CONNECTICUT
Policy and Management

The Connecticut Geospatial Strategic Plan (2023-2028)

ACKNOWLEDGEMENTS AND DOCUMENT INFORMATION

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For more information about methods, data collection, or results in this document contact Carl Zimmerman, PhD, GIS Coordinator at the GISO[1]. To discuss policy or governance issues, contact Alfredo Herrera, Connecticut's Geographic Information Officer (GIO)[2].

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EXECUTIVE SUMMARY

This strategic planning process, focused on the GIS community and related data, is the first effort of its kind for the GISO[3] and represents an important milestone for Connecticut. Pursuant to Connecticut General Statutes Section 4d 90-92, the GISO is tasked with the coordination, procurement, and management of GIS data and geospatial technologies for the community of users in the State of Connecticut. To carry out this mandate, a five-year geospatial strategic plan will be produced annually starting with a 2023-2028 timeframe. The outcomes of this plan are to improve efficiencies, coordination, and access to data; and increase analytic capabilities. Sections 48 and 49 of Public Act 21-2[4] are emphatic statements by the General Assembly and the self-organized GIS user community about creating a more effective and centralized GIS system in Connecticut.

The Connecticut Geospatial Strategic Plan (CGS Plan) contains:

- The new GISO **Mission and Vision** statements, which are the guiding principles for the planning process;
- **Strategic Drivers** which are the critical issues and themes of the stakeholders.
- The five core **Geospatial Strategic Goals** driving the five-year plan.

The CGS Plan utilized three forms of data collected about the GIS community and the geospatial profession: stakeholder surveys, interviews with subject matter experts, and a literature review. Collected data was aggregated and winnowed from information collected on governance, GIS data sets, organizational issues, geospatial technologies,

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[3] Two earlier statewide GIS planning effort occurred in 2007 and 2021.
[4] These sections were later incorporated into the CGS as 4d-91 and 4d-92.

and the needs of the GIS community within and outside of governments. From this data, a review and aggregation process produced a list of results called the Strategic Drivers containing critical stakeholders' issues and themes. Some of the most important are:

- The role of the GISO and effective communication with stakeholders;
- Support of local communities and organizations;
- The role of the GIS Advisory Council (GAC);
- Increasing the utility of the Geodata Portal;
- GIS data, standards, acquisitions, and services;
- Funding issues related to imagery and data acquisition and support of stakeholders;
- Societal and equity issues.

The list of Strategic Drivers was internally and externally evaluated, ranked, and scored to create the Strategic Goals, which are the most important component of this document. The goals focus on *data management, funding, data access, capacity building, and communication.* The related activities and outputs function as the basis for an operational plan for the GIS Office in the next five years. Some of the most important upcoming activities include setting data standards for priority data sets, the creation of data uploading/collection tools, web GIS services, increased traffic for the Geodata Portal, and capacity building for State Agencies.

The five **Geospatial Strategic Goals** and some of the key related outputs are listed below:

Goal 1: Use effective governance, policies, and standards to manage geospatial data.
>   *Outputs to achieve these goals are*:
>   - The creation and maintenance of a Statewide Data Upload and Aggregation Tool;
>   - Development of standards and governance for all priority data sets.

Goal 2: Implement a sustainable funding model for imagery acquisition, GIS data, and geospatial technologies.
>   *An important output to achieve this goal is*:
>   - Tracking the GIS community for their data needs; identifying successes and value-added activities related to the uses of geospatial data; and developing relationships with the legislators.

Goal 3: Increase access to data, spatial analysis, web services, and visualization capabilities for local and regional governments, community organizations, the private sector, and other stakeholders.
>   *Outputs to achieve these goals include*:
>   - Creation of a statewide base map;
>   - Development and maintenance of a State Parcel Viewer;
>   - Development and maintenance of a State Hosted Geocoder.

Goal 4: Provide direct analytic support and enhance capacity building for State Agencies.
>   *Outputs to achieve these goals include*:
>   o Providing direct support to agencies through training and outreach;
>   o Building web applications to help with their analytic needs;

Goal 5: Broaden communication and engagement across different levels of government and other organizations.
>   *Outputs to achieve these goals include*:
>   o Consistent production of the GISO Newsletter;
>   o Participation in federal and national conferences, and regional and local stakeholder events such as technical meetings and professional gatherings.

CONTENTS

VISION AND MISSION STATEMENTS

The **Vision and Mission Statements** for an organization are a conceptual framework to describe the principles, operations, and values that help guide their decision-making. These statements are derived from the enabling legislation, interviews with the GIS Community, and stakeholder needs for the Connecticut (CT) geospatial system. They help structure the strategic planning process for the Connecticut GISO around a set of core values.

The **Vision Statement** describes the aspirational goals and desired future state of the GISO:

> *"The CT GIS Office will be the leader in data collection, analysis, and dissemination for the Connecticut geospatial community. We will serve as a center for collaboration, innovation, and excellence in GIS and will improve the quality and quantity of geospatial data to enable better decision-making."*

The **Mission Statement** describes the operational values of the organization and how the GISO plans to use them to achieve its established vision.

> *"The mission of the CT GIS Office is to effectively coordinate and promote the development and sharing of geospatial information for Connecticut stakeholders. We support the geospatial community by facilitating capacity-building, providing expertise, and establishing policies for the collection, management, and distribution of geospatial information."*

INTRODUCTION

What is a Geographic Information System (GIS)?

A geographic information system (GIS) is a system that facilitates location information to be stored, manipulated, and visualized in a geographic context. A GIS combines spatially enabled databases and digital mapping information. GIS data and geospatial tools are enabling technologies because they create digital models of reality that are intuitive, interoperable, and scalable while benefitting from the ever-increasing processing power of computers. In addition, GIS data does not sit alone on a computer. Information is shared across a community of GIS users who work together. Any strategic document needs to assess the entire geospatial ecosystem that includes stakeholders, geospatial, data, technologies, management, and operations (Lewin and Williams, 2021) both in and out of State Government.

GIS and Government

Location information and GIS data are linchpins of modern governance and planning. GIS data[5] are now intertwined with many government services (e.g., emergency management, military applications, taxation, environmental regulation, and transportation) and are vital for planning, coordination, and operations at all levels of government because they provide context and situational awareness to users.

The management of land records, for instance, has profoundly changed with the introduction of GIS tools and data. Cadastral data and parcel maps have been around for hundreds of years and are used for the critical job of defining property ownership. Traditionally, that information was on paper or mylar. Today that task is accomplished using scalable geospatial tools and GIS data. For instance, the 1.2 million parcels[6] for the 169 municipalities in Connecticut can now be viewed and analyzed as a single unit

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[5] The terms GIS, location, and geospatial data are typically utilized interchangeably. Though they have slightly different meanings and usage, we will primarily utilize the term "GIS data" in this document.

[6] Available for download on CT Geodata Portal.

within a web map or GIS package. The interoperability of GIS data also allows those same parcels to be linked to data like environmental, transportation, or economic information to answer new questions like "How much tree cover does every parcel in Connecticut have?" or "Which properties could have a new warehouse?" or "what is the typical assessed value of a house in a neighborhood?" Aerial imagery is another example of a common and critical geospatial dataset. It provides a comprehensive snapshot at a point in time of our cities, neighborhoods, and local forests and is widely used as the base information in web maps such as Google Earth. Imagery has been used for over 80 years within Connecticut for planning, property, emergency management, and military uses. Finally, address and geocoding information are critical to emergency management applications, public health, and vehicle routing applications.

Who is the GIS Community in Connecticut?

