extend existing laws and regulations related to copyright and intellectual property, privacy, security, confidentiality, data ownership and public information access rights. This framework will seek to establish open information access and exchange in Belize on par with other developed countries in the world, to further reinforce government transparency and public information access rights, while respecting security and privacy concerns. It will also aim to strengthen the intellectual property rights that are an essential component of a knowledge economy in today's globalized world.

Objective: Adopt an Operating Model

The NSDI Unit is to adopt a specific operating model that will reinforce its purpose to promote, facilitate, coordinate and support the BNSDI community. This operating model and the effectiveness of the NSDI Unit will be assessed by the oversight committees on a periodic basis, as part of a comprehensive performance monitoring and adaptive management approach. The primary functions of this unit will be to continue facilitating coordinated development of new FGDS, compliance with data custodianship, operations and maintenance of any central facilities, technical support for the web-enabling of selected e-Government applications, ensuring that available data are utilized effectively for land and resource planning and development investment, as well as providing spatial analysis and decision support to the Executive Council and others on an as-needed basis. The NSDI Unit will purposely avoid growing a larger service function in favor of such need being covered through internal capacity building within the entities, or through private sector or NGO services.

Objective: Craft a Financial Model

A forward looking and progressive financial model is required for the BNSDI to ensure the free flow of vital information across society while respecting certain rights and responsibilities and recognizing the special demands placed on data custodian entities. Most

fundamental data must be developed and maintained by entities to conduct their business in any case. By sharing this information with others it is possible to eliminate the redundant maintenance of the same information by other entities, and to increase mutual knowledge and coordination through access to a broader range of more accurate and timely information than might otherwise be conveniently available. International experience suggests that the benefits gained from increased utilization of government data by both government and non-government entities at little or no cost most often far exceeds the cost recovery that can be gained through charging schemes.

The BNSDI financial model will consider the impacts, opportunities and constraints of various data and service pricing strategies and usage restrictions, and the support of public benefit, educational, research and economic development sectors in society. The BNSDI financial model will be fashioned around the following guiding principles:

- Financial provisions must be made to ensure that data custodian entities that maintain information ***beyond*** their own internal needs on behalf of others are provided with sufficient financial, technical and human resources to do so;
- Most government data should be made available among government entities electronically and free of charge;
- Government data that is not the subject of security, privacy or confidentiality concerns should be made available to the public at the cost of dissemination, with no restrictions on its use for public interest, research or value-added commercial purposes. This will be a departure from the current practice in Belize, but international experience suggests that the resulting dramatic increase in data utilization and positive impacts on public service, education, economic growth and diversification far outweigh any partial cost recovery that might be gained through more restrictive charging and usage limiting schemes. This issue will no doubt incite significant debate, and should be carefully considered before making final decisions in either direction, as the conclusion will have a profound impact on the final form, function and societal outcomes of the knowledge economy in Belize with implications far beyond the BNSDI issue alone;
- Government entities should be free to charge competitive market rates for value-added geoprocessing, spatial analysis, and other related services, where these are aligned and consistent with their primary government service responsibilities. Care must be taken to ensure that entities do not unduly restrict use of their data as a mechanism for monopolizing their service offerings.

4.0 STRATEGIES AND WORK PLANS

The implementation of the BNSDI will need to be an incremental process that is carefully coordinated with the Executive leadership and the primary stakeholder entities in order to both maintain alignment with country-wide policies and directions, while also making sure there is direct relevance and practical near-term benefit to the involved organizations.

Implementation planning for the BNSDI is being conducted with a global view of a full range of potential future applications of the BNSDI in mind, using international sound practices and precedent around the world as the reference benchmark. The assessment of needs and priorities must also consider those that have been expressed through the e-Government programme, and the various associated projects and programmes completed, ongoing and planned. Implementation for the BNSDI is being carried out pragmatically, starting with building an initial foundation programme in collaboration with a select set of entities that are the primary custodians of the most commonly needed geospatial data, then expanding the stakeholder community incrementally over time.

