

# Memorandum

## **TO:** SMART CITIES AND SERVICE IMPROVEMENTS COMMITTEE

FROM: Matt Loesch

SUBJECT: GIS STRATEGIC PLAN

**DATE:** April 23, 2021

Approved	KHLLM	Date	28 April 2021	

## **RECOMMENDATION**

Accept the report on the direction and service priorities of the City's Geospatial Information Systems (GIS) Center of Excellence which will present strategic initiatives.

## **OUTCOME**

The Smart Cities and Service Improvements Committee will receive information on the direction and service priorities of the City's Geospatial Information Systems (GIS) and current strategic initiatives.

## **EXECUTIVE SUMMARY**

This report provides an assessment of the Enterprise GIS program, identifies gaps, and outlines recommendations for ongoing investment and improvement. This plan provides a detailed resource to guide the Enterprise GIS team in the effective strategic management and support of geospatial data, systems, and applications.

## History

San José GIS began in the late 1970s with a source map from Pacific Gas and Electric (PG&E). Over the 1980s, the general plan, zoning, and utility maps were built. The technology was maintained using basic Computer Aided Drafting (CAD) software until the mid-1990s when several departments adopted a few technologies to interface with location information. This resulted in duplication of effort and discrepant data. Beginning in 2001, the Enterprise GIS team in Department of Public Works created the first citywide base map that included parcels and street centerlines. Several mapping products were produced and maintained through the early 2000s with the focus on the base map. In 2013, following recommendations from several technology studies, the Enterprise GIS team adopted the Esri ArcGIS platform and implemented its Local Government Information Model (LGIM) data standard.

From 2014, the Enterprise GIS team continued in partnership with departments to migrate data, applications, and software licensing into a central environment. The GIS program has standardized on a set of core technologies commonly used across the enterprise. This standard technology stack has been critical for advancing GIS use and ensuring interoperability across the departments. The citywide spatial data repository has grown since the mid-2010s from just over 250 datasets to now having almost 800 datasets available for city staff to use. It is consistently structured, centrally managed, and continuously maintained.

#### Assessment

There are six core components of an Enterprise GIS system: data, infrastructure, software/ applications, procedures/workflow, workforce, and governance. Data is a core component of a GIS system, but all six components are interrelated and important to the success of an overall program. The six components of the Enterprise GIS program were assessed in three tiers: User Surveys, Department meetings, and a review against the Urban & Regional Information Systems Associations (URISA) GIS Capability Maturity Model.

User surveys were sent to over two hundred City staff in twelve departments. The response rate was over seventy-five percent. Five categories of takeaways were evident from the surveys as common recurring themes: (1) Staff wants more training and communication on GIS; (2) the Enterprise GIS team should develop bandwidth to support department requests beyond department expertise or capacity; (3) Staff wants broader access to GIS tools; (4) GIS integrations with City business systems are of growing demand; and (5) Staff is interested in access to an advanced analytics platform.

Department meetings were conducted in nine departments in an interview and freeform discussion format. The purpose of these meetings was to seek clarity on survey feedback and understand departmental initiatives, priorities, challenges, and needs. The first of three themes from these meetings was that departmental investments in GIS vary widely and supplemental support is needed from the Enterprise team. The second theme was that departmental GIS teams have an operational focus and lack a strategic or organizational view. There is an expectation that the Enterprise GIS team should support departments that have unmet GIS needs and bridge the gap between operational and strategic skills and perspectives. The third theme was there is a broad desire for increased communication among Citywide GIS staff, and the Enterprise GIS team should establish an improved governance structure as part of that communication. The initial focus of the action items is to identify and address gaps in the Enterprise GIS program. Future efforts will involve more comprehensive needs assessments within departments and alignment of enterprise priorities.

The URISA GIS Maturity Model defines a framework for an effective Enterprise GIS program. It provides evaluation criteria associated with well-managed GIS that maximizes effectiveness and return on investment. It is commonly accepted, local government-focused, and best practices-based assessment methodology. There are forty-five categories of measures roughly evenly split between Enabling Capabilities and Execution Abilities. Enabling Capability

measures the organization's implementation of technology, data, resources, and infrastructure to support Enterprise GIS operations. Execution Ability indicates the organization's ability to use enabling technology, specifically its level of standardization and optimization of services. On Enabling Capability San José captured just over 17 of the 23 available points (75%) and on Execution Ability San José earned 55 of the 110 available points (50%). These results reflect San José's investment in GIS with a focus on data and infrastructure. It also identifies the opportunity for continued growth in the formalization of service delivery.

#### Recommendations

The assessment has resulted in recommendations and outcomes across the six core areas of an Enterprise GIS system. Each objective is based on opportunities identified through the assessment and includes a set of associated action items aligned to the core areas. Twenty recommended action items are already in progress or continued from prior work plans. Twenty-four additional recommended action items are noted and are part of this plan to implement. Of greatest note, an improved GIS Governance structure should be implemented and is currently in the planning stage.