The GISO serves a large and varied set of users, stakeholders, and constituents (Appendix 2). Any strategic planning document for the entire Connecticut geospatial ecosystem should also include governance for a broad and diverse set of stakeholders (FGDC, 2009), GIS data and standards, geospatial technologies and infrastructure, management, values, and operations (Figure 1). Explicitly, a goal of this strategic planning process was to receive input from a broad range of constituencies including those users that have not previously been actively involved in the GIS community.
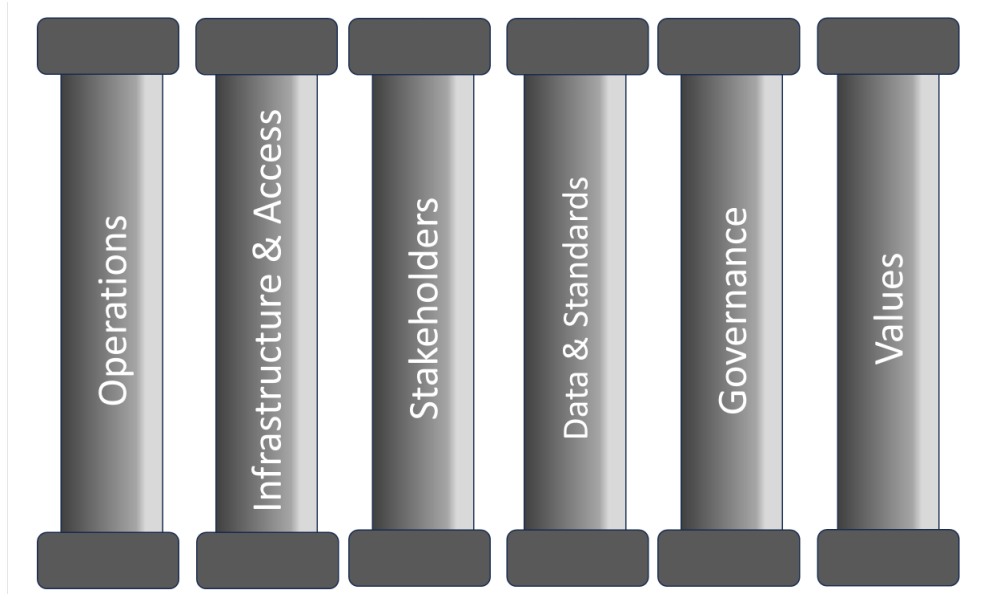
Figure 1: The Geospatial System of Connecticut

Return on Investments for Geospatial Data

GIS is considered a critical technology as it is a data integrator, scientific tool, and visualization engine that facilitates the digitization of the world and utilizes the continuing waves of digital information from satellites and sensors. Governments around the world are investing in geospatial data and infrastructure (UN-GGIM, 2020). The United States government continues to invest in geospatial technologies for climate change, scientific, environmental, and security applications (FGDC, 2020). The National Geospatial Agency (NGA), for instance, is doubling its size and opening a large $1.7 billion complex in St. Louis to support military operations and intelligence that use GIS data (NGA, 2023).

Investment in geospatial data, governance, and geospatial technologies by the GISO is critical to the betterment of public goods[7] and will exceed several million dollars over the next five years. The underlying assumption for the GISO is that the coordination, acquisition, and centralized management of GIS data and geospatial technology are

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[7] Public goods are defined as a product or service given to the public for their benefit and well-being without profit motives, often for unmet needs.

worthwhile public investments and that the return on investment (ROI) benefits all citizens and stakeholders. The GISO provides procurement of this data as a public good (Fernando, 2022) and it should provide economic, analytic, and operational benefits through centralized services that improve data utility, data interoperability, and reduce the barrier of entry to geographic analysis.

Research indicates that data interoperability and accessibility for users and stakeholders drive the ROIs of geospatial data acquisition. Trapp et al (2015) in a meta-analysis of the efficacy of investment in geospatial data found that larger geographic areas yield higher returns on investment and a typical Return On Investment[8] (ROI) was about 3.5 to 1. Results from Indiana (SSJ, 2020) and ESRI (ESRI, 2023), and other case studies, detail significant ROIs for geospatial data as a public good with ROI returns of up to 34: 1[9]. The Federal National Agriculture Imagery Program (NAIP) conservatively calculated their ROI at about to 8 to 1.

History and Timeline

The political culture of Connecticut is rooted in the concept of "home rule" and direct democratic values from its founding days (ACIR, 2022). Even now, Connecticut does not have a county government system and many Connecticut governmental functions are locally oriented. For instance, Connecticut manages its Inland Wetlands and Watercourses through each of the 169 municipalities [10]. Connecticut also maintains 65 local health departments and districts (CADH, 2024), or one per three

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[8] A return on investment is calculated in the most basic sense at the net return on investment divided (benefits) divided by cost. Quantifying the benefits is the most difficult part of the process.

[9] ROIs are often dependent on their method of calculation. Different methods may reveal different levels of benefits.

[10] See 22a-37: Inland Wetlands and Watercourses Act. Many towns have Inland Wetlands Agents.

municipalities, while much larger states like Michigan have one health district per county.

For two decades, the geospatial system in Connecticut has had a reputation for being ineffectively managed with redundant and decentralized programs and an unclear policy direction (Appendix 3). In 2005, the GIS Council was instituted in an attempt to resolve those issues. Soon after, the *Strategy for Connecticut Enterprise GIS* report was created (AG, 2007). This was an initial effort to define the strategy of a statewide GIS program, "based on the needs of all stakeholders in the state including State, Regional, and Local Government as well as private citizens." The goals in the plan included a new GIS Coordination Unit and a small number of standard data layers. This approach proved unsustainable, and the Council was later disbanded/shut down. Evaluations of the GIS system noted limited coordination, a lack of standards, and uneven and irregular investments in GIS data -- the antithesis of a modern GIS system using standards-based governance, centralized platforms, and interoperability of data to have accessible data and low barriers of entry for users and stakeholders. Momentum increased again in the late 2010s coincident with the rise of data science and the creation of the Connecticut Chief Data Officer (CDO) position within the Connecticut Office of Policy and Management (OPM) in 2014.

In 2020, the Statewide CT GIS Task Force (Task Force), a stakeholder-driven group, instituted a review of the statewide GIS system and the needs of the users. This effort reshaped the policy path for GIS in CT and became the basis for the founding legislation of the GISO in its contemporary form (Wilson et al, 2021). Many of the Task Force's recommendations were instituted (Appendix 4).

Following the release of the Task Force document, the enabling legislation, Sections 78 and 79 in Public Act 21-2, were quickly passed. The focus in 2021 turned to establishing a governance structure which included creating the new GISO, hiring the GIO, and establishing the GAC.

The present governance structure was put into place with responsibilities for coordinating, managing, procuring, and administering GIS data and geospatial technologies. Specifically, the GISO is responsible for (DAPA, 2023):

- Coordinating the collection, compilation, and dissemination of GIS data with stakeholders.
- Managing a publicly accessible geospatial database.
- Using GIS to support economic development efforts in CT.
- Providing training and outreach on the use of GIS.
- Administering a statewide orthoimage and lidar program.
- Adopting geospatial data standards, guidelines, and procedures.
- Performing technical data processing to create, aggregate, and organize data.
- Developing broadband data and mapping in accordance with Public Act 21-159.
- Developing priorities for GIS data through an annual five-year plan.

Data Themes and Standards

GIS data and related geospatial technologies are critical components of the GISO's responsibilities. The coordination, management, and procurement of GIS data requires standards, specifications, and best practices to maximize the utility and interoperability of the data. The enabling legislation specifically identifies Aerial imagery (e.g., ortho-imagery), Elevation (e.g., Lidar and lidar-derived products), and Cadastral data as foci. In addition to these core data sets, OPM also assists municipalities and the Councils of Government (COGs) with their data needs. Wilson et al. (2021), noted other data sets produced by various COGs that were considered important- many in the environmental, land use, and transportation domains.[11]

The Federal Geospatial Data Committee (FGDC) plays a critical role in providing the National Spatial Data Infrastructure (NSDI) framework which has a focus on eight core

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[11] Regional Zoning, Region Multi-use Trails, sidewalks, Multimodal Transportation Network, Parking Inventory, Addresses, Planimetrics, Brownfield inventory, Open Space, Imagery; Employers, Flood Susceptibility, and Land Cover

data themes most important to the Federal government: Address, Cadastral, Elevation, Geodetic Control, Government Units, Hydrography, Ortho-imagery, and Transportation (FGDC, 2020). Guidance for data standards can be found with FGDC, the American Society for Photogrammetry and Remote Sensing, and states with more mature GIS programs like Massachusetts.