4.1 Implementation Strategies

International experience suggests some basic lessons learned that have been used to define the BNSDI initiation and principles for building the foundation programme that is currently underway. The more practical and important of these include the following:

Develop and maintain commonly needed data sets. Data is often the single most significant constraint in the initiation of SDI. Once a commitment to SDI has been made by a community, the initial cost and time required to get a reasonably functional SDI off the ground is greatly influenced by the type, amount, quality, consistency and accuracy of existing information. Collecting original information is costly. Compiled information that is in paper form, or a digital form that is not well structured, likewise can be costly to convert to a well-structured digital form that is more universally useful, often representing 75% or more of the cost of implementing a new GIS system in an organization. Digital data that has been developed around a single purpose may not have the content, format or level of accuracy needed by other applications. Conversely, data that has been structured around international standards and sound practices with careful adaptation to local conditions has a much higher chance of being able to serve the many different purposes that the standards were developed to support.

There are data topics that are more universally needed than others. Most users need topography, but few need to know the precise location of meteorological weather stations or botanical specimen collection sites, for example, although those topics may be very important in their own right and to the specific people and organizations that collect and use that information. The term “fundamental datasets” is used to label commonly needed information needed by the broadest spectrum of users. Ensuring effective development, maintenance and

access to accurate and timely FGDS is therefore of vital importance to a fledgling SDI programme.

While it is usually more effective to create an initial digital database through a "bulk load" data compilation and automation process, once that information is in place it is usually someone's job to record changes that happen on the ground, especially in cities and towns where those changes are regulated. For example, a new building, or the demolition of an old one, should have a building or demolition permit process associated with it. Likewise, the building of a road or extension of a utility network usually necessitates plans and design drawings that require a review and approval process prior to construction. Recording the results of these transactions in the form of building outlines, road edges and utility network extensions can all be captured at the point of transaction, assuming that the policies, procedures, technical infrastructure, standards and trained staff are in place to do so. In short, it has been found from experience that updating data that changes frequently through carefully controlled day-to-day transactions is more advantageous than periodic compilation.

Data custodian organizations must have the capability, capacity and resources needed to maintain fundamental data on behalf of others. Those organizations that maintain fundamental data on behalf of a community of users must be able to do so in an accurate and reliable manner that meets the mutual needs of those users. In some cases maintaining information on behalf of a broader group of stakeholders may require more information, more accuracy, specific content and format requirements, and more time-sensitive updates than might otherwise be needed to support the otherwise less stringent internal needs of the custodian organization. In such cases, ensuring that the data model has been structured in a practical form that is both usable and maintainable, and that the custodian has both the capacity and the resources to fulfill and be accountable for their responsibilities beyond their own immediate needs is a government-wide concern, rather than just that of a single entity.

Derive early results to pay big dividends. To most, the concept of BNSDI does not become tangible or understandable until results can be seen and experienced directly. It is therefore important to choose an initiation target for BNSDI development that includes provision for early results and "quick wins". Such results can raise the awareness and capture the imagination of the users and decision makers, and are vital in gaining and sustaining support at all levels. Therefore it is important to identify and exploit high-value/high-visibility opportunities in parallel to a carefully structured and executed strategic planning process.

Build a basic enabling framework for SDI to function. A certain level of infrastructure development is needed for BNSDI to take root. Certain essential policies, laws, regulations, technology standards, data standards, service level agreements, common operating procedures, physical infrastructure and capable staff must be in place at some level for the BNSDI to exist and sustain. Much of this enabling environment overlaps with the needs of e-Government and other facets of the broader concept of a societal information infrastructure. In Belize, NSDI Unit is playing a key role in establishing the enabling environment that will

allow BNSDI and other aligned initiatives to thrive. Once a minimum basic foundation is built, it can be expanded at an appropriate rate in pace with need and capabilities.

