
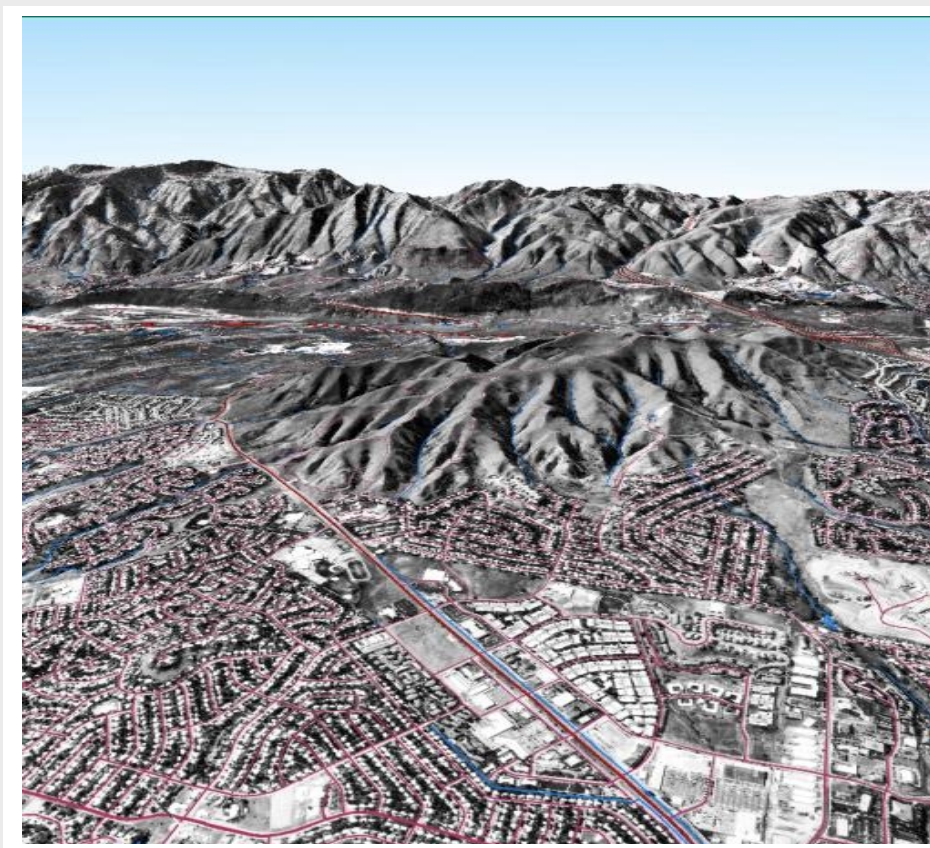


STATUS AND POTENTIAL ROLE OF STATE, TRIBAL, REGIONAL, AND LOCAL PUBLIC ENTITIES IN THE NATIONAL MAP PROGRAM

**An evaluation of business needs, geographic data requirements,
and avenues for National Map Program partnerships
with the federal government** 



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EXECUTIVE SUMMARY

Study on the Status and Potential Role of State, Tribal, Regional, and Local (STRL) Public Entities in the National Map Program

STATUS OF NATIONAL MAP PROGRAM AND NSDI

The U.S. Geological Survey (USGS) has launched ambitious plans for a major modernization of the National Map Program (also being referred to as “TNM”). This new vision includes a commitment by the USGS to improve the map content and currency of constituent map themes and to make digital map data more accessible to users. The USGS National Map modernization effort captures the fundamental elements of the NSDI meeting the USGS mapping mission element. As conceived originally the NSDI provides a framework for improvements in processes and programs for the creation, sharing, and use of geographic information at a national scale.

Modernizing the National Map program as well as realizing the goals of the NSDI requires necessitates the development of effective partnerships and improved collaboration between the Federal government and public agencies at the State, Tribal, Regional, and Local (STRL) level. The USGS and its sister federal agencies are aware that meeting the modernization goals requires policies, practices, and technical tools that are not currently in place.

Over the past 10 years, efforts lead by federal agencies have tested partnership programs and made significant progress toward forging significant collaborative relationships with STRL organizations. Through this study, the authors conclude that much more progress is needed for the building and sustaining of federal-STRL partnerships. We state the following key observations and in this report offer recommendations about changes and improvements to better enable and support collaboration

- There is a significant lack of understanding, among federal geographic data providers, about the business requirements and data needs of STRL agencies
- Despite the contributions of the Federal Geographic Data Committee (FGDC), there is essential lack of coordination in geographic data programs and sharing of data among federal agencies
- To a great extent, the scale, accuracy, and currency of geographic data generated by federal agencies does not fulfill the needs of a majority of STRL organizations
- Nationally applicable mechanisms for STRL data sharing with the Federal government do not exist and consequently, STRL organizations do not have an easy to use technical or administrative framework to provide data

Much work remains to be done but with the foundation laid over the last ten years, many of the stated goals of the USGS, the Office of Management and Budget and information management needs of all level of government can be met.

BACKGROUND AND PURPOSE OF THIS STUDY

The overall goal of the study was to provide input and recommendations to the USGS on the development of partnerships and better collaboration with public agencies at the State, Tribal, Regional, and Local level to support National Map activities—particularly compilation, update, and sharing of geographic data. The authors attempted to provide practical information and recommendations that could help guide TNM development and to do this within the broader spectrum of the National Spatial Data Infrastructure (NSDI) and other Federal and State policy, investments and activities that support it.

The following key topics were addressed in this study:

- Characterize the nature, programmatic basis, and business requirements of State, Tribal, Regional, Local (STRL) entities
- Define and prioritize geographic needs of STRL entities and current attempts to meet those needs
- Examine STRL geographic data needs in relationship to data services and products available from federal agencies
- Document incentives, inhibitors, and opportunities for effective partnerships with STRL entities
- Provide practical recommendations to the USGS and sister federal agencies for improving geographic data coordination and collaboration among federal agencies

This study was undertaken as a defined task under an IPA with the Kentucky Governor's Office of Technology. The project was in collaboration with and under the Direction of Susan Carson Lambert, former Director of the Kentucky Office of Geographic Information. Primary contractors for this work were Peter Crosswell and Jim Fries, both experienced GIS practitioners and consultants with PlanGraphics, Inc. Most of the work on which this report is based took place during 2002. The authors took advantage of their direct experience in projects with several hundred public agencies across the U.S. and the results of work carried out by other professionals as documented in literature (see bibliography), and the comments of Peer Reviewers that included:

- Bruce Oswald, New York State Information Technology Office
- Molly Singer, International City/County Managers Association
- Hugh N. Archer, Kentucky Department for Natural Resources

- Francis H. Harvey, University of Minnesota
- Vicki Lukas, U.S. Geological Survey, Geography Discipline
- Leslie Wollack, National States Geographic Information Council and NASA

BUSINESS CASE AND GEOGRAPHIC DATA NEEDS OF STRL ORGANIZATIONS

Types of STRL Entities

In order to forge successful partnerships and mechanisms for geographic data collaboration with STRL entities, it is important to understand their character and status. When looked at from a national perspective, the range of STRL entities present a fairly complex fabric of nested or overlapping geographies with legal and administrative foundations, business requirements, and geographic data needs that vary considerably from region to region.

The authors identified the following five categories of STRL entities: a) Tribal Governments, b) Interstate or Multiple State Agencies, c) States, Commonwealths, and Trust Territories, d) Regional Agencies and Special Districts, and e) Local Governments. The jurisdictional complexity of public organizations in the U.S. is revealed in the table below showing a total of 18 types into which the 5 major jurisdictional categories are divided.

Governmental and Public Entity Types

| | |
|---|---|
| TG: Tribal Governments | TG1: Tribal Nations TG2: Alaskan Native Villages |
| ST: States, Commonwealths, and Trust Territories | ST1: States and Commonwealths ST2: District of Columbia ST3: Commonwealth/ Trust Territories |
| LG: Local Governments | LG1: County LG2: County-type Areas w/o County Gov't. LG3: Municipal Government LG4: Township Government |
| IM: Interstate or Multi-State Agencies | IM1: Commissions IM2: Compacts |
| RG: Regional Agencies and Special Districts Agencies | RG1: Econ. Development Agencies, Districts, Authorities RG2: Transportation Service Districts/Authorities RG3: Planning and Zoning Commissions/Agencies RG4: Natural Resources Districts and Authorities RG5: Utility Districts and Authorities RG6: School Districts RG7: Other Regional and Service Districts |

All of these entities are potential Federal partners in support of the National Map program—if not as generators of data then as users. It is important to understand the nature of and relationships among these entities to identify where the partnership opportunities may exist.

Business Requirements for Geographic Data

In an exploration of geographic data needs, the authors began with a characterization of the business requirements for the public entities. This includes an identification of broad public agency program areas and geographically related business processes. A business process is an activity or collection of related activities that responds to a program need and generates a product, service, or some other measurable result for a particular “customer” or recipient. Many business processes in STRL organizations are geographic in nature. That is, they involve the collection, compilation, management, use, or distribution of geographically referenced data. We identified a total of 27 business processes that are common to multiple public sector organizations and used these as one basis to examine geographic data requirements. These business process, explained more fully in Section 2 and Appendix A, are listed below:

- BP1: Billing, Tax, Fee Management and Collection
- BP2: Budget/Financial Analysis
- BP3: Business Activity Tracking
- BP4: Comprehensive Land Use Assessment and Planning
- BP5: Construction Project Planning and Design
- BP6: Cultural/Historical Resource Assessment
- BP7: Demand Modeling and Analysis
- BP8: Economic/Demographic Forecasting
- BP9: E-Government Services
- BP10: Emergency Response
- BP11: Emergency/Disaster Planning
- BP12: Environmental Regulation and Management
- BP13: Environmental/Natural Resource Inventory
- BP14: Facility Inventory and Tracking
- BP15: Health/Safety Permitting and Enforcement
- BP16: Incident/Complaint Tracking
- BP17: Land Development Inspection and Enforcement
- BP18: Land Development Review and Permitting
- BP19: Legal Analysis/Judicial Actions
- BP20: Property Valuation
- BP21: Public Info. Preparation and Distribution
- BP22: Public Meetings/Hearings
- BP23: Public Service Planning and Delivery
- BP24: Site/Facility Maintenance Operations
- BP25: Site/Facility Maintenance Planning
- BP26: Special Engineering Analysis or Modeling
- BP27: Special Planning Studies

A wide range of formal mandates drives these business processes and requirements, including federal and state statutes, local ordinances, regulations, legal decisions and actions, executive orders, formally adopted policies or procedures, contractual relationships, etc. The authors’ review of business processes and the legal and policy environments in which they operate **strongly confirms the critical role that geographic information plays in the function of STRL organizations.**

Geographic Data Use

Through experience in many GIS projects and a review of applicable literature, the authors defined a set geographic data themes as a starting point to examine requirements

by STRL entities. A total of 83 data themes were identified. These were categorized into the following “theme groups”:

- Base map themes (encompasses many of FGDC Framework Themes)
- Aerial imagery
- Elevation/Terrain/Topography
- Map control and reference grids
- Governmental/Service/Administrative districts
- Utility and infrastructure
- Emergency planning and management
- Land cover, cultural and environmental resources
- Hydrography, landscape, and geological resources
- Property-related
- Socioeconomic

The priority of geographic data themes was evaluated by comparing all 83 themes to STRL business requirements. A scoring process, explained in Section 3, resulted in the designation of the following 22 themes as “High-Priority”:

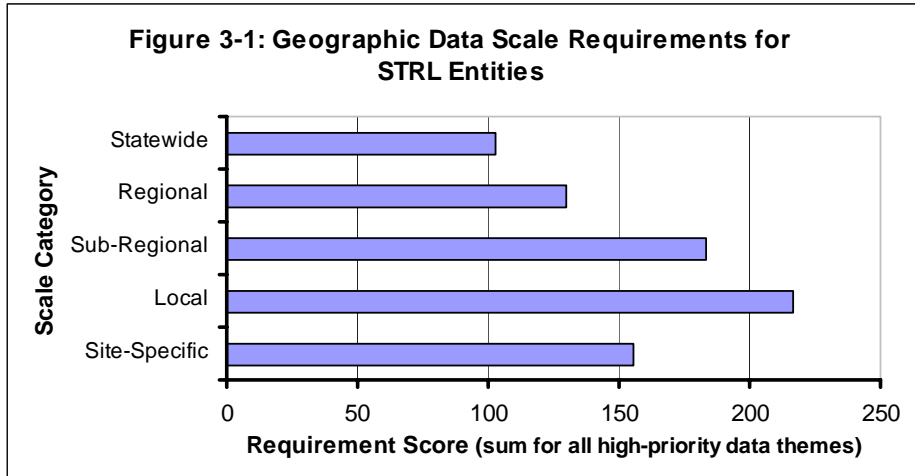
- Governmental Jurisdictions
- Transportation— Major Roads
- Transportation—Local Streets
- Local Administrative Areas
- Planimetric Features—Detailed
- Geodetic Control Points/Monuments
- Transportation Facilities--Highway
- Transportation Facilities—Local
- Survey System Corners/Grid Lines
- Orthoimagery— Detailed
- Regional Agency Boundaries
- Sanitary Sewer Treatment/Collection
- Water Distribution System
- State Administrative Districts
- Other Special Zones or Districts
- Planimetric Features—General
- Surface Hydrography
- Assessment Parcels
- Flood Zones
- Water Supply and Transmission
- Government Buildings
- Emergency Planning and Management

In addition to data content and format, users’ needs for geographic data and maps generated from this data are very sensitive to map scale and accuracy. Map features collected and presented at too small a scale may be of little or no use for local applications. Similarly, very detailed and highly accurate data and maps may not serve the needs of a large area planning study which might require that the data be generalized. This study has identified the following “Scale Categories” to further examine scale/accuracy relationships and needs.

| Scale Category | Scale Range | Map Accuracy |
|----------------|---|-----------------------|
| Statewide | Less than 1:250,000 | 150 meters or coarser |
| Regional | 1:50,000 to 1:250,000 | 25 to 200 meters |
| Sub-Regional | 1:10,000 to 1:50,000 (1" in. = 833 ft. to 4166 ft.) | 3 to 30 meters |
| Local | 1:1,200 to 1:10,000 (1" in. = 100 ft. to 833 ft.) | .3 to 6 meters |

| | | |
|---------------|--|--------------------|
| Site-Specific | 1:1,200 and larger (1" in. = 100 ft. and larger) | .5 meters or finer |
|---------------|--|--------------------|

An evaluation of the STRL Scale Category requirements for each high-priority data theme is summarized in the following table.



This shows a clear need for geographic data compiled at relatively large scale and high accuracy level compared to data and map products typically available from federal sources and in many cases, adequately filled by STRL entities themselves. **It is the authors' conclusion that the significant divergence that exists between the typical scale and accuracy of map and data products generated by Federal agencies and the needs of STRL agencies and therefore, sharing their data or providing regular updates to federal programs provides little value for them and is a major factor in the low level of use by STRL agencies—particularly local governments.**

Suitability of Current Federal Data for STRL Entities

Section 4 includes a high-level review of geographic data programs and sources in federal government agencies. The authors conducted a qualitative assessment of the suitability of current federal data for satisfying the needs of STRL entities. A summary of the results of this assessment are provided below, the purpose of which is to identify possible gaps in Federal agency data programs that could be enhanced to better address the need of STRL entities.

| High Priority Geographic Data Theme | Federal Data Availability/ Suitability for STRL Use |
|-------------------------------------|--|
| Planimetric Features--General | Fair |
| Planimetric Features-Detailed | Poor |
| Transportation— Major Roads | Good |
| Transportation—Local Streets | Fair |

| | |
|---|------|
| Orthoimagery— Detailed | Poor |
| Geodetic Control Points/Monuments | Good |
| Survey System Corners/Grid Lines | Good |
| Governmental Jurisdictions | Fair |
| Regional Agency and District Boundaries | Poor |
| Local Administrative Areas | Poor |

| High Priority Geographic Data Theme | Federal Data Availability/ Suitability for STRL Use |
|--|--|
| State Administrative Districts | Poor |
| Other Special Zones or Districts | Poor |
| Sanitary Sewer Treatment and Collection | Poor |
| Transportation Facilities--Highway | Good |
| Transportation Facilities--Local | Poor |
| Water Distribution System | Poor |
| Water Supply and Transmission | Poor |
| Flood Zones | Good |
| Surface Hydrography | Good |
| Assessment Parcels | Poor |
| Emergency Planning and Management Themes | Poor |
| Government Buildings | Poor |

This assessment has revealed a number of important factors that influence how the National Map is used by STRL entities and the potential for partnerships to support data maintenance and sharing:

- Federal government agencies have been active in producing geographic data in automated form—at 1:24,000 or smaller scale, that are useful to STRL entities but which satisfy only a small portion of their needs
- No federal agency sources have been identified as “Very Good” in their Availability/Suitability for STRL entities. Availability/Suitability of Federal sources for six themes have been rated as “Good”. These include: Transportation-Major Roads; Geodetic Control; Survey Corners/Grid Lines; Transportation Facilities-Highways; Flood Zones; and Surface Hydrography.
- Sixteen (out of 22) themes have an Availability/Suitability of “Fair” or “Poor”. These lower ratings result from a number of factors that limit use by STRL agencies, including—a) Federal agencies are not typically responsible for collecting data for the theme (e.g., water and sewer utility, local cadastral data); b) Federal agency data is available but it is often out of date; c) Federal agency data is available but geographic coverage is spotty; and d) Federal agency data is not compiled at a scale or resolution level suitable for many STRL agencies.
- The Census Bureau TIGER program has been a primary source of nationwide transportation network and government jurisdictional boundary data—even with its acknowledged limitations in accuracy and currency.
- Detailed data included in the Emergency Planning and Management set of themes is generally not currently available at an accuracy level that is needed for emergency management programs.

STRL PARTNERSHIP AND COLLABORATION—POSSIBILITIES, ISSUES AND CHALLENGES

Inhibitors and Incentives for Collaboration

Through an analysis of STRL entity programs and data needs as well as a review of the status of the National Map and geographic data programs by other federal agencies, the authors identified a series of “inhibitors” and “incentives” for federal-STRL collaboration and partnerships. The inhibitors and incentives listed below have been evaluated and provide a foundation for recommendations provided in the report.

| | |
|-------------------|--|
| Incentives | <ol style="list-style-type: none"> 1. Great need for current, high-quality geographic data 2. Potential for cost and resources savings 3. History and structure for statewide coordination of GIS 4. Federal and state mandates/policies in support of and interest in STRL partnerships 5. Homeland security drivers 6. Existing programs involving Federal partnerships 7. Existing federal geographic data initiatives 8. GIS technology advances 9. Technical advances in data conversion, aerial imagery capture, and data extraction 10. Computer hardware and network technology 11. Maturing user base 12. Open systems and related standards |
| Inhibitors | <ol style="list-style-type: none"> 1. Lack of understanding about Federal data and its availability 2. Confusing array of Federally administered programs for geographic data management and distribution. 3. Scale/detail of maps not great enough 4. Quality or currency limitations 5. Use of different coordinate systems and projections and geographies that cross coordinate system zones 6. Small local governments and regional agencies lack technical and staff resources to use digital geographic data 7. State, Tribal, and local data distribution and cost recovery policies may conflict with Federal laws and regulations 8. Political and jurisdictional complexity and inconsistency inhibits coordination and common collaborative strategies 9. Increased concerns about data security limiting Web-based access 10. Financial pressures in most state and local governments limit taking on new initiatives 11. Insufficient leadership and coordination roles to implement and oversee. 12. Lack of legal instruments and terms/administrative Inertia |

Technical Issues and Challenges for STRL Collaboration

There are many technical concerns that present challenges and opportunities for implementation of a modernized “new vision” National Map Program. Of particular

concern are the following technical issues related to database structure that can complicate geographic database exchange to support National Map update and distribution.

- GIS Software Architecture and Open Systems

- While “open systems” developments in GIS have greatly increased opportunities for data access and exchange, different GIS software packages still have proprietary elements that limit complete transparency and data integration. Even with the improvements in open systems, software from GIS vendors contains proprietary elements that limit the portability of data and applications. The federal government, lead by the FGDC should continue active role in standards organizations and use its influence to accelerate software-related standards adoption.

- Physical Database Design

- There is little commonality, among different jurisdictions, in logical or physical database design (definition of map features or objects and their logical or physical relationship). Database design templates prepared by vendors, government organizations, or standards organizations do exist for certain geographic data themes but these are not necessarily applied with consistency at the state, tribal, and local level.

- Database Classification and Coding

- Just as there are differences in technical database architecture and physical database design, organizations will also make decisions and set standards for positional accuracy and for coding or classifying GIS data. Accuracy for map feature capture may vary significantly depending on organization’s needs, the initial sources for GIS data, and the techniques that are used.

- Positional Accuracy

- Positional accuracy requirements will vary by data theme, type of organization, and the specific application for which the geographic data is being used. Individual jurisdictions that are performing map compilation and update may provide different levels of positional accuracy. The National Map update program must be sensitive to this and allow for the acceptance of data at different levels of accuracy. At the same time, there must be standards for minimal levels of accuracy that provides a baseline for data nationwide. Existing standards endorsed by the FGDC provides a basis for consistent specifications, testing, and documentation of map accuracy levels.

A process for on-going update and maintenance of a multi-theme National Map Program cannot assume that there will be full consistency in data architecture and design among STRL source organizations. It will be important to establish a suitable data model and accompanying technical procedures for data. The concept must imply an intermediate format (the STDS of the 21st century?) that can easily support both upload and download of data themes from and to the native formats supported by the organizations maintaining and using the data.

Institutional and Policy Issues and Challenges for STRL Collaboration

Non-technical challenges in building partnerships are many and exceed the technical issues in importance. The authors have explored many of these and suggest the following as the principal concerns that should receive attention.

- Complex mix of federal programs
 - A major inhibitor the National Map program and the building of the NSDI is the confusion and perceived lack of coordination and overlap among federal agencies. The problem is both perceived and real but it does inhibit National Map and NSDI progress.
- Political complexity and regional variability
 - The political and legal basis and the relationships among STRL organizations vary greatly among states and regions of the U.S. This makes it difficult to create a “template” partnership structure (roles, procedures, etc.) that works well for all jurisdictions. Organizational relationships and partnerships must respond effectively to this the complexity without a one-model-fits-all approach.
- Difference in policies for geographic information distribution:
 - The fact that some state and local governments have placed certain legal controls and cost recovery policies on geographic data distribution may directly conflict with federal policies incorporated in the current OMB Circular A-130 for “free distribution or cost of reproduction” of data. Recent controls evolving from homeland security concerns create a moving target for the immediate future and additional complexities in establishing a consistent policy basis for nationwide National Map partnerships.
- Digital divide
 - Over 650 of 3066 counties in the country have a population of less than 20,000. In a recent survey by NACo (National Association of Counties, 2001) reveals that 47% of counties in the U.S. are considered to be “somewhat behind” or “significantly behind” in use of the Internet and

28% are in a similar status in regards to general use of information technology. It is clear that many of the low population local governments of the U.S. do not have the financial resources and technical expertise to support digital data maintenance in a National Map program partnership although they may still be data users. A partnership program must take these limitations into account.

- Private Mapping Industry Role in Data Compilation and Distribution
 - Factors surrounding Private-Public Sector interrelationships in compiling geographic data and services for data distribution can work to support or to inhibit the development of the National Map and an effective NSDI. Public agencies at all levels have provided a market for private industry providers who have developed tools and procedures to provide geographic data products and services efficiently. The legal and economic factors of public-private relationships need be considered in forging a National Map partnership program that addresses the private sector in an effective and appropriate way:

RECOMMENDATIONS

Section 5 of the main report presents, with detailed explanation, a set of recommendations that cover, technical, organizational, and policy areas relating to federal-STRL coordination and collaboration. Key recommendations are summarized below:

- Assign strong leadership to FGDC or ‘recreate’ as necessary to revive an organization serving as the main entity for Federal coordination in geographic data coordination and standards. Use the strong OMB mandate (revised Circular A-16) as basis for operation with goal of increasing and improving collaboration among federal agencies
- “Harmonize” the concept of *The National Map* with the FGDC Framework initiative and overall concept of the NSDI, and redefine *The National Map* as a *National Base Map* (see Sections 4 and 5 of the report).
- To address the broader set of data themes needed by STRL and federal agencies, define in a logical context, the following additional geographic databases—*a) A National Thematic Geographic Database*, *b) An Extended State-Regional-Local Geographic Database*, and *c) An Emergency Management and Planning Database* that specifically address national, state, and local emergency management and homeland security needs. See Figure 5-1 in the body of the report.

- Continue and increase efforts to apply applicable standards for geographic data and services that are developed by appropriate standards groups (e.g., FGDC, OGC, ANSI, ISO).
- Conduct an analysis of the a) business needs and associated mandates/drivers for geographic data and b) the status of geographic data programs in the federal sector to complement the analysis of the state, tribal, regional, and local sectors in this document. Use this as a basis for improved federal collaboration and for development of the GeoSpatial One-Stop Portal.
- Through OMB leadership and with support of the broader geospatial community establish a National Spatial Data Council (NSDC) similar to that recommended in the 1998 NAPA study and consider the GeoData Alliance as foundation for developing such a council. Other solutions may be structured, but the perception of multiple federal entities with overlapping jurisdictions must be limited for effective partnerships, the contracts and license variations can be exponentially reduced through a single point of federal contact for data exchange.
- Examine and implement creative financing approaches like those suggested by Cahan (2000) e.g., a National Information Technology Finance Corporation that would act as a central “bank” to support the raising, management, and distribution of funds for geographic database development and maintenance.
- Federal agencies should sponsor a study to examine and develop recommendations to resolve differences in the Federal, State, and Local policies and programs governing distribution and cost-recovery for geographic data. This study should re-examine Federal statutes and policies (FOIA, privacy restrictions, Copyright, OMB Circular A-130, etc.), state open records laws and polices, and local programs for geographic information distribution and sale with the goal of establishing operationally successful and sustainable data management and distribution programs for all levels of governments. Recent research initiated by federal partners through the National Academy of Science will include some of these issues with respect to data licensing.
- The Federal government (USGS recommended) should assign an NSDI coordinator for each state. This echoes recommendations stated in the past by the NAS Mapping Science Committee for state liaison positions and it augments the role now played by Geography Discipline State Liaisons.

In general, the author’s agree with an observation made recently by one of the participants seated to comment on *The National Map* vision by the Mapping Science Committee – “This is some of the most important work of our generation.” The vision of *The National Map* is right on target and the USGS Geography Discipline has the mission and the mandate. There are however, mountains to move on the way to a successful

implementation of the vision. Hopefully the thought, care, research, analysis and studied recommendations that the authors' have made in this document can help the provide a little excavation energy for some of the mountain moving the U.S. geospatial community has to undertake to realize the vision.

SECTION 1 INTRODUCTION AND BACKGROUND

1.1 PURPOSE

The U.S. Geological Survey (USGS) has prepared ambitious plans for a major modernization of the National Map program (also being referred to as “TNM”). This stated “new vision” modernization effort calls for a significant shift from the current mapping environment that still relies heavily on the distribution of paper maps and which has inherent delays in updates to the major map themes that are encompassed by the National program which include:

- High-resolution digital orthorectified imagery from aerial photographs, digital airborne sensor or satellite imagery that will provide some of the feature information now symbolized on topographic maps.
- High-resolution surface elevation data including bathymetry to derive contours for primary series topographic maps and to support Earth surface modeling and the production of accurate orthorectified imagery.
- Vector feature data for hydrography (rivers and water bodies), transportation (roads, railways, and waterways), structures, government unit boundaries, and publicly owned land boundaries.
- Geographic names for physical and cultural features to support the U.S. Board on Geographic Names and other names such as for highways and streets.
- Land cover data that classify the land surface into categories such as open water and high-density residential.

The new vision for the National Map includes a commitment by the USGS to improve the map content and currency in update for these map themes. Implicit in the vision is the development of more effective means for gathering information and for electronic distribution of National Map data to users. Meeting these ambitious goals will be greatly dependent on the establishment of effective partnerships between the Federal government and public agencies at the State, Tribal, Regional, and Local (STRL) level. This report addresses these goals and provides recommendations on a strategy to accomplish them. Specifically, the study was undertaken to answer the following questions and provide recommendations on the development of partnerships:

- What are the types of STRL public entities that may play a role, with the federal government, in the National Map program?
- What is the legal basis and programmatic mandate for these entities?
- What are the business requirements that drive a need for geographic data?
- What types of benefits are or may be derived from the use of geographic data and GIS technology?

- What type of geographic data is required to meet these entities' business needs?
- What are the characteristics of these data in terms of content, format, and accuracy?
- What is the priority of particular types of geographic data for the STRL entities and how are the geographic data needs of these organizations being fulfilled now?
- What geographic data currently generated and distributed by federal agencies may serve the needs of STRL entities?
- What STRL organization data needs not currently being met by federal agencies could become part of an enhanced National Map program?
- What types of Federal-STRL partnerships will be effective and mutually beneficial to all parties and what factors inhibit or provide incentives for the development and operations of partnerships?
- In light of data needs and the identified incentive and inhibitors, how should partnerships be created?

This study relies to a great extent on the work carried out by researchers and planners over the last decade or more. Many insightful observations and recommendations (some acted and others not) have been offered by professionals and project teams that have evaluated technical and institutional strategies for national mapping and geographic data coordination. One result of this study has been to re-examine this past work and provide conclusions reflecting earlier recommendations in the context of geographic data coordination issues today.

1.2 NATIONAL MAP PROGRAM BACKGROUND AND FOUNDATION

The National Map Program has a long, successful history. The move for modernization is driven by a heightened awareness of the value of current and accurate maps and geographic data, as well as tremendous advances in information technology (GIS, an explosion of digital geospatial data creation, data communications, telecommunications, GPS, remote sensing, the Internet, very powerful computer hardware, and easy-to-use software). These advances have provided a means for great improvements in the compilation, distribution, integration, and use of digital map data. Access to GIS and information technology by users in all government and private sectors has increased demand for digital products. The current "new vision" put forth by the Geography Discipline of the USGS responds to its mission for civil mapping in the U.S.:

The USGS is committed to meeting the Nation's needs for current base geographic data and maps. Our vision is that, by working with partners, we will ensure that the Nation has access to current, accurate, and nationally consistent digital data and topographic maps derived from those data. This synthesis of

information, products, and capabilities, the National Map, will be a seamless, continuously maintained set of public domain geographic base information that will serve as a foundation for integrating, sharing, and using other data easily and consistently.

The issue of partnerships to support mapping and geographic data maintenance and distribution has been explored in recent years. Some recent studies and reports include Ventura (1995), Dawes, *et al.* (1997), Mapping Science Committee (1994, 2001), National Academy of Public Administration (1998), and Johnson *et al.* (2001). Cahan (2000) examines details and poses options for organizational and financial relationships to promote development of the NSDI. He makes a convincing case for the establishment of consortia (different types and organizational make-up depending the state or area) operating under a clear set of guidelines and national coordination. His observations call for some creativity in forging partnerships with a consistent structure but sufficient flexibility avoiding the trap of a “one model fits all” approach.

Most recently, Susan Carson Lambert and Gene Thorley conducted a new study (see Lambert and Thorley (2002)). During the study, USGS personnel throughout the Geography Discipline and in other USGS Disciplines at the Reston Headquarters Office were interviewed. The 46 interviews centered on what partnership issues the interviewees considered important and relevant for implementing the vision for an enhanced National Map. One overwhelming response from the people interviewed at every level of the organization was that “Successful implementation of the National Map vision is critically dependent on partnerships.” Lambert and Thorley grouped all the comments from the interviews into categories, identified critical partnership success factors for the National Map, and articulated a set of 33 recommended actions necessary to ensure success.

1.3 FEDERAL GEOGRAPHIC DATA COORDINATION RELATED TO NATIONAL MAP PROGRAM

The National Map Program is part of a broader series of federal initiatives for the improvement in collection, maintenance, and availability of geographic information. Federal responsibilities for geographic information coordination were firmly established through Office of Management and Budget Circular A-16, originally issued in 1990. Circular A-16 provides direction for Federal agencies that produce, maintain, or use spatial data either directly or indirectly in the fulfillment of their mission. This Circular establishes a coordinated approach to electronically develop the National Spatial Data Infrastructure (NSDI) and establishes the Federal Geographic Data Committee (FGDC), giving FGDC important roles in the development of standards and coordination of mapping and spatial data activities at the Federal level.