Technology and Software

The dissemination, centralization, and management of data require significant software and hardware resources. The GISO has an evolving technological infrastructure in support of the regulatory goals outlined above with much of the procurement occurring after the start of the Strategic Planning process. Consequently, this document will primarily focus on the broader goals of the Strategic Plan for the GISO and the stakeholders. Future iterations of this Plan will discuss the maturity of our technologies and software.

These are recent highlights for technology and software improvements for the GISO:
- The GISO now has a data distribution portal called the Geodata Portal using ArcGIS Hub software that is federated to several State Agencies and the Connecticut Open Data Portal. It has the ability to host communication content (like the Newsletter), web mapping, and large data portals such as the recently completed Parcels site.
- The GISO has an ArcGIS Online Account used to communicate about and distribute authoritative data through web services and digital mapping.
- The GISO has servers for processing and analysis and GISO staff have modern workstations for processing and analyzing geospatial data sets.

Geospatial Strategic Planning: Purpose and Scope

The GAC and GISO are responsible for creating the annual CGS Plan with a five-year time horizon. The GAC and the Geospatial Strategic Planning Committee reviewed and advised on the objectives and methods for this project. The CGS Plan is a management activity used to set organizational priorities, common goals, and assess strategy in response to changes in geospatial technologies, GIS data, and

stakeholders. This document is an initial baseline for future iterations and will be conducted in the GISO in concert with the GAC[12].

The geospatial strategic planning process for 2023 included the following activities:

- The creation of the GISO Vision and Mission statements.
- A review of literature on current and future trends in GIS and geospatial technologies, best practice examples of geospatial planning documents, and information on the GIS system and Connecticut stakeholders.
- Creation of a methodology for this Planning process.
- Stakeholder surveys and interviews to collect GIS community perceptions and attitudes regarding their GIS data, service needs, and governance issues[13].
- Identification of five Strategic Goals that align with the CT State Data Plan (DAPA, 2023), the founding legislation, and stakeholders' goals, needs, and interests. Methodology.

The Data Collection phase of the Geospatial Strategic Planning process involved multiple sources of information: 1) an initial literature review to find important internal and external themes; 2) a web survey of stakeholders and users; and 3) interviews with influential stakeholders and subject matter experts (SMEs). See Appendix 5 for more detailed information.

A literature review was conducted to inform the stakeholder data collection process and identify possible external threats, opportunities, and future changes in GIS data, geospatial technologies, and societal and scientific themes. Geospatial strategic planning documents from other states and select Federal Agencies were also reviewed to find appropriate planning models and best practices for the Connecticut plan. The limited number of historical planning and operational documents about the GIS community and GIS data were collected to find unresolved problems and stakeholder issues. Some key themes from the literature review include:

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[12] The current expectation is that a major revision of the document will occur every five years with a minor update in other years.

[13] An explicit goal was to receive input from constituencies that have not previously been actively involved in the GIS community.

- **Workforce**
    - The GIS workforce continues to need to "up-skill" with new automation, cloud computing, and machine learning / artificial intelligence skills required. Retention management is a work in progress for the geospatial sector (Van Wegen, 2023)
- **Technology Trends**
    - The geospatial user community is subject to the same technology trends as other digital-intensive industries – large and rapidly growing datasets and new technologies to use them (e.g. cloud computing) (Gandhi et al, 2016).
    - Blurring of the physical and digital worlds using digital twins and virtual reality (McKinsey, 2022).
- **Data**
    - A critical trend to reduce cost and integrate data sets (especially geospatial) is improving interoperability and the use of data with standards. Governments and data standard organizations like the Open Geospatial Consortium are invested in promoting standards and data is moving to the cloud (Datta, 2019).
    - Build out of new GIS domains: Underground, inside buildings, underwater.
- **Societal Issues**
    - Climate change and the application of GIS, environmental justice, and equity.

In Spring 2023, a survey was created to learn more about the attitudes and needs of the GIS Community in Connecticut using the Survey 123 cloud-based platform from ESRI. The 26-question survey covered the user's knowledge of the new governance system, important data sets, impacts of technology, organizational concerns for all participants, and opportunities to comment on previously unidentified concerns using open-ended questions. The survey was distributed through email, websites, listservs, and professional user groups to ensure a wide reach. Survey respondents (n=104) were from across the state and from the governmental, non-profit, and consulting sectors. The most important issues were identified by internal review. Open-ended

answers were grouped by theme and response frequency. A few of the most important results:

- Parcel, government boundaries, and imagery data are most important to users;
- Users are not worried about the rate of technological change;
- Seek out underserved users and stakeholders;
- Emphasize standards, enhanced capabilities, and data sharing.

In Spring 2023, interviews were given to 32 subject matter experts (SMEs) and community leaders using Survey 123 from ESRI using a standard list of questions that covered the same topic areas as the Web Survey. Interviews were conducted through Teams so that an automatic transcript could be produced but not shared. Respondents came from the GAC, State Agencies, professional organizations, and different levels of government (Appendix 2). A standard list of structured questions was given to the respondent and follow-up questions were used to explore topics. The Interviewer wrote summaries of the answers in a Survey 123 application for analysis and summary. The summary of the open-ended responses was an important additional source of user interest and opinions. A few of the most important results include:

- Users are seeking reliable access to data sets;
- Support municipalities by offering new technologies and better decision-making tools;
- Improve data accuracy and access while enhancing visualization capability;
- Improve collaboration and communication, especially with the higher education community.

Aggregation and Synthesis of the Data Collections Streams

After these three separate data streams were collected, a set of synthesis, aggregation, and summary processes were undertaken to make a priority list from which Strategic Goals could be created (Figure 2).
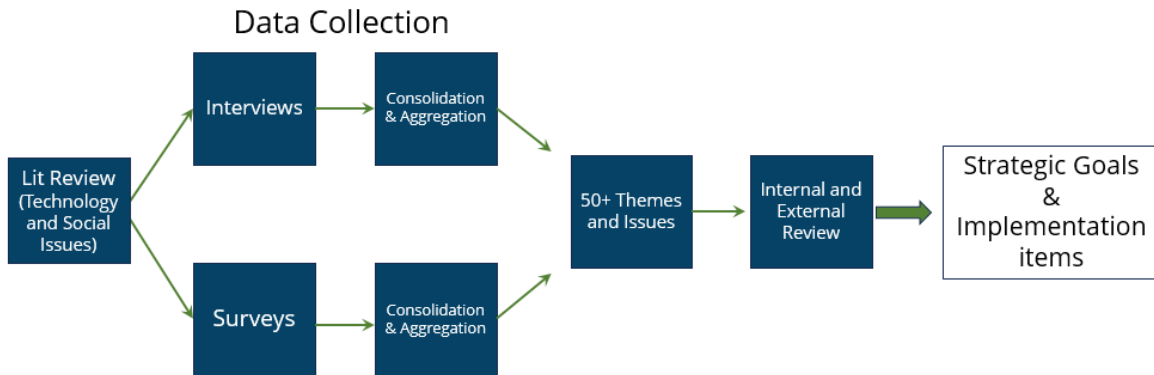
Figure 2: Overview of Data Collection, Aggregation, and Synthesis

The initial steps included:

- The literature review flagged stakeholder issues from multiple documents;
- The GISO conducted multiple internal reviews to determine the most significant results from the interviews and surveys;
- The GAC was given a summary of the results for comment and prioritization.