Adapt models and standards to meet local needs and priorities. Models and standards from around the world are useful as a reference, but must be adapted to meet local needs and priorities. There are many NSDI and GIS "federations" that have been implemented around the world over the past two decades, but only a few of these have been well integrated with e-Government and similar programmes. There is also a growing body of standards for many facets of GIS, NSDI, and ICT in general. Belize is in a unique position to implement the BNSDI in a form that builds directly on the e-Government environment already being established, building on existing standards, to take advantage of and synergize the good GIS development efforts that all the key entities have already undertaken, to add value to the e-Government initiative by spatially enabling key services, and to make a fundamental contribution to the significant development and change that Belize is undergoing at this period in its history.

4.2 Work Plans

Based on the implementation strategies laid out in the previous section, it is proposed to stage the development of BNSDI. Each of the three stages is designed to focus on particular elements and issues that must be addressed in sequence and to build on the accomplishments of the previous Stage, to ensure that the BNSDI becomes and remains an essential component of the Belize government. The objectives of the three stages are to:

Stage 1 – Foundation Development. Establish the BNSDI foundation and show visible results;
Stage 2 – Institutionalization. Strengthen and institutionalize the foundation elements;
Stage 3 – Ongoing Adaptive Management. Monitor progress and make periodic adjustments to both long term and short terms aspects of the Programme.

The three Stages as presently conceived are described below. The first Stage, Establishing the Foundation, is already underway and is to be completed during 2018. Subsequent Stages are to be revised in close collaboration with the involved stakeholder entities and with the benefit of new information and insights that will be gained through the Stage 1 effort.

Stage 1 – Establishing the Foundation

The first stage of BNSDI development, expected to last approximately 1 year and initiated in late 2017, is to establish the basic foundation elements of the BNSDI that will be extended and built upon in subsequent stages. Encompassing a set of tactical 'quick wins', this stage will include the refinement of the BNSDI requirements assessment, policy document, this BNSDI Strategic Plan and subsequent Programme Design and Implementation Strategy documents that delineate data, technical and institutional target states. This stage will also cover the following:

- alignment of existing major data development projects;
- establishment of a geospatial portal and data clearinghouse;
- population of the clearinghouse with representative data from all selected entities;
- leveraging existing data for visible results;
- establishment of representative committees to participate in and guide the BNSDI development process; and
- ensuring that capacity building programmes are in place for all participating entities that need it to be responsible custodians and users of the BNSDI.

Stage 2 – Strengthening and Institutionalization

The second Stage is expected to last approximately 24 months, and will include the expansion and refinement of the BNSDI infrastructure foundations established in Stage 1. This covers the following:

- addition of data and metadata;
- assisting new entities to join the stakeholder community;
- monitoring data and capacity building projects;
- continued collaboration with entity working groups on issues of common interest;
- continued provision of analyst support to the executive committee and others; and
- added integration and spatial-enablement of applications on the e-Government portal and government entity websites where appropriate.

Stage 3 – Monitoring and Adaptive Management

The final Stage will ensure that the BNSDI is integrated and adopted as an essential and permanent function within central Government. Depending on decisions made during the development of the BNSDI Strategic Plan, this will include:

- final implementation of the chosen business model; and
- recruitment and training of permanent staff.

A scope and time frame for this final phase of development will be developed during Stage 1 as part of the Programme Design and Implementation Plan.

5.0 NEXT STEPS

This Strategic Plan has been prepared to ensure that there is a common vision and philosophical "compass direction" in place and agreed upon before embarking on the more detailed and pragmatic aspects of the subsequent Programme Design and Implementation Plan documents. The initial draft of this document has been developed in consultation with Belize leadership to ensure that it is in general alignment with the country's high-level policy context and directions. It will then be circulated to the key stakeholder entities for further technical review and comment that will be considered in the development of a final copy of the Plan. Once finalized, this document will be used as the starting point for the team to further interpret the requirements and gap analysis results that have, under separate cover, analyzed in some detail the full range of requirements for the BNSDI to meet the present and medium term future needs of Belize. This document will also be used in setting of priorities in consultation with entity representatives, and the development of the Programme Design and Implementation Plan. This will set the direction, projects and programmes that will be carried out in the next stage of BNSDI development.