Below are the outcomes of each core area:

**Data**: Pivot data focus toward support for integrations, applications, and analytics **Infrastructure**: Increase redundancy, reliability, and security of enterprise GIS server platform

**Software / Applications**: Provide broad access to GIS tools for users at all levels; Standardized solution deployment and support

**Procedure / Workflow:** Expand GIS coordination; Streamline project intake and delivery

**Workforce**: Build an Enterprise GIS team capable of leading GIS coordination, supporting department requests, and building GIS capacity citywide **Governance**: Implement an Enterprise GIS Governance Structure

## **BACKGROUND**

Geographic Information Systems (GIS) are a critical, business-enabling technology that is used throughout the City of San José to improve efficiency and inform decision-making. GIS provides a framework for the input, storage, analysis, transformation, and visualization of spatial data and allows for the integration of disparate business data through spatial context. It has applicability across City departments to improve business efficiency and support strategic initiatives.

The City has made a significant investment in GIS technology and over the past decade has made considerable progress toward building a functional Enterprise GIS with a standard, centralized GIS platform and broadly accessible, authoritative GIS data. The Enterprise GIS program is unique in that it is one of the few programs in the City that has a bottom-up approach, where GIS users have largely driven investment, policy, and strategy. A strong core of GIS users across

various departments has served an informal GIS governance function for years, and the Enterprise GIS team formed, in part, to simplify administration and maximize the cost-effectiveness of shared investments prioritized by the user community and the business areas they support. Now there is increasing value in formalizing governance and broadening access to geospatial data and tools beyond technical GIS users.

## <u>History</u>

The City of San José was an early adopter of GIS technology; however, initial implementations were disjointed and lacked centralized investment and standardization. GIS was generally implemented on a department level. Platforms varied by department, lacking consistency and interoperability and often duplicating efforts. This has improved through recent efforts to centralize data, infrastructure, and GIS software licensing. Increased levels of GIS coordination among departments have realized significant benefits for the enterprise.

Following are key events in the City's history with GIS:

- Late 1970s: The first digital mapping program began when the City acquired a PG&E map. This base map was updated and used to create other maps for many City programs, including the City's general plan, zoning, and utility infrastructure. It provided a good representation of the City but was not created with modern digital technology and lacked accuracy.
- **1995-2000:** Over time departments with conflicting priorities and various levels of funding created their own mapping groups and began capturing their own data. Efforts to adopt a single citywide GIS software platform failed, and different GIS products and data formats were used across departments.
  - **1995:** Department of Public Works (DPW) formed the City's first GIS program using the Intergraph GeoMedia product suite.
  - **1999:** Planning, Building, and Code Enforcement (PBCE) adopted GIS using MapInfo Professional.
  - **2000:** Environmental Services Department (ESD) implemented their GIS using ArcGIS suite.
- **2001-2003:** DPW led the creation of the citywide base map consisting of parcels and street centerlines.
- **2004:** GIS staff from various departments formed a GIS Standards Committee and a GIS Technical Advisory Committee (GIS-TAC).
- **2005:** An Enterprise GIS program was implemented and managed from within DPW. Citywide base map data was standardized in Oracle Spatial. The adoption of an Oracle backend allowed each department to continue using their choice of off-the-shelf GIS software. Significant benefits were realized from data sharing.
- **2006:** GIS-TAC established enterprise standards for GIS data, software, and hardware. The standards supported maintenance of the City's base map and creation of additional of GIS datasets based upon it. Oracle Spatial was named the common storage format.

- 2007: A report on the City's GIS was completed and presented to City Council. The report detailed the City's progress in implementing GIS. It discussed the vision for an open, interoperable, and efficient data-centric system and outlined recommendations to achieve this vision.
- **2009-2010:** Management Partners conducted an information technology optimization study. The effort included a focus group with GIS-TAC members to identify opportunities to optimize GIS technology citywide. The report included recommendations to better coordinate GIS efforts across departments and explore options for centralized funding.
- 2012: The City Auditor's Office completed an audit of IT general controls, examining the security and recovery of data, applications, and systems. GIS was identified as a key enterprise system serving critical citywide functions. It was noted that the City had three different, independently purchased GIS software packages and recommended that software be inventoried, standardized, and shared, where possible.
- **2013:** DPW began transitioning the Enterprise GIS from Intergraph to Esri's ArcGIS platform, adopting the Local Government Information Model (LGIM) data standard.
- **2014-Present:** The Enterprise GIS team has been working with departments to bring their authoritative GIS data into the enterprise environment. Departments continue to own and maintain their data, but it is based on a standard schema, hosted on a shared platform, and published on centrally managed infrastructure for enterprise use.

Figure 1 shows the status of departmental data migration into the enterprise environment. Departments that are integrated have migrated their existing GIS data and data management activities into the enterprise database environment. Data resides in a production, LGIM-compliant enterprise geodatabase on a shared database server, where departmental data stewards maintain it using versioned editing workflows. A weekly routine replicates all enterprise data to a set of publication geodatabases for general use.