Circular A-16 has been recently revised (August 19, 2002) from the 1990 version to reflect changes in technology, further describe the components of the National Spatial Data Infrastructure (NSDI), and assign agency roles and responsibilities for development

of the NSDI. It establishes a stronger role and requirements for federal agency coordination (lead by the Federal Geographic Data Committee) and emphasizes the need for partnerships with STRL entities and the private sector. See Robinson (2001) for a historical review and status summary of A-16.

Digital geospatial initiatives come and go in the national scene. There are enduring long-term core mission specific tasks, however, that have been assigned to some federal entities. Topographic base mapping is one of the core missions of the Geography Discipline of the USGS, which it has fulfilled since the late 1800s. That purpose is articulated in one of the goals for the Discipline's Strategic Corporate Business Practices—*USGS is the Guarantor of National Basic Data Completeness, Consistency and Accuracy*:

The Geography Discipline participates as a partner with other federal agencies, governments, and others to supply the trusted, standardized base themes upon which users can attach their mission specific data and analysis. In OMB Circular A-16 the Department of the Interior (USGS) has been assigned the lead responsibility for several data components, including hydrography, elevation, imagery, and geographic names. The other National Map themes, transportation, structures, land cover, and boundaries, will be created, maintained, and disseminated in cooperation with other Federal agencies through contracting and formal data sharing agreements with the responsible agencies.

The National Map Program is one building block of a broader National Spatial Data Infrastructure (NSDI). The National Map Program should be refined and developed within the context of other elements of the NSDI including such initiatives as:

- Federal Geographic Data Committee (FGDC) standards development
- FGDC supported I-Teams (multi-agency, multi-governmental teams supporting maintenance of Framework data)
- The FGDC-sponsored Geodata Clearinghouse Program
- The Bush Administration E-Gov Initiative GeoSpatial One Stop (GS1S)
- Individual Federal Agency portals for distributing geographic data
- SLTR government geographic data clearinghouses.

Through partnerships, technology, policy, influence, and leadership, the National Map, is the core mission of the USGS Geography Discipline, is one important USGS contribution to the NSDI and other national initiatives.

1.4 CURRENT PROGRAMS AND OPPORTUNITIES FOR DATA SHARING AND COLLABORATION

1.4.1 Successful Federal Government Programs for Cooperative Mapping and Geographic Database Development

The USGS and other Federal agencies have a long history of partnerships for specific geographic database development efforts. Some of these operate on a national level where cost/resource-sharing agreements can be put in place. A summary of selected examples include:

USGS Digital Orthophoto Quarter Quad Program

The concept of a National Digital Orthophoto Program (NDOP) was proposed jointly in 1990 by the U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service and Farm Service Agency and the U.S. Geological Survey (USGS). The primary goal of this program is to ensure the public domain availability of digital Orthophoto quadrangle (DOQ) data for the Nation.

A DOQ is a computer-generated image of an aerial photograph in which displacements caused by camera orientation and terrain has been removed. These products combine the image characteristics of a photograph with the geometric qualities of a map and can be used in numerous geographic information system (GIS) applications either alone or in combination with other digital data, such as Digital Line Graphs (DLG) or Digital Raster Graphics (DRG).

The USGS began to produce DOQs in 1991 and currently has nearly 50,000 available for distribution. Complete DOQ coverage of the conterminous United States under this program is expected by the year 2004. Thereafter, the DOQs will be updated on a 10-year cycle for most areas, and on a 5-year cycle in areas where land use change is more rapid.

This ambitious goal will be achieved through cooperative funding arrangements with Federal, State, and local government agencies and the private sector. The majority of the DOQ production work under this program is accomplished through contracts with private sector organizations.

USGS Digital Raster Graphics

The U.S. Geological Survey (USGS), through an innovative partnership agreement with the Land Information Technology Company, Ltd., of Aurora, Colorado, produced digital raster graphics (DRG) from 1995 to 1998. The objective of the program was to scan all USGS standard quadrangle maps quickly and at low cost.

More than 60,000 maps were scanned during the original program. The series includes DRGs of USGS standard quadrangle maps of the United States and its trusts and territories.

Since 1999 about 1,000 new DRGs have been made per year. In May 2001 a complete revision to the Standards For Digital Raster Graphics was approved. Starting in October 2001, all new DRGs are produced to the revised standard. The new standard is backwardly compatible with the original standard: all original coverage DRGs also conform to the revised standard. The most noticeable change in the new "second generation" DRGs is an increase in scan resolution from 250 dots per inch (dpi) to 500 dpi. For more information about the revised standard, see http://mcmcweb.er.usgs.gov/drg/drg_standard_change.html States formed multi-agency consortiums to cooperate with USGS to fund the creation of the DRGs. This was a successful program with clear objectives, and methods for engagement by partners to create a data product everyone was interested in using.

Federal Emergency Management Agency (FEMA) Digital Flood Insurance Rate Map (DFIRM) Program

The Federal Emergency Management Agency (FEMA) Flood Hazard Mapping Program has specific mandates within the Housing and Urban Development Act of 1968 (also known as the National Flood Insurance Act of 1968), as amended; the Housing and Urban Development Act of 1969; the Flood Disaster Protection Act of 1973, as amended; and the National Flood Insurance Reform Act of 1994. These Acts authorize FEMA to identify, publish, and update information with respect to all flood prone areas in the nation. FEMA has complied with this mandate by publishing and updating flood maps for more than 19,000 communities.

Because flood hazard conditions change over time due to natural and manmade changes in watersheds and floodplains, FEMA has an ongoing program to update flood maps for flood prone communities. However, flood map update needs are increasing and Federal funds are limited, thus a significant portion of the approximately 100,000-panel flood map inventory is becoming outdated. To reverse this trend, FEMA designed a plan to modernize the flood map inventory. Over time, FEMA plans to eliminate the existing backlog of outdated flood maps and convert all flood maps to a digital format.

One of the key objectives of the FEMA Map Modernization Plan is to increase local involvement in, and ownership of, the flood mapping process. To meet this objective, FEMA developed and implemented the Cooperating Technical Partners (CTP) Program. As technologies have improved and applications have expanded dramatically, many State agencies, regional agencies, and local communities have become technologically sophisticated and have invested significant resources in flood hazard identification. The Map Modernization Plan presents initial guidance for the CTP Program. Additional information about the CTP Program is available from FEMA's Flood Hazard Mapping web site at www.fema.gov/mit/tsd/ctp_main.htm.

NASA State, Local Tribal Regional Projects

NASA Earth Science Enterprise (ESE) implemented a Broad Agency Announcement for Geospatial Applications for State, Local, Tribal, and Regional Government Agencies (BAA - SLTR) to extend the benefits of NASA-derived data, research, and technology from global and national levels to state, local, regional, and tribal levels. This is an effort to translate scientific and technical capabilities in Earth science into practical tools for public and private sector decision makers. This goal is part of the strategy of ESE to encourage and facilitate the realization of economic and social benefits from the nation's investment in Earth science information and technology.

A major objective of the BAA - SLTR Program is the development and implementation of applications that provide ongoing operational support to the user community. NASA will act as a catalyst for the development and adoption of methods and techniques that draw upon science, data, and technology derived from ESE-funded research and from commercial data, data products, and industry capabilities. The intention of BAA - SLTR is the implementation of ongoing applications that create systemic change in the end-user organization, lead to better-informed decision-making, and increase productivity as measured in cost/time savings or cost avoidance. The initiative will also:

- Support development of a robust remote sensing community involving public and private sector partners,
- Transfer remote sensing and associated technologies to the user community with the prime responsibility in the nation for resource management and related activities requiring geospatial information,
- Stimulate the use of commercial data, data products, and operational capabilities by public sector organizations, and
- Coordinate the capture and dissemination of geospatial data at the state, local, regional, and tribal levels with national and global spatial data infrastructures.

NASA, as a research and development organization, cannot provide funding to support the post-development operational requirements and services of other agencies or organizations. The BAA-SLTR partners, whether exclusively or in association with other public or private entities, will ultimately be responsible for making their systems operational and for sustaining them over the long term.

The history of existing Federally sponsored programs for geographic data development provides some valuable history and lessons learned regarding how to structure multi-organizational partnerships, funding strategies, and institutional arrangements. When partners can identify a common need, and appropriate and effectively negotiated resources and incentives can be brought to bear on the common need, chances of success go way up for all parties concerned to enjoy success in achieving their common ends.

1.4.2 Other Programs Involving Federal, State or Local Partnerships

Over the last decade, there have been a number of pilot efforts and operational programs that have tested aspects of partnerships, in certain regions of the country, that could help answer some questions about partnership development to support national mapping. Some good examples include:

New York State Digital Orthoimagery Program

The program was established in collaboration with representatives from federal, state, county, local and private sectors. It was specifically designed to meet the needs of county and local governments and recognizes that, if those needs are met, the needs of state and federal governments will be met as well. The program consists of base products, which are 100% State funded, and an array of options, which can be selected and funded by local governments or agency partners. The options, if exercised, replace the base products and are priced at the difference between the base product and the upgrade. This program design offers very attractive upgrade pricing for local governments to tailor the digital orthoimagery products to meet their particular requirements, at far less cost than if they were to contract for these products on their own. Since the state is contracting for large blocks of digital orthoimagery (typically between 10,000 and 14,000 square miles each year), the cost per square mile for the products are considerably lower than what would be expected if a single county (typically 400 - 1000 square miles) were to contract for the same products.

Options or upgrades will allow funding partners to replace the base products with other products. Options for the 2' ground sample distance (GSD) panchromatic base product covering rural areas include an upgrade to color infrared film; resampling the imagery to produce orthoimagery at 1' GSD (having the same accuracy as the 2' GSD product); or upgrading to the true 1' GSD orthoimagery (produced from lower altitude imagery) in either natural color or color infrared. Options for the 1' GSD natural color base product covering urbanized areas include color infrared film, and resampling to produce orthoimagery at either .75' GSD or .5' GSD (at the same accuracy as the 1' GSD product).

All of the delivered digital orthoimagery will be in State Plane Coordinates, based on the North American Datum of 1983 (NAD-83), compressed in MrSID format and tiled to 3000' x 2000' (for 1' GSD products) or 6000' x 4000' (for 2' GSD products) tiles. The State will be funding an option to provide an additional delivery of the same digital orthoimagery in Universal Transverse Mercator (UTM) coordinates, based on NAD-83. The imagery will be available on the GIS Clearinghouse website, in a manner similar to the currently available orthoimagery.

The Virginia High Resolution Base Mapping Program

The program is to establish one consistent, accurate, foundational base map to support statewide implementation of Phase II wireless E911 (E911 for Cell Phones). The VA Public Safety Services Board also recognized the opportunity and sought to establish a

foundation upon which all local government and many regional, state, and federal spatial data applications could be built in order to establish and maintain an efficient statewide spatial information infrastructure.

Process:

The imagery is being developed at one of 3 scales for the landbase of Virginia:

- 1:4,800 scale (2' resolution) in rural areas
- 1:2,400 scale (1' resolution) in urban and suburban areas and
- 1:1,200 scale (.5' resolution) in areas where localities choose the option to purchase higher accuracy product.

The extent of each scale was initially determined by evaluating population and housing densities to determine those areas that would be flown for 1:4,800 and 1:2,400 scale imagery. Each locality was then offered the opportunity to upgrade the imagery in their locality through the program by providing the cost difference between what the program would have paid and the cost of their optional upgrade.

One local government had an existing contract to develop digital orthophotography in the same flight season that was consistent with the VBMP product. This locality agreed to make their data available for the Base Mapping Program and will receive compensation equal to savings to the program. This funding must be spent on additional cadastral or planimetric mapping in the locality. The high-resolution digital orthophotography product will be licensed to all governments and public sector organizations in Virginia at no cost. The license will allow each government or organization free use of the data, but will restrict the government, agency, or organization from redistributing the digital product.

The Virginia Geographic Information Network (VGIN) will then license to one or more private sector firms the right to distribute the high-resolution digital orthophotography product to the private sector, the public, and to organizations and governments outside of Virginia.

Delaware National Map Pilot

The Delaware pilot provides current, seamless base geographic datasets for the entire State through partnerships with multiple Delaware agencies. The project has implemented a Web-based mapping site (www.datamil.udel.edu/nationalmappilot/) to address data integration issues for combining data, including geographic names, from multiple sources and to incorporate the graphic product-generation functionality developed within the USGS-ESRI Cooperative Research and Development Agreement. Capabilities include selection of geographic area and content defined by the user and provision for obtaining user feedback to help maintain data currency.

Texas National Map Pilot

This pilot expands on the USGS relationship with the Texas Natural Resource Information System (TNRIS) to use its statewide geographic database, StratMap, as the primary data source for *The National Map* in Texas. Specific pilot activities include an innovative partnership with TNRIS in the Brownsville area, in which the USGS will develop a Web interface between StratMap and *The National Map* to serve prototype output digital and map products for *The National Map*. The pilot also includes an inter-agency agreement with the Department of Housing and Urban Development in the Eagle Pass area for monitoring colonias, in which the USGS refined local data linkage and integration techniques in cooperation with TNRIS. Future pilot developments will focus on automated updating techniques using local datasets.

Wisconsin Land Information Program

The Wisconsin Land Information Program (WLIP) is a voluntary, statewide program that provides financial and technical support to local governments for land records modernization efforts. All seventy-two Wisconsin counties participate in the Program. The Wisconsin Land Information Board (WLIB) oversees the Program's policies.

The Board's statutory authority includes preparing guidelines to coordinate the modernization of land records and land information systems; implementing a grant program for local governmental units; approval of countywide plans for land records modernization; serving as the clearinghouse for access to land information; and providing technical assistance and advice to state agencies and local governmental units with land information responsibilities. Areas in which the WLIP (2002) awards grants are: training and education, Land information system base budget awards, contribution-based awards, strategic initiative awards (these are divided into parcel mapping, publication of parcel assessment and tax data on the internet, basic data creation for floodplain mapping, and WLIS node pilot).

SECTION 2 CHARACTERIZATION OF STATE, TRIBAL, REGIONAL, AND LOCAL ENTITIES

2.1 DESCRIPTION OF STATE, TRIBAL, REGIONAL, AND LOCAL ENTITIES

Different levels of government and a variety of public organizations characterize the political jurisdictional geography of the United States with authority granted by both the governed citizens and higher levels of government. The Federal-State-Local hierarchy largely characterizes governmental authority and jurisdiction in the U.S. In some parts of the country, Native Tribal organizations and groups have retained levels of political autonomy and governmental authority over specific areas. A wide array of regional agencies have been created—usually operating within a specific state but sometimes crossing state boundaries. These diverse set of regional agencies have been assigned specific roles and powers over specific geographic areas for regulatory, economic, planning, management, or service delivery purposes.

As illustrated in Figure 2-1, the range of public entity types makes for a very complex fabric of organizations that generate, use, and distribute geographic data. This complexity is even more pronounced given the considerable inconsistency among states and regions of the U.S. in the legal basis for and governmental relationships between these public entities—particularly local government and regional agencies. In some cases, defining jurisdictional boundaries is difficult—local government boundaries may not be well-delineated, cities can cross county boundaries, and regional agency boundaries often have no direct relationship with the boundaries of cities and counties.

Figure 2-1: Levels of Geographic Data Use

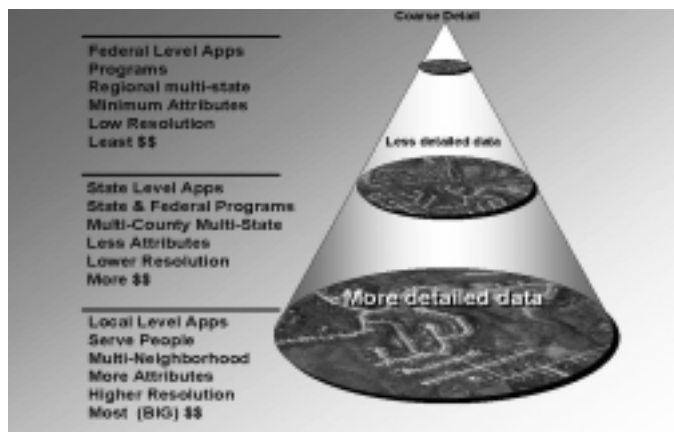


Table 2-1 identifies the types of State, Tribal, Regional and Local (STRL) “public entities” that are the subject of this report. A total of five major types are defined—

a) Tribal Governments, b) Interstate or Multiple State Agencies, c) States, Commonwealths, and Trust Territories, d) Regional Agencies and Special Districts, and e) Local Governments. Each of these major types is sub-classified yielding a total of 18 sub-types. This breakdown has been largely derived from the U.S. Bureau of the Census (see U.S. Census Bureau (2002a, 2000b, 1999) with some modification and additional explanation by the authors. Table 2-1 provides information about the nature of these public entity types, their legal basis, and governance structure. All of these entities are potential Federal partners in support of the National Map program—if not as generators of data then as users. It is important to understand the nature of and relationships among these entities to identify where the partnership opportunities may exist.

Table 2-1: Major Public Entity Types in the U.S.

| Government/ Public Entity Type | Description | Legal Basis | Governance Structure |
|--|---|---|--|
| TG: Tribal Governments | | | |
| TG1: Tribal Nations | Includes independent Tribal governments, e.g., Saginaw Chippewa Indian Tribe, Navaho Tribe, etc. | Sovereignty, Treaty | Chief, Nation or Tribal Council. All can be selected through election or consensus by tribal members. |
| TG2: Alaskan Native Villages | Includes Alaskan tribal corporations and villages. | Sovereignty | Corporations governed by a Board of Directors elected by shareholders. President selected by Board. May have an appointed staff. |
| IM: Interstate or Multi-State Agencies | | | |
| IM1: Commissions | Interstate commissions can address a wide range of issues, ranging from economic development to environmental quality. Examples include the Appalachian Regional Commission, the Great Lakes Commission, and the Ohio-Kentucky-Indiana Regional Council of Governments. | Federal Law, State Law | Appointed Commissioners or Governing Board. Some may have members designated by state or federal statute. An Executive Director may be hired by members or appointed. |
| IM2: Compacts | Compact agencies involve interstate agreements approved by the U.S. Congress. Examples include Breaks Interstate Park Commission, Delaware River Basin Commission, ORSANCO, Multistate Tax Commission, the Lake Tahoe Regional Planning Commission, the Waterfront Commission of New York Harbor, etc. | State Law, Federal Law, Court Decree | Membership usually established by creation statute. Actual membership appointments may vary by Compact and participating parties. An Executive Director may be hired or appointed. |
| ST: States, Commonwealths, and Trust Territories | | | |
| ST1: States | 50 States (including Commonwealths) | State Constitution | Elected State Legislature and Governor, with Governor serving as Chief Executive. |
| ST2: District of Columbia | The District of Columbia is considered to be a State equivalent. | Federal Constitution, Federal Law | A District Council and a Mayor are elected separately. Both appoint or hire staff. |
| ST3: Commonwealth/ Trust Territories | American Samoa, Guam, No. Mariana Islands, Puerto Rico, and U.S. Virgin Islands. Also includes autonomous republics and entities of the former U.S. Trust Territories of the Pacific Islands (TTP) maintaining free association with the U.S. (e.g., Federated States of Micronesia, Republic of the Marshall Islands) | Congressional Compact, Other | Governor may be elected or appointed. Legislative bodies are usually elected. |
| RG: Regional Agencies and Special Districts Agencies: Regional agencies and special districts have publicly mandated missions and authorities over a specific geographic area that normally crosses over the boundaries of governmental jurisdictions. They provide specific single and multiple services or support that may not be performed by general purpose local governments or states. They are organized as separate entities often with independent governing boards, have government-like character, and possess substantial autonomy. | | | |
| RG1: Economic Development Agencies, Districts and Authorities | Examples include traditional industrial and economic development, redevelopment or renewal, and investment agencies, districts, and authorities. Enterprise zones are also covered. In addition, the category includes sports, stadium, civic center, auditorium, and resort and tourism districts and financing authorities. | State Law, Sub-state Agreements, Local Statute | Governing body typically appointed but may be elected. An Administrator or Manager may be appointed or hired by Directors. |
| RG2: Transportation Service Districts and Authorities | Includes public transit districts, mass transportation authorities, road and highway districts, parking improvement areas, parkway and toll road authorities. Other examples range from bridge and tunnel authorities to port/navigation/ferry and airport authorities and districts. | State Law, Sub-state Agreements, Local Statute | Board members may be elected or appointed. A Director is typically hired or appointed. |
| RG3: Planning and Zoning Commissions and Agencies | Examples from different states include Councils of Governments, Regional Planning Councils, Area Development Districts, and Metropolitan Planning Organizations, and Metropolitan Planning Commissions. | State Law, Sub-state Agreements, Local Statute | Members usually appointed by governed jurisdictions although some may be elected. A Director may be appointed, or body may rely on assistance from participating jurisdictions. |
| RG4: Natural Resources Districts and Authorities | Examples include agricultural districts, soil and land conservation and reclamation districts, natural resources conservation districts, water conservation and management districts, irrigation districts, solid water and recycling districts and authorities, river authorities and boards, watershed districts, pollution control districts and agencies, flood control districts, and others. Some obscure types of districts (e.g., predatory animal control district, pure sugar beet seed district), fall under this category. | State Law, Sub-state Agreements, Local Statute | Members may be elected or appointed by Governor. A Director may be hired or appointed by Board or State authority. |
| RG5: Utility Districts and Authorities | Examples include municipal power districts corporations, agencies, and authorities; hydroelectric resource districts and authorities, geothermal heating districts, natural gas authorities, water and sewer districts, drainage and stormwater districts, municipal utility districts that may provide several services, communications districts, sanitary districts, and general public service districts and boards. | State Law, Sub-state Agreements, Local Statute | Commissioners, Directors, and Board members may be appointed or elected. Larger entities normally appoint a Director or Manager. |
| RG6: School Districts | This category includes only independent school districts. Districts that are dependent on another state or local government are considered to be a part of those categories. | State Law | School Board may be elected or appointed. Superintendent or District Administrator usually hired by Board with possible oversight by State Education Agency. |
| RG7: Other Regional and Service Districts | There are many types of independent, publicly-mandated service districts in different parts of the U.S. Some examples include: housing improvement districts, health and hospital districts, cultural/historic landmark districts or authorities, emergency service districts, weather modification districts, fire protection districts, geologic hazards abatement districts, and districts or agencies that are authorized to conduct multiple functions. | State Law, Sub-state Agreements, Local Statute | Boards may be appointed or elected. If staff exists, it is normally headed by a Director selected by the Governing Board. |
| LG: Local Governments | | | |
| LG1: County | This category includes legally established and recognized units of government that correspond to the geographical boundaries of counties or similar units but that may be known by different names. Includes "Parish" (LA), "Borough" (AK), and "Municipios" (PR). | State Law, Charter | Elected County Council, Commission, or Magisterial Board. Chief Executive is often the County Judge or equivalent title. Administrator (e.g., County Manager) may be elected or appointed. |
| LG2: County-type Areas without County Government | This category includes: a) County areas with legally designated city-county consolidated governments (e.g., Nashville-Davidson Metro Gov, City and County of Denver), b) areas having certain types of county offices but as a part of another government (e.g., Kings County -NYC Borough of Brooklyn, Philadelphia), c) unorganized areas designated as counties but without county government (e.g., eight Connecticut and five Rhode Island counties). | State Law | Governing body can be independent or part of larger government unit. Representatives are usually elected. May have separate staff or rely on associated government (e.g., City). |
| LG3: Municipal Government | Municipal Government is defined to include Cities, Boroughs (except in Alaska), Towns (except in the six New England States and in Minnesota, New York, and Wisconsin), and Villages. This categories includes cities in Virginia that are jurisdictionally independent of the surrounding County | State Constitution, Legislative Act, Charter, Incorporation | Elected Council, Commission, or Board. Chief executive may be elected (e.g. Mayor) or appointed (e.g., City Manager). |
| LG4: Township Government | This category includes Townships (e.g., as in New Jersey and most Midwest states) governmental units officially designated as "Towns" in the six New England states, New York, and Wisconsin, some "Plantations" in Maine, and "Locations" in New Hampshire. "Township" and "Town" are used interchangeably in Minnesota. | State Constitution, Legislative Act, Charter | Supervisory Board usually elected, but members may be appointed in some locations. Larger units can have independent staff or supervisors may rely on larger jurisdiction (e.g., County). |

2.2 PROGRAM AREAS AND BUSINESS PROCESSES DEPENDENT ON GEOGRAPHIC INFORMATION

Because the missions of STRL entities involve the management and support of people, infrastructure, and resources that are geographically distributed, they are greatly dependent on geographic information and maps. Many STRL organizations do not manage geographic information as a long-term investment and asset. There are still too many cases of maps and geographic data being collected for a single purpose, without an organized maintenance program, and with ineffective distribution. Despite such commonplace shortcomings, the demand for geographic information is great, and the potential benefits from more coordinated program for collection and update are significant.

As a starting point to characterize the need for and uses of geographic among STRL entities, we have defined a number of “public agency program areas” in which geographic data is important. These 27 program areas are adapted from Census Bureau categories (see U.S. Census Bureau (2001a, 2001b)) with some modification based on the authors’ understanding of public agency missions and mandates and the review of other studies including David, E.E. and Others (1998). These Program Areas are organized under “General Government” and “Utility/Infrastructure” categories. The Program areas are explained below.

General Government Program Areas

- **Economic Development and Investment:** Identification, creation, and promotion of opportunities for public and private economic investment and development.
- **Housing and Community Development:** Construction and operation of housing and redevelopment projects, and other activities to promote or aid housing and community development.
- **Public Welfare:** Public employment for all public welfare activities and expenditures for welfare activities and provision, construction, and maintenance of nursing homes and welfare institutions owned and operated by a government for the benefit of needy persons.
- **Health and Hospitals:** Out-patient health services, other than hospital care, including public health administration; research and education; categorical health programs; treatment and immunization clinics; nursing; environmental health activities such as air and water pollution control; ambulance service if provided separately from fire protection services; and other general public health activities such as mosquito abatement. Also includes financing, construction, and operation of nursing homes, as well as financing, construction, acquisition, maintenance, or operation of hospital facilities; provision of hospital care; and support of public or private hospitals.

- **Education and Libraries:** Finance and construction of educational facilities and the actual operations of school systems. Establishment and operation of public libraries and support of privately operated libraries.
- **Public Safety and Emergency Preparedness:** Preservation of law and order, protection of persons and property from illegal acts, and the prevention, control, investigation, and reduction of crime. Operation of correctional facilities and programs for all statuses of offenders. Firefighting operations, including prevention, avoidance, and suppression of fires. Provision of ambulance, medical, rescue, or auxiliary services provided by fire protection agencies. Development and implementation of programs to respond to all types of natural and man-caused disasters and emergency incidents. This program area covers all emergency planning, preparedness, response, and mitigation activities including security operations falling under federal and state Homeland Security provisions.
- **Natural Resources:** Conservation, promotion, and development of natural resources such as water, forests, minerals, and wildlife. Includes flood control, forestry and forest fire protection, and fish and wildlife programs. Environmental quality activities not related to water supply, wastewater treatment, stormwater management, and solid waste are covered, including, for example, protection of air quality, public lands, and wetlands; watershed management and protection; geological surveying and mapping; dam and reservoir safety; and public education programs.
- **Agriculture:** Development, improvement, promotion, and conservation of natural resources for agricultural purposes; and the regulation and inspection of agricultural products and establishments.
- **Parks and Recreation:** Provision and support of recreational and cultural-scientific facilities and activities, including Golf courses, playfields, playgrounds, public beaches, swimming pools, tennis courts, parks, auditoriums, stadiums, auto camps, recreation piers, marinas, botanical gardens, galleries, museums, and zoos. Also includes building and operation of convention centers and exhibition halls.
- **Property and Taxation:** Establishment of geodetic control systems for surveying, development of information on real property location and characteristics and maintenance of property record systems, determination of property tax assessments and collections, and all other tax programs (e.g., income, personal property, corporate, etc.).
- **Elections:** Determining election unit boundaries and all activities associated with conducting public elections, including registering and tracking voters.
- **Government Finance, Judicial, and Legislative:** Courts (criminal and civil) and activities associated with courts, legal services, and legal counseling of indigent or other needy persons. Legislative activities involved in the making, enacting, and repeal of laws. General accounting, auditing, budgeting,

purchasing, custody of funds, and other finance activities for agencies and officials. General government-wide executive, administrative, and staff service efforts other than financial, judicial, legal, and legislative activities.

- **Facility/Property/Asset Management:** Acquisition, tracking, maintenance, and management of real property and capital equipment, including constructing and operating general public buildings such as, courthouses, city halls or fiscal courts, office buildings, and annexes. Another important aspect of facility/property/asset management is GASB 34 reporting. Many reporting entities in the U.S. are spatially enabling their GASB 34 reporting.
- **Miscellaneous Other:** Activities not applicable to other general government functions including activities ranging from inspection programs for elevators to operating cemeteries.

Utility and Infrastructure Program Areas

- **Highways and Parking Facilities:** Construction, maintenance, and operation of highways, streets, and related structures, including toll highways, bridges, tunnels, ferries, street lighting, and snow and ice removal. Construction, purchase, maintenance, and operation of public-use parking lots, garages, parking meters, and other distinctive parking facilities on a commercial basis.
- **Transit:** Construction, maintenance, operation and support of public mass transit systems—bus, commuter rail, light rail, or subway systems.
- **Air and Rail Transportation:** Construction, maintenance, operation, and support of airport facilities. Construction and operation of rail lines and systems.
- **Waterborne Transport:** Construction, maintenance, operation, and support of canals and other waterways, harbors, docks, wharves, and related marine terminal facilities.
- **Electric Power:** Operation and maintenance of electric power system, including production or acquisition and distribution of electric power.
- **Gas Supply and Transmission:** Operation and maintenance of gas supply facilities and systems including acquisition and distribution of natural gas.
- **Telecommunications:** Operation, maintenance, and construction of public communications systems and networks, including radio, telephone, Internet, and cable services.
- **Solid Waste Management:** Street cleaning, solid waste collection and disposal, and provision of sanitary landfills.
- **Wastewater:** Provision of sanitary sewers and sewage disposal facilities and services.

- **Stormwater and Drainage:** Provision, maintenance, and operation of storm sewer systems and facilities and management of ditches and drainage from water runoff. Drainage of crop fields for production purposes is considered to be a part of agriculture.
- **Water Supply and Distribution:** Operation and maintenance of water supply systems including acquisition and distribution of water to the general public or to other local governments for domestic or industrial use.
- **Irrigation, Reclamation, and Soil and Water Conservation:** Acquisition and distribution of water for irrigation of agricultural lands, reclamation of range and crop lands, and activities to conserve and manage soil and water resources.

***NOTE:** Readers may be interested in a somewhat different breakdown of governmental programs defined in the Federal Enterprise Model (FEA) Business Reference Model (BRM) from the U.S. Office of Management and Budget (released in mid-2002) The BRM defines 35 internal and external “lines of business” under three broad “business areas”. The BRM applies to the Federal government and does not encompass all programs of STRL entities. The FEA also includes an application reference model (ARM) and Technical Reference Model (TRM) planned for release in late 2002. See www.feapmo.gov.*

Table 2-2 shows how these Program Areas apply to the different STRL entities by assigning a relationship level of “Primary” or “Secondary” to each Program Area for each Public Entity type. A Primary relationship means that the Program Area is very closely tied to the entity’s mission and is a central and essential part of the entity’s ongoing responsibility. Secondary relationship refers to cases where the Program Area plays a support or subordinate role and is not directly tied to the entity’s mission. A blank indicates no significant relationship.