APPENDIX A - GLOSSARY OF TERMS AND ACRONYMS

(Use only those mentioned in the document)

AbnPAMO	Association of Protected Areas Management Organizations
BCC	Belize City Council
BCCI	Belize Chamber of Commerce and Industry
BEL	Belize Electric Company Limited
BPD	Belize Police Department
Bmp CITCO	Belmopan City Council
BERDS	Biodiversity and Environmental Resource Data System of Belize
BEST	Belize Enterprise for Sustainable Technology
BLPA	Belize Livestock Producers Association
BNCC	Belize NSDI Coordination Center. Function or unit proposed to provide the facilitation, coordination, promotion and support that is needed to build and operate an NSDI
BNE	Belize Natural Energy Ltd.
BNSDI	Belize National Spatial Data Infrastructure
BTB	Belize Tourism Board
BWSL	Belize Water Service Limited
CARDI	The Caribbean Agricultural Research and Development Institute (CARDI) was established in 1975 to serve the agricultural research and development needs of the member states of the Caribbean Community (CARICOM).
CATHALAC	Water Center for the Humid Tropics of Latin America and the Caribbean (in Spanish ¨CATHALAC¨- Centro del Agua del Trópico Húmedo para America Latina y el Caribe) is an autonomous international organization dedicated to promote sustainable development through applied research and development, education, and technology transfer in the areas of integrated watershed management, climate change, environmental modeling and analysis, and risk management in Latin America and the Caribbean
CBA	Central Building Authority
CEO	Chief Executive Officer / Chief Environmental Officer
CCCCC (5C's)	Caribbean Community Climate Change Center
CIMSS	Cooperative Institute for Meteorological Satellite Studies
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CITO	Central Information Technology Organization
CRIP	Climate Resilient Infrastructure Project.
CZMAI	Coastal Zone Management Authority and Institute
EIA	Environmental Impact Assessment
ERI	Environmental Research Institute of the University of Belize
FAO	The Food and Agriculture Organization of the United Nations leads international efforts to defeat hunger. Serving both developed and developing countries, FAO acts as a neutral forum where all nations meet as equals to negotiate agreements and debate policy. FAO is also a source of knowledge and information. We help developing countries and countries in transition modernize and improve agriculture, forestry and fisheries practices and ensure good nutrition for all. Since our founding in 1945, we have focused special attention on developing rural areas, home to 70 percent of the world's poor and hungry people.
FCD	Friends for Conservation and Development
FGDS	Fundamental Geospatial Data Set. This is any data theme or topic that is needed in common across a stakeholder community.
GB	Gigabyte
GEF	Global Environment Facility.
GeoNode	GeoNode is an open-source, web-based application and platform for developing geospatial information systems (GIS) and for deploying spatial data infrastructures (SDI)
GeoSMS	A standard that allows geospatial location information to be communicated through a short messaging service (SMS) between different mobile devices or applications
GFDRR	Global Facility for Disaster Reduction and Recovery