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FULLY INTEGRATED	PARTIALLY INTEGRATED	NOT INTEGRATED
Airport DPW Fire	PBCE (Planning)	ESD (Watersheds)
Housing IWM MWS	Transportation	
OEM   PRNS   RWF   SBRW	Data from city business systems (not native to GIS)	Police

Figure 1: Status of departmental GIS data migration into the enterprise database environment

#### Vision

The early vision for the City's Enterprise GIS was to develop an open, interoperable, and efficient data-centric system to provide quality data to the enterprise user community. Data remains a core focus of the Enterprise GIS team, but as geospatial technology has evolved, the Enterprise GIS vision has expanded. To that end, the following strategies guide the efforts of the Enterprise GIS team:

- Simplify administration and maximize the cost-effectiveness of GIS investments through centralization and standardization.
- Establish and implement GIS standards, policies, and business practices, considering the needs and resources of City departments.
- Maintain the Enterprise GIS platform as the citywide repository for production and publication of authoritative GIS data, ensuring that data is complete, accurate, and accessible.
- Ensure that enterprise systems are stable, modern, and secure; establish a commonly supported software version and apply regular upgrades.
- Pursue new and innovative applications for geospatial technologies, balancing value, sustainability, and supportability.
- Provide geospatial coordination throughout the City, building partnerships with departments and providing support to leverage Enterprise GIS investments and adopt standards.
- Promote the integration of geospatial technologies into business systems and operations.
- Support emergency planning, response, and recovery.

In line with its vision, the Enterprise GIS team supports an Enterprise GIS server platform, centralized GIS software licensing, and a growing repository of Enterprise GIS data in a standard data model, which is accessible to users and applications across the City. The Enterprise GIS team maintains the City's base map data and leads efforts to bring siloed departmental data into the enterprise repository, applying data standards and establishing data stewardship.

## **Organization and Staffing**

The City's Enterprise GIS program is resourced in DPW. The current organization is based on a hub-and-spoke model with the Enterprise GIS team in DPW and departmental GIS teams or individual staff within several other departments. The Enterprise GIS team aims to realize economies associated with shared data and systems by defining standards and processes for the enterprise, maintaining foundational GIS datasets, and administering Enterprise GIS infrastructure and software licensing. Departmental GIS staff generally leverage enterprise investments to provide a wide range of GIS services and support within their departments based on operational needs and strategic initiatives.

Currently, GIS positions within the City break down as follows:

- Enterprise GIS (DPW): Eight-member team consisting of four GIS Specialists, one Senior GIS Specialist, two Information Systems Analysts, and a GIS Manager
- Airport: Three-member team consisting of two GIS Specialists and one Senior GIS Specialist
- Department of Transportation (DOT): Five GIS positions throughout the department, including three GIS Specialists, one Senior GIS Specialist, and one Information Systems Analyst as well as developers working on GIS integrations
- Fire: One Senior GIS Specialist position
- Planning, Building and Code Enforcement (PBCE): One GIS Specialist position
- Police: One Information Systems Analyst primarily supporting Police and Fire dispatch plus a 12-member Crime Analysis Unit that uses GIS to perform analysis
- Parks, Recreation and Neighborhood Services (PRNS): One Senior GIS Specialist position
- Water Utilities: Four-member team consisting of three GIS Specialists and one Senior GIS Specialist; the team is located within ESD but specifically supports Municipal Water System (MWS), Regional Wastewater Facility (RWF), and South Bay Water Recycling (SBWR)
- Office of Emergency Management (OEM): One temporary grant-funded GIS Specialist position approved through June 30, 2021
- City Manager's Office (CMO), Housing, Office of Economic Development (OED), and the Environmental Services Department (ESD) (outside of Water Utilities) do not have dedicated GIS positions but have analysts using GIS alongside other responsibilities.

In total, 25 dedicated GIS positions exist citywide, including:

- 14 GIS Specialists
- Six Senior GIS Specialists
- Four Information Systems Analysts
- One Supervising Applications Analyst

## Data Architecture

The Enterprise GIS team has been heavily focused on data management and integration of siloed departmental data stores into the enterprise. For the past five years, significant resources have been directed at standardization of departmental GIS data, migration into the Enterprise GIS environment, and establishing maintenance workflows and data stewardship arrangements to ensure the long-term viability of the data. Several core principles apply to the Enterprise GIS data repository and drive ongoing data management and integration efforts:

- Adopt a standards-based architecture (i.e., LGIM).
- Incorporate common core elements across GIS datasets.
- Eliminate duplicate data.
- Ensure data stewardship and maintenance workflows.
- Use codeless Extract, Transform, and Load (ETL) as a standard mechanism to integrate GIS with other business systems.

As departmental data is migrated into the enterprise, each department maintains responsibility for managing its own data on the shared production infrastructure. The Enterprise GIS team supports the infrastructure, replication/publication workflows, enforcement of standards, and maintenance of base map (roads, addresses, parcels) and DPW data (stormwater and sanitary sewer networks). Figure 3 provides a high-level schematic of the enterprise data environment.

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Figure 3: Enterprise GIS data management and publication

## **Standard Technology Platform**

The City has adopted Esri technology as the standard GIS software platform across the enterprise. The Enterprise GIS team supports a robust, centralized GIS server environment for citywide use that has over 20 websites, GIS, database, and ETL servers hosting Esri ArcGIS platform components and a standardized set of ancillary components designed to complement the ArcGIS platform to provide a full range of functionality. The Enterprise GIS server environment supports multiple access scenarios, including anonymous public-facing applications, internal-only applications, and secure Internet-facing applications. The system design aligns with Information Technology Department (ITD)'s four-tier network architecture pattern and leverages Transport Layer Security (TLS) for secure information transfer.