Table 2-2: Program Area Responsibilities for Government and Public Entities

| LEGEND: ■ indicates Primary Responsibility ■ indicates Secondary Responsibility | Government and Public Entity Program Areas* | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|-----------------------------------|----------------|----------------------|-------------------------|-----------------------------|--------------------------------------|-------------------|-------------|--|--------------------------------|-----------|---|------------------------------------|---------------------|---------------------------------|---------|-----------------------------|----------------------|---------------------------------|-----------------------------|--------------------|------------------------|-------------------------------------|-------------------------|-------------------------------|--|
| | General Government | | | | | | | | | | Utility/Infrastructure-Related | | | | | | | | | | | | | | | | |
| | Economic Development and Investment | Housing and Community Development | Public Welfare | Health and Hospitals | Education and Libraries | Homeland Security/Emergency | Public Safety and Emergency Response | Natural Resources | Agriculture | Parks, Cultural Resources, Recreation, Tourism | Property and Taxation | Elections | Government Finance, Judicial, and Legislative | Facility/Property/Asset Management | Miscellaneous Other | Highways and Parking Facilities | Transit | Air and Rail Transportation | Waterborne Transport | Electric Power and Distribution | Gas Supply and Distribution | Telecommunications | Solid Waste Management | Wastewater Collection and Treatment | Stormwater and Drainage | Water Supply and Distribution | Irrigation, Reclamation, and Soil and Water Conservation |
| Governmental and Public Entity Types | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TG: Tribal Governments | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TG1: Tribal Nations | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| TG2: Alaskan Native Villages | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| IM: Interstate or Multi-State Agencies | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| IM1: Commissions | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| IM2: Compacts | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| ST: States, Commonwealths, and Trust Territories | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ST1: States and Commonwealths | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| ST2: District of Columbia | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| ST3: Commonwealth/ Trust Territories | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| RG: Regional Agencies and Special Districts Agencies | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RG1: Econ. Development Agencies, Districts, Authorities | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| RG2: Transportation Service Districts and Authorities | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| RG3: Planning and Zoning Commissions/Agencies | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| RG4: Natural Resources Districts and Authorities | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| RG5: Utility Districts and Authorities | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| RG6: School Districts | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| RG7: Other Regional and Service Districts | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| LG: Local Governments | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| LG1: County | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| LG2: County-type Areas w/o County Gov't | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| LG3: Municipal Government | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| LG4: Township Government | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |

Several conclusions may be drawn from examination of Table 2-2:

- Tribal and State/Commonwealth Governments have a significant responsibility for the majority of General Government program areas. State/Commonwealth Governments, in particular, are less often responsible for Utility/Infrastructure Program Areas since many of these are the primary responsibility of private utility companies or local governments
- Interstate/Multi-State Agencies have very specific roles in only a few Program Areas (e.g., economic development, natural resources, agriculture)
- Regional agencies are generally responsible for a limited number of Program Areas that are defined in the legal mandate that created the individual agency. Among the most frequent are utility service, economic development, natural resources, and highways.
- Local governments (particularly municipalities and counties) have primary responsibility for a wide range of General Government and Utility/Infrastructure. In fact, the only Program Areas in which Municipality/County

responsibility is uncommon are those utility supply and services that are more often run by private companies or cooperatives (e.g., electric power and distribution, electric power and distribution, gas supply and distribution, and telecommunications) and waterborne transportation.

2.3 BUSINESS PROCESSES

A business process is an activity or collection of related activities that responds to a program area need and generates a product, service, or some other measurable result for a particular “customer” or recipient. Many business processes in STRL organizations are geographic in nature. That is, they involve the collection, compilation, management, use, or distribution of geographically referenced data. For example, field inspections or inventories result in reports or compiled databases with geographically-referenced data, land use planning requires the generation of maps and analysis of geographic data to evaluate future impacts, and permitting processes are dependent on geographic information for permit application and approval.

The details of business processes are unique to specific agencies, but it is useful to define general business processes that apply more or less universally across all program areas and public entity types. The 27 business general businesses processes (BPs) listed below cover the majority of activities carried out by the STRLs in which geographic data plays a clearly recognizable role. This business process definition is based on the authors’ experience with over 400 STRL organizations in all regions of the country and from a review of pertinent literature, including Council of State Governments (2002), Kraybill and Lobao (2001), National Association of Counties (2001), Greene (2000), Engle (1999), David *et al.* (1998), and Oakley (1994). Appendix A includes a description of these business processes.

- BP1: Billing, Tax, Fee Management and Collection
- BP2: Budget/Financial Analysis
- BP3: Business Activity Tracking
- BP4: Comprehensive Land Use Assessment and Planning
- BP5: Construction Project Planning and Design
- BP6: Cultural/Historical Resource Assessment
- BP7: Demand Modeling and Analysis
- BP8: Economic/Demographic Forecasting
- BP9: E-Government Services
- BP10: Emergency Response
- BP11: Emergency/Disaster Planning
- BP12: Environmental Regulation and Management
- BP13: Environmental/Natural Resource Inventory
- BP14: Facility Inventory and Tracking
- BP15: Health/Safety Permitting and Enforcement
- BP16: Incident/Complaint Tracking
- BP17: Land Development Inspection and Enforcement
- BP18: Land Development Review and Permitting
- BP19: Legal Analysis/Judicial Actions
- BP20: Property Valuation
- BP21: Public Information Preparation and Distribution
- BP22: Public Meetings/Hearings
- BP23: Public Service Planning and Delivery
- BP24: Site/Facility Maintenance Operations
- BP25: Site/Facility Maintenance Planning
- BP26: Special Engineering Analysis or Modeling
- BP27: Special Planning Studies

Table 2-3 compares these business processes to the Public Entity Program Areas described above. A *Primary* responsibility means that the business process is frequently carried out and is an essential part of the program area. A *Secondary* responsibility indicates that the business process is often part of the program area but plays a less critical role. This table provides a picture of the relative commonality or frequency of occurrence of business processes within different program areas. Several geographic business processes, such as: B2 (Budget/Financial Analysis), BP18 (Land Development Review and Permitting), BP21 (Public Information Prep. and Distribution), BP23: Public Service Planning and Delivery, and BP27 (Special Planning Studies).

Table 2-3: Business Process Relationships with Public Entity Program Areas

| Geographic Business Process | Governmental and Public Entity Program Areas* | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|-----------------------------------|----------------|----------------------|-------------------------|--------------------------------------|--------------------------------------|-------------------|-------------|--|--------------------------------|-----------|---|-------------------------------------|---------------------|---------------------------------|---------|-----------------------------|----------------------|---------------------------------|-----------------------------|--------------------|------------------------|-------------------------------------|-------------------------|-------------------------------|--|
| | General Government | | | | | | | | | | Utility/Infrastructure-Related | | | | | | | | | | | | | | | | |
| | Economic Development and Investment | Housing and Community Development | Public Welfare | Health and Hospitals | Education and Libraries | Homeland Security/Emergency Planning | Public Safety and Emergency Response | Natural Resources | Agriculture | Parks, Cultural Resources, Recreation, Tourism | Property and Taxation | Elections | Government Finance, Judicial, and Legislative | Facility/Property/ Asset Management | Miscellaneous Other | Highways and Parking Facilities | Transit | Air and Rail Transportation | Waterborne Transport | Electric Power and Distribution | Gas Supply and Distribution | Telecommunications | Solid Waste Management | Wastewater Collection and Treatment | Stormwater and Drainage | Water Supply and Distribution | Irrigation, Reclamation, and Soil and water Conservation |
| Billing, Tax, Fee Mgmt. and Collection | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Budget Analysis/Preparation | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Business Activity Tracking | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Comprehensive Land Use Planning | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Construction Proj. Planning and Design | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cultural/Historical Res. Assessment | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Demand Modeling and Analysis | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Economic/Demographic Forecasting | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| E-Government Services | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Emergency Response | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Emergency/Disaster Planning | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Environmental Regulation and Mgmt. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Environ./Natural Resource Inventory | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Facility Inventory and Tracking | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Health/Safety Permitting and Enforce. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Incident/Complaint Tracking | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Land Development Insp. and Enforce. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Land Development Rev. and Permitting | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Legal Analysis/Judicial Actions | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Property Valuation | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Public Information Distribution | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Public Meetings/Hearings | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Public Service Planning and Delivery | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Site/Facility Maintenance Operations | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Site/Facility Maintenance Planning | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Special Engineering Analysis | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Special Planning Studies | | | | | | | | | | | | | | | | | | | | | | | | | | | |

The 27 general business processes are compared to the public entity types in Table 2-4. This comparison table scores the individual business processes to derive composite score of “importance,” with each business process-public entity type pair receiving a score of 0 (blank) to 3. A score of “3” means “High” importance and indicates that the business process plays a critical and essential role for the public entity type. Lower scores imply less importance, with a blank indicating that the business process plays an insignificant role for the public entity. The business process importance score will be used in Section 3 as a weighting factor to evaluate the priority of geographic data themes for STRL entities. The assignment of scores is based on the subjective judgment of the authors using their

familiarity of a wide range of STRL agencies in all regions of the U.S. and through consultation of applicable literature (see citations above).

Table 2-4: Business Process Importance for Governmental and Public Entities

| Geographic Business Process | Government/Public Entity Type | | | | | | | | | | Composite Score |
|--|-------------------------------|------------------------------------|---------------------------------------|---------------------------------------|---|-------------------------------|---------------------------------|---------------------------------|----------------------------|--------------------|-----------------|
| | Tribal Government (TG1, TG2) | States/Territories (ST1, ST2, ST3) | Regional - Economic Development (RG1) | Regional-Transportation Service (RG2) | Regional - Planning/ Natural Resources (RG3, RG4) | Regional-Public Utility (RG5) | Regional-School Districts (RG6) | Regional-Special Services (RG7) | County/Township (LG2, LG4) | Municipality (LG3) | |
| Billing, Tax, Fee Mgmt. and Collection | 3 | 3 | 2 | 3 | 1 | 3 | 3 | 2 | 3 | 3 | 11.3 |
| Budget Analysis/Preparation | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12.0 |
| Business Activity Tracking | 1 | 3 | 3 | 1 | 2 | 2 | 1 | 2 | 3 | 3 | 8.8 |
| Comprehensive Land Use Planning | 1 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 8.2 |
| Construction Proj. Planning and Design | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 11.2 |
| Cultural/Historical Res. Assessment | 3 | 3 | 2 | 1 | 3 | 1 | | 1 | 3 | 3 | 10.3 |
| Demand Modeling and Analysis | 1 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 7.5 |
| Economic/Demographic Forecasting | 2 | 3 | 3 | 1 | 2 | 2 | 3 | 2 | 2 | 2 | 9.2 |
| E-Government Services | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 2 | 3 | 3 | 9.8 |
| Emergency Response | 3 | 3 | 1 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 11.2 |
| Emergency/Disaster Planning | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 11.3 |
| Environmental Regulation and Mgmt. | 3 | 3 | 1 | | 3 | 2 | 1 | 2 | 3 | 3 | 10.5 |
| Environ./Natural Resource Inventory | 3 | 3 | 2 | | 3 | 1 | | 1 | 2 | 1 | 8.7 |
| Facility Inventory and Tracking | 3 | 3 | 1 | 3 | 1 | 3 | 3 | 2 | 3 | 3 | 11.2 |
| Health/Safety Permitting and Enforce. | 3 | 3 | | | 1 | 2 | 2 | 1 | 3 | 3 | 10.0 |
| Incident/Complaint Tracking | 3 | 3 | | 2 | 1 | 3 | 1 | 1 | 3 | 3 | 10.3 |
| Land Development Insp. and Enforce. | 3 | 3 | | | 2 | 2 | 1 | 1 | 3 | 3 | 10.0 |
| Land Development Rev. and Permitting | 3 | 3 | 1 | 1 | 2 | 2 | | 2 | 3 | 3 | 10.3 |
| Legal Analysis/Judicial Actions | 3 | 3 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 10.5 |
| Property Valuation | 3 | 2 | 2 | | 1 | 1 | 1 | 1 | 3 | 3 | 9.0 |
| Public Information Distribution | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 11.3 |
| Public Meetings/Hearings | 1 | 2 | 1 | | 1 | 1 | 1 | 1 | 3 | 3 | 6.8 |
| Public Service Planning and Delivery | 3 | 2 | | 3 | | 2 | 2 | 2 | 3 | 3 | 9.5 |
| Site/Facility Maintenance Operations | 3 | 3 | | 2 | 1 | 3 | 2 | 2 | 3 | 3 | 10.7 |
| Site/Facility Maintenance Planning | 3 | 3 | | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 11.0 |
| Special Engineering Analysis | 2 | 3 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 8.3 |
| Special Planning Studies | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12.0 |

* The calculation of the composite score first generates subtotal scores for all public entity types and then creates one average score for the main public entity classes: 1) Tribal, 2) States/Territories, 3) Regional Agencies, 4) Local Governments. These four subtotals are then added to compute the final composite score.

With a maximum importance score of 12, the business processes exhibit a range from 7.0 to 12.0. The highest scoring business processes include: Billing, Tax, Fee Management and Collection; Budget/Financial Analysis; Construction Project Planning and Design; Emergency Response; Emergency/Disaster Planning; Facility Inventory and Tracking; Public Information Distribution; Site/Facility Maintenance

Planning; Special Planning Studies. High scores for these business processes reflect their commonality across most public entities.

SECTION 3

GEOGRAPHIC DATA NEEDS OF STRL PUBLIC ENTITIES

The business processes presented in Section 2 depend upon readily available geographic data. This section characterizes geographic data used by public entities as a first step in evaluating the priority of the data and the potential for Federal partnerships in support of the National Map Program.

3.1 EXPLANATION OF GEOGRAPHIC DATA THEMES

3.1.1 Scale and Accuracy Issues

The usefulness of maps and geographic information to STRL agencies is directly related to positional accuracy and the scale at which the geographic information is presented in map form. Positional accuracy is the level of conformance between the location of a feature as depicted on a map and its true location on the Earth. It is normally expressed as a maximum error in terms of a distance in meters or feet. “Absolute accuracy” is expressed in reference to an accepted coordinate system—usually a plane coordinate system like State Plane or Universal Transverse Mercator (UTM). Map scale is a ratio: map feature size/actual size of a feature as it is depicted on a map (where size is a measure of linear distance). Scale is best represented as a Representative Fraction (RF) but is often shown as an “inch-scale equivalent.” For example, an RF of 1/1,200 (also represented as 1:1,200) is the same as “1 inch = 100 feet.” “Large scale” (large RF) means that features are mapped at a size closer to their actual size while “small scale” maps depict features in a less detailed way. Large scale means “small area” and small scale implies coverage of a larger area. Strictly speaking, the scale at which a map is presented as a digital display or in hard copy form is independent of its positional accuracy. With automated mapping capabilities, users may generate maps at scales that suit their needs—with an understanding that a change in scale does not change the accuracy. In practice, it is common for certain standard map sets to be associated with a specific scale and established accuracy such as the USGS topographic map series at 1:24,000 scale.

Users’ needs for geographic data and maps generated from this data are very sensitive to scale and accuracy. Map features collected and presented at too small a scale may be of little or no use for local applications. Similarly, very detailed and highly accurate data and maps may not serve the needs of a large area planning study which might require that the data be generalized.

This study identifies and compares several “Scale Categories” to further examine scale/accuracy relationships and needs. Table 3-1 defines five scale categories and provides an explanation of the typical types of map products that cover a range of map

scales from very site-specific to very general—all of which have some value for STRL entities and as well for federal agencies.

Table 3-1: Explanation of Geographic Scale Categories

| Scale Category ¹ | Scale Range ² | Map Accuracy ³ | Common Examples of Map Products |
|-----------------------------|--|---------------------------|--|
| Statewide | Less than 1:250,000 | 150 meters or coarser | State Highway or political maps; statewide thematic maps |
| Regional | 1:50,000 to 1:250,000 | 25 to 200 meters | USGS 1X2 degree topographic map series; County Highway Maps; County comprehensive plan maps; utility service district maps |
| Sub-Regional | 1:10,000 to 1:50,000 (1" in. = 833 ft. to 4166 ft.) | 3 to 30 meters | USGS 7.5 minute topographic maps; utility service area maps; FEMA Flood Insurance Maps; NRCS Soil Survey Maps; many types of maps that use the USGS 7.5' quad as base. |
| Local | 1:1,200 to 1:10,000 (1" in. = 100 ft. to 833 ft.) | .3 to 6 meters | Local parcel maps; local utility distribution system maps; local planimetric base maps; large-scale city street maps |
| Site-Specific | 1:1,200 and larger (1" in. = 100 ft. and larger) | .5 meters or finer | Local subdivision plats; local site plan maps; construction plans or as-built drawings |

Footnotes:

¹Terms used for general categories that represent a range of scales and associated level of detail at which maps are compiled and used.

²Range of scales at which maps in this category are typically compiled and used. Expressed as a representative fraction (RF).

³Normal level of absolute accuracy for most maps in this category. This is considered to be a minimal level of expected accuracy. With greater use of high-precision photogrammetric mapping and GPS equipment for field data collection and post-processing, these accuracy levels can often be much better.

3.1.2 Data Theme Description

The term “geographic data theme” is used to refer to an aerial image or set of map features with important attributes that characterize those features. In GIS usage, a data theme consists of logically-related spatial features in raster or vector form along with core attributes, stored in a database, that uniquely identify and describe the features (e.g., a unique ID or key field, type or class designation, an identifying name, and important physical or descriptive information). “Geographic Data Theme” is loosely equivalent to the terms, “layer” or “data set” and is used here in a manner consistent with its usage in the Federal Geographic Data Committee (FGDC) Framework initiative (FGDC, 1995).

Table 3-2 identifies and briefly describes a wide range of geographic data themes that are used by STRL entities. Many of these have applicability across a wide range of organizations and program areas while others have a more limited or specialized purpose. To better visualize the scope of this data theme range, the themes are organized under the following “data theme groups”:

- **Base Map Themes**—Those reference layers in the GIS that provide a foundation for other layers and which are frequently needed by a large number of users. The themes in this group include several that have been formally defined Framework Working Group of the Federal Geographic Data Committee

(FGDC) with contribution by the Mapping Science Committee of the National Research Council and USGS through their vision of the National Map.

- Aerial Imagery: Raster imagery including raw data or geographically rectified ortho imagery from satellite or aircraft platforms. Note: the orthoimagery FGDC Framework Theme is included in this data theme group.
- Elevation/Terrain/Topography: Spot elevation or raw mass point elevation data sets, digital elevation or digital terrain models in grid or TIN format, or derived themes such as slope and aspect. Note: the Elevation FGDC Framework Theme is included in this data theme group.
- Map Control and Reference Grids: Themes containing surveyed benchmarks or control points to which x,y or x,y,z coordinates have been assigned. This theme also includes recognized land survey corners and lines (e.g. PLSS) and user-specific map sheet grids.
- Governmental/Service/Administrative Districts—Data layers that represent boundaries of governmental jurisdictions, areas designated for administration of services or program management, or political districts associated with elections of local, State, or federal officials.
- Utility and Infrastructure—Data layers dealing with man-made facilities that are related to transportation, the delivery of utility service, buildings, or other constructed facilities.
- Emergency Planning and Management—These themes depict features and areas that are essential to planning for and responding to natural and human-induced events and local public safety incidents. This includes hazard areas, as well as facilities and resources to support response.
- Land Cover, Cultural and Environmental Resources: Depict natural and vegetative land cover, natural features, areas with special environmental qualities such as wildlife habitats, areas specially designated for environmental management or protection, and areas developed for access to recreational and environmental resources. Also includes data and features supporting the monitoring environmental quality.
- Hydrography, Landscape, and Geological Resources: Includes all surface water bodies, streams and rivers, basin and watershed boundaries, and sub-surface hydrology. This group also includes soil types, surficial geology (bedrock or unconsolidated deposits), and quarry or mineral extraction sites.
- Property-related—All data representing the legal and assessed boundaries of real property and associated features that relate to property taxation, land subdivision and development, and the conveyance of rights associated with tracts of land. It also includes themes for tracking government owned-land and buildings.
- Socio-economic—Data themes that deal with economic, business, demographic, and land use characteristics of the land.

Table 3-2 gives a brief description of each theme and shows a scale category relationship indicating the scale categories for which the data theme is most often compiled and used. A total of 83 geographic data themes have been defined. The authors selected these themes from their experience working with many state, regional, and local organizations nationwide and by consulting several applicable studies and surveys including, Ventura (1995), Frank, S., *et al.* (1995 and 1996), Greene (2000), Mapping Science Committee (1995, 2001), National States Geographic Information Council (2002), Croswell and Lambert (1999), O’Looney (1997), The intent was to establish a set of “raw” data themes as a high-level logical design for STRL. This list does not include narrowly used special-purpose data themes that may be compiled and used for a very specific purpose or the many geographic datasets that could be generated through analysis or combination of the original data themes.

Table 3-2: Description of Geographic Data Themes Used by State, Tribal, Regional and Local Governments and Public Entities

| LEGEND: Primary Relationship Secondary Relationship | | Scale Category ¹ | | | | |
|--|---|-----------------------------|----------|--------------|-------|---------------|
| | | Statewide | Regional | Sub-Regional | Local | Site-Specific |
| Geographic Data Theme | Explanation | | | | | |
| Base Map Features | | | | | | |
| Digital Raster Graphics | Scanned USGS 7.5' topographic quadrangles registered to the UTM coordinate system. | | | | | |
| Planimetric Features/Structures-General | Features captured from aerial photography or imagery. Typically large scale and include selected man-made structures (buildings, tanks, etc.). Depending on the compilation scale, they may be captured as point features and displayed with standard cartographic symbol. | | | | | |
| Planimetric Features-Detailed | Features digitized from aerial photography through stereocompilation or sometimes field data capture. Large scale containing many detailed features such as sidewalks, curbs and road edges, building outlines, parking lots, and man-made structures (storage tanks). | | | | | |
| Transportation—Major Roads and Highways | Interstates, State and County highways with attributes for route numbers and other information. May be referenced using a Linear Reference System. | | | | | |
| Transportation—Local Streets | Local streets with address range attributes and local route numbers (County, Town) when they exist. | | | | | |
| Aerial Images | | | | | | |
| Low Resolution Imagery | Imagery from satellite scanners or scanned from hard copy sources-not necessarily ortho corrected, with pixel resolution greater than 5 meters. | | | | | |
| Orthoimagery—General | Orthorectified raster data derived from scanned aerial photography or satellite imagery with a pixel size normally in the 1 to 5 meter range. | | | | | |
| Orthoimagery—Detailed | Orthorectified raster data derived from scanned aerial photography or from digital aerial cameras. Pixel size less than 1 meter (down to .25 meters) | | | | | |
| Terrain/Topography | | | | | | |
| Digital Elevation Model—Detailed | DEMs used to create detailed contours (5-foot interval or better) or for detailed topographic analysis. Consist of dense collection of elevation mass points are collections and detailed topographic breaklines. May be used to generate digital terrain models (TIN or Grid format). | | | | | |
| Digital Elevation Model—General | A grid of elevation values sampled at a designated interval. In the case of the 7.5' USGS DEMs, the grid is based on a 30-meter x 30-meter interval of elevation values. | | | | | |
| Spot Elevations | Points with an assigned elevation value. | | | | | |
| Topographic Contours-Detailed | Depiction of general elevation variation using isolines that follow an elevation above sea level. Normally uses a contour interval of less than 10 feet. | | | | | |
| Topographic Contours-General | Depiction of general elevation variation using isolines that follow an elevation above sea level. Normally uses a contour interval of 10 feet or greater. | | | | | |
| Map Control and Reference Grids | | | | | | |
| Geodetic Control Points/Monuments | Horizontal and/or vertical control points established with accurate field survey techniques with permanent marker and documentation. Can be referenced with high precision to geographic coordinates (lat/long), horizontal and vertical datum, and appropriate plane coordinate systems. | | | | | |
| Survey Control Points | Horizontal and/or vertical points established to support surveying or mapping projects. May be referenced to a datum and coordinate system or just locally defined (e.g., fixed point for site survey). May or may not have a physical marker. | | | | | |
| Survey System Corners/Grid Lines | Corner points and/or boundary lines of recognized land survey systems (varies) depending on area of the country (e.g., Public Land Survey System in Midwest and West). | | | | | |
| Map Sheet Grid | Grids, normally rectangular, that define the boundaries of standard map sheets used by an organization (e.g.,USGS Topographic Quads, County grid for parcel mapping) | | | | | |
| Governmental/Service/Administrative Districts | | | | | | |
| Governmental Jurisdictions | National, State, County, Tribal jurisdiction, and municipal boundaries. | | | | | |
| Regional Agency and District Boundaries | Independent, publicly mandated agencies with granted authority over a specific geographic area. Examples including regional planning agencies, natural resource management or conservation districts (e.g. Flood Control), transportation or utility service districts or authorities, independent school districts, and many others. | | | | | |
| Local Administrative Areas | Districts defined by or for local government agencies to support administration of local programs or allocation of local services. Examples include: city or county run school districts, planning neighborhoods, traffic analysis zones, maintenance zones. | | | | | |
| Local Election Districts | The boundaries of districts represented by local elected officials, such as judges, and members of city or county councils. | | | | | |
| State Administrative Districts | Districts developed by State agencies to organize the administration of duties and the delivery of services. | | | | | |
| State and Federal Election Districts | The boundaries of the federal and State representative and State senatorial districts. | | | | | |
| Utility Service Areas | Areas served by a designated public or private utility (e.g., water, sewer, gas, electric, telephone). | | | | | |
| Voting Precincts | The boundaries of precincts that are assigned to voters, indicating the polling location where they will vote. | | | | | |
| Other Special Zones or Districts | Other geographically defined areas that have some significance to local or statewide programs. Examples include: zip code areas, permanent or temporary areas to which access restrictions apply. | | | | | |

Table 3-2: Description of Geographic Data Themes Used by State, Tribal, Regional and Local Governments and Public Entities (continued)

| Utility and Infrastructure | | | | | | |
|---|---|--|--|--|--|--|
| Project Areas--Regional or State | Planned or current construction or development projects throughout the State and administered by State or regional agencies. | | | | | |
| Electric Distribution Facilities | The facilities supporting the distribution of electrical power to individual buildings and sites. These features include poles, primary, secondary, and service distribution lines (above and below ground), transformers, switches, and other control devices. | | | | | |
| Electric Generation and Transmission Facilities | The facilities that form the infrastructure supporting the generation and transmission of electrical power. Features may include power generation plants, transmission towers, substations, and transmission lines. | | | | | |
| Gas Distribution Facilities | The facilities supporting the distribution of natural gas to individual buildings and sites. These features include mains and service lines, manholes, valves, meters, and other flow control devices. | | | | | |
| Oil and Gas Supply and Transmission | The infrastructure required to extract, process, and transmit oil and gas from sites of production to sites of consumption. | | | | | |
| Project Areas--Local | Planned or current construction or development projects administered by local authorities. | | | | | |
| Public/Private Transit | Public transit facilities and routes, private transport facilities, and areas served by private transporters. | | | | | |
| Railroad Lines and Facilities | All facilities that support railroad operations, including active and abandoned rail lines, railroad stations, etc. | | | | | |
| Sanitary Sewer Treatment and Collection System | All facilities associated with collection and treatment of wastewater. Features include treatment plants, interceptor lines, sewer mains and laterals, lift stations, manholes, etc. | | | | | |
| Storm Sewer/Drainage Control Facilities | Maintained storm sewers and drainage facilities designed to collect and control storm drainage in local areas. Includes underground storm sewers, catch basins, inlets, maintained open channels, retention ponds, etc. | | | | | |
| Telecommunication Facilities | All facilities supporting telecommunications, including cellular phone towers, telephone lines, and exchange boxes, as well as cable TV infrastructure. | | | | | |
| Transportation Facilities--Highway | Infrastructure related to the construction and operation of highways (State, Interstate), such as bridges, overpasses, highway signs, pavement characteristics, etc. | | | | | |
| Transportation Facilities--Local | Infrastructure related to the construction and operation of local roads such as traffic signs, signals, pavement types, and other road characteristics. | | | | | |
| Water and Air Transportation Facilities | Airports, seaports, river ports, locks, and all associated facilities that support the movement of goods through the air or on the water. | | | | | |
| Water Distribution System | All the water distribution facilities, including mains, hydrants, valves, service lines, pump stations, etc. | | | | | |
| Water Supply and Transmission | All facilities related to the supply and treatment of water from wells and reservoirs to the transmission of water (through major distribution mains) to the local distribution network. | | | | | |
| Emergency Planning and Management | | | | | | |
| Areas at Risk | Sites or areas with great risk impact in disaster (e.g., power plants, hazardous material storage sites, etc.) | | | | | |
| Critical Emergency Facilities | Facilities such as Emergency Operation Centers, shelters, and other sites that support the management of events during emergency operations. | | | | | |
| Emergency Monitoring Sites | Locations and data associated with equipment and features that are used to detect and monitor emergency situations. Examples include weather stations, flood gauges, etc. | | | | | |
| Emergency Supply Points | Important repositories of supplies needed during emergencies. These may be storage locations of special equipment or commercial wholesalers of food, clothing, or medical supplies. | | | | | |
| Evacuation Routes | Designated routes to be followed by citizens when evacuating areas in the case of a hurricane or similar emergency. | | | | | |
| Flood Zones | Areas along river or stream courses and coastal areas susceptible to flooding as defined and mapped by FEMA or another recognized organization. Will categorize areas by level of flooding threat. | | | | | |
| Flood Control Facilities | Includes flood control facilities such as levees, dams, flood walls, floodgates, jetties, or any other structures or devices with the purpose of controlling water flow and floodwaters. | | | | | |
| Natural Hazard Risk Areas | Areas or locations that have a special risk related to a naturally occurring disaster (not including flood zones, Examples include landslide or mudslide areas, earthquake zones or fault lines, etc. | | | | | |
| Public Safety | Locations of public safety facilities (police, fire, emergency medical stations), response or reporting areas associated with public safety services, mapped information on incidents such as crime, accidents, medical response, and fires. | | | | | |
| Land Cover, Cultural and Environmental Resources | | | | | | |
| Agricultural Production | May include information about crop and livestock production information at a detailed level (individual field or farm basis) or a general aggregation of production for larger geographic areas (e.g., County) | | | | | |
| Air and Water Monitoring Sites | Locations of facilities and equipment that are used to monitor the quality of air and water and monitoring data associated with these sites. | | | | | |
| Cultural Resources | Locations of architectural survey sites, archeological survey sites, sites being evaluated as National Register sites, and other types of cultural resources. | | | | | |
| Designated Environmental Areas | Areas designated for special management or protection because of environmental or natural qualities (scenic area, physical, biological). May include government managed forests, nature preserves, wildlife refuges, conservation easements, etc. | | | | | |
| Forest Management Areas and Forest Data | Defined zones inside forests (e.g., management units, compartments, zones, stands) used for prescribing and tracking management activities and data associated with those areas. | | | | | |
| Land Cover | A characterization of the vegetative or non-vegetative cover at the surface. Land cover is differentiated from "land use" which classifies areas based on the use of the land. | | | | | |
| Local Park and Recreational Facilities | All areas and features administered by local authorities that have been designated for recreational use. These features include trails, camping areas, swimming areas, parks, playgrounds, athletic fields, and picnic areas. | | | | | |
| Rare, Threatened, and Endangered Species | Locations of recorded sightings of rare, threatened, and endangered species. This information will have restrictions on access and distribution. | | | | | |
| Significant Plant or Animal Habitats | Habitats associated with significant plant or animal species. These areas may or may not be protected areas. This information may have restrictions on access and distribution. | | | | | |
| State and Federal Park and Recreational Facilities | All areas and features administered by federal or State authorities that have been designated for recreational use. These features include trails, camping areas, swimming areas, parks, and picnic areas. | | | | | |
| Wetlands | Land areas in which the water table is high and which exhibit seasonal, intermittent, or permanent wet conditions. | | | | | |

Table 3-2: Description of Geographic Data Themes Used by State, Tribal, Regional and Local Governments and Public Entities (continued)

| Hydrography and Geological Resources | | | | | | |
|--|--|--|--|--|--|--|
| Mineral Sites and Quarry Operations | Delineated areas of known or suspected deposits of economically valuable minerals or rocks and actual sites of mining or quarrying operations. | | | | | |
| Soils-General | General soil associations mapped for large areas giving a general indication of soil characteristics and topographic location | | | | | |
| Soils-Detailed | Detailed soil units from Soils Surveys conducted by the U.S. Natural Resource Conservation Service (NRCS) or another recognized organization that differentiates mapped units in the basis of a range of physical, topographic, and chemical properties. | | | | | |
| Subsurface Hydrology | Underground water bodies such as aquifers and underground rivers and streams. | | | | | |
| Surface Hydrography | Rivers, streams, lakes, ponds, and other water bodies visible on the surface. | | | | | |
| Surficial Geology | Composition and geological type of bedrock or unconsolidated geological deposits at the surface or immediately below the soil. | | | | | |
| Watersheds/River Basins | Areas delineated by their drainage patterns, where all surface water in the area drains to a single river or stream. Watersheds may be delineated in a nested fashion where major watersheds (or hydrologic units) cover very large areas of the State and each encompasses successively smaller watersheds. | | | | | |
| Property/Cadastral | | | | | | |
| Assessment Parcels | Parcels defined by local assessors (and recognized by State Depts. of Revenue) and listed on tax rolls w/ unique parcel ID. A parcel may be formed from one or more legal lots. | | | | | |
| Government Buildings | Buildings owned by federal, State, or local government agencies | | | | | |
| Government-owned Properties | Properties (parcels) owned by federal, State, or local government agencies | | | | | |
| Legal Lots | Legally defined lots documented through recorded subdivisions, official surveys, deeds, or other legal instruments that define boundaries under designated ownership. May include easements or rights that legally restrict or grant certain uses to all or part of the lot. | | | | | |
| Special Tax Rate Areas | Areas that have significance in property valuation and/or tax administration such as assessment neighborhoods or special districts such as fire protection district, public utility service districts; special fee districts (e.g., street light improvement zones), etc. | | | | | |
| Subdivision Boundaries | The boundaries of Parcel subdivisions that conform to the original parcel or portion of that parcel that was subdivided. | | | | | |
| Utility and Railroad Easements | Defined areas or corridors encompassing all or portions of single or multiple parcels that designate specific restrictions or rights associated with that area (e.g., corridor for the path of an underground water or electrical line). | | | | | |
| Socioeconomic | | | | | | |
| Business License and Business Activity | Data indicating locations where business licenses have been granted. These data will be point data and associated tabular databases. | | | | | |
| Census Geography and Demographic Characteristics | Census areas consist of census tracts and block groups defined by the U.S. Census Bureau (CB). Demographic data collected by the CB Census Bureau are associated with the block groups and tracts. | | | | | |
| Community/Regional Amenities and Conditions | Many data associated with quality of life and conditions in an area. May include restaurants, shopping centers, places of worship, specific types of schools, and availability of activities and conditions associated with traffic, basic services, climate, etc. | | | | | |
| Land Use-Detailed | Land use characterizations based on parcel boundaries, often supported by large-scale aerial photography. | | | | | |
| Land Use-General | General categories of current land use usually mapped using small-scale imagery such as satellite imagery or high-altitude aerial photography, and not referenced to parcel or lot boundaries. | | | | | |
| Land Use-Planned | Map information usually prepared as part of a comprehensive land use planning project. It depicts general areas (on a City or County scale) defining planned types of use or development for a defined future period. | | | | | |
| Zoning | Area defined by a local jurisdiction which define acceptable types of development. | | | | | |

3.2 IMPORTANCE OF GEOGRAPHIC DATA TO STATE, TRIBAL, REGIONAL, AND LOCAL ENTITIES

3.2.1 STRL Programmatic Mandates Requiring Geographic Data

To gain an initial impression of the importance of geographic data for STRL entities, the data themes have been compared to the entities in Table 3-3. This assignment of “primary” and “secondary” relationships is based on the authors’ experience with STRL organizations and consultation of literature cited above in 3.1.2. This general evaluation reveals, not surprisingly, the popularity of certain themes that may be referred to as foundation or Framework. This includes such themes as geodetic control, survey system

grids, transportation, planimetric base features, governmental and district jurisdictional boundaries, hydrography, orthoimagery (particularly high-resolution), and Census/Demographic data.