Next, a master list of 50 Strategic Drivers was created from the steps above. Another round of prioritization and aggregation was conducted on that list of 50 to make a final pool of strategic goals. The next steps included:

- An external review of the priority list by Connecticut GIS stakeholders was conducted in Farmington, Connecticut in June 2023. All items were placed on tables and participants were given a chance to rank and vote on the most important themes and issues. Then the review participants discussed their choices in a group setting and notes were taken.
- An additional round of prioritization on the Master list was conducted internally by the GISO and staff voted for the priority topics.
- These two sets of lists were then combined and scored to create a final list of Geospatial Strategic Goals (Appendix 6) Strategic Drivers of the Goals and Grouped Results

The Strategic Drivers (Table 1) include 15 themes and over 50 key issues that are aggregated and winnowed from the Data Collection phase. These are the most vital issues from Connecticut's stakeholders and user communities and represent **a compact and aggregated list of results** derived from the multiple data collection streams. This list is ranked by both an external review process and internal staff reviews. If a theme or issue is repeated over multiple years it will be a priority.

Table 1: Strategic Drivers with grouped themes and issues. It includes the year a theme was identified.

Themes	Issues from the Data Collection Phase	Year
GIS Office and Governance	1. Some uncertainty regarding the role and visibility of the GIS Office, though generally positive response to GISO and GIO. 2. Stakeholders want a focus on coordinating and procuring GIS data. 3. Stakeholders want a focus on standards and effectiveness. 4. Stakeholders are worried about the lack of communication and connectivity with stakeholders across the user base and across and within work domains. 5. Stakeholders want consistent and regular communication formats. 6. GAC meetings have been inconsistently scheduled.	2023
GIS Advisory Council and Governance	1. The GIS Advisory Council is welcomed by stakeholders, but the intended leadership role is still uncertain, and visibility needs to be expanded. 2. Stakeholders don't have awareness of the GAC role and want more communication and outreach, especially to the represented sectors. 3. Stakeholders want to identify professional organizations and other groups that should be more actively sought for participation in the GIS Advisory Council that are represented (e.g. Surveyors and the wider higher ed community.	2023

Geodata Portal and Data Delivery	1. Limited use and awareness of the Geodata at this time but believe it will be beneficial. 2. Stakeholders wonder when new data will start being more prominent in the GP and believe that it is not getting enough data. 3. Stakeholders can't find training for it. 4. Stakeholders have limited or little awareness of the outreach, web services, groups, and communication functionality available in the platform.	2023
State Agencies and Program Maturity	1. Outside of Agencies on Advisory Council, immature or underdeveloped GIS and geospatial programs at State Agencies. 2. The pool of workforce talent is limited in state agencies and users are seeking more training opportunities. 3. The use of geospatial analytics and other more sophisticated approaches is mostly untapped. Agreement that GIS is underutilized. 4. The GIS Office should provide consulting and analytic support services for Agencies lacking analytic capabilities. 5. No workforce geospatial job classifications in government that allows for professional growth and equitable pay. 6. Expand geospatial literacy, GIS Science methods, and ethical use of geospatial data for state workforce and administrative leadership	2007,2021, 2023
Training and Education for the CT Workforce	1. Education and training access and availability have been identified as an issue across multiple dates. A wide variety of solutions have been presented but none is most prominent. 2. Stakeholders feel like training opportunities for technology, ethics, and techniques are not readily available. 3. A modest concern for the rate of technical change and upskilling with new technologies. 4. Hands-on learning and tailoring education to the specific needs of stakeholders especially in downstream analytics and geospatial processing/uses. 5. Expand workforce expertise and understanding of recent potential disruptive digital technologies like	2007,2021, 2023

	AI/ML, and drone technologies and prepare the geospatial community for cloud computing and other forms of digital transformations	
Higher Ed and Outreach	1. A desire for higher education involvement/collaboration and focus on a wide variety of training for data types and technologies. 2. Stakeholders believe the CT higher education system has significant capabilities and expertise that are currently not being used for outreach and training to stakeholders, underserved professions, and marginal communities. 3. The ability to link the needs of practitioners with higher education expertise is not being utilized especially to tap skills found in the university system (e.g. cloud computing, drones, AI/ML).	2007,2021, 2023
Education for K-12 and Community Colleges	1. Help support and expand geospatial and geographic education for K-12 and Community Colleges which is limited to non-existent.	2023
Funding	1. Long-term issue regarding the lack of sustainable funding sources for imagery and GIS data. This continues to be an issue as the desire for authoritative data sets and standardization requires ongoing procurement, funding, and planning. 2. Lack of sustainable funding for Higher Ed entities like CT ECO and others conducting geospatial research. 3. Solicit ROI benefits and data from the stakeholder community.	2007,2021,2023
Private Sector	1. The private sector feels somewhat forgotten despite having a prominent role in supporting GIS in many municipalities. 2. Not a lot of information flows back and forth between GAC and private sector domains like surveying and engineering, despite extensive use of location data by these professions. 3. The stakeholders emphasize the critical need for highly reliable data services from primary data sets that support consulting and geospatial technology improvements.	2023

Municipalities and Other Organizations: Resource Restraints	1. Respondents continue to mention the need to support small towns with data and technical support because of limited resources. 2. Some stakeholders emphasized fear of centralization and loss of identity for small towns. 3. Calls for assistance for small non-governmental organizations like non-profits, land conservation, and community human services organizations.	2007, 2023
Technology and Pace of Change	1. The concern over the rate of change is mixed. Cloud workflows and open-source tools are deemed the most likely to impact the work methodologies of practitioners. The pace of technology change is not of great concern, yet many respondents are still worried about updating to the newest generation of tools, data, and software.	2023
Data Distribution, Services, and Standards	1. Stakeholders want centralization, standardization, and authoritative data sources. Strong need for leadership from the new GIS Office. 2. Interest in stakeholders getting data sources with standards to improve integration, accuracy, and interoperability. 3. Ortho-imagery, cadastral data, and governmental unit data were considered highly important to respondents. They should be supported. High-resolution land cover, buildings, and addresses were also important. Other important data sets from open-ended responses were transportation, environmental, and infrastructure/utilities. 4. Addresses and Cadastral data were considered by stakeholders to need the most frequent update along with ortho-imagery, transportation data sets, land-use/land cover, and planimetric data. 5. Parcel quality and standards have been challenging to organize. 6. The process of sharing data across different levels of government is cumbersome and disorganized.	2023
Economic Value	1. Use parcels across the state for economic development related to farming, commercial development, forestry, and multi-family development.	2023

	2. Make it less difficult to conduct basic analyses for opportunity and constraint analyses by planners and integrate them into a service. 3. Facilitate integration of data into administrative and commercial products to expand the utility of imagery and other data sets. 4. GIS data facilitates communication and helps solve problems for complicated societal problems.	
Societal Themes and Equity	1. Stakeholders believe that GIS data and tools can be used to provide better healthcare access and environmental benefits like greenhouse gas reduction. 2. Help organizations like land trusts, small social service agencies, and marginalized neighborhoods build data and mapping capacity. 3. Focus on societal Issues including housing, climate change, and environmental justice that increase equity. 4. GIS and geospatial technologies should be approached with an "equity lens" and be used to address disparities and promote community well-being.	2023
Organizational Support	1. Address the lack of awareness and knowledge of data science and geospatial software tools and GIS within practitioners' organizations. 2. Reduce resource constraints in organizations including lack of funding and manpower to support increased adoption of geospatial technologies and data. Support workforce and analytic capabilities.	2023

THE STRATEGIC PLANNING FRAMEWORK: STRENGTHS & OPPORTUNITIES VERSUS GAPS & WEAKNESSES

Geospatial strategic plans for government often include an evaluation framework such as the SWOT (Strengths, Weaknesses, Opportunities, Threats) framework[14] which is commonly used in state plans of this type. Because this is the first cycle of this process, the focus of the planning framework is addressing previous concerns and establishing a baseline for future efforts. This framework combines **Strengths and Opportunities** in one section and **Gaps and Weaknesses** in another**. The Strategic Goals** are derived from the strengths and weaknesses.