Specifically, the City has standardized on the following GIS technology stack and maintains licensing and infrastructure for enterprise use:

- GIS: Esri's ArcGIS platform for desktop and server
- ETL: Safe Software Feature Manipulation Engine (FME) spatial ETL toolset
- **Database:** SQL Server enterprise geodatabases using Esri's local government information model (LGIM) geodatabase model
- Server: Microsoft Windows Server and IIS web servers

• License monitoring: Open license monitoring (LM)

In alignment with its objectives to provide a cost-effective, modern, and reliable Enterprise GIS platform, the Enterprise GIS team aims to maintain the platform at a current, supported software version that is consistently adopted across the enterprise. As a general guideline:

- One ArcGIS Enterprise and one FME Server version upgrade are applied per year, with service packs and patches applied as necessary during standard maintenance windows.
- ArcGIS and FME upgrades bring the environment to the most current supported version, generally, after Service Pack 1 (or x.x.1 version) is released.
- Windows Server and SQL Server are upgraded on an as-needed basis to keep products under Microsoft general support, compatible with the enterprise-standard ArcGIS and FME versions, and in alignment with ITD's standard supported versions.

## **Centralized Software Licensing**

In addition to the central GIS server environment, the Enterprise GIS team maintains a consolidated license server with desktop ArcGIS and FME software licensing and an ArcGIS Online organization for enterprise use. Most departments have consolidated their GIS software licensing and use the enterprise license server. Most also leverage the enterprise ArcGIS Online account and enterprise Spatial Database Engine (SDE) and ArcGIS Server environments with the following exceptions:

- DOT maintains its own ArcGIS Server and SDE environments and an ArcGIS Online organization. They also use the enterprise ArcGIS Server and SDE environments, as some of their data and workflows have migrated into the enterprise, while some remain in DOT.
- ESD maintains its own ArcGIS Online organization but leverages the enterprise ArcGIS Server and SDE environments and has migrated their data into the enterprise.

Effective December 30, 2020, the City begins a three-year Enterprise License Agreement (EA) with Esri that provides increased access to software licensing citywide, including additional seats of core (non-royalty bearing) desktop and server software and extensions, Portal named user licenses for all City staff, and a consolidated ArcGIS Online organization. This is critical to supporting the City's growing demand for GIS capabilities but also requires careful administration to ensure responsible use and a sustainable budget. To that end, the focus will be on supporting growth by adding capacity and redundancy to the central environment, rather than adding separate departmental environments.

#### **System Integrations**

A growing number of business systems are integrated with GIS, including AMANDA, DOT's Unity platform, and the computer-aided dispatch (CAD) system used by both Police and Fire. The City has established codeless extract-transform-load (ETL) as the standard mechanism for integrating business systems with GIS for the following reasons:

- It is less expensive to implement and support than custom code or APIs.
- It is widely accessible with a robust, easy-to-learn toolset.
- A centralized processing server allows jobs to be scheduled and managed from one place.
- It supports the LGIM implementation by allowing GIS data to remain LGIM-compliant regardless of third-party system requirements.

Safe Software FME has been established as the standard spatial ETL tool. FME workbenches are currently used throughout various departments to bring data from business systems into Enterprise GIS and process data from Enterprise GIS into business systems or external workflows. System integration via ArcGIS Server web services is the only other supported mechanism for integration of City business systems with GIS. Routine data processing and task automation not associated with complex business system integrations remain well-suited for scripted routines and geoprocessing models. Each solution design should target the most suitable, supported method based on the use case at hand (Table 1).

PROCESSING METHOD	APPLIES TO	STANDARD TECHNOLOGY	FREQUENCY
Spatial ETL	Business system integration	FME	Scheduled (via FME Server)
Web service	Business system integration	ArcGIS Server	Real-time, on-demand
Scripted routine	Routine data processing; Task automation	Python; Model Builder	Scheduled (via Windows Task Scheduler)

#### Table 1: GIS user survey responses by department and user type

## **Middleware and Custom Applications**

The Enterprise GIS team has been largely data and infrastructure-focused and has traditionally avoided the development of custom GIS applications internally, instead favoring out-of-the-box ArcGIS Online-based applications or, where necessary, vendor-supported custom solutions, such as the Datamark Address Portal. In general, other departments have been free to acquire or build their own GIS applications or application platforms leveraging enterprise data and web services. To that end, the following are significant departmental investments in custom GIS applications or third-party middleware. Most of these are not owned or supported by the Enterprise GIS team but provide core City applications that have dependencies on the Enterprise GIS.

- **Geocortex:** PBCE hosts and supports a Geocortex implementation (Essentials and Analytics) integrated with AMANDA. Internal viewers are hosted on the Geocortex platform and used citywide staff. A public-facing viewer is planned for the future.
- Web Application Builder (WAB) Developer Edition: Various departments use Esri's WAB Developer Edition to build and host custom GIS applications based on Esri's JavaScript API and common application framework. Various versions of WAB

Developer Edition are in use, and each department hosts their own resulting applications, but they often consume services or web maps from the City's enterprise ArcGIS Server environment or ArcGIS Online organization. Some levels of duplication may exist among custom widgets developed by different teams.