Public organizations and governmental units at all levels in the U.S. rely on various types of official mandates as their basis for existence and for carrying out their work. The Federal government, for example, exists through the creation and ratification of the U.S. Constitution and legislation, by Congress, and Presidential policies or executive orders. Similarly, individual states have adopted constitutions, passed laws, issue executive mandates. The Federal government and state governments have created numerous subordinate units of government under their constitutional powers and provisions and through passage of individual statutes. In turn, the subordinate governmental entities have established and formalized their own procedures for implementing rules of governance. Likewise, sovereign native populations have organized independent governance structures and operating mechanisms and procedures.

The number and diversity of public entities across the U.S. makes it quite difficult to comprehensively and concisely categorize the basis or mandates for the myriad of programs and activities that require geographic data. Nevertheless, activities carried out under all of the business processes can generally be associated with one or more of the following types of official mandates or directives:

- Federal or state constitutional authority
- Charter for local government
- Federal or state statute
- Federal or state regulation or administrative rules
- Delegated authority (e.g., granted authority from Federal government to state, tribal, or local entity)
- Local government ordinance or administrative rule
- Case Law establishing precedents for action
- Judicial actions and orders
- Charter or official policy and mission statements defining the role and responsibility for regional agencies and public utilities
- Executive Order from elected official
- Official order or resolution from elected or appointed governing body (e.g., city or county council, tribal council, regional agency or public utility governing board, elected school board).
- Official policies adopted by public agencies
- Contracts, interagency agreements, or official fee or funding programs for public services or programs

In most cases, public entity programs and business processes that require or involve the use geographic information will fall under at least two and often three or more of the mandates. For example, one unit of government may pursue a program like water pollution control after enacting its own local law to accept delegation of the program from a higher tier government entity. It may also pursue the water pollution control activity because financial assistance is available, the program enables growth and expansion, and customers pay the entity to deliver sewer service. A few examples of the more common mandates at the state, regional, or local level that drive the need for geographic data by STRL organizations include:

- State laws implementing U.S. Environmental Protection Agency programs such as air pollution control, drinking water and wastewater revolving funds, hazardous and solid waste, underground storage tanks, non-point source pollution, and water quality planning and watershed management.
- State and local laws requiring the valuation of real property and equalization of assessments.
- State and community public health laws and regulations requiring immunization prior to attending public school, authorizing tuberculosis prevention and control, and pursuing vector elimination.
- State and local laws and policies to assist agricultural communities and silvicultural enterprises, including soil and water conservation, soil surveys, empowerment zones, forest management incentives, and rural development.
- State, regional, and local transportation/transit planning and improvement statutes and ordinances.
- County or local statutes and ordinances mandating comprehensive land use planning or zoning
- State and community laws governing mitigation of natural hazards, including community implementation of the National Flood Insurance Program.
- Local funding authorizations and financial assistance for moderate and low-income housing development.
- Local ordinances and official policies (often approved by City or County Councils) that define requirements for land development permitting (e.g., subdivision approval, building permits)
- Federal Communications Commission E911 regulations and programs in state and local governments that necessitate road and address mapping activity. The FCC Phase II wireless rules are of particular significance.

- Government Accounting Standards Board Statement #34 (GASB34) which makes a strong case for improved inventory and monitoring of publicly owned infrastructure (buildings, roads and transportation facilities, utilities) and encourages the use of GIS technology to support the recommended tracking of assets and public financial management.
- State statutes creating coordinating bodies for geographic information management, e.g., the Kentucky Office of Geographic Information and the Geographic Information Advisory council that is advisory to the Chief Information Officer.

It is obvious that governmental bodies require some official basis or authorization before pursuing program and work activities. In certain program areas, authorizing declarations specifically reference or direct how geographic information will be used in conducting work activities. As confirmed in many recent studies—David, et al (1998); Frank, et al (1996); Greene (2000); Johnson, et al (2001); Kentucky Office of Geographic Information (2000); Mapping Science Committee (1995, 1997, 2001, 2002); National States Geographic Information Council (2002); Ventura (1995); Cahan (2000), **public entities have strong legal, financial, and policy mandates that require the collection, use, and distribution of geographic data—whether or not such data management is explicitly cited in the mandate.**

All 27 business processes are conducted by different level governmental entities under one or more mandates in the form of policy statements, statutory laws, administrative regulations, or judicial decisions.

The existence of Federal financial assistance and mandates in the form of delegable and other programs does have, no doubt, an important influence on many of the business processes conducted by non-federal governmental organizations, but in a large number of cases, similar business activities would be conducted even if Federal incentives and requirements were absent. In other words, STRL entities will continue to conduct work involving the use of geographic information because their individual mission's demand it.

Programs and business processes related to public health, development of land and natural resources, and infrastructure, including real property and structures, have the clearest basis for using spatial data because they involve activities tied to distinguishable locations on the land surface. In addition, they have a longer history with and represent some of the earliest uses of specific location-based information. At the same time, governmental entities are increasingly using geographic information in program areas and businesses processes that have not traditionally relied heavily on locational references. For example, STRL entities have begun to use geographic information to perform interpretation and planning in social service provision, education delivery, and promotion of economic development, and it appears likely that this trend will continue and expand to other business process areas.

Overall, non-federal government agencies have compelling economic and programmatic reasons to develop, use, and maintain geographic information as they fulfill their mandatory and volitional responsibilities to their citizens, constituents, and customers. These reasons, and the resulting use of geographic information, will only increase for STRL entities in the future in response to growth and competitive pressures, issue and technological complexity, reduced funding and increased accountability, and expanded information availability. While STRL entities will independently continue to develop and use geographic information, it is imminently more sensible to create opportunities for collaborative programs and ventures involving multiple levels of jurisdictions than it is for each governmental jurisdiction to pursue its own stand-alone activities.

3.2.2 Costs and Benefits of Geographic Data

The most compelling justification for spatial data is the common locational identification that it provides. The ability to tie events, incidents, facilities, and facts to a specific location or place on the surface of the Earth creates a unique and cross-cutting reference that all users, regardless of the level of government or type of program, can understand and share.

While the number of authoritative studies or sources that establish costs for spatial data management and GIS is exceptionally limited indeed, it is important to attempt to establish the general size of the overall investment and the range of expenditures being experienced by STRL entities. According to figures cited in *Financing the NSDI* (2000), worldwide GIS sales range from slightly less than \$1.1 billion in 1998 to an estimated \$1.7 billion in 2002. The document acknowledges that up to 80 percent of the costs for GIS projects may be made up of expenditures for spatial data, and these figures are omitted from the preceding totals. If all costs for spatial data were included, the \$1.1 to \$1.7 billion estimates would certainly be several times larger. Unfortunately, the NSDI document made no attempt to segment the GIS sales into the STRL entities that are the focus of this report.

The National Academy of Public Administration's 1998 publication, entitled *Geographic Information for the 21st Century-Building a Strategy for the Nation*, provides additional refinement on the range of costs being incurred for GIS and spatial data by various segments of the private and public markets. The document reports that "Federal Agencies are spending \$2.5-3.0 billion annually on the collection and management of geospatial data," and it further indicates the addressable share of the information services market for products like commercial satellite imagery as \$86 million for state and national government and \$576 million for local governments.

To be sure, neither source provides much of the needed detail on the actual expenditures being made by STRL entities, but they do convey an indication of the large and growing nature of spatial data management and GIS expenditures.

Costs-benefit analyses were routinely conducted for many STRL GIS projects in the 1980s and early 1990s to establish the efficacy of the new efforts, but once benefits were generally demonstrated to exceed costs, interest in performing the expensive and involved analyses declined. In more recent years, only a few investigations of the costs and benefits of spatial data and GIS have been conducted at the state and local level.

The Montana Geographic Information Council conducted an analysis of GIS implementations in state and county government in 1998. Nine case studies (three local governments and six state agencies) were performed using the Gillespie model for calculating efficiency and effectiveness benefits (1997). The analysis confirmed cost-benefit ratios ranging from 1.2 to 5.6 for effectiveness benefits, but the report also indicated that state and local governments are developing or tracking minimal economic data that can be used to justify investments in spatial data and GIS technology. Two other important conclusions from the analysis were that the greatest long-term gains come from the elimination of redundant data and adherence to common data standards and that data should be collected to satisfy the needs of the most beneficial GIS applications.

In an attempt to determine spatial data expenditures and resulting benefits, the Ohio Department of Administrative Services through the Ohio Geographically Referenced Information Program (OGRIP) conducted a Cost-Benefit Analysis of Spatial Data for nine Ohio state agencies in 2000 and 2001. Ohio operates an intermediate to advanced spatial data management program that is considered representative of approximately one-quarter to one-third of the states. The quantitative analysis performed using a proprietary cost-benefit model determined that between \$225 and \$250 million had been expended for spatial data management by the nine agencies from 1991 through 2000 and that future annual expenditures will likely be in the range \$45 million in current dollars.

The Ohio cost-benefit results also confirmed earlier cost-benefit findings that spatial data programs almost always require large front-end data investments that may represent 75 to 80 percent of total program costs and that the tangible and intangible benefits that are realized materialize over longer horizons (five to seven years), which often extend beyond the time frame of the initial development expenditures. Despite their obvious value, it remains clear that spatial data management endeavors continue to be time consuming and expensive to establish and maintain.

Because of the high front-end or entry costs and the divergence between the timing of expenditures and benefit realization, spatial data management programs must produce extensive and demonstrable benefits for STRL entities that begin or continue to invest in them. In other words, clear and persuasive evidence or demonstrations of the range of potential benefits must exist for decision makers to justify spatial data investments during a time when funding for many government programs is decreasing. To substantiate decisions to fund spatial data activities, government officials at all levels generally rely on economic analyses previously completed by other agencies engaged in similar efforts and internal assessments of the benefits that are likely to realistically accrue in their own programs and for their constituents.

A thorough evaluation of benefits for spatial data management programs requires that SRTL governments examine both tangible and intangible factors. Tangible or quantifiable benefits are those for which a dollar value can be established, while intangible or non-quantifiable benefits, which may be just as real as tangible outcomes, are not easily measured in market or monetary terms.

A history of operational use of geographic data and GIS technology over the past 20 years has revealed the following general types of benefits that public agencies can expect to see from well-planned and coordinated implementation efforts.

| | |
|---|--|
| Reduction in labor time | Profound and direct efficiencies in the staff time use for map and geographic information maintenance, access, analysis, and use. Experience from sites with operating GIS show efficiency gains from 3:1 to 25:1 in “search and access” times. Savings of time in the analysis of geographic information to generate useful products is profound—in many cases allowing the generation of products that would not be feasible using manual means. |
| Information security and protection against catastrophic loss of records | Many public agencies continue to maintain valuable geographic information (e.g., land records, infrastructure data) in hard copy form—often without hard copy backups. Automating this data protects agencies from losses that, in financial terms may be incalculable. This automation also prevents loss and degradation of hard copy records through normal use and provides a multiple-user environment. |
| Avoidance of new staff and overhead costs in the future. | Public agencies are continually faced with new and sometimes unexpected costs resulting from new legislation and regulations, judicial actions, economic pressures, etc. Having a flexible legacy system in place that can be used to meet new mission mandates with a minimum of new data creation and application development can help meet new challenges. |
| Avoidance/reduction of infrastructure costs | Geographic data and GIS technology has provided significant benefits to public agencies (particularly local governments) that have used the technology with integrated facility management systems (for maintaining all infrastructure: buildings, roads, bridges, utilities, etc.). Savings in through improved coordination of maintenance activities and use of high-quality geographic information to support engineering design work can result in great financial savings. Use of the technology for long-term infrastructure planning and remedial maintenance planning also delivers considerable financial benefits. |
| Cost or Damage Avoidance | The use of inaccurate or inconsistent data can result in incomplete or incorrect interpretations and decisions, often requiring additional expenditures. Resources are also committed to redundant data collection and maintenance efforts, which impede consistent access to data and information sharing and exchange. By sharing data between entities and not creating data redundantly all entities sharing the data can avoid costs and do their missions rather than create base data over and over. Also, using the same base data over a geography enables easier overlay analysis because everyone’s data goes down on the same base and at least a few of the variables are removed from the accuracy equation. |
| Improvement in the quality and timeliness of public services | Automated geographic data accessible through information technology and GIS tools delivers potentially profound benefits that cannot easily be quantified but which have a positive result in raising the quality of services for citizens and business. Web-based GIS tools used as part of e-government and “311 non emergency service” programs are enhancing city services while reducing government labor costs and turnaround time. |
| Investment in Data Improvement | Practical cases have shown that the process for geographic database development results in an improvement of the quality and detail of information maintained by public agencies. Metadata development is a resource that supports ongoing update and data access. It is difficult to |

| | |
|--|--|
| | quantitatively measure the value of this data improvement, but it will provide the basis for enhanced operations, better decision-making, and the ability to respond to growth. This data improvement should be considered an investment that yields future payback. |
| Environmental Protection and Sustainable Growth | A principle use of geographic data is to support growth management and to protect environmental and cultural resources (which carry a huge economic value and benefit). Decision support systems based on sound geographic databases are a foundation for intelligent growth planning decisions. |
| Homeland Security | Up-to-date geographic data is a foundation for emergency management and homeland security initiatives that focus on threat identification, emergency planning, emergency response, and assessment/recovery. The result, when used effectively with GIS and other IT tools results in saved lives and property. |
| Industry and Economic Development Incentive | The U.S. has been the world leader in the spatial information technology industry. This is an international growth market that benefits U.S. based firms and the overall economy. Expenditures from public agencies have helped fuel industry growth and the leadership of U.S. firms. Continued investments by Federal, state, and local governments in the technology and related services not only provides operational benefits but helps support an important sector of the U.S. technology industry. |

While relatively few well-documented cost/benefit studies have been carried out, there is a small body of information, from user organizations, that confirm the general benefit outcomes and ranges that were found in earlier studies, analyses, and investigations. Examples include Baltimore County Maryland's Cost Benefit, Geographic Information Systems, (Office of Information Technology business Application's Unit, GIS, 2001) URISA's *Determining, Measuring, and Analyzing the Benefits of GIS* (Gillespe, 2000); the Montana Geographic Information Council's *Analysis of Geographic Information Systems (GIS) Implementations in State and County Governments of Montana* (McInnis and Blundell, 1998); work done by Bhagwat from the Illinois State Geological Survey on the value of geologic maps (Bhagwat, 2000, and Bhagwat and Ipe, 2000); the United Nations' *Geographical information Systems in the Census Process-Technology Options, Costs, and Benefits* (Deichmann, 1997); Ohio Geographically Referenced information program's *Costs and Benefits of Spatial Data in Ohio* (PlanGraphics and Booz Allen Hamilton, 2001); and ESRI's Return on Investment section of the *Government Matters* newsletter (2000, 2001, and 2002). In addition to these sources, numerous older analyses, reports, and articles exist and, as a result of more recent findings, are considered to remain valid and relevant.

Tangible benefits produce reductions, savings, or improvements in the form of labor hours or dollars for both recurring and non-recurring expenditure categories. The elimination of redundant personnel and non-personnel expenditures is a typical tangible benefit for the following activities:

- Collecting spatial data
- Compiling, updating, and maintaining spatial records
- Searching, retrieving, and refilling spatial data records
- Using and analyzing spatial data.

Importantly, these savings are realized at all organizational levels, including management, technical and operations, and clerical or administrative functions. Further, the benefits accrue to both spatial data management programs and IT system support services.

In addition to actual costs reductions, work performance levels or efficiency percentages are improved, resulting in less inefficiency, greater time savings, and improved productivity. As a result, personnel or dollars can be redirected to other high priority activities and assignments, and the long-term need to add staffing to perform redundant functions is decreased. This is particularly significant because recurring labor costs often represent the single largest cost element for spatial data management programs.

Another tangible benefit is cost avoidance. Out-of-date, incomplete, or inconsistent spatial data content promotes duplication and impedes information sharing and ready exchange, and its use contributes to increasing inaccuracy and common errors and mistakes in analysis, all of which must eventually be corrected. Inaccuracies and errors can, however, be especially critical in emergency situations, resulting in delayed, ineffective, or excessive response.

Improved and enhanced spatial data certainly allows users to more easily and quickly identify the spatial data sets most applicable to their needs, but it also permits spatial data to be used for more and different activities. In particular, complex analyses can be performed faster for larger areas, and opportunities for more advanced process analysis increase. Consequently, work productivity increases, and certain activities that may have previously been too complicated or expensive become feasible.

Because the cost of government programs is not always offset by quantitative benefits, intangible benefits become an especially important determinant in the formulation of spatial data management initiatives. Intangible benefits typically include more efficient decision-making, streamlined and enhanced coordination, improved communications and reduced customer burden, and increased accountability and organizational knowledge.

One of the key intangible benefits that is realized from having access to accurate, consistent, and up-to-date spatial data at an appropriate scale for use is more effective and responsive decision-making. Improved and expanded spatial information can have a very direct and dramatic impact on decision-support functions that, in turn affect, policies, programs, and day-to-day actions of government. Improved decision making capability based on access to appropriate spatial data enables governments at all levels to respond to new initiatives or unforeseen events.

Better or increased coordination permits agencies to concentrate more on managing and improving their own internal data sets and not on maintaining working data exchange relationships with all of the other organizations with which they share spatial data. Furthermore, it allows inter-related services to interact more effectively and for products derived through spatial data sharing to exhibit improved consistency. It also promotes sharing of costs for spatial data collection, maintenance, and updating.

Greater access to appropriate spatial data means that more individuals are able to obtain, use, and understand both existing and future sources of information. Users become more informed about and aware of programs and services, and spatial data becomes a common way to communicate important information about events and services throughout agencies, businesses, and the general public.

The institutionalization of process knowledge within governments is yet another intangible benefit that emerges as spatial data program maturity increases. Advances in program maturity, in turn, encourage a wider sharing of expertise and services through convenient accessibility of spatial data sets. Oftentimes, employee morale is improved, program accountability expectations are raised, and the credibility and public image of government programs are elevated.

3.3 PRIORITY OF GEOGRAPHIC DATA THEMES

The priority of geographic data for STRL entities is determined by comparing each data theme to the 27 business processes. A scoring process takes into account the business process weight from Table 2-4. Table 3-4(a) shows the results in which a score of 1, 2, or 3 indicates the strength of relationship between the data and its use in the business process. A blank indicates no significant relationship. These scores are based on the authors' experience and literature review. A "Raw Composite Score" is computed by multiplying each individual score by the "Business Process Weight" and adding all of the weighted scores for the data theme. A "Normalized Score" (based on 100) is then computed and Data Theme Priority class (High, Moderate, Low) is assigned.

Table 3-3: Data Theme Used by STRL Entities

| LEGEND | Public Entity Type | | | | | | | | | |
|--|------------------------------|------------------------------------|---------------------------------------|---------------------------------------|---|-------------------------------|---------------------------------|---------------------------------|----------------------------|--------------------|
| | Tribal Government (TG1, TG2) | States/Territories (ST1, ST2, ST3) | Regional - Economic Development (RG1) | Regional-Transportation Service (RG2) | Regional - Planning/ Natural Resources (RG3, RG4) | Regional-Public Utility (RG5) | Regional-School Districts (RG6) | Regional-Special Services (RG7) | County/Township (LG2, LG4) | Municipality (LG3) |
| Primary Relationship | | | | | | | | | | |
| Secondary Relationship | | | | | | | | | | |
| Geographic Data Theme | | | | | | | | | | |
| Base Map Features | | | | | | | | | | |
| Digital Raster Graphics | | | | | | | | | | |
| Planimetric Features/Struc.-General | | | | | | | | | | |
| Planimetric Features-Detailed | | | | | | | | | | |
| Transportation—Major Roads | | | | | | | | | | |
| Transportation—Local Streets | | | | | | | | | | |
| Aerial Images | | | | | | | | | | |
| Low Resolution Imagery | | | | | | | | | | |
| Orthoimagery— General | | | | | | | | | | |
| Orthoimagery— Detailed | | | | | | | | | | |
| Terrain/Topography | | | | | | | | | | |
| Digital Elevation Model—Detailed | | | | | | | | | | |
| Digital Elevation Model—General | | | | | | | | | | |
| Spot Elevations | | | | | | | | | | |
| Topographic Contours-Detailed | | | | | | | | | | |
| Topographic Contours-General | | | | | | | | | | |
| Bathymetry | | | | | | | | | | |
| Map Control and Reference Grids | | | | | | | | | | |
| Geodetic Ctrl Points/Monuments | | | | | | | | | | |
| Survey Control Points | | | | | | | | | | |
| Survey System Corners/Grid Lines | | | | | | | | | | |
| Map Sheet Grid | | | | | | | | | | |
| Governmental/Service/Administrative Districts | | | | | | | | | | |
| Governmental Jurisdictions | | | | | | | | | | |
| Regional Agency/District Boundaries | | | | | | | | | | |
| Local Administrative Areas | | | | | | | | | | |
| Local Election Districts | | | | | | | | | | |
| State Administrative Districts | | | | | | | | | | |
| State/Federal Election Districts | | | | | | | | | | |
| Utility Service Areas | | | | | | | | | | |
| Voting Precincts | | | | | | | | | | |
| Other Special Zones or Districts | | | | | | | | | | |
| Utility and Infrastructure | | | | | | | | | | |
| Project Areas-Regional or State | | | | | | | | | | |
| Electric Distribution Facilities | | | | | | | | | | |
| Elec. Generation and Transmission | | | | | | | | | | |
| Oil and Gas Supply and Transmission | | | | | | | | | | |
| Project Areas-Local | | | | | | | | | | |
| Public/Private Transit | | | | | | | | | | |
| Railroad Lines and Facilities | | | | | | | | | | |
| Sanitary Sewer Treatment/Collection | | | | | | | | | | |
| Storm Sewer/Drainage Control | | | | | | | | | | |
| Telecommunication Facilities | | | | | | | | | | |
| Transportation Facilities—Highway | | | | | | | | | | |
| Transportation Facilities—Local | | | | | | | | | | |
| Water/Air Transportation Facilities | | | | | | | | | | |
| Water Distribution System | | | | | | | | | | |
| Water Supply and Transmission | | | | | | | | | | |

| LEGEND | Public Entity Type | | | | | | | | | |
|---|------------------------------|------------------------------------|---------------------------------------|---------------------------------------|---|-------------------------------|---------------------------------|---------------------------------|----------------------------|--------------------|
| | Tribal Government (TG1, TG2) | States/Territories (ST1, ST2, ST3) | Regional - Economic Development (RG1) | Regional-Transportation Service (RG2) | Regional - Planning/ Natural Resources (RG3, RG4) | Regional-Public Utility (RG5) | Regional-School Districts (RG6) | Regional-Special Services (RG7) | County/Township (LG2, LG4) | Municipality (LG3) |
| Primary Relationship | | | | | | | | | | |
| Secondary Relationship | | | | | | | | | | |
| Geographic Data Theme | | | | | | | | | | |
| Emergency Planning and Management | | | | | | | | | | |
| Sites at Risk | | | | | | | | | | |
| Critical Emergency Facilities | | | | | | | | | | |
| Emergency Monitoring Sites | | | | | | | | | | |
| Emergency Supply Points | | | | | | | | | | |
| Evacuation Routes | | | | | | | | | | |
| Flood Zones | | | | | | | | | | |
| Flood Control Facilities | | | | | | | | | | |
| Natural Hazard Risk Areas | | | | | | | | | | |
| Public Safety | | | | | | | | | | |
| Land Cover, Cultural and Environmental Resources | | | | | | | | | | |
| Agricultural Production | | | | | | | | | | |
| Air and Water Monitoring Sites | | | | | | | | | | |
| Cultural Resources | | | | | | | | | | |
| Designated Environmental Areas | | | | | | | | | | |
| Forest Management Areas and Data | | | | | | | | | | |
| Land Cover | | | | | | | | | | |
| Local Park and Rec. Facilities | | | | | | | | | | |
| Rare, Threat. & Endangered Species | | | | | | | | | | |
| Significant Plant/Animal Habitats | | | | | | | | | | |
| State & Federal Park, Rec. Facilities | | | | | | | | | | |
| Wetlands | | | | | | | | | | |
| Hydrography and Geological Resources | | | | | | | | | | |
| Mineral Sites/Quarry Operations | | | | | | | | | | |
| Soils-General | | | | | | | | | | |
| Soils-Detailed | | | | | | | | | | |
| Subsurface Hydrology | | | | | | | | | | |
| Surface Hydrography | | | | | | | | | | |
| Surficial Geology | | | | | | | | | | |
| Watersheds/River Basins | | | | | | | | | | |
| Property/Cadastral | | | | | | | | | | |
| Assessment Parcels | | | | | | | | | | |
| Government Buildings | | | | | | | | | | |
| Government-owned Properties | | | | | | | | | | |
| Legal Lots | | | | | | | | | | |
| Special Tax Rate Areas | | | | | | | | | | |
| Subdivision Boundaries | | | | | | | | | | |
| Utility and Railroad Easements | | | | | | | | | | |
| Socioeconomic | | | | | | | | | | |
| Business License/Business Activity | | | | | | | | | | |
| Census Geography/Demography | | | | | | | | | | |
| Community/Regional Amenities | | | | | | | | | | |
| Land Use-Detailed | | | | | | | | | | |
| Land Use-General | | | | | | | | | | |
| Land Use-Planned | | | | | | | | | | |
| Zoning | | | | | | | | | | |