Strengths and Opportunities

- *The Connecticut GIS Community*
  - The creation of the GISO is a result of a long-term effort (over a decade) by the CT geospatial community to create a centralized coordinating body and promote standards for GIS data and governance (Wilson, 2021). The local geospatial community, including the GIS Network, is active and self-organizing and a good working relationship exists between the GIS Network and the GISO.

- *Governance*
  - The governance and leadership structure has been modernized and centralized with a GAC and GIO. In addition, the GISO has statutory authority to address coordination, centralization, and acquisition of GIS data sets.
  - The GISO has a contemporary management structure with a GIO and staff with extensive professional experience. The GIO, Alfredo Herrera, was

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hired in December 2021 and the professional positions have been filled out since the Summer of 2022.

- o The GIS Advisory Council was formed in June 2021 with designees from a variety of stakeholders including OPM, State Agencies, the Councils of Governments (COGs), private sector, utilities, and higher education.

- o The use of the workgroup governance structure has moved ahead several identified issues such as parcel drafting standards.

- **Programs**

  - o The Broadband program is mature and likely one of the best in the country.

  - o Data acquisition: Two statewide data collection flights (2023 (completed) & 2026 (in process)) for aerial imagery, lidar, and other elevation products have been initiated. The 2023 data is being produced now and the 2026 flight is under contract and planning for it has already begun.

  - o The collection breadth of a single state-wide parcel data set has improved in the past three years and for the first time a full parcel data set with harmonized computer-aided mass appraisal (CAMA) attributes is available for all 169 municipalities.

- **Hardware and Software**

  - o Software and hardware tools are now in place to analyze and process large state-wide GIS data sets and distribute them using web-based services.

  - o A statewide geospatial hub called the CT Geodata Portal went online in November 2022 and is federated to the largest producers of GIS data in the State of CT: CT Eco (within UCONN CLEAR), DOT, DEEP.

  - o The ArcGIS Online software allows for distributed web mapping, data services, and download.

  - o Hardware acquisition: New servers were purchased and installed in the fall of 2023 for scalable geoprocessing and analytic processing. A wide

variety of software is being used including ESRI desktop and cloud products (e.g., Hub and ArcGIS Online) and many open-source tools from the Python and R data science ecosystems.

- ***Stakeholders***
  - Many State Agencies make limited use of their existing geospatial data and need help understanding the utility of geospatial analytics and processing.
    - Opportunity: Providing consulting services, training, and analytic capabilities will unleash new capabilities and services, especially in the social services and public health areas. The GISO has started reaching out to Agencies to discuss their needs and use cases.
  - Higher education in GIS, remote sensing, and Geospatial Technologies is strong in CT with a variety of programs and credentials available from both public and private universities. For instance, the imagery and land use classification data has been handled by CT Eco for about two decades.
  - Connecticut is a state with many small towns and local service organizations. These communities and organizations often lack analytic and data skillsets or infrastructure.
    - Opportunity: Providing hosted geospatial services and data through the Hub environment that is adapted to their needs and will open new tools to these underserved localities.
  - A wide variety of training opportunities can be available through outreach, curated information, and collaboration with Connecticut Universities and Colleges.
  - Technical work groups are now meeting on issues such as parcel standardization and guidance.

Gaps and Weaknesses

The weaknesses and gaps identified primarily come from previous GIS policy and governance work, interviews, and the stakeholder survey. As such, they focus mostly on existing problems identified previously or perceptions of issues in the CT GIS system. Gaps and weaknesses include:

- ***Unresolved Issues from Previous Years***
    - Unresolved issues still exist from previous reviews (2008, 2021) of the state geospatial system such as communication with stakeholders, lack of coordination and standards on all the primary data sets, and issues with supporting smaller Municipalities and non-government organizations (NGOs).
- The perception from users still is that it is hard to find data and they want authoritative, centralized sources of data. Though improving, the Geodata Portal is still not widely used by stakeholders and practitioners.
- The State Agencies don't have extensive geospatial skill sets and supporting practitioners. They need further support and training to increase geospatial literacy and analytic capacity. Many State Agencies have little or no knowledge, support, or staff to support geospatial analyses. State employees lack awareness of the rapid changes occurring in digital tools and methodologies such as data science, machine learning, and artificial intelligence.
- Smaller communities and community organizations are not seeing the benefit of GIS and geospatial data because of a lack of resources. Data sets are not being accessed by smaller communities that currently exist. The outreach and technical support are not yet mature or consistently available.
- The GISO needs to develop internal quality control processes for ongoing improvements in data being served as authoritative geospatial data sets.

- The Parcel Data Collection program is not fully operational and still lacks comprehensive standards for parcel geometry and CAMA data along with an importation/upload tool.

- ***Training***
  - While the state has many strengths in higher education, formal or curated training for geospatial practitioners is still undeveloped. Many online resources now exist that could be adapted.

- ***Governance Concerns***
  - Stakeholders still do not fully understand the roles of the GISO and GAC. They are also concerned that information is not moving vertically through industries to the GAC and back down again. In particular, the private sector and some specific adjacent professions like Surveyors are not as well integrated into the system.
  - The engagement with the private sector and communication on their issues is not well-established.

- ***Operations***
  - Funding for the aerial imagery and Lidar flights in 2023 and 2026 was provided by the American Rescue Act. No permanent funding stream exists for data acquisition and funding will revert to the one-off approach utilized in the past.
  - The State of Connecticut does not have a logical professional path for state employees in GIS, geospatial technology, and data science to grow within the system. Geospatial staff and managers have titles obliquely related to the profession such as Associate Research Analyst and job classifications do not reflect contemporary trends in data science and spatial analysis.
  - Data changes continually so, both the processes and procedures regarding archiving systems and quality control remain problematic and underdeveloped.

THE FIVE GEOSPATIAL STRATEGIC GOALS

The enabling legislation for the GIS Office requires an annual plan that is interpreted as using a geospatial strategic planning framework. This framework typically includes foundational strategic goals. The planning process identified **five overarching goals** from the data collection, assessment, and winnowing process that include reviews by both internal and external SMEs, stakeholders, and OPM staff. Each goal has related activities and outputs detailed in the Tables below. Details of the five-year plan for the GISO and the path to achieving these goals are outlined below. Each of the five goals has related objectives, activities, and outputs using a format from the U.S. Dept of Commerce (2021). For the 19 objectives and their related activities, benchmarks, dates, and reporting metrics are provided which describe the operational route for implementation of each objective.

Goal 1: Use effective governance, policies, and standards to manage geospatial data.