- **DOT custom applications:** DOT has a portfolio of custom applications that they are actively developing. This includes various applications integrated with their Unity platform (Salesforce). Some of these applications rely on ETL workbenches running in the enterprise server environment, but the applications are hosted on various DOT-managed cloud platforms.
- Service Locator: ESD has a custom Leaflet application that functions as a service locator on the City website. This application is currently owned by ESD, hosted on serverless cloud infrastructure, and supported by a single resource on the Enterprise GIS team. This application is stable and functional. Efforts are needed to modernize, formalize ownership, and maintenance responsibilities.
- **Maps Gallery:** The Maps Gallery is a custom Angular application written by DPW Technology Services. This application has no dedicated GIS functionality but provides a searchable catalog of citywide GIS applications and is used by internal staff and the public to find interactive maps and applications. Generally, little to no maintenance is needed on this application; it is simply configured to incorporate updated applications as warranted.
- Datamark Address Portal: A primary objective of the Enterprise GIS team over the past two years has been to establish and build out a comprehensive and authoritative address point dataset, known as the Master Address Database (MAD). The MAD provided a baseline for the Local Update of Census Addresses (LUCA) initiative for Census 2020, feeds various City business systems, and complies with NextGen 9-1-1 requirements. In conjunction with building out the MAD, the Datamark Address Portal was implemented to ensure ongoing maintenance of the MAD by PBCE's addressing staff. The Datamark Address Portal provides a single interface for addressing staff to create and update addresses in both the MAD and AMANDA, ensuring a level of synchronization between the two systems. The Datamark Address Portal is a custom application developed by Michael Baker International and hosted onsite at the City on a dedicated Apache Tomcat server, consuming data and services from the Enterprise GIS server environment. Michael Baker is currently under contract for enhancements and support.

## ANALYSIS

The Enterprise GIS team has an approved work plan detailing projects and initiatives for Fiscal Year (FY) 2020-2021. The work plan covers larger efforts, exclusive of platform administration responsibilities, support requests, emergency response prioritizations, and smaller one-off tasks. This section details projects and initiatives that are already included in the Enterprise GIS team's work plan, many of which are currently underway.

#### **Current and Planned Efforts**

#### Enterprise Data Management

The Enterprise GIS team is responsible for ongoing maintenance and Quality Assurance/Quality Control (QA/QC) of base map, sanitary sewer, and stormwater data in the enterprise environment. Base map data includes cadastral base, street centerline, and addresses. Generally, data management falls into two categories: updates and discrepancies. Updates are tracked through AMANDA and include sanitary and stormwater edits resulting from improvement plans, Capital Improvements Projects (CIP), other agency projects, or annexations or base map edits resulting from tract maps, parcel maps, street dedications/vacations, or annexations. Figure 4 shows the number of plans completed each calendar year since 2016.



Figure 4: Plans completed annually by Enterprise GIS team

In addition, data discrepancies are commonly reported through the Solar Winds ticketing system for data-related issues that are not related to a new map or plan. As the base map data has become more widely used and more visible, the number of discrepancy requests has increased, especially for base map and sanitary datasets, as illustrated in Figure 5. The Enterprise GIS team aims to resolve reported discrepancies as quickly as possible and maintain a backlog in Solar Winds totaling less than ten open issues at any given time.



#### Figure 5: Service requests assigned to Enterprise GIS team by year and request type

#### Departmental Data Migration

The Enterprise GIS team continues to focus on partnering with departments to bring siloed departmental data into the Enterprise GIS repository. Most recently, the SBRW and Airport migrations were completed as part of the FY19-20 work plan. Police and ESD Watersheds are the only remaining departments with identified, authoritative GIS data that have no data in the enterprise environment (Figure 1). However, data discovery efforts are needed within some departments that have already migrated their data into the enterprise to inventory and prioritize additional data for migration. This applies to DOT, PBCE (particularly, Planning), and potentially other areas of ESD (outside of Water Utilities).

#### Master Address Database

The MAD is an address point feature class residing in the Enterprise GIS data repository that serves as the City's authoritative source for address data. The Enterprise GIS team supports the continued development, maintenance, synchronization, and integration of the MAD into other City business systems. The MAD program includes three core components:

- **Business system integrations:** As the source of truth for address data, the ultimate vision is that all City business systems that use address data will validate against the MAD. Several business systems are actively targeted for integration (Table 2), and other opportunities are in discovery.
- MAD-AMANDA sync: The City maintains a goal of 99 percent synchronicity between the MAD and the active addresses in AMANDA, PBCE's permitting system. Extensive cleanup efforts have already occurred to achieve the current match rate of 98.6 percent. Additional cleanup within AMANDA to reach 99 percent is being coordinated with PBCE to close out Phase II of the sync effort. Phase III is planned and will incorporate database schema changes in AMANDA to support unit-level addresses and parent-child

relationships. At that point, the sync efforts will expand to incorporate unit-level addresses from the MAD into AMANDA. (This synchronization model has the potential to be applied to other business systems as well.)