Table 3-4 (a): Priority of Geographic Data Themes

| Business Process Weight* → | Business Processes | | | | | | | | | | | | | | | | | | | | Raw Composite Score | Normalized Score (based on max. score of 100) | Data Theme Priority Class | | | | | | | | |
|--|--|-----------------------------|----------------------------|---------------------------------|--|-------------------------------------|------------------------------|----------------------------------|-----------------------|--------------------|-----------------------------|------------------------------------|--------------------------------------|---------------------------------|---------------------------------------|-----------------------------|-------------------------------------|--------------------------------------|---------------------------------|--------------------|---------------------|---|---------------------------|---------------------------------|--------------------------|--------------------------------------|--------------------------------------|------------------------------------|------------------------------|--------------------------|-----|
| | Billing, Tax, Fee Mgmt. and Collection | Budget Analysis/Preparation | Business Activity Tracking | Comprehensive Land Use Planning | Construction Proj. Planning and Design | Cultural/Historical Res. Assessment | Demand Modeling and Analysis | Economic/Demographic Forecasting | E-Government Services | Emergency Response | Emergency/Disaster Planning | Environmental Regulation and Mgmt. | Environ./ Natural Resource Inventory | Facility Inventory and Tracking | Health/Safety Permitting and Enforce. | Incident/Complaint Tracking | Land Development Insp. and Enforce. | Land Development Rev. and Permitting | Legal Analysis/Judicial Actions | Property Valuation | | | | Public Information Distribution | Public Meetings/Hearings | Public Service Planning and Delivery | Site/Facility Maintenance Operations | Site/Facility Maintenance Planning | Special Engineering Analysis | Special Planning Studies | |
| Geographic Data Theme | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Base Map Features | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Digital Raster Graphics | 1 | 1 | 1 | 2 | 1 | 2 | | 1 | 1 | 3 | 3 | 2 | 3 | 2 | 1 | 2 | | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 287 | 41 | Mod | |
| Planimetric Features-General | 2 | 2 | 1 | 3 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | 3 | 1 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 481 | 69 | High | |
| Planimetric Features-Detailed | 2 | 2 | 1 | 2 | 3 | 2 | 2 | 2 | | 3 | 3 | 2 | | 3 | 3 | 2 | 3 | 3 | 3 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 538 | 77 | High | | |
| Transportation— Major Roads | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 608 | 87 | High | |
| Transportation—Local Streets | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 3 | 3 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 597 | 86 | High | |
| Aerial Images | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Low Resolution Imagery | | | | 1 | | | | | | | 1 | 1 | 2 | | | | | | | | | 1 | | | | | 1 | 55 | 8 | Low | |
| Orthoimagery— General | 1 | 1 | 2 | 2 | 1 | 2 | | 1 | 1 | 2 | 3 | 3 | 3 | | | | 1 | | 1 | 1 | | 1 | 3 | | 1 | 1 | 1 | 2 | 282 | 40 | Mod |
| Orthoimagery— Detailed | 2 | 1 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 1 | 2 | 2 | 2 | 3 | 507 | 73 | High | |
| Terrain/Topography | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Digital Elevation Model—Detailed | | 1 | | 2 | 3 | | | | 2 | 2 | 3 | 2 | 2 | 1 | 1 | | 2 | 2 | 1 | 2 | | 1 | | 2 | 1 | 3 | 2 | 311 | 45 | Mod | |
| Digital Elevation Model—General | | | | 2 | 2 | | 2 | | 2 | 2 | 3 | 2 | | | | | 1 | | | | 1 | | | | | 2 | 2 | 145 | 21 | Low | |
| Spot Elevations | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | 2 | 2 | 40 | 6 | Low |
| Topographic Contours-Detailed | | 1 | | 2 | 3 | | 1 | | 2 | 2 | 2 | 2 | 2 | 1 | 1 | | 3 | 3 | 1 | 2 | | | | 2 | 1 | 3 | 2 | 314 | 45 | Mod | |
| Topographic Contours-General | | | | 2 | 2 | | 2 | | 1 | 2 | 2 | 2 | 2 | | | | 2 | | | | | | | | | 2 | 2 | 149 | 21 | Low | |
| Bathymetry | | 1 | | 1 | 2 | | | | 1 | 1 | 2 | 2 | | | | | | 1 | 1 | 1 | | | | | | | 1 | 1 | 142 | 20 | Low |
| Map Control and Reference Grids | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Geodetic Ctrl Points/Monuments | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 1 | 2 | 3 | 2 | 3 | 2 | 532 | 76 | High | |
| Survey Control Points | | | | 2 | 3 | 3 | | | | 2 | 2 | 2 | 1 | | | | 3 | 3 | 2 | 3 | 2 | 1 | | 3 | 2 | 3 | 2 | 367 | 53 | Mod | |
| Survey System Corners/Grid Lines | 2 | 2 | 2 | 3 | 3 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 514 | 74 | High | |
| Map Sheet Grid | 1 | 1 | 1 | 3 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 368 | 53 | Mod | |
| Governmental/Service/Administrative Districts | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Governmental Jurisdictions | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 3 | 612 | 88 | High | |
| Regional Agency Boundaries | 3 | 2 | 2 | 3 | | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 1 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 1 | 3 | 509 | 73 | High | |
| Local Administrative Areas | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | | 2 | 1 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 1 | 3 | 589 | 85 | High | | |
| Local Election Districts | 1 | 1 | | | | | | | | 1 | | 1 | | | | 1 | | | 3 | | 1 | 1 | | | | | 1 | 106 | 15 | Low | |
| State Administrative Districts | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 1 | 2 | 3 | 3 | 3 | | 3 | 488 | 70 | High | | |
| State and Federal Election Districts | 1 | 1 | | | | | | | | 1 | | 1 | | | | 1 | | | 3 | | 1 | 1 | | | | | 1 | 106 | 15 | Low | |
| Utility Service Areas | 3 | 3 | 2 | 3 | 2 | | 3 | 1 | 2 | 1 | 1 | 1 | | 3 | | 1 | 1 | 1 | 2 | 3 | 1 | 1 | 3 | 3 | 3 | 1 | 2 | 412 | 59 | Mod | |
| Voting Precincts | | | | | | | | | | | 1 | | | | | | | | 1 | | 1 | 1 | | | | | 1 | 41 | 6 | Low | |
| Other Special Zones or Districts | 2 | 2 | 2 | 2 | 1 | 3 | 2 | 2 | 2 | 2 | 3 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 1 | 3 | 481 | 69 | High | |
| Utility and Infrastructure | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Project Areas-Regional or State | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 3 | 2 | 2 | 1 | 1 | 3 | 2 | 2 | 2 | 2 | 3 | 1 | 1 | 1 | 2 | 2 | 407 | 58 | Mod | |
| Electric Distribution Facilities | 2 | 1 | 1 | 1 | 2 | | 1 | 1 | 1 | 2 | 2 | 1 | | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 3 | 3 | 2 | 2 | 362 | 52 | Mod | |
| Electric Generation/ Transmission | 1 | 2 | 1 | 2 | 2 | | 2 | 1 | 1 | 2 | 2 | 2 | | 3 | 2 | 1 | 2 | 2 | 1 | 2 | 1 | 1 | | 3 | 3 | 2 | 1 | 371 | 53 | Mod | |
| Gas Distribution Facilities | 2 | 1 | 1 | 2 | 2 | | 2 | 1 | 1 | 2 | 2 | 1 | | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 3 | 3 | 3 | 1 | 366 | 53 | Mod | |
| Oil & Gas Supply/Transmission | 1 | 1 | 1 | 2 | 1 | | 2 | 1 | | 2 | 2 | 2 | | 3 | 2 | 1 | 2 | 3 | 1 | 2 | 1 | 1 | 3 | 3 | 2 | 1 | 358 | 51 | Mod | | |
| Project Areas-Local | 1 | 2 | 2 | 2 | 3 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | | 3 | 3 | 2 | 2 | 1 | 3 | 1 | 2 | 2 | 2 | 2 | 418 | 60 | Mod | |
| Public/Private Transit | 2 | 3 | 1 | 1 | 1 | | 1 | | 2 | 1 | | | | 1 | 1 | 1 | | 1 | | | 2 | 1 | 2 | 1 | 1 | | 1 | 211 | 30 | Low | |
| Railroad Lines and Facilities | 1 | 1 | | 1 | 1 | | 1 | 1 | 1 | 2 | | | | 1 | 1 | 1 | 1 | 1 | | | | | 1 | 1 | 1 | | 1 | 157 | 23 | Low | |
| Sanitary Sewer Treat./Collection | 2 | 3 | 1 | 2 | 3 | | 2 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 1 | 1 | 2 | 1 | 1 | 3 | 3 | 3 | 2 | 2 | 495 | 71 | High | |
| Storm Sewer/Drainage Facilities | 2 | 3 | 1 | 1 | 3 | | | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 2 | | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 3 | 3 | 2 | 2 | 389 | 56 | Mod | |
| Telecommunication Facilities | 1 | 2 | 1 | 2 | 2 | | 2 | | 1 | 3 | 3 | | | 2 | 1 | 1 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 297 | 43 | Mod | |
| Transportation Facilities-Highway | 2 | 3 | 1 | 2 | 3 | 2 | 2 | | 1 | 3 | 3 | 2 | 1 | 3 | 1 | 1 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 523 | 75 | High | |
| Transportation Facilities-Local | 1 | 3 | 1 | 2 | 3 | 2 | 2 | | 1 | 3 | 3 | 2 | 1 | 3 | 1 | 1 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 523 | 75 | High | |
| Water, Air Transportation Facilities | 1 | 2 | 1 | 2 | 2 | | 2 | | 1 | 3 | 2 | | 1 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 336 | 48 | Mod | |
| Water Distribution System | 3 | 2 | 1 | 2 | 3 | | 2 | | 2 | 2 | 2 | 1 | | 3 | 3 | 2 | 3 | 3 | 1 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 493 | 71 | High | | |
| Water Supply and Transmission | 1 | 2 | 1 | 2 | 2 | | 3 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 1 | 3 | 3 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 457 | 66 | High | |
| Emergency Planning and Management | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Areas at Risk | | | | | | | 2 | | 3 | 3 | 3 | 2 | | | | | | | 1 | 1 | 2 | 2 | | | | 2 | 134 | 19 | Low | | |
| Critical Emergency Facilities | | | | 2 | 1 | | 2 | | 3 | 3 | 3 | 2 | | | | | | | | 2 | 2 | | | | | | | 118 | 17 | Low | |
| Emergency Monitoring Sites | | | | | | | | | 3 | 3 | 1 | | | | 2 | | | | | | 1 | | | | | | | 76 | 11 | Low | |
| Emergency Supply Points | | | | | | | | | 3 | 3 | | | | | | | | | | | 1 | | 1 | | | | | 54 | 8 | Low | |
| Evacuation Routes | | | | 2 | 2 | | | | 2 | 3 | 3 | | | | | 2 | | | | | 1 | | 3 | 2 | | | 2 | 175 | 25 | Low | |
| Flood Zones | 2 | 1 | 1 | 3 | 3 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 1 | 2 | 1 | 2 | 3 | 2 | 3 | 3 | 2 | | 1 | 1 | 3 | 2 | 459 | 66 | High | |
| Flood Control Facilities | 2 | | | 2 | 3 | | | | | 3 | 3 | 2 | | 2 | 1 | | 2 | 2 | | 3 | | 1 | | 1 | 1 | 2 | 2 | 272 | 39 | Mod | |
| Natural Hazard Risk Areas | | | | 2 | 1 | | | | 2 | 3 | 3 | 2 | 3 | | 2 | | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | | 2 | 1 | 247 | 35 | Mod | |
| Public Safety | 2 | 3 | 2 | | | | 1 | | 2 | 3 | 3 | 2 | | 1 | 2 | 3 | 1 | 1 | 3 | | 2 | 2 | 2 | | | 1 | 312 | 45 | Mod | | |

Scores on Data Theme Priority
 Blank = Not Important
 1 = Low
 2 = Moderate
 3 = High

Table 3-4 (a): Priority of Geographic Data Themes (continued)

| Land Cover, Cultural and Environmental Resources | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-----|-----|-----|------|------|-----|
| Agricultural Production | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 117 | 17 | Low | | | |
| Air and Water Monitoring Sites | | | | 1 | 1 | | | 2 | | 1 | 1 | 1 | 3 | 2 | 1 | 2 | 2 | 1 | 2 | 1 | | | | | | | | | | 1 | 191 | 27 | Low | | |
| Cultural Resources | 1 | | | 2 | 2 | 3 | | 2 | | | | | | | | | | | 3 | 1 | 1 | 1 | 1 | | | | | | 2 | 169 | 24 | Low | | | |
| Designated Environmental Areas | 1 | | | 2 | 2 | 2 | | | | | | | 3 | 2 | | | | | | | | | | | | | | | | 2 | 188 | 27 | Low | | |
| Forest Management Areas & Data | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | | | | | 2 | 3 | | | | | 1 | 2 | | | | | | | | | | 2 | 198 | 28 | Low | | |
| Land Cover | 1 | 1 | 1 | 3 | 3 | 2 | 2 | 3 | | 1 | 2 | 3 | 3 | | | | | | 3 | 2 | 1 | 2 | 1 | 1 | 1 | | | | 1 | 2 | 324 | 46 | Mod | | |
| Local Park/Recreational Facilities | 2 | 2 | | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 3 | 2 | 2 | 1 | 1 | | | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 375 | 54 | Mod | |
| Rare, Threat., Endang. Species | | | | 1 | 2 | 1 | | | | | | | 3 | 3 | | | | | 3 | | | | | | | | | | | 1 | 139 | 20 | Low | | |
| Significant Plant or Animal Habitats | | | | 2 | 2 | 1 | | | | | | | 3 | 3 | | | | | 3 | | | | | | | | | | | 1 | 147 | 21 | Low | | |
| State, Federal Park/Rec. Facilities | 2 | 2 | | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 3 | 2 | 2 | 1 | 1 | | | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 367 | 53 | Mod | |
| Wetlands | | | | 2 | 3 | | | 1 | 1 | 1 | | | 3 | 3 | 1 | | | | 1 | 3 | 2 | 2 | 1 | 2 | | | | | 1 | 1 | 2 | 266 | 38 | Mod | |
| Hydrography and Geological Resources | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mineral Sites/Quarry Operations | 1 | | | 1 | 1 | 2 | | | | | 1 | | 2 | 2 | 1 | 1 | | 2 | 1 | | 1 | 1 | | | | | | | | 1 | 178 | 26 | Low | | |
| Soils-General | | | | 1 | 1 | 1 | | | | | | | 2 | 3 | | | | | | | | | | | | | | | | 1 | 86 | 12 | Low | | |
| Soils-Detailed | 1 | | | 3 | 3 | 1 | 1 | | | | | 1 | 2 | 3 | | | | | 2 | | 2 | | | | | | | 1 | 3 | 3 | 244 | 35 | Mod | | |
| Subsurface Hydrology | | | | 1 | 1 | | | | | | | | 2 | 3 | | | | | 1 | | | | | | | | | | | 2 | 2 | 145 | 21 | Low | |
| Surface Hydrography | 1 | 1 | | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 1 | 2 | 1 | 3 | 1 | 2 | 2 | 3 | 3 | 3 | 3 | 468 | 67 | High | | |
| Surficial Geology | | | | 1 | 3 | | | | | | | | 2 | 3 | | | | | | 1 | | | | | | | | | | | 1 | 108 | 15 | Low | |
| Watersheds/River Basins | 1 | | | 1 | 2 | 2 | | | | 1 | 2 | 2 | 2 | 3 | | | | | 1 | 1 | 2 | 2 | | | | | | | | 1 | 1 | 2 | 285 | 41 | Mod |
| Property/Cadastral | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Assessment Parcels | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 1 | 3 | 1 | | | | | | | 1 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 3 | 465 | 67 | High | |
| Government Buildings | 2 | 3 | 2 | 1 | 3 | 2 | 2 | | | 3 | 3 | 3 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 452 | 65 | Mod | |
| Government-owned Properties | 3 | 3 | | 1 | 3 | 2 | | | | 3 | 1 | 1 | | | | | | 2 | 1 | | | | | | | | | | | | 2 | 324 | 46 | Mod | |
| Legal Lots | 2 | 1 | | 1 | 2 | 1 | | | | | | | | | | | | | | 3 | 3 | 3 | 1 | 2 | | | | | | 2 | 242 | 35 | Low | | |
| Special Tax Rate Areas | 3 | 1 | 3 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 207 | 30 | Low | |
| Subdivision Boundaries | 3 | 1 | 2 | 1 | 1 | 1 | | | | 1 | | | | | | | | | | 3 | 3 | 3 | 2 | 2 | | | | | | 2 | 281 | 40 | Mod | | |
| Utility and Railroad Easements | 2 | 1 | 2 | 1 | 1 | | | | | | | 1 | | | | | | | | 1 | | | | | | | | | | | 3 | 211 | 30 | Low | |
| Socioeconomic | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Business License and Activity | 2 | 1 | 3 | 2 | | | | 1 | 1 | 2 | | 1 | | | | | | | | 1 | 1 | 1 | | 1 | 1 | | | | | 2 | 150 | 22 | Low | | |
| Census Geography/Demography | 2 | 3 | 2 | 3 | 1 | 1 | 3 | 3 | 2 | 2 | 3 | 2 | 1 | | | | | | | 2 | 2 | | 2 | 2 | 3 | | 2 | 1 | 3 | 354 | 51 | Mod | | | |
| Community/Regional Amenities | 2 | 2 | 3 | 3 | 1 | 2 | 1 | 2 | 2 | | 1 | | | | | | | | | 1 | 1 | | 1 | 2 | 1 | 1 | 1 | 1 | | 3 | 250 | 36 | Mod | | |
| Land Use-Detailed | 2 | 1 | 2 | 3 | 3 | 3 | 2 | 2 | | 1 | 2 | 2 | | | | | | | 3 | 1 | 2 | 3 | 1 | 2 | 2 | 2 | 1 | | | 1 | 3 | 394 | 56 | Mod | |
| Land Use-General | 1 | | | 3 | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | 3 | 118 | 17 | Low | |
| Land Use-Planned | | 1 | 1 | 3 | | | 2 | 2 | 2 | 2 | | 2 | 1 | 2 | | | | | | 2 | 3 | 2 | 1 | 3 | 2 | 2 | | | | 1 | 3 | 281 | 40 | Mod | |
| Zoning | 1 | | | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 3 | 1 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | | | | | | 3 | 392 | 56 | Mod | | |

*This weight is the composite score from Table 2-4 (Business Process compared to Public Entities)

An ordered list of the data theme priorities is shown in Table 3-4(b). Twenty-one data themes have been initially identified as “high priority”. These include the themes:

- Governmental Jurisdictions
- Transportation— Major Roads
- Transportation—Local Streets
- Local Administrative Areas
- Planimetric Features—Detailed
- Geodetic Control Points/Monuments
- Transportation Facilities--Highway
- Transportation Facilities—Local
- Survey System Corners/Grid Lines
- Orthoimagery— Detailed
- Regional Agency Boundaries
- Sanitary Sewer Treatment/Collection
- Water Distribution System
- State Administrative Districts
- Other Special Zones or Districts
- Planimetric Features—General
- Surface Hydrography
- Assessment Parcels

- Flood Zones
- Water Supply and Transmission
- Government Buildings.

Concentrating on these 21 High Priority data themes allows a focused evaluation of relationships and partnership opportunities between STRL entities and the federal government. The set of 21 themes is intuitively consistent with what most geographic information users in State, Tribal, Regional, and Local agencies would identify as being high-priority. All STRL organizations have important geographic data needs encompassed by themes not on this high-priority list, but they tend to be tied to specific programs and have less applicability to a wide range of business processes.

Table 3-4 (b): Ordered List of Data Theme Priority

| Geographic Data Theme | Normalized Score | Priority Class |
|--------------------------------------|------------------|----------------|
| Governmental Jurisdictions | 89 | High |
| Transportation— Major Roads | 88 | High |
| Transportation—Local Streets | 86 | High |
| Local Administrative Areas | 86 | High |
| Planimetric Features-Detailed | 78 | High |
| Geodetic Ctrl Points/Monuments | 77 | High |
| Transportation Facilities--Highway | 76 | High |
| Transportation Facilities--Local | 76 | High |
| Survey System Corners/Grid Lines | 74 | High |
| Orthoimagery— Detailed | 73 | High |
| Regional Agency Boundaries | 73 | High |
| Sanitary Sewer Treat./Collection | 71 | High |
| Water Distribution System | 71 | High |
| State Administrative Districts | 71 | High |
| Other Special Zones or Districts | 70 | High |
| Planimetric Features-General | 70 | High |
| Surface Hydrography | 68 | High |
| Assessment Parcels | 67 | High |
| Flood Zones | 66 | High |
| Water Supply and Transmission | 66 | High |
| Government Buildings | 65 | High |
| Project Areas--Local | 60 | Mod |
| Utility Service Areas | 59 | Mod |
| Project Areas-Regional or State | 59 | Mod |
| Land Use-Detailed | 58 | Mod |
| Zoning | 57 | Mod |
| Storm Sewer/Drainage Facilities | 56 | Mod |
| Local Park/Recreational Facilities | 54 | Mod |
| Survey Control Points | 54 | Mod |
| Electric Generation/Transmission | 53 | Mod |
| Map Sheet Grid | 53 | Mod |
| State, Federal Park/Rec. Facilities | 53 | Mod |
| Gas Distribution Facilities | 53 | Mod |
| Electric Distribution Facilities | 52 | Mod |
| Oil/Gas Supply and Transmission | 51 | Mod |
| Census Geography/Demography | 51 | Mod |
| Water, Air Transportation Facilities | 48 | Mod |
| Government-owned Properties | 47 | Mod |
| Land Cover | 46 | Mod |
| Topographic Contours-Detailed | 45 | Mod |
| Public Safety | 45 | Mod |
| Digital Elevation Model—Detailed | 45 | Mod |
| Telecommunication Facilities | 43 | Mod |

| Geographic Data Theme | Normalized Score | Priority Class |
|-----------------------------------|------------------|----------------|
| Digital Raster Graphics | 42 | Mod |
| Orthoimagery— General | 41 | Mod |
| Land Use-Planned | 41 | Mod |
| Watersheds/River Basins | 41 | Mod |
| Subdivision Boundaries | 41 | Mod |
| Flood Control Facilities | 39 | Mod |
| Wetlands | 38 | Mod |
| Community/Regional Amenities | 37 | Mod |
| Natural Hazard Risk Areas | 36 | Mod |
| Soils-Detailed | 35 | Mod |
| Legal Lots | 35 | Mod |
| Utility and Railroad Easements | 30 | Low |
| Public/Private Transit | 30 | Low |
| Special Tax Rate Areas | 30 | Low |
| Forest Management Areas | 29 | Low |
| Designated Environmental Areas | 28 | Low |
| Air and Water Monitoring Sites | 27 | Low |
| Mineral Sites/Quarry Operations | 26 | Low |
| Cultural Resources | 25 | Low |
| Evacuation Routes | 25 | Low |
| Railroad Lines and Facilities | 23 | Low |
| Land Cover | 22 | Low |
| Business License and Activity | 22 | Low |
| Significant Plant/Animal Habitats | 21 | Low |
| Topographic Contours-General | 21 | Low |
| Subsurface Hydrology | 21 | Low |
| Digital Elevation Model—General | 21 | Low |
| Rare, Threatened, Endang. Species | 20 | Low |
| Bathymetry | 20 | Low |
| Sites at Risk | 19 | Low |
| Land Use-General | 17 | Low |
| Critical Emergency Facilities | 17 | Low |
| Agricultural Production | 17 | Low |
| Surficial Geology | 15 | Low |
| Local Election Districts | 15 | Low |
| State/Federal Election Districts | 15 | Low |
| Soils-General | 13 | Low |
| Emergency Monitoring Sites | 11 | Low |
| Low Resolution Imagery | 8 | Low |
| Emergency Supply Points | 8 | Low |
| Voting Precincts | 6 | Low |
| Spot Elevations | 6 | Low |

The high-priority data themes include many of the “foundation” themes such as governmental and administrative boundaries, transportation facilities, and public utilities (water and sewer). Assessment parcels—important for all STRL entities—are also in the High Priority class. There are some themes and data sets now generated by the USGS as part of the National Map, and by other Federal agencies that are not classified as High Priority. These include such federally-maintained digital data sets as 1:24K scale DLG files, DEM data, DRG files, DOQQ imagery, SSURGO soils, NWI wetlands, and others which are considered Moderate Priority from the STRL perspective. These data sets may be quite valuable for many STRL entities, but they are not as important, in a comprehensive sense, as the high priority data themes identified here for STRL entities. These federal agency sources tend to be very useful for federal and state agencies (see Table 3-3) but much less so for local agencies.

It is important to note that geographic data themes that are part of the “Emergency Planning and Management” group have not been scored as high-priority. This reflects that fact that these themes have a specific significance for emergency planning, emergency operations and public safety and are not directly important to a wide range of business processes or organizations. However, some of these data themes fill a critical role since they support programs for the protection of lives and property. The increased focus on homeland security issues at the national, regional, and local level call for specific attention to certain data themes in the Emergency Planning and Management data theme group which were not scored in the High Priority category. In addition to the original 21 scored High-Priority themes we recommend that the following themes be considered High-Priority:

- Sites at Risk
- Critical Emergency Facilities
- Emergency Monitoring Sites
- Emergency Supply Points
- Evacuation Routes
- Natural Hazard Risk Areas
- Public Safety.

In the remaining parts of this report, these seven themes will be collectively referred to as “Emergency Planning and Management Themes.”

As discussed above, compilation scale and positional accuracy are critical factors determining the usefulness of geographic data and maps for all user groups. The business processes presented in this report make use of data from a wide scale and accuracy range. Table 3-5 examines the scale and accuracy requirements for the high-priority data themes through a comparison and scoring for each public entity type. This table organizes these themes under each of the five Scale Categories (Site-Specific, Local, Sub-Regional, Regional, Statewide). A Score of 1, 2, or 3 (low, moderate, high) is assigned to each data theme-entity pair with a blank indicating no significant requirement.

Table 3-6 provides an overall picture of geographic data scale requirements. The composite scores for Scale Categories shows that the predominate requirement, by a considerable margin, is for Local data (scale: 1:1,200 to 1:10,000; accuracy of 0.3 to 6 meters). Sub-Regional data (scale: less than 1:10,000 to 1:50,000; accuracy of 3 to 30 meters) is closely followed by Site-Specific (scale: larger than 1:1,200; accuracy of 0.5 meters or better).

Table 3-6: Summary of Scores for Scale Category Importance for High-Priority Data Themes

| Scale Categories | High Priority Data Themes | | | | | | | | | | | | | | | | | | | | | | | Composite Score |
|------------------|----------------------------|----------------------------|------------------------------|----------------------------|-------------------------------|-----------------------------------|------------------------------------|----------------------------------|----------------------------------|-----------------------|--------------------------------------|-------------------------------------|---------------------------|--------------------------------|----------------------------------|------------------------------|---------------------|--------------------|-------------|-------------------------------|----------------------|-----------------------------------|-----|-----------------|
| | Governmental Jurisdictions | Transportation—Major Roads | Transportation—Local Streets | Local Administrative Areas | Planimetric Features-Detailed | Geodetic Control Points/Monuments | Transportation Facilities--Highway | Transportation Facilities--Local | Survey System Corners/Grid Lines | Orthoimagery—Detailed | Regional Agency, District Boundaries | Sanitary Sewer Treatment/Collection | Water Distribution System | State Administrative Districts | Other Special Zones or Districts | Planimetric Features-General | Surface Hydrography | Assessment Parcels | Flood Zones | Water Supply and Transmission | Government Buildings | Emergency Pging and Mngmnt Themes | | |
| Site-Specific | 7 | 5 | 8 | 4 | 8 | 12 | 11 | 8 | 8 | 6 | 7 | 6 | 6 | 5 | 7 | 0 | 7 | 8 | 6 | 8 | 10 | 8 | 155 | |
| Local | 12 | 12 | 10 | 8 | 9 | 12 | 11 | 11 | 11 | 9 | 12 | 9 | 9 | 6 | 7 | 8 | 11 | 10 | 11 | 9 | 11 | 10 | 217 | |
| Sub-Regional | 12 | 12 | 9 | 6 | 4 | 8 | 10 | 6 | 11 | 0 | 11 | 8 | 8 | 9 | 8 | 10 | 9 | 7 | 10 | 8 | 9 | 11 | 184 | |
| Regional | 10 | 11 | 0 | 5 | 0 | 4 | 7 | 0 | 7 | 0 | 9 | 8 | 7 | 9 | 8 | 9 | 7 | 4 | 4 | 9 | 6 | 7 | 130 | |
| Statewide | 9 | 9 | 0 | 0 | 0 | 4 | 6 | 0 | 5 | 0 | 7 | 6 | 6 | 9 | 7 | 6 | 5 | 0 | 3 | 6 | 7 | 7 | 103 | |

Footnotes:

- 1 Range of scales at which maps in this category are typically compiled and used. Expressed both as a representative fraction (RP).
- 2 Normal level of absolute accuracy for most maps in this category. This is considered to be a minimal level of expected accuracy. With greater use of high-precision photogrammetric

There is a clear need for geographic data compiled at relatively large scale and high accuracy level compared to data and map products typically available from federal sources and in many cases, adequately filled by STRL entities themselves. **It is the authors' conclusion that the significant divergence that exists between the typical scale and accuracy of map and data products generated by Federal agencies and the needs of STRL agencies and therefore, sharing their data or providing regular updates to federal programs provides little value for them and is a major factor in the low level of use by STRL agencies—particularly local governments.**

3.4 CURRENT SOURCES AND UPDATE VOLATILITY FOR STATE, TRIBAL REGIONAL, AND LOCAL GEOGRAPHIC DATA NEEDS

Sources and techniques for developing a geographic database and for updating geographic data themes vary depending on data content, format, and scale requirements. Table 3-8 is used to identify typical sources for data compilation and update as a first step in examining roles for different parties in the National Map.

The geographic data themes provide a picture of natural or cultural features and events that are changing over time. All users require data that meets certain requirements for currency. Users often do not need geographic data that is completely up-to-date at all times, but it is important to identify currency requirements and to build an update strategy to respond to the needs of users. Certainly, it may be said that as the timeliness in posting of actual changes to digital maps and geographic databases improves, those digital products become more valuable to users and respond better to their business needs.

A general impression of currency needs is conveyed in Table 3-7 through the assignment of a “volatility” rating to the high-priority data themes. Data volatility is a general indication of the frequency of change to geographic features included in the theme. Volatility is identified as: a) Low (significant changes occur rarely—every two years or more), b) Moderate (significant change occurs but not on a frequent basis—annually or several times per year), c) High (significant changes occur frequently, at least every 2 to 3 months), d) Very High (changes occur very frequently—at least on a monthly basis but often more frequently. While volatility will vary from place to place, this general volatility rating gives an indication of requirements for data theme update. Ideally, update for all data themes should occur (and be reflected in the GIS database) on a continual basis with a short time lag after the change occurs. This is often difficult for technical reasons, because of difficulties in tracking changes or limitations in the availability of sources that reflect changes. Some changes will occur in very limited geographic locations (e.g., construction project areas) while most of the area of coverage will remain unchanged. Establishing update cycles must take into account conditions in particular localities and regions.

Table 3-7: Typical Sources for Development and Update and Volatility of High-Priority Geographic Data Themes

| High-Priority STRL Geographic Data Theme | Typical Sources to Support State, Tribal, Regional, and Local Mapping Needs | Volatility |
|--|--|---|
| Water Distribution System | a) Digital or hard copy maps and records from local (City or County) water utility or public works department or regional water authority/district, b) initial data conversion can be supported by heads-up digitizing of certain features (e.g., hydrants) from high-resolution digital imagery, d) field capture (e.g., hydrant and valve location and attributes) using GPS-equipped handheld computer, e) In some cases, engineering plans or As-built drawings may contain best information. As-built drawings are the best source for GIS database update. | Very High or High for areas experience growth. Moderate for non-growth areas. |
| State Administrative Districts | Specific state agencies with responsibility over programs to which the district applies. <i>Note: These boundaries often coincide with County boundaries.</i> | Low |
| Other Special Zones or Districts | a) Local government mapping or legal records offices (Clerk, Recorder, Registrar) maintain legal records on district boundaries, b) individual regional agency or district often maintains maps or boundary descriptions, c) County or City Assessor may have automated or hard copy maps with district boundaries that impact taxation (e.g. tax neighborhood maps), d) state agency with oversight responsibility (e.g., State Planning Office, Public Utility Commission) may have maps or records on boundary location. <i>Note: Boundaries may coincide with other boundaries (parcel or legal lot lines, street centerlines, right-of-way lines, city or county boundaries, physical features). It is important to maintain proper boundary coincidence.</i> | Low or Moderate |
| Planimetric Features-General | a) State transportation agency digital or hard copy highway maps may have some planimetric features, b) hard copy USGS quadrangle maps or DLG24 files (where available) <i>Note: Quality of sources will vary greatly among states and counties.</i> | Moderate |
| Surface Hydrography | a) Hard copy USGS quadrangle maps or DLG24 files (where available), b) USGS National Hydrographic Database (NHD) where available, c) detailed photogrammetric base maps prepared by local governments or regional agencies (e.g. Flood Control districts), d) Special studies and mapping by U.S. Army Corps of Engineers. <i>Note: NHD 100K of limited use to STRL entities except for very general applications. NHD24 projects will provide data of greater applicability.</i> | Low |
| Assessment Parcels | a) Local property assessment offices usually maintain hard copy or digital parcel maps, b) In some cases state revenue departments may provide central clearinghouse for parcel maps, c) NILS program (BLM, USFS) may have some data on federal land holdings. | Very High to High |
| Flood Zones | a) FEMA DFIRM (digital flood insurance rate maps) where available, b) hard copy or scanned FEMA FIRM maps in many areas, b) in some cases regional or local agencies responsible for flood and drainage control (e.g. Flood control districts) may have contracted the production of flood zone maps, d) for some communities or basins, the U.S. Army Corps of Engineers may have prepared flood zone maps (may be necessary to contact specific COE district for availability). | Low but more frequent for large construction areas altering drainage or putting in place major flood control |
| Water Supply and Transmission | a) Digital or hard copy Maps and records from local (City or County) water utility or public works dept. or regional water authority/district may provide details on water withdrawal locations, reservoirs, water transmission mains, b) Water well locations available in digital or hard copy sources from local health agency or state agency (environmental regulatory agency or state geological survey). | Moderate to Low |
| Government Buildings | Sources vary greatly depending in the governmental entity. Best source to check is the organization's facility management, property management, or general services office. | Low |
| Emergency Planning and Management Themes | Sources vary greatly. The primary sources are hard copy or digital records held by the federal, state, or local agency responsible for tracking the sites or facilities in these themes. | High to Moderate |

¹Includes the following themes that are deemed high-priority because of their significance for federal, state, regional, and local emergency management and homeland security programs: Sites at Risk, Critical Emergency Facilities, Emergency Monitoring Sites, Emergency Supply Points, Evacuation Routes, Natural Hazard Risk Areas, Public Safety.