Justification: *Over the past 20 years, Connecticut stakeholders have clamored for effective and standardized GIS data, standards, and policies. Standardization makes the use of GIS data easier, more interoperable, and cost-effective. Centralized governance leads to less confusion and redundancy in data and information acquisition, reduces overall costs for geospatial data, and makes data delivery simpler.*

Table 2: Goal 1 objectives, activities, and outputs

Objectives	Activities	Output / Date
Objective 1.1: Implement and strengthen data standards and governance to facilitate reliable access to authoritative versions of the Spatial Data Infrastructure (SDI) core data sets	A. Create a framework for developing policies and standards for all SDI data sets and provide supplemental technical documentation.	• Release standards and guidance for priority data sets (2026) • Provide one-time grant support for towns and COGs to meet parcel standards. (2024)
	B. Publish standardized parcel geometry and assessment data for all 169 towns of CT	• Complete parcel geometry and assessment standards (2024) • Complete minimum viable product schema for assessment data (2024)
	C. Hold GIS Stakeholder Meetings, bi-annually.	• Create regular forums with stakeholders to discuss issues related to governance, interoperability, technical issues, and standards

Objective 1.2: Develop data management and analytic capacities including automated data checks and validation within the GIS Office	A. Develop quality assurance processes for core datasets and build or acquire capacity to conduct automated checks on acquired data sets	• Statewide Data Upload and Aggregation Tool (2025)
	B. Provide staff with analytic tools and access to technical training such as attending professional conferences	• Have GIS Office staff attend a minimum of 1 conference or technical training a year
Objective 1.3: Maintain an inventory of key data sets (existing and desired) that identify data producers, stewards, and consumers.	A. Survey stakeholders and all users about usage patterns and needs for GIS data	• Stakeholder and data survey as part of the annual Geospatial Report
	B. Identify data stewards and owners for all GIS data assets	
Objective 1.4: Conform to principles and guidance laid out in the State Data Plan	Provide access to projects and documents to the Chief Data Officer	• Develop shared intake process for data analytics and GIS projects

Goal 2: Implement a sustainable funding model for imagery acquisition, GIS data, and geospatial technologies.

Justification: The enabling legislation for the GISO tasks the GIO with procurement and management of GIS data acquisition but does not provide any new funding for imagery and other geospatial data. In addition, the use of enterprise GIS from ESRI requires fees and consistent funding for software. After the American Rescue Plan Act funding ends, new resources should be found. A sustainable solution needs to be found that works within the context of the GIS community.

Table 3: Goal 2 objectives, activities, and outputs

Objectives	Activities	Output / Date
Objective 2.1: Evaluate the social and economic benefits of geospatial data	Identify projects that demonstrate the costs, benefits, and challenges of geospatial data, especially imagery data, in an analytic, social, and economic sense through stakeholder interviews and outreach	• Track and promote successes and challenges both internally and externally in the Annual Report
Objective 2.2: Facilitate outreach opportunities to improve the visibility of GIS Office and educate decision-makers on the benefits of geospatial technologies and GIS data	Participate in engagement activities through state agencies and the legislature, and at conferences, professional events, and hearings.	• Active participation in two events per year with towns and COGs • Active participation in two non-geospatial professional events • Active participation in two legislative events
Objective 2.3: Understand options for sustainably implementing periodic capture of imagery and other data products	A. Track municipal and COG imagery and spatial data needs	• Annual Geospatial Report
	B. Identify funding and cooperative partnership opportunities with towns, federal entities, and state agencies	• Successful periodic capture of imagery and other data products

Goal 3: Increase access to data, spatial analysis, web services, and visualization capabilities for local and regional governments, community organizations, the private sector, and other stakeholders.

Justification: *Users want access to high-quality data. Web services are the easiest and most sustainable method for delivering quality geospatial data to stakeholders and the user community of Connecticut.*

Table 4: Goal 3 objectives, activities, and outputs

Objectives	Activities	Output / Date
Objective 3.1: Provide access to foundational social, cadastral, administrative, and environmental data and services for communities and partnerships	A. Create core sets of environmental, social, and administrative layers at standard geographies that can be easily integrated into a web mapping environment.	• Statewide Base Map with a variety of data sets (2025)
	B. Build web applications to provide data services (such as a cadastral data viewer), support administrative functions, and perform spatial analysis with periodic updates	• State Parcel Viewer (2024) • State Hosted Geocoder (2024)
	C. Increase Geoportal stakeholder usage and data availability	• Add two new Geoportal agency partners by 2026 • Create a bidirectional federation workflow with an open data portal (2026) • Create site usage and tracking mechanism (2026)
Objective 3.2: Create a baseline inventory of data and	A. Visit each geographic region of the state periodically to foster relationships and identify stakeholder needs,	• 1 regional visit per year

analytic requirements for communities	especially communities, and organizations not currently using geospatial tools	
	B. Use direct outreach to private sector consultants, and COGs who work with municipalities to solicit feedback about GIS data and geospatial technology policies	• Attend conferences or similar events, annually
Objective 3.3: Expand data outputs from geospatial data	A. Create automation and training for raster processing. B. Provide additional data services from imagery and other data.	• Attend stakeholder events and participate in relevant work groups. • Add two data sets per year from 2024 to 2028
	C. Provide access to automation for analytic and geospatial workflows	• Post Python and R automation online in GitHub or similar public repository (ongoing).

Goal 4: Provide direct analytic support and enhance capacity building for State Agencies.

Justification: *Except for a few Agencies like the Department of Transportation and the Department of Energy and Environmental Protection, State Agencies have limited internal capabilities in geospatial technology, geospatial analytics, and data science. They need support to conduct core data analyses and improve analytic capabilities.*

Table 5: Goal 4 objectives, activities, and outputs

Objectives	Activities	Output / Date
Objective 4.1: Improve and expand geospatial literacy and ethical use of geospatial data across state agencies	Provide direct training, learning materials, and technical support to Agencies including consultancy-type services.	• Create an online learning area with curated training materials (update annually starting 2024)
Objective 4.2: Enhance access to geospatial analytic services and improve the analytic capacities of Agencies	A. Build agency-specific web applications for critical data sets and analyses	• Meet with Agencies to determine needs (2024-2028)
	B. Provide regular technical and analytic assistance such as a regular help desk or office hours	• GIS workgroup meetings to identify projects and share knowledge • Publish Newsletter consistently up to several times a year
Objective 4.3: Enable access to templates and automation for standard geospatial workflows	Converting non-spatial data to spatial data types	• Provide access to Python and R automation and scripting on GitHub or similar (ongoing)
Objective 4.4: Initiate, develop, and maintain business and Agency relationships to understand mandates, processes, and operational needs	A. Interact with Agencies and present a structured introduction to GIS data and geospatial topics, either individually or in larger groups	• Provide at least one training to all Agencies annually
	B. Track geospatial capabilities and outputs completed to support Agencies	• Annual Geospatial report

	C. Assist with the evaluation of geospatial models, analytic frameworks, and spatial analysis for stakeholders	• Provide direct support as needed (ongoing)
Objective 4.5: Support increased access to GIS desktop software and open-source scientific computing tools	A. Facilitate increased access to desktop GIS software and identify options for supporting it	• Increase usage of GIS tools by state agency workforce • Document options for open-source GIS usage in a learning portal and GitHub
	B. Determine feasibility of state-wide enterprise licensing	

Goal 5: Broaden communication and engagement across different levels of government and other organizations.

Justification: Connecticut has traditionally been a home rule state and GIS data was handled in a siloed fashion. An opportunity exists for communication, cooperation, and integration across a wider array of governments and other organizations. Resources, data, and analytic capabilities can reach smaller communities and non-traditional users of GIS. Furthermore, the CT higher education system has significant capabilities that are not well utilized by the external GIS Community.

Table 6: Goal 5 objectives, activities, and outputs

Objectives	Activities	Output / Date
Objective 5.1: Provide consistent communication and facilitate stakeholder cooperation on policy, data, and technologies and improve access to best practices and new techniques	A. Develop a communication plan/strategy	• Produce newsletter consistently
	B. Participate and present at the GIS Network, have periodic and consistent attendance at public events	• Attend all GIS Network events (ongoing)
	C. Participate in state, regional, and national level geospatial events and forums such as NSGIC, periodically	• Broaden bi-directional communication and collaboration and improve interaction with different levels of government and across the GIS community
Objective 5.2: Make the GIS Office the recognizable face of GIS data and geospatial capacity in CT	Develop branded materials to represent the GIS Office	• Distribute branded materials at external activities and promote successes through communication channels (2025)
Objective 5.3: Collaborate with CT institutions of higher education, including	A. Create Hub sites or events where communities and academics can learn more about each other.	• Develop relationships with higher education centers including MAGIC, and UCONN

community colleges, to utilize their skill sets to solve community problems, provide technological leadership, and support geospatial literacy.	B. Support and promote vocational and professional training programs for GIS, geospatial technologies, and data science	CLEAR to cooperate on programs for internships and professional development opportunities (2026)

CONCLUSION

This CGS Plan introduces Vision and Mission Statements for the GISO and provides five Strategic Goals that provide policy and guidance over a five-year planning window (2023-2028). It responds to the most pressing needs and issues of the Connecticut GIS and geospatial user communities. 18 objectives along with corresponding activities and outputs are identified that will allow the GISO to meet its statutory obligations to provide authoritative GIS data delivery and services. This document will be updated annually, and adjustments will be made to strategic goals and objectives depending on external factors, stakeholder needs, and changing conditions. The GAC and GISO will work together to update the Plan using feedback from the GIS Community. The current expectation is that an annual update of this Plan will be produced and every fifth year a larger data collection effort and document revision will be completed. Each revision is intended to address the needs and concerns of the GIS Community in Connecticut.