• **Datamark Address Portal:** The Datamark Address Portal is a web-based GIS viewer developed by consultants, Michael Baker International. It has recently undergone significant enhancements to improve its usability. Michael Baker is currently supporting the application, but additional development work is needed to refactor and bring the solution in line with supported City standards.

COMPLETED	TARGETED	
AMANDA/Geocortex (PBCE)	Lookup Tool (Enterprise GIS/ITD/ESD/DOT)	
LUCA (Census)	Residential Parking Permit (DOT)	
Maps Gallery (Enterprise GIS)	Vehicle Abatement (DOT)	
Chameleon (DPW Animal Care Services)	Weed Abatement (DOT)	
9-1-1 CAD (Police/Fire)	Outdoor Event Permit (DOT)	
Rent Registry (Housing)	Signal Projects (DOT)	
	Maintenance Requests (DOT)	
	Electrician Work (DOT)	
	Tree and Sidewalk Inspection (DOT)	
	Multiple Housing Roster (Housing)	
	Versaterm RMS (Police)	
	Firehouse RMS (Fire)	

## Table 2: Business systems targeted for MAD integrations

## Esri Enterprise Agreement

Effective December 30, 2020, the City begins a three-year Enterprise Agreement (EA) with Esri that includes uncapped licensing for core ArcGIS Desktop and Server products, Portal named user licenses for all City staff, and a consolidated ArcGIS Online organization. With the EA in place, the Enterprise GIS team is partnering with departmental GIS leads to provide Tier I technical support. The Enterprise GIS team also assumes responsibility for enterprise license management. Planned projects that have been on hold pending licensing are moving into implementation as priority efforts, most notably the ArcGIS Online consolidation, ArcGIS Portal implementation, and EOC infrastructure.

While the EA effectively addresses existing GIS software licensing shortages throughout the City and provides increased access to GIS tools for users at all levels, its effective management is of critical importance to the long-term success of the Enterprise GIS program. The EA further re-enforces the need for collaborated infrastructure and justified, well-planned deployments in order to maximize return on investment and ensure that that the GIS ecosystem is sustainable beyond the initial three-year agreement term.

#### ArcGIS Online Consolidation

The Esri EA includes a single ArcGIS Online organization. During Year 1 of the EA implementation, the City will need to consolidate the multiple existing organizations into one. Currently, in addition to the enterprise organization, ESD, DOT, Airport, and Police all have separate organizations, although Airport and Police rarely use ArcGIS Online due to security-sensitive data. The focus of the consolidated effort will involve DOT and ESD. As part of the consolidation, efforts are needed to streamline content and sharing, removing duplication. Content intended for internal use will be migrated to the onsite Portal, and ArcGIS Online will host primarily public-facing content, content shared outside the organization or content that needs to support significant surge capacity.

#### ArcGIS Portal Implementation

The buildout of an on-premises ArcGIS Portal environment is currently underway and is a core component of the EA rollout. The Portal environment provides map authoring and spatial content sharing capabilities like ArcGIS Online but internal to the City. Leveraging licensing made available through the EA, the Portal environment includes a managed ArcGIS Server site that supports user-published content and will aim to provide broader accessibility to GIS tools and content throughout the enterprise, addressing current shortages with ArcGIS Online licensing. Aside from the infrastructure effort, there are two core components to the portal rollout that will occur in phases throughout the EA term:

- Because the EA includes greater allotments of Portal licensing than ArcGIS Online, the initial implementation effort will involve migrating appropriate internal content from ArcGIS Online to Portal. This complements the ArcGIS Online consolidation effort.
- Significant effort will be needed to establish standards for administration and upkeep of the Portal organization and to conduct outreach and training for new users. This effort will extend beyond Year 1 of the EA.

## EOC GIS Infrastructure and Applications

Dedicated GIS server infrastructure for the Emergency Operations Center (EOC) has been acquired with grant funding. The EOC infrastructure hosts a stand-alone SQL/SDE instance, and a stand-alone ArcGIS Server environment will be built out as part of the Esri EA rollout. A copy of the Enterprise GIS databases is also replicated to the EOC infrastructure weekly (Figure 3). The environment is internal to the City and designed to allow EOC GIS operations to run independently in the event connectivity is lost to the central GIS environment during an emergency. As the City's central GIS server environment becomes more robust, fully migrates to ITD's Hyperconverged Infrastructure (HCI), and incorporates redundant components across multiple data centers, the EOC infrastructure will be reevaluated.

A second grant-funded project was recently completed and delivered a GIS roadmap for the EOC and toolsets that support damage assessment of shelter workflows. The critical next step is the operationalization of these tools and integration into emergency plans. This is an OEM-led, multi-departmental effort supported by the Enterprise GIS team.

#### GIS Server Re-Architecture

The existing virtual Enterprise GIS infrastructure was migrated to HCI in May 2020. In September 2020, the Enterprise GIS database environment was also upgraded and migrated to a SQL high-availability cluster spanning across datacenters. Additional infrastructure improvements are planned for the Enterprise GIS server environment, leveraging both ITD's infrastructure investments and the Esri EA. Planned infrastructure work includes migration of the ArcGIS Server environment to HCI and deprecation of physical servers; systematically incorporating redundancy and high-availability at the application and web tiers; reevaluating the publication database environment; adding a staging environment (development and production environments exist today); and migration of imagery libraries to a shared storage appliance. Along with the re-architecture, continued focus will be placed on streamlining system maintenance, monitoring, and support. In alignment with this objective, a monthly GIS Change Control meeting was recently implemented to review and coordinate major system changes.