GHG	Green House Gas
GIS	Geographic Information System. A Geographic Information System is a computer system designed to allow users to collect, manage, and analyze large volumes of spatially referenced and associated attribute data. The major components of a GIS are: a user interface system; data base management capabilities; data base creation/data entry capacity; spatial data manipulation and analysis packages; and display/product generation functions.
GoB	Government of Belize
GPS	Global Positioning System
HOT	Humanitarian OpenStreetMap
Hydromet	Belize National Meteorological Center
ICT4D	Information and Communications Technology for Development
IICA	The Inter-American Institute for Cooperation on Agriculture (IICA) is a specialized agency of the inter-American system, and its purposes are to encourage and support the efforts of its Member States to foster agricultural development and rural well-being in their territories.
IoT	Internet of Things
IUCN	International Union for Conservation of Nature
LiDAR	Light Detection and Ranging
LLES	Limited Level Environmental Study.
Metadata	Standardized catalog of information about each geospatial data set
MFED	Ministry of Finance and Economic Development
MFFSD	Ministry of Forestry, Fisheries and Sustainable Development
MLGRD	Ministry of Local Government and Rural Development
MNRA	Ministry of Natural Resources and Agriculture
MoESTPU	Min of Energy, Science & Technology, and Public Utilities
MoFED	Ministry of Finance and Economic Development
MoH	Ministry of Health
MoNS	Ministry of National Security
MoWT	Ministry of Works and Transport
Multispectral	Remote sensing device that records reflected light from the earth's surface in multiple bands of the spectrum
NASA	The National Aeronautics and Space Administration (NASA) is the agency of the United States government that is responsible for the nation's civilian space programme and for aeronautics and aerospace research
NAVCO	National Association of Village Councils Organization
NCCC	National Climate Change Committee was established to advise government on issues regarding climate change
NCRIP	National Climate Resilient Investment Plan
NEAC	National Environmental Appraisal Committee. The Committee was established to review development projects in the context of the national environment.
NEMO	National Emergency Management Organization
NFAB	National Fisheries Advisory Board established to provide guidance on fisheries commodities extraction strategies and policies
NGO	Non-Governmental Organization
NICH	National Institute for Culture and History
NMO	National Mapping Organization
NMS	National Meteorological Service
Node	A facility that is connected to other facilities over the Internet for the purpose of publishing and sharing data
NPAC	National Protected Areas Committee. This Committee was established to advise the government of Belize on issues concerning the national protected area system
NREPS	Natural Resource and Environmental Sub- committee was established to increase the national understanding and acceptance of the linkages between natural resource and environmental protection and socio-economic development
NSDI	National Spatial Data Infrastructure. An institutional and technical framework for coordinating and sharing geospatial information across a stakeholder community.
OAS	Organization of American States

OGC	Open Geospatial Consortium
OIRSA	The International Regional Organization for Plant and Animal Health (OIRSA) is a technical organization established to provide administrative and technical support to the Ministries or Secretariats of Agriculture from its member countries, to protect and develop their agricultural resources in order to achieve a healthy production to satisfy population's demands and provide well-being. OIRSA's assistance is focused on its member countries' projects and plans for plant and animal health, food safety and facilitation towards agricultural commerce
OSM	OpenStreetMap (OSM) is a collaborative platform for the creation of fee and editable maps of the world by volunteers
QR Code	Quick Response Code – a type of matrix barcode
QuickStart	An activity that is an accelerated portion of a longer term initiative, intended to result in near-term, visible and compelling results.
RAM	Random Access Memory
RFID	Radio Frequency Identification
SAR	Synthetic Aperture Radar
SCADA	System Control and Data Acquisition
SDG	Sustainable Development Goals
SIB	Statistics Institute of Belize
SIF	Social Investment Fund
SISE	San Ignacio/ Santa Elena Town Council
SIG	Special Interest Group. A permanent multi-stakeholder body that is established to provide communication, coordination and support around a particular common interest or practice.
Spatial Data Clearinghouse	Common repository of geospatial information, often composed of data provided by multiple custodians
Stakeholder	Any organization or person that will be involved in the development and/or use of the Belize NSDI
TBSL	Total Business Solutions Ltd.
TOR	Terms of Reference
UAV	Unmanned Aerial Vehicle (also called a "drone")
UB	University of Belize
UNCCD	United Nations Convention to Combat Desertification
UNESCO	United Nations Educational, Scientific and Cultural Organization
UN OCHA	UN Office for the Coordination of Humanitarian Affairs
USGS	United States Geological Survey
VGI	Volunteered Geographic Information
WB	World Bank
Working Group	A temporary body, normally consisting of representative members from multiple concerned organizations, assigned to address a particular subject over a certain period of time