Several conclusions may be drawn about data sources and the timing of update for high-priority data themes by examining Table 3-7 and from the experience of the authors in working with state and local GIS programs:

- The best sources for initial geographic database compilation are often different than sources that should be used for on-going update. High volume data conversion for initial creation of a geographic database will rely to a large extent on already compiled maps, orthoimages, and field data gathering if needed. On-going database updates are best carried out using the original sources that document a change (e.g., as-built drawing, subdivision plat, inspection or maintenance report, permits, etc.). Since these types of documents are not always automated and often are not part of a map update workflow, it may be necessary to “re-engineer” business processes to make the update operation efficient. This can be organizationally difficult.
- The majority of the high-priority data themes have a volatility of High or Very High (at least in areas experiencing growth and new development). While requirements for the timing of data updates will vary somewhat by user and application, it is important to have database update procedures that reflect actual changes in a timely manner. For many themes, a minimal level of update frequency is two to three times per year, but often, local users will need updates on a more frequent basis.
- Changes to cultural (built) features normally occur incrementally and individually in small areas (e.g., new subdivision, commercial or office building, highway project) while much of the area covered by a geographic database will remain unchanged. Therefore, a database update process can be most efficiently managed if there is a mechanism to monitor change and schedule specific updates. This would require data custodians to have consistent access to records and sources that document changes.
- Existing sources of data that document changes to the land (e.g., roads and transportation facilities, buildings and planimetric structures, utility infrastructure) are often in form not directly useful for map update (e.g., engineering drawings in hard copy or CAD file format, site plans or building permits, field sketches). In addition workflows in government agencies that have responsibility for land development do not often include digital map update as a step in a records management process. This makes it difficult to use these sources efficiently for map update. Changes (technical and procedural) are taking place at local and state levels to channel data sources to support GIS programs. But much more education as well as programmatic models and technical tools and standards need to be established and adopted.
- Many features have placement “rules” that are dependent on other features (e.g., regional agency or district follow county or municipal boundaries; political jurisdictional boundaries may be coincident, in some locations, with street centerlines, parcel, or natural feature boundaries). To satisfy local needs, this boundary coincidence must be maintained in the database, but it can hard to glean from available source material.

- Utility infrastructure data is managed and tracked by a mix of organization types (private companies, city or county utility departments, or independent authorities). Service areas very often do not correspond to political boundaries. This complicates data management and demands that different partnership solutions be forged (including public-private) if this data is to be comprehensively maintained.
- Data themes to support emergency management and homeland security initiatives have special importance but are not well defined—in terms of content or responsibilities for compilation and maintenance. It is important to develop a more detailed logical and physical data models in areas which have already focused on critical infrastructure protection and asset management based on nationally accepted standards and to work out policies and procedures for agency roles and data access.

SECTION 4
AREAS FOR COOPERATION AND PARTNERSHIP—
FEDERAL AGENCIES VS. STATE, TRIBAL, REGIONAL, LOCAL ENTITIES

4.1 FEDERAL GEOGRAPHIC DATA USEFULNESS BY STATE, TRIBAL, REGIONAL, AND LOCAL ENTITIES

Plans being formulated now for creation of the “new vision” for the National Map program acknowledge current limitations of the program, as well as the vital role that partnerships with STRL organizations play in its future success. The authors find, however, that National Map planners have not yet sufficiently defined the type and characteristics of data themes needed by STRL entities and the relationship with components of the National Map. In light of the importance of partnerships to the success of TNM STRL partnerships in each region of the country there needs to be a model developed that focuses on a logical, statewide program of data updates on a timely basis flowing from local to county to state to TNM where strong state leadership exists and is possible. Section 3 addressed this issue by identifying High-Priority geographic data themes and the scale, accuracy, and volatility factors that govern their applicability to the STRL user community. This Section goes a step further in addressing the issue of National Map data usefulness by STRL organizations.

Table 4-1 presents a summary of the current status of federal programs and sources for geographic data that are or could be of importance to STRL entities. This table identifies the relationship between the high-priority data themes identified in Section 3 with—a) the associated FGDC Frameworks Theme, b) the component of the current National Map, and c) other established Federal programs or services for digital geographic data distribution. This table also offers an assessment, from the authors’ perspective, of the availability and suitability of federal geographic data for use by STRL entities. A subjective “rating” of Very Good, Good, Fair, or Poor, for each of the High Priority data themes has been assigned. The purpose of this table is to identify possible gaps in Federal agency data programs that could be enhanced to better address the need of STRL entities.

Table 4-1: Relationship of Federal Programs and Sources for Geographic Data Themes

| Corresponding Federal Government Data | | | | | |
|---|------------------------------|---------------------------------|--|---|---|
| High Priority Geographic Data Theme | Framework Theme ¹ | National Map Theme ² | Other Standard Federal Data ³ | Federal Data Availability/ Suitability for STRL Use | Comments ⁴ |
| Planimetric Features--General | ST | DLG24 | | Fair | The USGS Topographic Map series and DLG24 data sets provides country wide data at the 1:24K scale but in many areas, data is very outdated. |
| Planimetric Features--Detailed | | | | Poor | Not generally available from federal source with exception of specific federally-administered sites or projects (highway projects, parks, military bases) |
| Transportation—Major Roads | TR | DLG24 | NTA, TIG | Good | Major highways (U.S. routes and Interstates) readily available from NTA; other highways and roads from DLG24 although currency and availability varies greatly. Census Bureau TIGER files have limitations of accuracy, completeness and currency. Census Bureau to embark on major TIGER and Address file update and enhancement in 2003. |
| Transportation—Local Streets | TR | | TIG | Fair | TIGER data includes local roads and streets but accuracy, completeness, and currency makes it of limited use. |
| Orthoimagery—Detailed | | | | Poor | Not generally available from federal source with exception of specific federally-administered sites or projects (highway projects, parks, military bases) |
| Geodetic Control Points/Monuments | GC | | NGS, BLM GCDB | Good | Good data available on NGS and BLM registered control points. This will not include control data acquired by other sources but not submitted to these agencies. |
| Survey System Corners/Grid Lines | GC | | NGS, GCDB | Good | Good data available--at least in certain areas on government survey corners that have been re-surveyed and assigned geodetic control coordinates. Best data will be in BLM administered lands in western U.S. |
| Governmental Jurisdictions | GU | DLG24 | TIG, NGS, DLG24 | Fair | Fair data on state, tribal, and national boundaries. DLG24 and TIGER data will have County boundaries and municipal boundaries but accuracy and currency is often in doubt. There are no federal sources that keep track of municipal boundary changes from annexations and other local actions. The U.S. Bureau of Indian Affairs maintains boundary information for tribal areas. The currentness of the data will vary considerably. |
| Regional Agency and District Boundaries | | | | Poor | Little data available from federal agencies for boundaries of regional agencies and districts inside states |
| Local Administrative Areas | | | | Poor | Little or no data available from federal sources |
| State Administrative Districts | | | | Poor | Little or no data available from federal sources |
| Other Special Zones or Districts | | | | Poor | Little or no data available from federal sources |
| Sanitary Sewer Treatment and Collection | | | | Poor | Little or no data available from federal sources except is specific projects involving federal agencies or significant federal funding. |
| Transportation Facilities--Highway | ST | | NTA | Good | General facilities mapping from the BTS. More detailed data from highway engineering plans from USDOT. |
| Transportation Facilities--Local | | | | Poor | Little or no data available from federal sources except is specific projects involving federal agencies or significant federal funding. |
| Water Distribution System | | | | Poor | Little or no data available from federal sources except is specific projects involving federal agencies or significant federal funding. |
| Water Supply and Transmission | | DLG24 | | Poor | Little or no data available from federal sources except is specific projects involving federal agencies or significant federal funding. |
| Flood Zones | | | DFIRM | Good | Very good map information from FEMA FIRM program although much is still in hardcopy form. In certain areas, the U.S. Army Corps of Engineers has floodplain mapping. DFIRM program is progressing but much work still needs to be done to provide comprehensive |
| Surface Hydrography | HY | NHD | | Good | Good data at general scale nationwide from 100K scale NHD. USGS is encouraging states to proceed with 24K mapping. For local needs however, more detail is needed. |
| Assessment Parcels | CD | | | Poor | Very little data available from Federal agencies. Exceptions include mapping for some western areas by BLM and maps sometimes available on private in-holdings within federally administered lands (e.g., National Forests) |
| Emergency PIng and Mngmnt Themes | | | | Poor | Little comprehensive data useful for STRL entities is now available from the Federal government. Recent data collection programs instituted by the federal government (involving NIMA and USGS) are targeted at developing organized data sets to support emergency management and Homeland Security |
| Government Buildings | | | | Poor | Very little data available from Federal agencies. |

Footnotes:

¹Indicates digital data sets that are defined under the FGDC Framework Standards or data available as standard offerings from federal agencies. Framework themes include: GC-Geodetic Control; OR-Orthoimagery; EB-Elevation-Bathymetry; HY-Hydrography; TR-Transportation; GU-Governmental Units; CD-Cadastral; and ST-Structures (possible new addition to the original 7 Framework Themes).

²Data sets defined as part of the National Map Program of the USGS (not necessarily available for entire country) includes: DRG-Digital Raster Graphics; DOQQ-Digital Orthophoto quarter-quad data; DLG24-DLG formatted data from 1:24,000 scale quad maps; DEM-digital elevation model (grid-based) data for 7.5' quads or 1:250K scale quads; NHD- National Hydrography Dataset from the USGS-surface hydrography (rivers, streams, water bodies) from DLGs-initially at 1:100K scale with work toward 1:24K compilation; HU- Hydrologic Unit boundaries (basins and watersheds compiled at 1:100K scale (and some at larger scale) by the USGS and NRCS; LC-general land cover mapping from USGS (dated) at

³See Appendix B for brief explanation of Federal Agency geographic data sources

⁴Abbreviations used include: BLM (U.S. Bureau of Land Management); BOC (U.S. Bureau of the Census) COE (U.S. Army Corps of Engineers); DA (Department of Agriculture); DOQQ (USGS Digital Ortho Quarter-Quad Program); BTS (Bureau of Transportation Statistics of the U.S. Dept Transportation); EPA (U.S. Environmental Protection Agency); FEMA (Federal Emergency Management Agency); FWS (U.S. Fish and Wildlife Service); NGS (National Geodetic Survey) of the National Ocean Service; NPS (National Park Service); NRCS (U.S. Natural Resources Conservation Service of the Dept of Agriculture); OSM (U.S. Office of Surface Mining); USFS (U.S. Forest Service); USGS (U.S. Geological Survey)

Table 4-1 reveals a number of important factors that influence how the National Map is used by STRL entities and the potential for partnerships to support data maintenance and sharing:

- As cited in Section 1 and Appendix B, Federal government agencies have been active in producing geographic data in automated form—at 1:24,000 or smaller scale. Important examples include the USGS, Census Bureau, Natural Resource Conservation Service, and the Bureau of Land Management in the production of 7.5-minute quad based products.
- No federal agency sources have been identified as “Very Good” in their Availability/Suitability for STRL entities. Availability/Suitability of Federal sources for six themes have been rated as “Good”. These include: Transportation-Major Roads; Geodetic Control; Survey Corners/Grid Lines; Transportation Facilities-Highways; Flood Zones; and Surface Hydrography.
- Sixteen (out of 22) themes have an Availability/Suitability of “Fair” or “Poor”. These lower ratings result from a number of factors that limit use by STRL agencies including: a) Federal agencies are not typically responsible for collecting data for the theme (e.g., water and sewer utility, local cadastral data), b) Federal agency data is available but it is often out of date, c) Federal agency data is available but geographic coverage is spotty, d) Federal agency data is not compiled at a scale or resolution level suitable for many STRL agencies.
- The Census Bureau TIGER program has been a primary source of nationwide transportation network and government jurisdictional boundary data—even with its acknowledged limitations in accuracy and currency. The current “TIGER modernization” initiative has a goal of improving the quality of TIGER data. This program has the potential for supplying data for the National Map.
- Detailed data included in the Emergency Planning and Management set of themes is generally not currently available at an accuracy level that is needed for emergency management programs. Homeland Security initiatives at the Federal level—particularly the “133 Cities” project lead by USGS and the National Imagery and Mapping Agency (NIMA) are focused on providing much of this data.

4.2 INHIBITORS AND INCENTIVES FOR COLLABORATION AND PARTNERSHIP

Through an analysis of STRL entity programs and data needs as well as a review of the status of the National Map and geographic data programs by other federal agencies, the

authors identified a series of “inhibitors” and “incentives” for federal-STRL collaboration and partnerships. The inhibitors and incentives listed below have been evaluated and provide a foundation for recommendations provided in the report.

**Table 4-2: Description of Inhibitors and Incentives
for Collaboration and Partnerships with the Federal Government**

| Inhibitors and Incentives | Explanation |
|---|--|
| Inhibitors | |
| 1. Lack of understanding about Federal data and its availability | Despite good efforts on the part of the FGDC, USGS, and other Federal agencies to “advertise” and promote their data distribution programs, there is still a significant lack of understanding on the part of potential users about what data is available and how to get it. This gap is particularly prevalent among local governments, some state agencies, and certain types of regional agencies. |
| 2. Confusing array of Federally administered programs for geographic data management and distribution. | The “alphabet soup” of programs and initiatives for geographic data coordination and distribution and an apparent lack of coordination contributes not only to confusion but perceived duplication and even resistance. The existing mix of such programs as FGDC Subcommittees and Working Groups for standards development, GeoSpatial One-Stop, National Map, FGDC Clearinghouse Program, National Digital Earth Initiative, “133 Cities Project”, individual Federal agency geodata portals, and others tends to hurt rather than help the building of an effective NSDI. |
| 3. Scale/detail of maps not great enough | Users at the local level and among many state and regional agencies that are familiar with National Map program products and data provided from other state agencies often find the scale and detail insufficient for their use. Products compiled at a scale of 1:24,000 or smaller have limited applicability for local applications. |
| 4. Quality or currency limitations | In cases where scale and detail do serve users needs, they often find quality problems (positional accuracy, missing features) or lack of timely update to be severe limiting factors. Examples include currency of topographic maps and quality limitations of TIGER data. |
| 5. Use of different coordinate systems and projections and geographies that cross coordinate system zones | Different types of users have different needs for plane coordinate systems and map projections. This is sometimes a technical limitation and sometimes related to their area of jurisdiction. There is also the issue of continued legacy problems with NAD 27-based data. All of this is exacerbated by the fact that the jurisdictional areas of many STRL entities often cross coordinate system zones. Without easy means to transform projection/coordinate systems of federal digital products, their value to users decreases. |
| 6. Small local governments and regional agencies lack technical and staff resources to use digital geographic data | Despite the aggressive adoption of information technology and GIS by many STRL entities over the last decade, there remain many small local governments and regional agencies that face resource limitations and incomplete knowledge to make effective use of digital data. Such entities occur in every state. |
| 7. State, Tribal, and local data distribution and cost recovery policies may conflict with Federal laws and regulations | State open records laws (responding to the FOIA) define requirements and policies for access and distribution of government records and data. These laws and their interpretation vary from state –to state. Some states and many local governments have placed limitations on access and use of geographic data—in some cases setting up cost recovery programs for sales or fees for data and products. Depending on the case, these laws and policies may conflict with the Federal government’s tradition of more unrestricted data access. The political and legal autonomy of Tribal governments is a factor also. The potential for conflicting laws and policies can significantly impact the terms of federal partnerships. |
| 8. Political and jurisdictional complexity and inconsistency inhibits coordination and common collaborative strategies | As described earlier in this report, the political-geographic fabric of this country is complex, with considerable variability among states and regions. This makes it more difficult to devise “template” programs, policies, procedures, agreements, etc., that will work well in all cases. |
| 9. Increased concerns about data security limiting Web-based access | Since the Internet became a common environment for public agency communication and data access, access security has been a major concern. This has been pushed even more into the forefront since the September 11 attacks and the establishment of new policies at the federal, state, and local levels. There is a real policy conflict, not yet resolved, between providing reasonable access to geographic data and placing access restrictions on data that might increase criminal or terrorist threats. |
| 10. Financial pressures in most state and local governments limit taking on new initiatives | In the last year, most states and many local governments (not to mention the Federal government) have been faced with budget deficits, and it appears that, for many, this may be the case for the next one or more budget cycles. The lack of money for discretionary programs (under which GIS and geographic database efforts might fall) can restrict these entities’ interest in exploring new initiatives. |

**Table 4-2: Description of Inhibitors and Incentives
for Collaboration and Partnerships with the Federal Government (continued)**

| Inhibitors and Incentives | Explanation |
|--|---|
| Inhibitors (continued) | |
| 11. Insufficient leadership and coordination roles to implement and oversee. | While the FGDC has made solid progress in Federal coordination and support for developments at the local and state level, there is still a perception of confusion and lack of coordination in geographic data compilation and distribution at the Federal level. Strong leadership, sound coordination, and a clear message from the Federal mapping and geographic data community are lacking. Partnerships with STRL entities cannot succeed effectively until the picture improves at the Federal level. |
| 12. Lack of legal instruments and terms/administrative Inertia | Partnerships are first based on real need and the demonstration of mutual benefits to all parties. From there, it is important to have effective and practical written terms to formally establish a partnership and clear roles for administering and monitoring the partnership. While such relationships have been forged for specific projects between STRL and federal agencies, no generally applicable written instruments or sufficiently clear administrative procedures for partnerships now exist. Furthermore, some Federal requirements (e.g., FACA, anti-trust) actually interfere with partnership formulation. |
| Incentives | |
| 1. Great need for current, high-quality geographic data | As described in this report, there is an immediate, on-going, and deep need for maps and geographic data by STRL agencies. Much of this need is not being met effectively. |
| 2. Potential for cost and resources savings | Partnerships, if designed well, can deliver benefits in the form of actual reduction of costs and resource requirements. Such benefits are not always a given, but cost sharing and elimination of redundant operations offer huge opportunities for savings. |
| 3. History and structure for statewide coordination of GIS | While a complete administrative structure and clear roles for geographic data management and coordination do not now exist in STRL organizations, part of the puzzle has been established. The majority of states have assigned geographic information coordinating body and a manager. Many states have made good progress in coordination with local entities and the Federal government. Many large and mid-size cities, counties, Tribal governments, and regional organizations have formal GIS programs with a manager and staff. This existing structure can help support Federal collaboration and partnerships. Such organizations as NSGIC, NASCIO, NACo, NLC ICMA, and others also positioned to play a coordinating role. |
| 4. Federal and state mandates/policies and interest in STRL partnerships | The recent revision to OMB Circular A-16 and the strong Federal E-government portal mandate provide considerable impetus and support for partnership development. Also, many states have Executive Orders and formal policies that call for Federal-State-Local coordination in geographic data management. |
| 5. Homeland security drivers | New homeland security and related emergency management/public safety concerns provide strong support for a) compilation of geographic information and b) coordination, standards, and data sharing among federal and STRL organizations. This "driver" tied to considerable funding is a key element supporting and securing resources for federal partnerships. Geographic data being collected through Homeland Security funding initiatives (e.g., by NIMA) should be coordinated with other federal and state efforts. |
| 6. Existing programs involving Federal partnerships | There is a long history of federal partnerships between federal agencies and STRL entities that have resulted in mapping and geographic information. This includes cooperative programs with state governments for mapping and GIS development work (FGDC, USGS, NRCS, NASA, BIA, FEMA, others), as well as project-specific inventories and public works ventures that have included the creation of geographic data (FWHA, COE, EPA, USFS, USFWS). Elements of such past and existing programs likely provide a basis or starting point for new, more comprehensive partnerships for the National Map. |
| 7. Existing federal geographic data initiatives | While the existence of multiple geodata programs in federal agencies can create confusion, it does provide a history of operation that can be useful in enhancing National Map distribution. Federal agencies have made considerable progress in compiling and offering for distribution (often through agency-specific Web-based means) geographic information that they compile and maintain. Some examples include: USGS EarthExplorer, NOAA NWS AWIPS Map Database, US DOT Bureau of Transportation Statistics Geospatial Data and 2001 National Transportation Atlas Data, NOAA National Geodetic Survey, USFWS NWI Maps/Metadata, and others. |
| 8. GIS technology advances | Recent advances and the promise of future advances in GIS technology have made an immense impact on the rising demand for geographic data and the ways in which it is used. Some of the key areas of technological advance include: a) off-the-shelf menu-based desktop GIS, b) Web-based GIS software with growing capabilities, c) on-the-fly coordinate/projection transformation, d) powerful raster-vector integration, e) RDBMS-data warehouses, f) field-based GIS access, and g) improved map composition and map generation tools. |

**Table 4-2: Description of Inhibitors and Incentives
for Collaboration and Partnerships with the Federal Government (continued)**

| Inhibitors and Incentives | Explanation |
|---|---|
| Incentives (continued) | |
| 9. Technical advances in data conversion, aerial imagery capture, and data extraction | Several related advances have improved the availability of geographic data and provided opportunities for more timely updates: a) wider range of satellite-based, medium and high-resolution (5 meter to 0.5 meter) image products, b) digital aerial cameras promising to eliminate film based aerial photography and its inherent cost and inefficiencies, c) digital photogrammetric ortho generation and base map compilation techniques increasing the production speed and quality of the products, d) improved techniques for the conversion of paper maps (intelligent scanning, heads-up digitizing), e) software for the automated and semi-automated extraction of map features from aerial imagery, f) field-based techniques for geographic data capture including innovative uses of GPS combined with other computer-based technologies. |
| 10. Computer hardware and network technology | The increasing power and functionality of computer hardware with its lower cost, along with the range of devices available (from powerful but small PDAs to large computer servers) encourage more use of geographic data. The expansion of the Internet and the range of options and improved speeds in local area and wide area networks have continued to support the increased demand for data exchange. |
| 11. Maturing user base | Over the past decade, information technology and GIS has become familiar to most users in STRL organizations. At the same time, the general public and the private businesses that these organizations serve have become technology savvy and demand quick, often on-line, services. Public agencies have little choice than to implement automated solutions to respond to customer needs. The great interest in e-government and non-emergency 311 call-in centers rely to a large extent on GIS technology and data that drives GIS applications. |
| 12. Open systems and related standards | The movement in the information technology toward "open systems" has resulted in standards, networks, and software that support more flexible portability and interoperability. In the GIS industry, the open systems trend has started to make GIS and geographic data more accessible and usable in several ways: a) more flexible application development using standard languages supporting code re-use and portability, b) desktop software with the ability to read other software's native data formats, c) Open GIS Consortium standards for feature types, GML, Web services, etc. that gives a foundation for open software development, d) template database models and classification schemes by FGDC, some professional associations, and vendors, e) geospatial metadata standards. |

A major objective in building and sustaining effective partnerships between the Federal government and STRL organizations is to reduce the impact or risk of the inhibitors and capitalize to the greatest extent on opportunities and incentives. Table 4-3 gives some suggestions on approaches to meet this objective. The suggested strategies and actions in this table are directed primarily at the Geography Discipline of the USGS

Table 4-3: Strategies to Minimize Negative Impacts and Capitalize on Opportunities

| Inhibitors and Incentives | Explanation |
|--|---|
| Inhibitors | |
| 1. Lack of understanding about Federal data and its availability | a) Conduct/publish inventory of federal data holdings and their applicability for STRL use; b) Consider a redefinition of data themes that are included in a modernized <i>National Base Map</i> program (see Section 5) to provide better focus and to reduce confusion among multiple federal programs; c) Actively support federal geographic data cooperation and participation in the FGDC; d) Prepare explanatory materials that clarify the relationships among what some outside the federal government see as overlapping or redundant programs (the National Map, GeoSpatial Clearinghouse, GeoSpatial One-Stop, agency-based geographic data portals); e) Step up education and promotion efforts with STRL entities |
| 2. Confusing array of Federally administered programs for geographic data management and distribution. | FGDC with support of USGS and OMB take stronger leadership to clarify the role and objectives of individual programs and consolidate efforts where appropriate. FGDC and OMB design and position GeoSpatial One-Stop to be a central portal eliminating need to communicate directly with individual agency portals. |

**Table 4-3: Strategies to Minimize Negative Impacts and Capitalize on Opportunities
(continued)**

| Inhibitors and Incentives | Explanation |
|---|---|
| Inhibitors (continued) | |
| 3. Scale/detail of maps not great enough | a) With results of this study as direction, approach the National Map modernization with effort to increase resolution and scale of key themes (e.g., orthoimagery, transportation, hydrography, boundaries) in partnership with STRL agencies; b) Provide easily accessible metadata that clearly defines accuracy/detail and fitness for use in certain applications. c) Build in flexibility to ingest varying scales, resolutions and standards and formats for contributed data that will come from STRL entities into TNM |
| 4. Quality or currency limitations | a) With this study as a basis, make specific statements on update frequency and source by data theme; b) Define details of update approach and responsible parties to accomplish acceptable update cycle; c) Encourage and support development of automated tools for more effective and timely update (e.g., hard copy map source conversion, field data collection, automated feature extraction from imagery). |
| 5. Use of different coordinate systems and projections and geographies that cross coordinate system zones | a) Establish basic, standards for coordinate system and datum and apply the U.S. National Grid standard (FGDC, 2001) as appropriate for National Map data access. Establish software standards that require capability for on-the-fly coordinate/projection transformation using OGC specifications; b) Encourage and support states in development of statewide projections and coordinate systems to support applications at the Regional and Statewide scale; c) Establish basic requirements for geographic registration and import on non-projected map data sets (CAD files, non-registered raster file |
| 6. Small local governments and regional agencies lack technical and staff resources to use digital geographic data | a) Participate in existing Federal programs and activities of professional associations (e.g., NSGIC, NACo, NLC, NASCIO, and ICMA) for expanded use of information technology in public agencies. b) Develop organizational model that allows for "regional service centers" (e.g., at regional planning agencies) for data input and product generation where small local governments lack resources; c) institute strong and consistent leadership and support at the state government level to coordinate with counties and cities. |
| 7. State, Tribal, and local data distribution and cost recovery policies may conflict with Federal laws and regulations | a) OMB sponsor research to characterize status of state statutes and local laws and policies governing distribution/sale of geographic data and products; b) OMB re-assess current views on "open access" to geographic data in light of FOIA, Circular A-130, privacy restrictions, homeland security issues, etc. to develop updated policies for geographic data and associated fees; c) Prepare template language for partnership agreements – based on GeoData Alliance Open Data Consortium work |
| 8. Political and jurisdictional complexity and inconsistency inhibits coordination and common collaborative strategies | a) Recognize the differences and avoid a "one size fits all" approach; b) Make engagement by entities in the National Map partnerships very simple, flexible, and adaptable to specific organizational circumstances; c) Prepare a basic set of terms and policies, applicable nationwide, to be used as a basis for specific partnerships on a state-by-state basis; d) Assign a federal "NSDI Coordinator" in each state with broad responsibilities to coordinate Federal and STRL cooperation and partnerships |
| 9. Increased concerns about data security limiting Web-based access | a) Follow standard procedures (including best practices from NACo, NLC, NASCIO, ICMA, others) on Web-based security and privacy policies and tools; b) encourage resolution of confusion about government data availability given heightened homeland security concerns. Development consistent policies impacting security and sensitivity of geographic data themes. |
| 10. Financial pressures in most state and local governments limit taking on new initiatives | a) With participation from key professional organizations representing STRL organizations (NSGIC, NACo, ICMA, NGA NLC, ICMA) prepare clear "Business Cases" for the National Map participation; b) USGS and other parties use this as one part of a marketing campaign to garner support (see Lambert and Thorley); c) Federal government provide direct financial incentives to support geographic data compilation and update by STRL organizations – the author's realize that current budget conditions within the USGS do not currently allow for this recommendation, but feel strongly that monetary incentives are a very high priority for STRLs |
| 11. Insufficient leadership and coordination roles to implement and oversee. | a) FGDC assume more active leadership and coordination role (responding to clear mandate from revised OMB Circular A-16) and play more effective coordination role in support of the National Map and overall NSDI development; b) OMB clearly communicate goals, performance expectations and adopt active, participatory oversight on FGDC and individual Federal agencies; c) USGS place a "State NSDI Coordinator" in each state to have responsibility for STRL coordination and participation in the National Map program – a direction USGS in which USGS is currently heading re: distributed offices d) FGDC, USGS, and other organizations work with NSGIC and NASCIO to e) Establish a National Spatial Data Council as recommended by NAPA (Davis, 1998). |
| 12. Lack of legal instruments and terms/administrative Inertia | As part of a GIS coordination/NSGIC/NASCIO/NGA best practices model articulated in 6 offer model agreement language for federal → state → local engagement with terms & conditions and ways to engage partners with incentive and deliverables. Pay attention to the work the GeoData alliance is doing on the Open Data Consortium. |

**Table 4-3: Strategies to Minimize Negative Impacts and Capitalize on Opportunities
(continued)**

| Inhibitors and Incentives | Explanation |
|---|--|
| Incentives | |
| 1. Great need for current, high-quality geographic data | a) Follow-through with stated "new vision" for the National Map but adjust theme content and requirements with clear focus on volatility of specific themes and promote this to all user agencies, b) Support the development of better automated tools for data update (e.g., hard copy map source conversion, field data collection, automated feature extraction from imagery) |
| 2. Potential for cost and resource savings | a) Use the Business Case mentioned under Inhibitor #10 above to increase momentum and support for geographic data among STRL entities |
| 3. History and structure for statewide coordination of GIS | a) Establish a federal National Map Coordinator in each state to work closely with the state's Geographic Information Office, b) Coordinate with NSGIC to develop a methodology for soliciting a distributed USGS Mapping Office and c) with USGS Business and Partnership Development groups to help craft appropriate agreements and roles for the cooperating entities, d) craft an individual business plan for each state that is approved by both the USGS and the state. |
| 4. Federal and state mandates/policies and interest in STRL partnerships | Work with Public Interest Organizations who represent STRL entities and their constituents to identify cross-over mission responsibilities and give input to the USGS program leaders, partnership development and coordination and requirements people regarding their requirements, partnership capabilities and wishes. |
| 5. Homeland security drivers | a) Bring NIMA into active participation in the FGDC and establish policies regarding collection and distribution of imagery and data gathered under Homeland Security initiatives, b) Federal agencies with State and local government entities form an FGDC subcommittee to define/finalize a "critical infrastructure emergency management geographic data framework" to define data content, format, and quality needed for homeland security and emergency management, c) State governments (the geographic information office) become actively involved in statewide database development to respond to FCC E-911 Phase 2 wireless requirements |
| 6. Existing programs involving Federal partnerships | Assess the results of recent pilot and partnership programs and identify the key technical and organizational elements that will drive successful partnership efforts on a national scale. |
| 7. Existing federal geographic data initiatives | Conduct a federal government geographic information 'As-Is' status investigation and cross that information over with this report to identify opportunity targets. |
| 8. GIS technology advances | a) All GIS user organizations stay informed about GIS technology advances and their applicability to Federal and STRL entities, b) Federal and State agencies stay active in technology standards organizations that impact GIS software development (including OGC and the FGDC Interoperability Working Group) and encourage the development of software that supports open access. |
| 9. Technical advances in data conversion, aerial imagery capture, and data extraction | a) All GIS user organizations stay informed about technology advances in imagery collection and geographic data conversion, b) Federal and State agencies stay active in technology standards organizations that impact GIS software development (including OGC and the FGDC Interoperability Working Group) and encourage the development of software that supports open access. |
| 11. Maturing user base | All government entities should participate in and sponsor when possible user support and educational program. |
| 12. Open systems and related standards | a) OMB take strong role to strengthen and increase participation in the FGDC to support the National Map and the NSDI, b) FGDC, through subcommittees or working groups |

4.3 SUMMARY OF TECHNICAL ISSUES AND CHALLENGES

As cited in Tables 4-2 and 4-3 above, there are technical concerns that present challenges and opportunities for implementation of a modernized "new vision" National Map Program. Of particular concern are the following technical issues related to database structure that can complicate geographic database exchange to support National Map update and distribution.

GIS Software Architecture and Open Systems

While “open systems” developments in GIS have greatly increased opportunities for data access and exchange, different GIS software packages still have proprietary elements that limit complete transparency and data integration. In addition, user organizations may be using “legacy” GIS software (older versions of software) that further frustrates data integration and exchange. Several software industry trends have improved “openness” and interoperability and thereby enhancing users data access capabilities:

- Web-based software allowing geographic data access (via well-designed portals) by users with standard Web browsers.
- Desktop GIS “viewer” software that supports direct access (viewing, query, simple analysis) to multiple vector and raster formats
- Data architecture and software standards and specifications, established by the Open GIS Consortium, that have encouraged the software industry to develop more open products
- Trend toward the use of industry standard programming tools (C++, Java) reducing dependence on proprietary code for GIS application customizing
- Spatial data repository architectures for management of spatial and attribute data in relational databases providing a platform for wider access and data integration.