#### ArcGIS Pro Transition

ArcGIS Pro is Esri's next-generation desktop GIS software, and ArcGIS Desktop will eventually be phased out in favor of ArcGIS Pro. Some users have already adopted ArcGIS Pro for mapping and analysis, but transition of data management activities will require geodatabase upgrades and workflow changes that are not backward compatible. Careful planning is needed since various third-party extensions and add-ins are in use in different business areas and not all support ArcGIS Pro. PBCE was selected as the first department to transition due to their straightforward editing workflows and limited dependencies on ArcGIS Desktop; transition activities are currently underway. Initial assessments are being conducted for other business areas, and additional transition plans will be developed following the completion of PBCE.

#### **Imagery Acquisition**

The City of San José has acquired updated ortho-imagery annually since 2016 through costsharing into Santa Clara County's countywide capture project. Countywide 2016-2019 imagery has been processed, mosaicked, and published in the Enterprise GIS environment. A new five-year project is planned to begin in 2020 and will deliver countywide ortho-imagery each year along with delivery of an updated digital elevation model (DEM), digital surface model (DSM), oblique imagery, and building footprints with z-values in Year 1 (2020) and Year 4 (2024). All deliverables are highly valued by the Enterprise GIS community (Figure 8), and budget allotment is needed to fund the project.

#### Maps Gallery Support

The Maps Gallery contains a large catalog of interactive mapping applications, largely hosted on ArcGIS Online. Many of these have been built by the Enterprise GIS team, or the Enterprise GIS team has assumed support for them. Maps are checked regularly to ensure they are functional, but a standard approach is needed for recurring updates and enhancements to incorporate new features. Additional requests for new interactive maps and template-based solutions also come up regularly.

#### <u>Tolemi</u>

The Tolemi platform is a vendor-hosted, software as a service (SaaS) tool with customized predictive analytics capabilities to determine areas that are at risk for displacement. A version of the tool focused on small business displacement is in pilot by OED. Another pilot version focusing on identifying opportunity sites for housing development is currently publicly accessible for testing and feedback. The Enterprise GIS team's involvement is primarily in a supporting role, providing coordination and data resources, but the project is noteworthy as one of the City's first applications of predictive spatial analytics. The current Tolemi solutions are part of a two-year pilot that will end in 2021. An RFQ is currently in the works for continued support of the toolset on the current or an alternative platform.

#### Assessment

Given the nature of the Enterprise GIS strategic planning effort, broad user input is necessary to evaluate the effectiveness of the existing program and the current focus of the Enterprise GIS team's work and to prioritize future efforts and initiatives. A two-tiered approach was used to gather user input. First, a broad survey of GIS users was conducted to gather general feedback. Subsequently, a series of meetings were held with GIS staff in each department to discuss current operations, needs, and priorities in more detail. This input fed into a comprehensive assessment using the GIS Capability Maturity Model published by the Urban and Regional Information Systems Association's GIS Management Institute (URISA).

#### User Survey

An Enterprise GIS user survey was conducted in late 2019. The survey was sent to over 200 GIS users that were identified based on ArcGIS software use, either accessing desktop software licensing or having an ArcGIS Online organizational user account. 153 responses were received from users in 12 departments. Respondents classified themselves as GIS professionals (19), analysts using GIS software in non-GIS-specific positions (56), GIS product consumers (68), or interns doing GIS work (10). Figure 6 shows survey respondents by department and user type.

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Figure 6: GIS user survey responses by department and user type

Respondents also classified the use of geospatial technologies within their business area as heavily used and critical for supporting business (84), used with additional unmet needs (36), used somewhat (28), or not currently used but with identified needs (5). This breakdown is depicted in Figure 7 and provides some indication of the relative investment in geospatial technology across departments as well as additional opportunities that are recognized within the business areas.

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Figure 7: GIS user survey responses by level of departmental use

Survey respondents answered a variety of questions related to the availability of and access to GIS data, applications, and information products. Feedback was also requested on the level of service provided by the Enterprise GIS team and gaps in the current program. Following are broad takeaways based on common, recurring themes in the responses:

- **Training and communication:** Respondents requested additional training opportunities or indicated not being aware of available data, applications, and services or how to access and use these. Respondents sought training, ranging from technology-specific courses to potential offerings internal to the City and tailored to the City's Enterprise GIS. Respondents expressed interest in additional communication from the Enterprise GIS team, with a periodic GIS newsletter being the preferred channel followed by stakeholder meetings.
- **Bandwidth to support departmental requests:** Some respondents indicated GIS demand that exceeds their resources or need for support from the Enterprise GIS team, including assistance with resources to complete complex or time-sensitive projects. This includes development support for web GIS solutions.
- **Broader access to GIS tools:** Respondents requested more access to GIS tools across the enterprise, ranging from easy-to-use viewers that make GIS data accessible for non-GIS users to additional ArcGIS software licensing, including more licensing of base desktop software and access to additional products, such as Network Analyst, Business/ Community Analyst, and Insights.
- **Business system integration:** Respondents requested additional business data in the enterprise repository, for example, Police data, additional data on City programs, energy

benchmarking, and asset maintenance data. This goes beyond the migration of core departmental GIS datasets into the enterprise and extends to ETL workflows to bring in data that natively resides in business systems. Respondents also recognized the need for two-way integrations, with business data feeding into GIS and GIS being used to spatially enable business systems, and they sought assistance to design and build out integrations.