Future versions of this plan will focus on the maturity of the software and hardware infrastructure, better outreach to communities and users that are underserved or under-resourced, and the identification of explicit metrics to meet the objectives and activities. In addition, the community of stakeholder representation will be broadened to include tribal and federal organizations.

REFERENCES UTILIZED

Advisory Commission on Intergovernmental Relations, 2022. Home Rule and Local Control in Connecticut. CT.gov. Found at: https://portal.ct.gov/-/media/ACIR/Misc_Reports/2022/Draft_1_Home_Rule_and_Local_Control_in_CT.pdf

Applied Geographics (AG). March 8, 2022. Montana GIS Coordination Strategic Plan, for the Montana State Library. Montana State Library. Found at: https://ftpaspen.msl.mt.gov/EventResources/20220412141529_20678.pdf

Applied Geographics (AG). 2007. Connecticut Enterprise GIS. State of CT GIS Council. Found at: https://www.fgdc.gov/grants/2006CAP/relateddocs/103-06-3-CT-Strategic_Plan_10_04_2007.pdf

CADH. 2024. Public health. Connecticut Association of Directors of Health. Cadh.org. Found at https://cadh.org/public-health/

Conn. General Statutes. Sec. 4d 90-93. Found at: https://www.cga.ct.gov/current/pub/chap_061b.htm

Datta, A. Nov. 11, 2019. How are digital technologies influencing geospatial technology trends? GeospatialWorld.net. Found at: https://www.geospatialworld.net/blogs/geospatial-technologies-in-digital-platforms/

Department of Administrative Services, 2016. Connecticut's Open Data Initiative. CT Department of Administrative Services. Nascio.org. Found at: https://www.nascio.org/wp-content/uploads/2020/09/2016CT8-NASCIO-2016-Open-Data.pdf

ESRI, 2023. Return on investment, ten GIS case studies. ESRI.com Found at: https://www.drjill.net/a-retrospective-return-on-investment-study-for-spatial-data-infrastructure/

Federal Geographic Data Committee (FGDC). Revised: May 2009. Advancing Statewide Spatial Data Infrastructures in Support of the National Spatial Data Infrastructure (NSDI): Strategic Plan Guidelines for use by all stakeholders in the Geospatial Community. Prime Contractor: Applied Geographics. Found at: https://www.fgdc.gov/initiatives/50states/newspbp/StrategicPlanGuidelines_v2_052809_FinalVersion.pdf

FGDC, 2020. National Spatial Data Infrastructure Strategic Plan. 2021-2024. Federal Geographic Data Committee. FGDC.gov. Found at: https://www.fgdc.gov/nsdi-plan/nsdi-strategic-plan-2021-2024.pdf

FGDC. 2009. Strategic Plan Guidelines. To Support the Cooperative Agreements program, Category 3: Fifty State Initiative

Fernando, J. et al. March 20, 2022. What are public goods? Definition, how they work, and example. Investopedia.org. Found at: https://www.investopedia.com/terms/p/public-good.asp

Gandhi, P. et al., April 01, 2016. Web-based Technologies: Which Industries are the Most Digital (and why). Harvard Business Review. Found at: https://hbr.org/2016/04/a-chart-that-shows-which-industries-are-the-most-digital-and-why

GISAC. 2008. Utah Geospatial Infrastructure Strategic Plan. Found at: https://drive.google.com/file/d/0BxoOAQyOvGgaaHhyUTZwYWVFSW8/view?resourcekey=0-2kVZwHSAiv2PuCuu-GNdxw

IAAO Artificial Intelligence Task Force (2022). A review of the methods, applications, and challenges of adopting artificial intelligence in the property assessment office. *Journal of Property Tax Assessment & Administration, 19*(1). Retrieved from https://researchexchange.iaao.org/jptaa/vol19/iss1/2

Indiana Geographic Information Office (IGIO). 2022. GIO Strategic Plan: Five Year Strategic Plan. Found at: https://www.in.gov/gis/gio-strategic-plan/

Lewin, M. and Williams, A. 2021. Put Your Geospatial Strategy One Page. ArcUser: Manager's Corner. Found at: https://www.esri.com/about/newsroom/arcuser/1-page-strategy/

McKinsey. August 17, 2022. What is Industry 4.0, the Fourth Industrial Revolution, and 4IR? Mckinsey.com. Found at: https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-are-industry-4-0-the-fourth-industrial-revolution-and-4ir

NGA, 2023. About Next NGA West. National Geospatial Intelligence Agency. NGA.mil. Found at: https://www.nga.mil/about/About_N2W.html

Oregon Geographic Information Council (OGIC). Jan 25th, 2023. Strategic Plan for Geospatial Data Management 2023-2026. Oregon Enterprise Information Services. Found at: https://www.oregon.gov/geo/OGIC%20Documents/2023-26_Strategic%20Plan_Final.pdf

Saligoe-Simmel, J. (SSJ) 2020. A retrospective return on investment study for spatial data infrastructure. Professional Geographer. DrJill.net. Found at: https://www.drjill.net/a-retrospective-return-on-investment-study-for-spatial-data-infrastructure/.

United Nations: Committee of Experts on Global Geospatial Information Management (UN-GGIM). August 2020. Future trends in geospatial information management: the five-to-ten-year vision. Third Edition. GGIM.UN.org. Found at: https://ggim.un.org/meetings/GGIM-committee/10th-Session/documents/Future_Trends_Report_THIRD_EDITION_digital_accessible.pdf

U.S. Dept. of Commerce. 2021. Department of Commerce Geospatial Strategic Action Plan, Innovation for America's Data Agency. Commerce.gov. Found at: US-Dept-of-Commerce-Geospatial-Strategic-Action-Plan_FY23_Draft.docx

Van Wegen, W. Feb. 15th, 2023. Talent, technology, data, and climate at the forefront professionals' minds: Insights into key trends, development, and challenges in the geospatial sector. Gim-international.com. Found at: https://www.gim-international.com/content/article/talent-technology-data-and-climate-at-the-forefront

Wilson, E et al. January 2021. The Need for a Statewide GIS Center in Connecticut. Statewide Connecticut GIS Policy Task Force (SCG). Found at: https://media.clear.uconn.edu/projects/coordination/CT_GIS_WorkingGroup_FInal_Two Pager_0121.pdf

Wilson, E. June 14, 2022. GIS Coordination for Connecticut. Found at: https://storymaps.arcgis.com/stories/0cf4df1c755e4b8ca1ab36affd62718c

APPENDICES:

Appendix 1: Strategic Planning Work Group

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Appendix 2: The GIS Community, Users, and Stakeholders