Even with the improvements in open systems, software from GIS vendors today contains proprietary elements that limit the portability of data and applications. The federal government, lead by the FGDC should continue active role in standards organizations and use its influence to accelerate software-related standards adoption.

Physical Database Design

There is little commonality, among different jurisdictions, in logical or physical database design (definition of map features or objects and their logical or physical relationship). Database design templates prepared by vendors, government organizations, or standards organizations do exist for certain geographic data themes but these are not necessarily applied with consistency at the state, tribal, and local level. There are other physical design issues that can impact data access and exchange all of which must be taken into account in implementing partnership programs for geographic data maintenance and management including: a) map feature graphic structure (e.g., rules for segmentation of road or utility network), b) geodetic datum, map projection, and coordinate system, c) format and standards for type and placement of map feature annotation, d) map feature symbology and line types, e) variations in attribute data elements and database schema. Without implying a mandatory standard, the FGDC should take a stronger role in the

development of logical data models for high-priority themes. Where appropriate, the FGDC can coordinate in the development and adoption of basic physical data schemas to be used as starter-kit templates for implementation (with the goal of making data transfer and use easier and more consistent). These designs make maximum use of work already done by FGDC subcommittees and working groups, the Open GIS Consortium, and other existing standards and specifications

Database Classification and Coding

Just as there are differences in technical database architecture and physical database design, organizations will also make decisions and set standards for positional accuracy and for coding or classifying GIS data. Accuracy for map feature capture may vary significantly depending on organization's needs, the initial sources for GIS data, and the techniques that are used. Work carried out by several FGDC subcommittees and professional societies provides a starting point for the classification and coding of map features. It is understood that the National Map strategy must allow for regional and local differences where existing commonly used standards may deviate from a nationally endorsed scheme.

Positional Accuracy

Positional accuracy requirements will vary by data theme, type of organization, and the specific application for which the geographic data is being used. Individual jurisdictions that are performing map compilation and update may provide different levels of positional accuracy. The National Map update program must be sensitive to this and allow for the acceptance of data at different levels of accuracy. At the same time, there must be standards for minimal levels of accuracy that provides a baseline for data nationwide. Existing standards endorsed by the FGDC provides a basis for consistent specifications, testing, and documentation of map accuracy levels.

A process for on-going update and maintenance of a multi-theme National Map Program cannot assume that there will be full consistency in data architecture and design among STRL source organizations. It will be important to establish a suitable data model and accompanying technical procedures for data. The concept must imply an intermediate format that can easily support both upload and download of data themes from and to the native formats supported by the organizations maintaining and using the data.

4.4 SUMMARY OF INSTITUTIONAL ISSUES AND CHALLENGES

For the success of a nationwide National Map partnership program, it is essential to find appropriate ways to respond to institutional and political complexities. The most critical institutional issues (see Tables 4-2 and 4-3) include the following.

Complex mix of federal programs

In Table 4-2 it was noted that a major inhibitor the National Map program and the building of the NSDI is the confusion and perceived lack of coordination and overlap among federal agencies. The problem is both perceived and real but it does inhibit National Map and NSDI progress. The revised OMB Circular A-16 presents very clear mandates and assigned roles for coordination and accomplishments and the government performance review standards (GPRS) calls for accountability and results. The FGDC is given primary responsibility. The FGDC should be strengthened, all federal agencies that generate or distribute geographic data should participate, and the OMB should play a serious oversight role by establishing performance measures and progress monitoring.

Political complexity and regional variability

It has been noted that the political and legal basis and the relationships among STRL organizations varies greatly among states and regions of the U.S. This makes it difficult to create and “template” partnership structure (roles, procedures, etc.) that works well for all jurisdictions. In some cases, lack of coordination in mapping and GIS within STRL organizations further complicates the task of sustaining a successful partnership program. Organizational relationships and partnerships must respond effectively to this the complexity without a one-model-fits-all approach. The authors believe that state level coordination is absolutely essential and that there should be a federal representative placed in each state to support federal mapping work and to coordinate with local governments and regional agencies in the state. Partnerships must be cultivated, built, and nurtured—not mandated and they may take different forms depending on the circumstances. The consortium approach recommended by Cahan (2000) provides the beginning of an organizational/policy model for partnerships. Successful programs conducted in a number of states and regions of the U.S. also provide a basis for success.

Difference in policies for geographic information distribution

The fact that some state and local governments have placed certain legal controls and cost recovery policies on geographic data distribution may directly conflict with federal policies for “free distribution or cost of reproduction” of data. Recent controls arising from homeland security concerns may create additional complexities in establishing a consistent policy basis for nationwide National Map partnerships.

Digital Divide

Over 650 of 3066 counties in the country have a population of less than 20,000. A recent survey by NACo (National Association of Counties, 2001) reveals that 47% of counties in the U.S. are considered to be “somewhat behind” or “significantly behind” in use of the Internet and 28% are in a similar status in regards to general use of information technology. Another survey (Public Technology Inc. and ICMA, 2001) indicates that a

majority of cities and counties express major limitations in staff, technical expertise, and financial resources to support E-government and Internet applications. It is clear that many of the low population local governments of the U.S. do not have the financial resources and technical expertise to support digital data maintenance in a National Map program partnership. In the short-term, many municipalities and counties will not be in a position to provide data although they will be users of data or hard copy products generated from geographic databases. A partnership program must take these limitations into account.

Private Mapping Industry Role in Data Compilation and Distribution

Factors surrounding Private-Public Sector interrelationships in compiling geographic data and services for data distribution can work to support or to inhibit the development of the National Map and an effective NSDI. Public agencies at all levels have provided a market for private industry providers who have developed tools and procedures to provide geographic data products and services efficiently. Private industry providers often through active associations such as Management Association for Private Photogrammetric Surveyors (MAPPS) and the Spatial Technology Industry Association (STIA) see STIA (2001) are interested in maintaining and expanding market opportunities. Several specific concerns need to be considered in forging a National Map partnership program that addresses the private sector in an effective and appropriate way:

- The mapping industry has, for many years, voiced its opposition to the Federal government taking on mapping activities at scales larger than 1:24,000K.
- Many mapping companies with U.S. offices have or work with groups that provide “off-shore” labor for photogrammetric mapping or hard copy map conversion. Groups in such locations as India, Singapore, Malaysia, and China offer labor at a fraction of domestic rates. Also, certain state governments have set-up map conversion services using incarcerated personnel—again at rates lower than commercial rates. These developments have affected the domestic competitive environment. With recent focus on homeland security, there has also been some concern (whether or not for good reason) about security problems with having map data compiled outside the U.S.

SECTION 5
MODELS AND RECOMMENDATIONS FOR COOPERATION AND PARTNERSHIPS FOR THE NATIONAL MAP PROGRAM AND NSDI

5.1 EXISTING STANDARDS AND MODELS APPLICABLE TO NATIONAL MAP PROGRAM

Since the early 1990s, a significant amount of work has been done by government organizations, independent standards bodies, professional associations, and industry groups that may provide a basis for the National Map vision and the development of the NSDI. Key programs and standards are summarized in Table 5-1 with some ideas on how they may support the National Map.

Table 5-1: Existing Models and Standards Applicable to the National Map Program and NSDI Development

| Program or Standard | Description | Significance for National Map Program and NSDI |
|--|---|---|
| Federal Geographic Data Committee (FGDC) Standards and Programs | | |
| Framework Initiative | Defines the basic content and format of "foundation" geographic data themes with importance for a wide range of program areas and users. | Provides a basis for redefinition and elaboration to better address STRL needs and support the National Map program. |
| GeoSpatial Metadata | The FGDC Metadata content standard along with approved profiles, and specific implementations at the State and local level provides a template for common metadata management | |
| Mapping and Data Theme Content Standards | Several technical standards currently approved or in review provide a basis for common geographic data compilation and reporting: <ul style="list-style-type: none"> - U.S. National Grid - Geospatial Positioning Accuracy Standards (Parts 1, 2, 3) - Content Standard for Digital Orthoimagery, - Soil Geographic Data Standard - Cadastral Data Content Standard - Address Content Standard - Content Standard for Framework Land Elevation Data - NSDI Framework Transportation Identification Standard - Utilities Data Content Standard - National Hydrography Framework Geospatial Data Content Standard (in proposal stage) - Federal Standards for Delineation of Hydrologic Unit Boundaries (in proposal stage) See: http://www.fgdc.gov/standards/status/textstatus.html | In some cases, these standards may be used as-is by STRL agencies in specifications for GIS development. Content standards may be used as basis for logical and physical design for implementation. In some cases they need to be adapted to the scale and accuracy levels required by STRL entities. |
| Data Coding and Classification Standards | FGDC subcommittees and working groups have made good progress in developing geographic data classification standards for certain data themes. Key examples include: <ul style="list-style-type: none"> - Classification of Wetlands and Deepwater Habitats of the United States - Vegetation Classification Standard - Facility ID Data Standard - Earth Cover Classification System - Governmental Unit Boundary Data Content Standard | While many are oriented at data gathered commonly by federal agencies, they provide a basis for use by STRL entities |

Table 5-1: Existing Models and Standards Applicable to the National Map Program and NSDI Development

| Program or Standard | Description | Significance for National Map Program and NSDI |
|--|--|--|
| Federal Geographic Data Committee (FGDC) Standards and Programs (continued) | | |
| I-Teams | An FGDC program which provides a "template" and basic support for multi-organizational groups supporting Framework data development and maintenance | Lessons learned from existing I-Teams can provide practical information in the development of partnerships on a larger scale |
| New Digital Earth Reference Model | Draft model for management of geographic data using open standards. Developed by the Geospatial Applications and Interoperability Working Group of the FGDC. See FGDC 2001b. | Provides possible context for practical implementation of database and applications development and data sharing using open standards. |
| Other U.S. Government or Independent Standards | | |
| FIPS Standards | The Federal Information Processing Standards administered by the National Institute of Standards and Technology (NIST) includes certain standards applicable to geographic data coding and management. The Standard Industrial Code (SIC) system is one example | Should be applied where applicable |
| Spatial Data Standards from CADD/GIS Center | Logical model and physical design for implementation and data population for wide array of "base map" and thematic data layers. Developed and support by the CADD/GIS Center of the U.S. Army Engineer Research and Development Center, Vicksburg MS. Originally developed for us by military installations, it has been applied to general civil GIS implementations. Approved as standard under ANSI ICITS. (see www.wes.army.mil) | An elegant and mature but not widely used standard (outside of military installations) that potential could provide a template logical and physical design for STRL entities. |
| Federal Enterprise Architecture | OMB-sponsored model for information technology planning and implementation. Has goal of providing a consistent business-based, cross-agency framework for information technology. See: www.feapmo.gov . | May provide direction for improved coordination among federal agencies in geographic information compilation, sharing, and distribution |
| ANSI: International Committee for Information Technology Standards- Technical Committee L1 (GIS) | Committee which operates under the auspices of the American National Standards Institute (ANSI) sponsored by the Information Technology Industry Council (ITI). Formerly operated under the name: National Committee for Information Technology Standards (NCITS) as ANSI Committee X3. Technical Committee L1 encompasses GIS standards. U.S. TAG to the ISO Committee TC 211 (Geographic Information and Geomatics). | Provides appropriate independent "branding" of GIS-related standards and is body for coordination among multiple groups involved in standards development. Also supports coordination and harmonization of standards with the international community. |
| International Organization for Standardization (ISO)-Committee TC211 | Committee TC211 (Geographic Information and Geomatics) is the ISO Committee with a mission for defining and approving international standards for geographic information management and processing. With participation of the U.S. TAG, ANSI ICITS Committee L1, the Committee's work encompasses standards on geographic data format, feature definition and coding, data quality, Web-based services, and other areas. The Open GIS Consortium is a major participant. | Involvement by U.S. participants ensures coordination and harmonization with international community for geographic data standards. Provides important incentive for interoperability of software and data products. |
| Professional Association and Industry Consortia Standards and Resources | | |
| Open GIS Consortium (OGC) Specifications | OGC is an industry-lead consortium whose purpose is to develop and promote interoperability for technologies involving spatial information. It has a large, international membership that includes many information technology vendors, universities, and some government agencies. Open GIS Specifications cover such areas as: <ul style="list-style-type: none"> - Vector and grid feature format - Coordinate transformation - Catalog services - Web services for geographic information - Geography markup language (GML) | Generates specifications and supports their adoption in software and data products and applications to create better "cross-platform" interoperability and data sharing. |

Table 5-1: Existing Models and Standards Applicable to the National Map Program and NSDI Development

| Program or Standard | Description | Significance for National Map Program and NSDI |
|--|---|---|
| Professional Association and Industry Consortia Standards and Resources | | |
| NASCIO Enterprise Architecture Development Toolkit | Practical model and guidelines for organizational structuring and adoption of best practices for information technology programs in government. Focuses on state government but addresses relationships with federal and local governments for information sharing and technology transfer. See NASCIO (2002). | General model that serves as potential basis for government IT programs and practices including GIS. Provides sound models for coordination among agencies and multiple levels of government. |
| Professional Association Data Coding and Classification Standards | Certain professional associations have developed classification and coding schemes applicable to the professions they represent. Some of these may have an impact on the design and development of geographic databases. Some examples are: <ul style="list-style-type: none"> - Land-Based Classification Standards from American Planning Association (APA) - Parcel mapping guidelines from the International Association of Assessing Officers (IAAO) | For certain data themes, these coding schemes offer a basis for increased nationwide consistency |
| National States Geographic Information Council (NSGIC) | NSGIC is a National Organization of senior state geographic information system managers and other representatives from federal agencies, local government, private sector, academia and other professional organizations. They provide a unified state voice on geographic information and technology issues in areas of policy, liaison & networking, research & education and public relations. | State GI directors act as coordination entities in their jurisdictions, for technology, standards, policy, and fiscal resources across state government, with LRT in their states, with federal government |
| Other Standards and Programs | | |
| United Kingdom Ordnance Survey | The Ordnance Survey is the United Kingdom's mapping agency operating as an Executive Agency within the Ministry of Environment, Transport, and Regions. It has special status as a Trading Fund with responsibility for self-support through sales of products and services. It provides both large-scale and small-scale and small-scale base maps and data for use by governmental bodies, private firms, and citizens. | Provides possible organizational, financial, and technical model for the National Map in the U.S. This includes an effective Web portal and access tools, a practical financing mechanism, and efficient partnerships with government agencies and private companies. |
| USGS National Map Pilot Projects | Includes statewide pilots in Delaware and Texas testing map update and map distribution approaches. | |

5.2 SUGGESTIONS ON DATA THEME MAINTENANCE ROLES

Assigning roles for compiling and updating geographic data is critical for support of the National Map and overall geographic data maintenance. As currently defined the National Map Program New Vision does not make specific recommendations in regards to Federal agency roles versus those of STRL agencies. This issue was explored by the Mapping Science Committee (see Mapping Science Committee, 2001), which included the following general recommendations on data responsibility.

Potential Responsibilities for Data Layers in a Spatial Information Infrastructure

(Table 1, page 62 from: Mapping Science Committee, 2001)

| Theme | Federal | State | Local |
|--|--|--|--|
| Geodetic control | Primary | Supplementary | Supplementary |
| Cadastral information | Supplementary | Supplementary | Primary |
| Political boundaries | Primary for states and international | Primary for counties and state reserves | Primary for municipalities and local areas |
| Base cartographic and elevations | Primary for scales smaller than 1:24,000 | Supplementary for road building and state projects | Supplementary for local projects |
| Bathymetric | Primary for offshore | Supplementary for lakes & reservoirs | Supplementary for ponds |
| Geologic | Primary | Supplementary | Supplementary |
| Hydrography | Primary | Supplementary | Supplementary |
| Transportation and utilities | Supplementary | Primary for highways | Primary for streets |
| Soils | Primary for coordination | Supplementary | Supplementary |
| Vegetation | Primary for federal lands | Primary for state lands | Primary for local lands |
| Wetlands and wildlife habitat | Primary | Supplementary | Primary for survey |
| Cultural and demographic | Primary | Supplementary | Supplementary |
| Digital ortho- imagery (scale dependent) | Primary at coarse resolution | Supplementary | Primary at fine resolution |
| Statistical base maps and address files | Supplementary | Supplementary | Primary |

The panel responsible for the Mapping Science Committee report (2001) noted that:

A fundamental goal and driving force behind an extended Framework is that data will be collected once and maintained regularly. In other words, if a data layer is part of the NSDI and also a component of both a State Spatial Data Infrastructure (SSDI) and a Local Data Infrastructure (LSDI), the data for these layers need to be collected at a lowest level and generalized to the other levels. (pg. 61, 63)

The work of the Mapping Science Committee and the research conducting by the authors gives a basis for assignment of roles for maintenance of high-priority data layers. Table 5-2 presents the authors' suggestions on potential roles for the Federal government (USGS in coordination with other agencies) and STRL entities in on-going maintenance and management of high-priority data themes. These suggestions imply that the USGS (or other designated federal body) will adopt a leadership and coordination role somewhat broader than provided for under its current responsibilities at the same time, it acknowledges the essential role of STRL entities in regular update of geographic data themes.

Table 5-2: Suggested Roles for Data Theme Creation and Update Maintenance and Management

| High-Priority STRL Geographic Data Theme | Suggested Roles | | | | Comments |
|--|-----------------|-----------------------|-------------------------------|-------------|--|
| | Federal Gov't | State or Tribal Gov't | Reg. Agency or Public Utility | Local Gov't | |
| Governmental Jurisdictions | | | | | Federal government with primary role for state and tribal boundaries and for maritime territorial limits. State governments in close coordination with designated regional agencies have primary role for county and municipal boundaries |
| Transportation—Major Roads/Highways | | | | | State government primarily responsible for Interstate and state highways applying national data standards. Local governments primary responsibility for local roads and streets |
| Transportation—Local Streets | | | | | Update carried out primarily by local governments or designated regional agencies (e.g., planning commission, transportation agency) acting in support of local governments, or by state transportation agency. U.S. Census Bureau with State coordination provides support. |
| Local Administrative Areas | | | | | Update carried out by local governments or regional agencies acting in support of the local governments |
| Planimetric Features-Detailed | | | | | Selective updates for local areas from detailed records (building permits, as-built engineering drawings). State and local governments may play support role for selected planimetric features and structures. |
| Geodetic Control Points/ Monuments | | | | | Control points (captured by any organization) that become part of a National Map database will be comply with National Geodetic Survey documentation standards. |
| Transportation Facilities--Highway | | | | | Federal and State government primarily responsible for update of Interstate and state highways applying national data standards. |
| Transportation Facilities--Local | | | | | Local governments have primary responsibility for update. |
| Survey System Corners/Grid Lines | | | | | Federal or state agencies have lead and work with other entities. |
| Orthoimagery—Detailed | | | | | Recommend that federal government take lead role in national high-resolution orthoimagery program in partnership with other public entities. |
| Regional Agency, District Boundaries | | | | | Selected boundaries should become part of the National Map (e.g., multi-state regional agencies, certain regional agencies with federal program relationship) |
| Sanitary Sewer Treatment/Collection | | | | | Although some coordination at the federal level may be needed. Local governments and utility districts with support from appropriate state agency. Probably should not be formal part of federal the National Map. |

Legend:



Secondary Role: implies role in coordination, material support, standards development, or support in data collection or update



Primary Role: implies main responsibility for data gathering and entering into an accepted GIS data format for all or some features in the data theme

Table 5-2: Suggested Roles for Data Theme Creation and Update Maintenance and Management (continued)

| High-Priority STRL Geographic Data Theme | Suggested Roles | | | | Comments |
|--|-----------------|-----------------------|-------------------------------|-------------|--|
| | Federal Gov't | State or Tribal Gov't | Reg. Agency or Public Utility | Local Gov't | |
| Water Distribution System | | | | | Although some coordination at the federal level may be needed. Local governments, utility districts, private companies. State agencies may support local government or regional utility district in data compilation. Probably should not be formal part of federal the National Map. |
| State Administrative Districts | | | | | State responsible for maintaining boundaries of districts appropriate to that state government. Generally there will be no need for this theme to be part of the National Map |
| Other Special Zones or Districts | | | | | Specific roles will depend on the type of special district and its significance to federal agencies or STRL entities. |
| Planimetric Features-General | | | | | Could be part of federal program (Census Bureau) for capturing "map points". Coordination with State governments important. |
| Surface Hydrography | | | | | Federal agencies (lead by USGS) take lead role and coordinate with State governments for creation of 1:24K NHD. Regional agencies and local governments may map hydrography at larger scales. |
| Assessment Parcels (cadastral) | | | | | Federal government will take stronger role in mapping of parcels on federal lands and State governments should have primary role in mapping state properties in coordination with local assessment offices. Local government assessment offices will have prime responsibility for parcel map update—often using standards, support, and coordination from state government. |
| Flood Zones | | | | | Database development and update lead by and coordinated by FEMA with participation of state governments and selected regional flood authorities. |
| Water Supply and Transmission | | | | | Certain data elements (federally managed reservoirs) may need to be maintained by federal agency (e.g., Army COE). State/tribal level support for local update and maintenance is important. |
| Government Buildings | | | | | Specific roles will depend on the type of special district and its significance to federal agencies or STRL entities. |
| Emergency Planning and Management | | | | | Federal government has primary role in setting standards and collection/update of data for federal facilities and other designated areas. State should have primary role in data collection in close coordination with federal government. Local or regional agencies will provide support in data collection |

Legend:



Secondary Role: implies role in coordination, material support, standards development, or support in data collection or update



Primary Role: implies main responsibility for data gathering and entering into an accepted GIS data format for all or some features in the data theme

Table 5-2 yields some insights about the how the National Map Program should be defined and positioned relative to overall geographic data requirements of STRL organizations. Primary responsibility for certain data themes clearly falls with the Federal government (USGS or other agency), other themes are the domain of state or local agencies, and some require a strong shared responsibility. The authors suggest that the concept of the National Map be modified to better address the role and needs of federal agencies and STRL entities. Our general recommendations regarding better positioning of the National Map Program is described in the following

- “Harmonize” the concept of the “National Map” with the FGDC Framework Institutive and overall concept of the National Spatial Data Infrastructure. Redefine the National Map as the *National Base Map* that encompasses all seven Framework themes, with appropriate definitions on content, format, positional accuracy, geographic coverage and currency. This *National Base Map* should include the following high-priority themes defined in this study: Governmental Jurisdictions, Transportation (major highways and local streets), Geodetic Control, Survey System/Grid Lines, Orthoimagery (detailed as well as DOQQs), planimetric features (general), surface hydrography, parcels (for government properties), Government Buildings. In addition, include the “Digital Elevation Model” theme currently part of the National Map definition but not rated as high-priority for STRL entities. The minimal compilation scale for these themes would be 1:24,000 but certain themes may have better accuracy (e.g., transportation, detailed orthoimagery, parcels). Appendix C provides more detail about this proposed *National Base Map*. Note that this recommendation deviates in some significant ways from the currently defined vision for TNM:
 - Requires operational coordination between the USGS and other key federal agencies including the Census Bureau, NOAA, BLM, and others.
 - Calls for the development of the parcel (cadastral) on a national level— at least for public lands
 - Places the Federal government in a leadership role for the acquisition of both general and detailed orthoimagery
 - Partnerships with STRL entities for map compilation and update.
- The Geographic Names component currently included in the National Map should be considered a “derived product” that should eventually be produced through extract from other data themes and necessary reformatting. This component may also be included as an additional theme under the *National Base Map*.
- Establish procedures and technical processes for theme update that makes practical sense in light of map feature volatility and data requirements, available sources, and technical tools supporting update. Avoid blanket statement of “current within 7 days” since this can be misleading, not necessarily required by users, and not practical. Define update timing in an appropriate context (time from actual change or time from receipt of source material?)
- Separate the Land Cover component from the *National Base Map*. This has, for a long time, existed as neglected product, not regularly updated on a comprehensive basis by the USGS (although there have been periodic State and Federal projects for certain regions of the U.S.). While not of high-

priority for STRL entities, its importance for Federal programs should be further assessed and responsibility for its maintenance should be assigned, with a clear program for update.

- Define a second group of data themes called *National Thematic Geographic Database* or similar name. This is a logical concept rather than a physical database. It would encompass “non-base map layers” produced and maintained by federal agencies and available through the GeoSpatial One-Stop Portal. This would identify geographic data themes, logically separate from the *National Base Map*, that are maintained on a routine and large coverage basis by Federal Agencies (often in cooperation with State governments). This National Thematic Geographic Database could include any geographic database, with map data maintained in a suitable raster or vector format for the entire country or large regions of the country and made generally accessible. Some examples include: Wetlands (US F&W National Wetlands Inventory), Flood Zones (FEMA DFIRMs), Detailed Soils (NRCS SSURGO), and Land Cover. Many other themes could be included as well.
- Follow and augment plans for the GeoSpatial One-Stop Portal to provide very flexible metadata search tools to locate and characterize geographic data available.
- Define and create a national model for an *Extended State-Regional-Local Geographic Database*. This would include additional high-priority data that would be the primary responsibility of STRL entities. Some of these themes would provide source data to support the *National Base Map* and perhaps the *National Thematic Database* and the *Emergency Management and Planning Database*. This set of data would not be mandated or directly managed by the Federal government but there would be stronger Federal guidance and support for wide adoption.
- Create a logical data model and physical design for *Emergency Management and Planning Database*. Because of the importance of these themes, special circumstances regarding compilation, and possible restrictions on distribution of some data, logically define this is a separate geographic data set with clear responsibilities and policies for maintenance and distribution. This *Emergency Management and Planning* database may include some of the data in the National and State-Regional-Local themes described above.

5.3 RECOMMENDATIONS FOR NATIONAL MAP PROGRAM AND NSDI DEVELOPMENT

This Section provides a summary of recommendations, based on the authors’ study, for future positioning of the USGS National Map Program within the context of the National Spatial Data Infrastructure (NSDI) and relationships among Federal agencies and STRL

entities. These recommendations are meant to stimulate discussion and consideration of changes that the authors believe is necessary to improve mapping and geographic data collection, update, and distribution on a national scale.

5.3.1 Recommendations for Overall National Map Program Context and Foundation

- FGDC should take a lead role in clarifying related Federal programs for geographic data collection, update, and distribution. Prepare educational materials that explain the relationships.
- “Harmonize” the concept of the “National Map” with the FGDC Framework Initiative and overall concept of the National Spatial Data Infrastructure. Redefine the National Map as the *National Base Map*. See Section 5.2 for more detail.

5.3.2 Recommendations on Data Theme Organization and Responsibilities

- Redefine the National Map as the *National Base Map* that encompasses all seven Framework themes as well as additional data themes, with appropriate definitions on content, format, positional accuracy, geographic coverage and currency. To address the broader set of data themes needed by Federal agencies and by STRL entities, define, in a logical context, the following additional geographic databases:
 - A National Thematic Geographic Database, a logical concept rather than a physical database, that would encompass “non-base map layers” produced and maintained by federal agencies and available through the GeoSpatial One-Stop Portal
 - An Extended State-Regional-Local Geographic Database that would include additional high-priority data themes that would be the primary responsibility of STRL entities.
 - An Emergency Management and Planning Database comprised of themes (some with sources in the previously defined databases) that specifically address national, state, and local emergency management and homeland security needs. See Section 5.2 and Appendix C for more detail.
- The USGS, working with the FGDC and other Federal agencies, should clearly define the content, format, accuracy, quality, and currency requirements for the themes in the recommended *National Base Map* and establish realistic update cycles and procedures for update. Much of this work is already done however recommended changes from the current National Map Program will require some significant augmentation:

- Through close collaboration with the U.S. Census Bureau, U.S. DOT, and appropriate STRL partners, development and maintain a high-resolution street/highway database, with address data.
- Put programs and procedures in place to develop and update a high-resolution orthoimage database for all developed areas of the U.S. This would involve partnerships and possible contributions of funding from a large group of public and private participants
- Include parcels (for government owned land) and work toward building and maintaining this theme on a national level

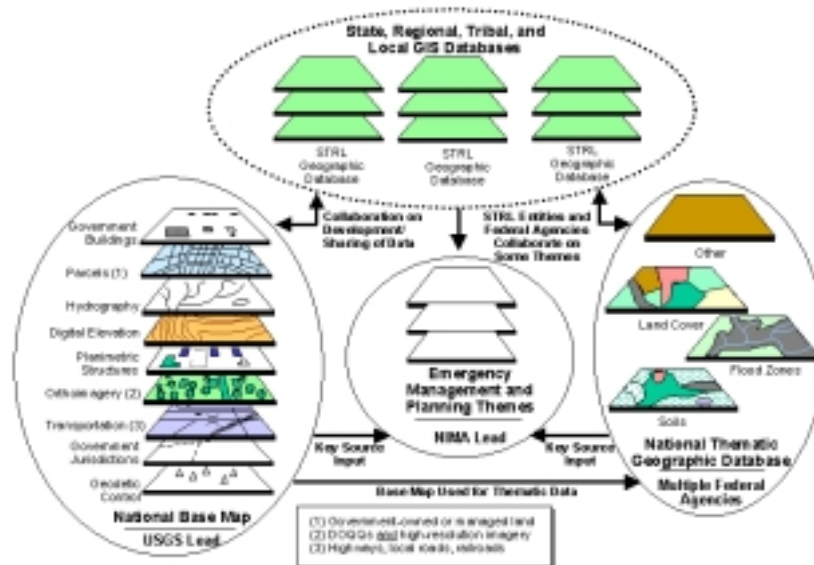
Implementation and deployment of the *National Base Map* through greater collaboration at the Federal level and partnerships with STRL entities will require additional work in defining digital map format rules ensuring consistency. This includes a number of critical areas such as— 1) segmentation rules for linear features (e.g., road segment), 2) positional accuracy, 3) applying a consistent linear reference system, 4) standardizing feature coding and classification standards, 5) rules governing graphic relationships among different features, 6) feature symbology and presentation, and 7) orthoimage standards (color, resolution, accuracy).

- Apply appropriate data coding and classification standards for *National Base Map* themes for geographic based on schemes already developed by key organizations including FGDC subcommittees, federal agencies, and professional organizations (see Table 5-1). The FGDC should commission a project with participation of key professional organizations (particularly NSGIC, NLC, NACo and ICMA) to review currently available coding and classification schemes for data included in the *National Base Map* and suggest modifications for deployment.
- Continue current efforts (current work involving the USGS, NIMA, FGDC) toward refinement and application of open GIS specifications from the Open GIS Consortium as path toward improved interoperability among software platforms. These specifications apply to feature formatting as well as the standard Web Services for geographic data distribution and on-line GIS services. As part of this effort examine other organizations (particularly the U.K. Ordnance Survey) that are adopting OGC-based standards for operation use.
- The Federal government, working with a newly created National Spatial Data Council, should take a prominent role in establishing data standards for and supporting the development of the *Extended State-Regional-Local Geographic Database* (see Section 5.2 and Appendix C for more detail). This is not the prime responsibility of any federal agency but since this the data themes included here have national significance and provide a source for some themes of the *National Base Map* and the *Emergency Management and Planning Database*, Federal support and involvement is important.

- As part of the recommendation for development of an *Emergency Management and Planning Database*, form a Working Group (perhaps under the FGDC) that includes Federal, State, and Local participants, to create a logical and physical data model, accuracy, and currency requirements for themes of this database. Define responsibilities for update and specific restrictions on access and distribution based on security or privacy implications. NIMA should take a lead role in this effort. Note: this may become associated with NIMA's recent announcement of the National Center for Geospatial Intelligence Standards (see *Federal Computer Week*, October 7, 2002).
- Apply appropriate technical standards for management of transformation among map projections and coordinate schemes. This includes the National Grid standard developed by the FGDC's Standards Working Group (FGDC, 2001a), consistent use of up-to-date adjustments to national vertical and horizontal datums, OGC coordinate transformation standards, and other application standards and specifications.

The general relationship among the geographic databases recommended above is illustrated in Figure 5-1 below.

Figure 5-1: Suggested Relationship Among Recommended Geographic Databases



5.3.3 Recommendations on Policy Concerns and Organizational Coordination

- Assign strong leadership to FGDC and revive this organization as the main entity for Federal coordination in geographic data coordination and standards. Use strong OMB mandate (Circular A-16) as basis for operation. OMB

assume strong oversight role and establish accountability for progress with adherence to the Government Performance Review Standards.

- Ensure that all federal agencies with an important role in mapping and geographic data handling are active participants in FGDC—including NIMA and NASA. It is very important that NIMA, which has recently taken on an active role in geographic data gathering for the U.S. in response to Homeland Security concerns, become an active part of the FGDC and collaboration with other agencies. As NIMA's long-term domestic mapping role is clarified, it will become very apparent that this role will be very dependent on inter-agency data sharing and partnerships with other Federal agencies and STRL entities. Such partnerships are critical to the long-term success of any domestic mapping program in which NIMA or other agencies are involved. NIMA should be assigned primary responsibility for the recommended *Emergency Planning and Management Database*. Appropriate policies on access and distribution of certain data themes could be assigned and managed.
- Conduct an analysis of the business needs and associated mandates/drivers for geospatial data in the federal sector to complement the analysis of the state, local and tribal sectors in this document.
- An evaluation of business needs, geographic data requirements, and avenues for National Map Program partnerships with the federal government— use the results of the two analyses to model the programmatic side of the U.S. geographic information setting
- Extend the analysis of the business needs and associated mandates/drivers for geospatial data in the state, local and tribal sectors to include 'focus group' meetings, to discuss TNM, and define partners expectations and necessary incentives
- Conduct similar focus group meetings with the public interest groups, i.e. ICMA, NACo, NLC, NSGIC, NASCIO, and interest consortiums (such as Spatial Technologies Industry Association, (STIA), Mapping Association of Private Photogrammetric Surveyors (MAPPS), and Geographic Leadership Consortium (GLC)) to ascertain who we can work with most effectively to help promote *TNM* partnership programs and also for advocacy in the Congress, State Legislatures, and County/City fiscal bodies.
- Update the FGDC/NSGIC framework inventory in cooperation with FGDC and National States Geographic Information Council (NSGIC) (include *TNM* themes)
- Identify 'quick wins' by cross correlating the resulting information from the business needs analyses and focus group meetings with local knowledge

(C&R staff and state liaisons) and knowledge about where the data gaps are from the updated inventory

- Carry out an inventory of Federal geographic data sources and current programs for update and distribution. Use this as a basis to define practical points for federal agencies coordination using the results of the federal data call that OMB issued in October of 2002 as the basis for the beginning of the work.
- Through OMB leadership and with support of the broader geospatial community (professional associations, public agencies, and private companies), establish the National Spatial Data Council (NSDC) as recommended in the 1998 NAPA Study (David, 1998) and expounded on by (Lambert and Garie, 1999). Incorporate ideas for the formation of the “U.S. Technology Partners” group recommended by Cahan, 2000. The essential purpose of such a group is to provide a focus for collaboration and partnerships among all public sectors and private industry to pursue goals for the NSDI. As suggested by NAPA, this would be a private, nonprofit corporation, preferably created by Federal statute having the following major objectives (David, 1998, p. xviii):
 - Provide a national forum for developing and maintaining the NSDI
 - Maintaining state-of-art knowledge about advances in geographic information and related technologies
 - Help ensure that goals set forth for the NSDI are actually carried out in practice by serving as a catalyst for implementation
 - Build a comprehensive and user friendly geographic information using a customer responsive and businesslike approach
 - Bring to the table the views on national standards of all interested parties and possibly assume over time the responsibility now housed in the FGDC for this function
 - Provide training and education on the utility of an techniques for fostering the NSDI

To this set of objectives identified by NAPA, an NSDC could also play an important role in the establishment of, and possible management of, a regional consortia, organizing and managing funding for data development, and preparing/overseeing contracts for multi-party data development work. There would be a strong relationship between the NSDC and the FGDC and active participation from government agencies, professional associations, and industry consortia. While

requiring more exploration, it is possible that the recently formed GeoData Alliance (see: www.geoall.net) is positioned correctly and could assume the role of an NSDC.

- The Federal government (USGS recommended) should assign an NSDI coordinator for each state. This echoes recommendations stated in the past by the Mapping Science Committee for state liaison positions and it augments that role now played by USGS advisors who now have multi-state responsibilities. These NSDI coordinators would be most appropriately placed in state geographic information offices (which now exist in officially mandated form in at least 30 states). An overall role of these coordinators is to be a link between federal agencies and STRL entities being knowledgeable and responsive to differences and needs among regions and states of the U.S. Specific responsibilities include:
 - Develop partnerships and consortia to support development and maintenance of the National Base Map including the development of financial relationships and agreements
 - Participate with other parties in the development of standards for the National Base Map and the Extended State-Regional-Local Geographic Database
 - Help parties in the state to organize regional “service bureaus” to support geographic data maintenance and services-particularly in areas where many low population cities and counties exist and which have limited resources for individual GIS programs
 - Encourage and assist in regional database development efforts involving multiple STRL entities to accelerate building of databases and to achieve economies of scale
 - Support regional and local entities in the development of operational GIS programs (working with the existing state geographic information offices, policy or advisory bodies, and user groups).
 - Participate in the activities of the National Spatial Data Council and FGDC
 - Participate and contribute to resolving issues impacting distribution and cost recovery policies for geographic data
- Template agreements for consortia – to that end, the GeoData Alliance is currently working on an Open Data Consortium project that seeks to create standardized sets of terms and conditions for data distribution. One of the deliverables is a *model data distribution agreement* that can be used among public data providers and private sector data distributors. The purpose is to

improve the market mechanisms for disseminating digital geographic information. See: http://www.geoall.net/docs/ODC_one-pager.pdf

5.3.4 Recommendations on Financial and Legal Concerns

- Examine and implement creative financing approaches like those suggested by Cahan (2000) such as a National Information Technology Finance Corporation that would act as a central “bank” supporting the raising, management, and distribution of funds for geographic database development and maintenance. Such a body could be established by law along with the NSDC.
- The OMB should sponsor a study to examine and develop recommendations to resolve differences in the Federal, State, and Local policies and programs governing distribution and cost-recovery for geographic data. This study should examine Federal statutes and policies (FOIA, privacy restrictions, Copyright, OMB Circular A-130, etc.), state open records laws and policies, and local programs for geographic information distribution and sale.
- Encourage the growth of the private geospatial industry in the U.S. This includes use of services database development and other services from private companies

The authors believe that a strict federal policy, with no flexibility from substantially “free distribution of geographic data” under FOIA accountability principles may not be the correct characterization or best policy to support development and to sustain an effective NSDI. Some combination of data licensing and cost recovery for commercial use GIS services should be made a facet of funding maintenance of the transactional data. Flexibility will be a significant success factor in dealing with over fifty different state statutory frameworks, and possibly thousands of different local government and utility practices regarding the ownership and control of critical data sets that will make up or serve to update NSDI and the National Map. A diversity of data sharing agreements will be required to deal with a cost effective plan to build and maintain the location based information infrastructure. Over the last twenty years, issues of liability, authority, open records, and copyright have evolved differently in different legal settings vis-à-vis “GIS data”. The effective use of such mechanisms as: a) licenses, b) agreements that include like-kind exchange of data or services, c) mutually supportive public-private ventures, d) royalties for value-added product development, and other legal and economic tools will not inhibit access to geographic information. More sophisticated policies could encourage the development of sustainable geographic databases, a growing public sector user base, and thriving geospatial industry.

5.3.5 Recommendations on Technical Development

- Continue with the GeoSpatial One-Stop portal technical design and apply Web-based standards consistent with the overall Federal E-gov portal

- initiative as well as those specific to geographic information (OGC specifications).
- With the understanding that multiple GIS user organizations at the STRL level will be operating with different software and using data architectures and physical designs that are not 100 percent consistent, it will be necessary to design and build and translation tool to support upload and download of data for the *National Base Map* and possible other themes as well.
 - The Federal government (USGS, NIMA, or other agency) should encourage and perhaps sponsor the development of GIS data update tools to provide users with efficient applications to update data according to *National Base Map* standards.
 - Federal, State, and Local governments should encourage GIS software vendors to support OGC specifications for interoperability through building compliant software tools and underlying data architectures. Mature OGC specifications should be included procurement specifications by public agencies.
 - The Federal government should increase its participation and investments in research efforts that result in improved technologies for map compilation. Government sponsored research, perhaps through private and university partnerships, with a goal to develop operational products (hardware and software) may focus on such areas as: satellite and aircraft scanner systems for digital image acquisition; digital photogrammetric compilation; LIDAR systems for digital elevation capture; automated feature extraction and land cover classification (from high-resolution imagery).

APPENDIX A
AUTHOR BIOGRAPHICAL SUMMARIES

PETER CROSWELL, EXECUTIVE CONSULTANT

Years Professional Experience: 26

Education: Bachelors in Geography and Mathematics with specialization in cartography and remote sensing, State University of New York-Albany; Masters, Geography and Geology, Western Illinois University; additional course work at Louisiana State University and University of Kentucky in Geology, Computer Science, and Public Administration.

Since 1985, as a consultant with PlanGraphics, Mr. Croswell has managed or been a major participant in more than 150 GIS and AM/FM planning, design, and implementation projects for federal agencies, state and local governments, regional organizations, utility companies, and private firms in North America, Europe, China, and the Middle East. Peter is an expert in enterprise GIS planning, design, and implementation for local and regional agencies. He has specific experience in database design and application development using many of the mainstream industry software products from ESRI, Intergraph, Microsoft, and Oracle. He has actively participated in research and educational endeavors on national and international GIS and IT standards and their impact on system development and deployment. This includes his work with the URISA Standards Committee, the Federal Geographic Data Committee, and the NAS Mapping Sciences Committee. Peter is also skilled with technical specifications and management of large data conversion efforts.

His experience spans all GIS user sectors- federal government, state government, regional agencies, local government, utility organizations, and the private sector. This includes GIS planning and development projects for several federal agencies, 10 states, and over 60 cities, counties, and regional agencies. He is skilled with the development of technical specification and implementation of GIS operations as well as developing organizational environments, policies, and procedures for coordination and information exchange. His past experience with GIS-related standards and work with the FGDC and federal agencies gives him a unique perspective on requirements and collaborative approaches for supporting the National Map Program.

Prior to joining PlanGraphics, Mr. Croswell participated in the development and then served as manager of the Kentucky Natural Resources Information System (KNRIS) with the state of Kentucky Natural Resources and Environmental Protection Cabinet (KNREPC) and was the Administrator of the Cabinet's Lands Unsuitable for Mining Program. In this role, he worked closely with federal agencies (USGS, USEPA, NRCS, USFWS, USFS, OSM, NASA, and others in developing a statewide GIS database). He also served as a Cartographer for the New York State Sea Grant Institute. Mr. Croswell

received a master's degree in geography and geology from Western Illinois University and a bachelor's degree in geography and mathematics from the State University of New York at Albany where he graduated magna cum laude and was inducted into Phi Beta Kappa.

Mr. Croswell is active in professional associations and participates through paper presentations and educational symposia sponsored by URISA, ASPRS and other organizations. He has served on the Board of Directors of URISA, chaired its Standards Committee, and served as URISA President for the 1996-99 term and is a recipient of URISA's Horwood Best Paper Award (1990) and Leadership Award (2000). He is a certified Professional Project Manager (PMI Institute), an ASPRS Certified Mapping Scientist and a recipient of ASPRS's President's Award for Practical Papers (1990). Mr. Croswell is co-author of: *Geographic Information Systems: A Guide to the Technology*, a GIS reference book originally published in 1991 by Van Nostrand Reinhold and the Chief Editor of the 1998 URISA Publication, *Spatial Information Technology Standards and System Integration*. He is also a contributing author to *Profiting from a Geographic Information System* published in 1993 by GIS World, Inc., and *GeoSpatial Data Infrastructure: Concepts, Cases, and Good Practice* (Oxford University Press, 2000).

T. JAMES FRIES, EXECUTIVE CONSULTANT

Years Professional Experience: 29

Education: B.S. (magna cum laude), College of Agriculture and Natural Resources, Michigan State University; M.S., College of Agriculture and Natural Resources, Michigan State University.

Mr. Fries has been a consultant with PlanGraphics since 1998 and has been a key participant or manager of statewide and local government GIS planning and development projects. He managed the statewide GIS and spatial data cost-benefit analysis study for the State of Ohio, as well as GIS planning, database creation, and application development projects for the Kentucky Chemical Stockpile Emergency Preparedness Program, the Kentucky Workforce Development Cabinet, the Kentucky Cabinet for Families and Children, the Kentucky Cabinet for Economic Development, the Kentucky Geological Survey, the Kentucky Revenue Cabinet, the Kentucky Public Service Commission, and the Kentucky Water Resources Development Commission. He has also been responsible for managing numerous assignments for the state Office of Geographic Information under PlanGraphics' master GIS consulting contract with the Commonwealth of Kentucky. These projects have ranged from developing FGDC-compliant metadata for statewide raster data sets and a training program to encourage Kentucky's local governments to pursue collaborative GIS partnerships to managing production of digital orthophotography and satellite imagery and a raster imager server to distribute data files to users. He also served as the lead facilitator for issues relating to IT business processes, funding, procurement, and staffing for PlanGraphics' enterprise IT strategic planning project for the State of Oregon. Almost all of Mr. Fries' state-level projects have required a thorough knowledge of the programs and activities conducted by federal agencies like USGS, USFWS, NRCS-USDA, FEMA, EPA, and the Army Corps of Engineers.

In addition to his extensive experience with state-level GIS projects, Mr. Fries has also managed or participated in numerous local government and utility GIS projects. These range from county, municipal, and utility system GIS implementation planning to developing specifications for addressing and various parcel, land base, and utility infrastructure conversion projects. As with his state-level projects, these local and utility engagements have required that he have a detailed understanding of the relationships between different levels of government, including federal and state regulatory programs.

Before joining PlanGraphics, Mr. Fries served as a consultant and contract training instructor for the Bureau of Land Management's National Training Center, taught undergraduate and graduate college courses, and directed a nationally acclaimed landscape-scale biodiversity conservation project for The Nature Conservancy in Texas. In addition, he has 12 years of senior state government experience managing water and other natural resource planning and implementation programs and projects in both Texas and Kentucky. He also worked as a River Basin Planner with the former presidential

Missouri River Basin Commission. His work in all of these capacities has involved interacting closely with many various federal, state, and local agencies, including operating cooperative projects that have ranged from regulatory compliance and refuge land acquisition to data collection studies and multi-purpose water project planning. He has worked especially closely during his career with particular federal agencies, including the former WRD of the USGS, USFWS, BLM, the Army Corps of Engineers, EPA, USDA, USDOC, and FEMA.

He holds a Bachelor of Science and a Master of Science in natural resources and water resources, respectively, from Michigan State University. In addition to pursuing Ph.D. coursework in demography and community health at the University of Texas at Austin, he has completed numerous continuing education and professional development training programs. He is active in several professional organizations dealing with water resources and biodiversity of conservation and is a contributing author for *Funding Clean Water* (D.C. Heath and Lexington Books, 1983) and *Collaborative Planning for Wetlands and Wildlife* (Island Press, 1995).

SUSAN CARSON LAMBERT, GEOGRAPHER

Years Professional Experience: 30

Education: Bachelors - double major in Geography with a specialization in Geographic Information Systems and a minor in Southern Studies from the University of South Carolina.

Ms. Lambert's current assignment, which commenced in early 2002, is an Interagency Personnel Agreement as an Intergovernmental Advisor to the USGS Geography Division to help develop *The National Map*. She is working to develop close working relationship between State and local governments and professional organizations, and the USGS and other Federal organizations, needed to ensure the success of the effort. Ms. Lambert provides education about *The National Map* and works to engage State and local government organizations in institutional arrangements that will move *The National Map* concept to reality. She is based in Frankfort, Kentucky. She is currently also the Principal Investigator on a \$1.3 million NASA funded investigation to create an updated Kentucky landcover map, stratified forest inventory, urban landuse maps and tools with which to use the data and products resulting from the Kentucky Landscape Snapshot project <http://kls.state.ky.us>

She served as the Executive Director of the Kentucky Office of Geographic Information Systems (GIS) where she was responsible for coordinating GIS activities in the Commonwealth. This coordination involved establishing partnerships with federal, state, county and local governments and non-governmental entities. She also coordinated and staffed 9 committees and subcommittees associated with the 25-person Geographic Information Advisory Council. She also established a training program for the GIS technical community, which involves the formulation of curriculum and training classes at the Governor's Office for Technology training branch.

Ms. Lambert began her career as a land surveyor, then draftsman and cartographer. She came into the service of the Commonwealth from the Federal Sector via the United States Geological Survey's Water Resources Division where she functioned as a geographer and cartographer for 12 years. During her tenure with USGS she headed the South Carolina water use program, which produces a national report of water use in the United States. She worked as a team member on surface water and ground water hydrologic studies that involved water quality, quantity, sampling, gauging, and modeling activities. She also served on the Framework Working Group of the Federal Geographic Data Committee. The working group defined what basic digital geospatial themes are necessary to provide a minimum set of data layers for the maximum number of GIS users and applications.

She served on a national 25-person team headed by Visa International Founder and CEO Emeritus Dee W. Hock. The Drafting Team, which met for nine three-day sessions all around the United States in 2000, named the impending organization the "GeoData Alliance". The team brought into being a 'chaordic' organization that is a "bottoms-up"

initiative aimed at meeting the quickly changing demands for digital geographic information.

In March of 2000 she received the prestigious U.S. Geological Survey's 2000 John Wesley Powell award. The Powell award is much coveted by domestic civil mapping professionals. It was awarded to her for personal and professional efforts in the United States surveying and mapping community and for her advocating of the collaboration, sharing, and use of geographic information to address environmental and hazard related problems, while supporting governmental decision-making processes. She was also recognized for her national efforts as a leader and proponent of partnerships and data standards issues as well as her promotion of the geographic information technologies to help solve societal problems and for her authorship of several professional papers and articles that promote. In September of 2001, Ms. Lambert received the National States Geographic Information Council (a national organization of State GIS directors) Outstanding Service Award – for exceptional and dedicated service to NSGIC and indeed the Nation, by advancing the purposes of the Council. This award was made in recognition of her upholding the highest ideals of promoting good and effective government.

Ms. Lambert is active in several professional organizations, she co-founded the South Carolina Arc/Info User Group in 1990, and served as the 91-92 president, she also served as the president of the Southeast Regional Arc/Info User Group 91-92. She is a member of the Kentucky Women's Leadership Network 98-02. She co-founded the Kentucky Federal Technical GIS User Group in 1996. She served on the board of the National States Geographic Information Council (NSGIC) 98-00 and as President 00-01. She is currently serving as a trustee on the GeoData Alliance Council of Trustees 02-03. She also currently serves on the advisory User Working Group of the Socioeconomic Data and Applications Center (SEDAC), which is part of the Center for International Earth Science Information Network (CIESIN) at Columbia University. She is a frequent lecturer and presenter at conferences and universities around the United States.

APPENDIX B
DESCRIPTION OF GENERAL BUSINESS PROCESSES

| General Business Process | Description |
|---|---|
| BP1: Billing, Tax, Fee Management and Collection | All functions concerned with a) setting and collection of fees for governmental services, b) analysis and setting of tax rates including sales and property tax, c) collection of property taxes, d) analysis and establishment of special tax or special public fee zones including enterprise zones, e) setting of rates and collection of bills for utility or related services |
| BP2: Budget/Financial Analysis | All activities involving the analysis of public agency expenditures, financial requirements, public accounting, and preparation and approval of public agency budgets (including all general fund, capital expenses, and special funds). |
| BP3: Business Activity Tracking | Includes all tracking and monitoring of private business activity** |
| BP4: Comprehensive Land Use Assessment and Planning | Formally mandated and informal activities involving the development of plans to project and direct growth and the use of land. Includes all large and small scale land use inventory and mapping, formal statewide, county, or municipal comprehensive plan development, federal agency land use planning projects, or site-specific land use assessments and planning. |
| BP5: Construction Project Planning and Design | Preliminary and detailed planning and design work for the construction of buildings, roads, public utilities, and other structures. Includes all data gathering, field data collection, engineering analysis, and the preparation of preliminary and final engineering plans carried out by public organizations. |
| BP6: Cultural/Historical Resource Assessment | Inventory, analysis, and assessment of sites or structures with historical, cultural, or archaeological significance. Includes collection of information, compilation of maps and reports, and work leading to official designation of sites as nationally, statewide, or locally significance. Also includes assessment and evaluation work done in connection with land development projects. |
| BP7: Demand Modeling and Analysis | All activities carried out by public organizations that concern the projection of demand for commodities and services by the public or private sector to support planning, decision-making, or policy development. Some examples include: a) water consumption projections by a public utility, b) state or local transportation volume analysis, c) analysis of future demand for recreational or educational services. |
| BP8: Economic/Demographic Forecasting | Any public agency functions involving the analysis and forecasting of future demographic or economic conditions or activity. May include formal modeling or informal predictions to support decision-making and public policy development. |
| BP9: E-Government Services | Programs and specific development work involving the design and development of public agency Web-based portals Web-deployed applications for public services and transactions. This may include the access to geographic information to support general inquiries, conduct standard transactions (permitting and licensing application), fee payment, sale of government products, and support for non-emergency services (e.g., 311 call centers). |
| BP10: Emergency Response | Activities that concern a public agency's response to an emergency event (police, fire, medical, environmental or natural disaster). Encompasses emergency call taking, dispatch of appropriate resources, support to responders, and reporting of the response activity. |
| BP11: Emergency/Disaster Planning | All work by public agencies that involve planning and coordination for emergencies of all types (police, fire, medical, environmental or natural disaster). This includes the development of emergency plans, preparations for emergency response, crime analysis, allocation of resources for response, coordination of resources during emergencies, assessment of damage, and coordination of support or mitigation activities. |
| BP12: Environmental Regulation and Management | All activities concerned with the development of regulations and requirements for management and protection of the environment and natural resources (land, air, water) and for responding to the regulations. Encompasses: a) all types of environmental impact assessments, b) environmental analyses associated with permit or land development plans, c) development of plans or management practices for environmental protection. |
| BP13: Environmental/ Natural Resource Inventory | All studies and functions involving the collection and compilation of data on conditions and quality of land, air, water, and biotic resources to support environmental management, decision-making, and policy development. |
| BP14: Facility Inventory and Tracking | All activities involving the collection of information on the condition, quality, and status of public facilities and infrastructure (buildings, structures, roads, utilities). May include field data collection, standard inspection activities, and other means for facility information collection. |
| BP15: Health/Safety Permitting and Enforcement | Includes public organization activities concerning the development of policies, regulations, and ordinances for health and safety as well as the executing these programs at the local, regional, or statewide level. This includes all permit review, inspection, and enforcement work for such programs as (food services, septic systems, motor vehicle, mine safety, etc.). |

| General Business Process | Description |
|---|--|
| BP16: Incident/Complaint Tracking | Covers all activities performed by public organizations for logging, identifying, and geographically tracking incidents and complaints. This includes such activities at the local, regional, or state level as: a) local complaint monitoring for public or utility services, b) public safety incident tracking, c) traffic incident tracking and mapping, d) disease outbreak tracking. |
| BP17: Land Development Inspection and Enforcement | All monitoring, inspection and related enforcement activity associated with land development permitting (BP18). |
| BP18: Land Development Review and Permitting | Includes all public agency activities for the application, review, approval, and permitting of any land development activity. Some examples are: a) local subdivision, site plan, or building permit programs, b) local zoning, rezoning activities, c) special use permitting at the state or local level, d) mining permit programs, e) water withdrawal permit programs |
| BP19: Legal Analysis/ Judicial Actions | Public agency legal analysis, court-ordered functions, and judicial activity involving the use of geographic information. This may include: a) special geographic information analysis in a public court case (e.g., environmental damage claims, traffic accident liability claim), b) legal analysis for land use or public development project, c) criminal proceedings, d) assessment of fines for violation of permit terms or regulation/ordinance. |
| BP20: Property Valuation | Includes: a) appraisal of real or personal property for property taxation at the local level (carried out by local assessor or equivalent), b) appraisal of utilities for taxation at the local or state level, c) appraisals of public asset value, d) special project related land or property valuation associated with state or local project (e.g., road widening or new construction). This also includes site evaluation and parcel map compilation work. |
| BP21: Public Information Preparation and Distribution | This business process encompasses all general public information distribution activities involving geographic data. It includes preparation of hardcopy materials, brochures, guidebooks, etc. for use by the public, information distribution via the Web. |
| BP22: Public Meetings/Hearings | Includes formal hearings or meetings with the public that involve the use of geographic data or derived products. Some examples at the state, regional and local level include: a) local land use or zoning hearings, b) local commission or council meetings, c) public meetings associated with a state government program (e.g., environmental issue, construction project), d) property assessment dispute, e) school board public meeting. |
| BP23: Public Service Planning and Delivery | Involves analysis and planning work for determining required resources, resources distribution, and logistics associated with a service provided by a public agency. At the local government level this may include such services as solid waste collection, health service provision, social service provision, etc. State government service programs include a range of health, education, and human services that require definition of service areas and allocation of resources. |
| BP24: Site/Facility Maintenance Operations | Activities associated with the on-going maintenance, upkeep, and repair of public facilities (roads, utilities, sites, buildings, other structures). This includes work order management, assignment and dispatch of crews, and reporting/tracking of maintenance activity. |
| BP25: Site/Facility Maintenance Planning | Planning work associated with the up-keep and maintenance of public facilities and infrastructure (roads, utilities, sites, buildings, other structures). This includes capital project planning, maintenance scheduling, and related activities. |
| BP26: Special Engineering Analysis or Modeling | Covers a range of special studies or analyses at the statewide, regional or local that use geographic data to support decision-making. Some examples include: utility flow modeling to support design, special geophysical analysis for natural hazard assessment, traffic flow and routing. |
| BP27: Special Planning Studies | Includes any special public agency information gathering, planning, or assessment projects or studies that are not part of other business processes. |

APPENDIX C

SUMMARY OF FEDERAL DIGITAL GEOGRAPHIC DATA PROGRAMS

Other standard federal agency data consists of data sets usually, including digital maps in GIS format that are standard products of a federal agency and are available to users. This does NOT imply that these datasets have full geographic coverage over the U.S. or that they provide all the detail or map accuracy that might be needed by users. Most of these datasets are accompanied by metadata that describes content, format, quality, and accessibility. Not included here are many geospatial data sets that have been compiled at a national scale and level because the accuracy and detail limits its use by state, regional, and local entities. The USGS does provide an on-line, digital “National Atlas” (see www.nationalatlas.gov) with GIS data for many themes compiled by individual federal agencies-usually compiled at a scale of 1:1 million or smaller:

- **CA**—Census of Agriculture consisting of statistics from the DA mapped by County. Available through the National Atlas
- **CB**—Census geographic units and data from the BOC
- **DFIRM**—Digital Flood Insurance Rate Mapping compiled for many floodprone areas of the US normally at 1:24K scale by FEMA
- **EPA**—Envirofacts database with point locations and information on regulated facilities (e.g., water and air permitted discharge points) compiled and maintained by the EPA
- **EROS**—Earth Resources Observation Systems program of the USGS and NASA for archiving and distribution of earth imaging data (satellite and other aerial image data)
- **GCDB**—Geographic Coordinate Database consisting of coordinates for Public Land Survey System (PLSS) areas of the U.S.
- **GAP**—Map data from the GAP program to define habitat diversity. Available at 1:24,000 scale for selected states from the USGS
- **NC**—Nautical Charts maintained by NOAA’s Office of Coast Survey. Some available in raster scanned form and others in digital map show coastal features
- **NDI**—National dam inventory database compiled by the COE. Consists of point locations and information for over 7000 major dams in the U.S.
- **NGS**—Control point data maintained by the NGS as part of the National Spatial Reference System. NPS-GIS format files with boundaries of National Parks and Monuments from the NPS

- **NTA**—National Transportation Atlas data consisting of centerline alignments of nationally significant roads, railroads, waterways, airways, and transit ways compiled at a 1:100K scale by the BTS; EROS-Earth Resource Observation Program
- **NWI**—FWS National Wetlands Inventory maps compiled at 1:24K scale
- **STAT**—Statewide general soil association boundaries from the NRCS STATSGO dataset
- **SSU**—County-level detailed soil surveys at 1:24,000 scale from the NRCS SSURGO dataset
- **TIG**—TIGER data (road and related boundary information) from Census Bureau. Current project for major cartographic enhancement; data)

APPENDIX D
SUGGESTIONS FOR LOGICAL DEFINITION OF THE NATIONAL BASE MAP
AND EXTENDED STATE-REGIONAL-LOCAL GEOGRAPHIC DATABASE

Table C-1: Recommended National Base Map Themes

| Recommended National Base Map Theme | FGDC Framework | Current National Map Component | Comments |
|---|----------------|--------------------------------|---|
| Geodetic Control Points/ Monuments | X | | Includes control points from multiple Federal, State, and Local sources that have been placed and documented according to National geodetic Survey requirements. |
| Survey System Corners/Grid Lines | | X | Includes verified data from multiple Federal, State, and Local sources. |
| Governmental Jurisdictions | X | | Includes national and state boundaries and maritime territorial limits. |
| Transportation—Local Streets | X | | Data compiled and updated primarily by Census Bureau in close coordination with STRL entities. |
| Transportation— Major Roads and Highways | X | X | Data compiled by US DOT in close coordination with State Transportation authorities. |
| Railroad Lines and Facilities | X | X | |
| Orthoimagery— General | X | X | Continued DOQQ development using updated technology for acquisition and compilation (satellite imagery and full digital production). Update on a regular schedule in coordination with State governments. |
| Orthoimagery— Detailed | | | Federally lead effort for high-resolution (sub-meter) imagery acquisition for developed areas of U.S. using state-of-art technology (satellite imagery, digital aerial cameras, digital photogrammetric compilation). |
| Planimetric Features-General (Structures) | | X | Capture of features typical for current topographic mapping at 1:24,000 scale. As technology improves, use improved techniques including automatic feature delineation from imagery. |
| Digital Elevation Data | X | X | Includes current 7.5' minute quad DEM series and, where available from Federal agencies, more accurate data. |
| Surface Hydrography | X | X | Includes NHD data set at 1:100,000 with Federally lead effort, in partnership with States, to produce 1:24,000 scale data. |
| Assessment Parcels (Cadastral) | X | | Compiled and maintained for Federal land (in urban and rural areas) and private in-holdings within and contiguous too Federal tracts. |
| Government Buildings | | | Includes all major federal buildings mapped at least as point locations at 1:24,000 scale. |
| Geographic Names | | X | Continue to maintain the geographic names database but move toward automated maintenance (generated from other map themes). |

Recommended Extended State-Regional-Local Geographic Database Themes

| Recommended Extended State-Regional-Local Geographic Database Theme | FGDC Framework | Recommended National Base Map | Comments |
|---|----------------|-------------------------------|--|
| Geodetic Control Points/ Monuments | X | X | STRL source to feed National Base Map |
| Survey System Corners/Grid Lines | | X | STRL surveyor/engineer authorities work with Federal government (BLM, NOAA, USGS, COE) to improve accuracy of mapping. |
| Governmental Jurisdictions | X | X | Includes local government boundaries (County, Municipal, Township). |
| Transportation—Local Streets | X | X | Census Bureau works closely with STRL entities to map and update street network (including addresses). |
| Transportation— Major Roads and Highways | X | X | State transportation authorities working with Federal government provide data as one source for National Base Map |
| Orthoimagery— General | X | X | States work with Federal government (USGS) to acquire and update DOQQ coverage using updated acquisition and compilation techniques. |
| Orthoimagery— Detailed | | X | STRL cooperate with national program for acquisition of high-resolution orthoimagery for developed areas. |
| Planimetric Features-Detailed | | | |
| Surface Hydrography | X | X | |
| Assessment Parcels (Cadastral) | X | X | |
| Government Buildings | | X | |
| Local Administrative Areas | | | |
| Regional Agency, District Boundaries | | | |
| Sanitary Sewer Treatment/Collection | | | |
| Water Distribution System | | | |
| State Administrative Districts | | | |
| Other Special Zones or Districts | | | |
| Flood Zones | | | |
| Water Supply and Transmission | | | |

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