Organization	Stakeholder	Level
Interested Public	General Public	All
Private Sector	Consultancies and technical services companies	Municipal, State, National
DAPA/GIS Office	GIO, CDO, Open Data Coordinator	State
State Agencies	Data Officers and Analysts	State Agencies
GIS Advisory Council	Governance	Multiple
CT GIS Network	Users and the wider community	Multiple
COGs	GIS analysts and domain experts (e.g. transportation)	Regional
COGs	Municipal users	Municipal
Municipalities	CEOs	Local
Municipalities	Assessors	Local
Municipalities	Public Works	Local
Municipalities	Emergency Services	Local
Higher Education	Academics and Education	State
Affiliated professions	Urban Planners, surveyors, public health departments,	State

Federal Agencies	Dept. of Interior, Coast Guard, etc..	Federal
Tribal Groups		International
NGOs	Environment, agricultural, and Land Trusts	Mostly local
NGOs	Social Services Organizations and other non-traditional users	Mostly local

Appendix 3: Timeline of GIS and Geospatial Activities in Connecticut

Date	Activity	Notes
2005	CT GIS Council was created	Executive Order No. 4 and Public Act 05-3.
2007	Strategy for CT Enterprise GIS report released con	Strategic Planning document with recommendations
2011	CT Geographic Framework Data report was released in 2006	
2013	CT GIS Council was eliminated and OPM designated a successor organization	Public Act 13-299
2014	CT Open Data Portal launched. First Chief Data Officer hired	Created through Executive Order, No. 39 (DAS, 2016)
2018	A municipal parcel submittal process was created, and a new Chief Data Officer position was established at OPM	Public Act 18-17
2020	CT Legislative Working Group founded	Establishes baseline for state GIS system
2021	Establishment of GIS Office in OPM	Sections 78 and 79 of Public Act 21-2
2021	Geographic Information Officer hired (Alfredo Herrera)	
2022	CT Geodata Portal launched	Online at https://geodata.ct.gov/
2022	Technical Working Groups established	Parcels and CAMA, Parcel Drafting Standards, Aerial Imagery, GIS Clearinghouse
2022	Broadband Coordinator hired	
2023	CT Geospatial Strategic Plan	Data collection phase
2023	Three additional staff hired	GIS Coordinator and 2 GIS Analysts
2023	CT Statewide Imagery and Lidar Flown	Expected product deliveries in 2023-2024. Another set is planned for 2026.

Appendix 4: Task Force's Recommendation and Current Status

Recommendation	Status
Provide a State GIS Center where data coordination and standards can be centered.	*Implemented*
Create a funding mechanism to procure and coordinate data acquisition of aerial imagery.	*Partially implemented*[15]
Hire a Geographic Information Officer (GIO) and dedicated staff.	*Implemented*
Form a GIS Advisory Council for policy recommendations and guidance.	*Implemented*

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[15] No current dedicated funding for statewide imagery.

Appendix 5: Methodology

Survey:

To understand the needs of the GIS Community, this work used an online convenient sampling approach consisting of 28 questions which were created in the online platform Survey123 from ESRI[16]. The questions were intended to create a baseline to evaluate future changes in the GIS ecosystem and new user needs. The survey was sent out to the widest possible audience consisting of: the CT GIS Network listserv, professional community organizations like the Professional Surveyors and Planners, State Agencies, COGs, municipalities and their workers, and other organizations. Presentations were given at several events (e.g. COG meetings and GIS Network events) to promote participation.

The questions varied in style and included open-ended, Likert-style, and rank-order formats. Nine questions were open-ended, and four questions were about the practitioners (optional). The open-ended questions were intended to find out more about unrecognized issues from the stakeholders. These answers were summarized by theme and frequency. The questions centered on these topic areas:

- Information about the stakeholder including their professional role
- Employer and workplace questions such as type and location
- Question on governance regarding the GIS Office and Geospatial Advisory Council
- Data, standards, and needs
- Impacts of upcoming technologies
- Underrepresented organizations and stakeholders
- Broad or general concerns

The survey also included nine open-ended responses that were intended to give respondents a chance to provide broad responses. This was considered particularly important in the project because this is a baseline survey, and the current needs of stakeholders are not well understood.

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[16] Found at https://survey123.arcgis.com/)

Respondents:

Respondents from the public sector (76.9%), private sector (21.3%), and non-governmental organizations participated (6.7%). The geographic coverage of respondents was focused on Hartford but included participation from all the planning regions. A total of 104 responses were received from April 17th to June 14th, 2023.

Because of a problem with the online survey application mixing attributes and corrupting some data, the back end of the survey was revised. Three questions in the survey version lost a pair of attributes each. The survey (n=62), version 1, was open from April 17th to June 1st while version 2 (n=42) was open from May 18th to June 15th, 2023. While the attribute mixing issues in the application were fixed, the survey questions were the same. In future versions, it is recommended to write questions out before editing within the Survey 123 application.

Interviews:

To gain a better understanding of critical issues, a total of 32 interviews were conducted with GIS stakeholders at different levels of government, professional groups, the private sector, higher education, and members of the Geospatial Advisory Board – essentially trying to get coverage across the community of GIS users. These users had a variety of roles and competencies and worked primarily in the Hartford to Bridgeport corridor. Attempts were made to reach out to tribal and federal representatives and smaller community organizations. Finding people with interest and expertise in data science and GIS was difficult. This process should start sooner for future iterations. This is recommended to be a focus in the next data collection cycle.

Of the people successfully contacted 84% participated in the survey. Interviews were conducted from May 1st, 2023, through June 12th, 2023. Transcripts were automatically generated within Microsoft Teams and a summary of each question was written into the Survey 123 software from ESRI by the researcher. Identifying information was scrubbed out of the generated text. Summaries were made of each question. The interviews were conducted using a standard list of questions. To capitalize on the

expertise and the opinions of individual respondents, follow-up questions were utilized to fill out answers or probe more deeply. The interview questions covered themes including:

- The respondents' background
- Questions on governance, and specifically on the roles of the GIS Office (GISO) and GIS Advisory Council (GAC)
- The Geodata Portal
- Coordination and management of GIS data and geospatial technologies
- Workforce issues and digital technologies
- Training and support
- Increasing economic value using GIS data and technologies
- Societal and equity issues

Winnowing:

The data streams from the data collection phase (historical information and stakeholder information from 2008 and 2019, topics from the review of literature, survey, and their related open-ended questions, and the interview questions) were initially summarized. Three methods were used to find the most important topics. The first method triangulated issues by finding those issues from the past with those that were still considered important this year. The second method used frequency of occurrence in the open-ended responses. The third method took the most prominent results from the survey that were also identified as significant by the interview answers.

A master list of important issues was created from these methods. Two different methods were utilized to cull that list down. The first was an internal ranking review by the GISO staff and the second was an external review. This external review involved invited stakeholders who came to an in-person session meeting in Farmington, CT. A long list of issues and themes were presented and the stakeholders "dot voted" on the issues they thought were most important. An open-ended discussion on what they thought were critical issues (e.g. parcel data and support of the stakeholders). The highest-scoring themes were then combined by the author into the five Strategic Theme after several iterations and internal reviews (Appendix 6).

Appendix 6: Combining External and Internal Ranking of Themes for Goal Creation

Themes	External Review	Internal	Score	Score
GIS Office and Governance	Med	High	5	Move to objectives
GIS Advisory Council and Governance	Low	Low	2	Move to objectives
Geodata Portal	Med	High	5	Move to objectives
State Agencies	Med	High	5	**Yes**
Funding Sources and Support	High	High	5	**Yes**
Training and Education	Low	Low	2	Move to activities
Higher Ed, K-12 Education, and Community Colleges	Low	Low	2	Move to objectives
Private Sector	Low	Low	2	Move to activities
Municipalities and Other Organizations	High	High	6	**Yes**
Impact of Technology	Low	Low	2	Move to activities
Critical Data Sets	High	High	5	**Yes**
Social Themes and Equity	High	High	5	Move to objectives
ROI	Low	High	4	Move to objective
Communication and Outreach	Med	High	5	**Yes**