• Advanced analytics: Some respondents requested advanced analysis tools, acknowledging the increasing emphasis on analytics and data-driven decision-making and the value of spatial context to integrate otherwise disparate data sources. To be successful, implementation of a geospatial analytics platform (such as Insights for ArcGIS) will require readily accessible business and program-level data for use alongside native GIS datasets. Implementation efforts will need to involve both building out the platform and establishing or expanding business system integrations to bring in the necessary data for visualization. As such, this relates to the previous business system integration item.

Respondents were also asked to rate the potential business value of certain data acquisition investments. Results are provided in Figure 8.



Figure 8: Potential business value of enterprise data investments

## Meetings with Departments

Following the completion of the user survey, a series of meetings were held with lead GIS staff or primary GIS contacts in departments that largely confirmed the survey feedback, as the broad takeaways from the user survey were commonly reiterated throughout these meetings. In addition, the following key points were noted:

- Various levels of investment: Investment in GIS varies widely across departments. Even departments that have dedicated GIS staff may lack a formalized GIS work plan. The level of coordination and guidance from the Enterprise GIS team should adjust accordingly, with the goal of building GIS capacity and then maturity within the departments.
- **Operational versus strategic outlook:** Departmental GIS challenges are often operational in nature. Priorities tend to be short-term (i.e., immediate support issues versus strategic invest ments). Few departments are at the level of thinking broadly about strategic initiatives. A function of the Enterprise GIS team is to bridge this gap.
- **Collaboration and governance:** There is a broad desire for increased communication and collaboration among GIS staff across departments. This includes improved communication from the Enterprise GIS team, particularly related to outages and system changes, and revival of a technical advisory or user group that meets regularly as part of a formalized governance structure.

## GIS Capability Maturity Model

Considering the user feedback received through the survey and departmental meetings, a comprehensive assessment of the Enterprise GIS program was conducted using URISA's GIS Capability Maturity Model. The GIS Capability Maturity Model defines the framework for an effective Enterprise GIS and provides a set of standardized, commonly-accepted criteria on which to evaluate a GIS program based on best practices associated with a well-managed GIS that maximizes effectiveness and return on investment. The theoretical model of a capable and mature Enterprise GIS operation leverages URISA's many years of experience at the forefront of government and business applications of GIS. As a theoretical model, some interpretation or adaption for the City's unique environment may be necessary; however, the local government focus of the model makes it a well-suited assessment tool.<sup>1</sup>

Results of the GIS Capability Maturity Model assessment comprise the following overall scores:

- Enabling Capability: 17.4 of 23 (average rating: 0.75 of 1) Enabling capability measures the organization's implementation of technology, data, resources, and infrastructure to support Enterprise GIS operations.
- Execution Ability: 55 of 110 (average rating: 2.5 of 5) Execution ability indicates the organization's ability to use enabling technology, specifically its level of standardization and optimization of services.

The higher Enabling Capability score reflects the City's significant investment in GIS, including the focus on data management and infrastructure. The lower Execution Ability score identifies opportunities for growth in the standardization of services, including the formalization of processes for project requests, establishing models for standard solution deployment patterns, and incorporating feedback and assessment at the service request, project, and program levels.

<sup>&</sup>lt;sup>1</sup> URISA GIS Management Institute GIS Capability Maturity Model: <u>https://www.urisa.org/gismgmt</u>



Figure 9: Core components of an Enterprise GIS implementation

Following are broad takeaways categorized into the core areas that make up an enterprise GIS implementation (Figure 9):

- **Data:** The Enterprise GIS team, in partnership with the departments, has built a sizable Enterprise GIS data repository; adopted standards and practices to ensure that data is current; and converted large amounts of siloed GIS data into the enterprise repository, while establishing appropriate data stewardship arrangements. The focus on data will continue but with stable infrastructure, a standard data model in place, and buy-in from many departments, it can transition from build-mode to maintenance, enhancement, integration, and use. Key enhancement areas include metadata and business data integration to support applications and analytics.
- **Infrastructure:** The Enterprise GIS infrastructure is capable of supporting existing citywide demand with room for growth. The focus now is to incorporate high-availability components, partner with ITD on a disaster recovery plan, standardize maintenance and change control procedures, and expand the platform to support new and emerging technologies.
- Software and applications: Access to GIS software has been a limiting factor throughout the enterprise, but the implementation of the Esri EA will provide broader access to GIS software. The Enterprise GIS program would also benefit from establishing more standardized deployment patterns across solutions. Related growth areas include adding some level of internal development capacity on the Enterprise GIS team, establishing standards for vendors performing enterprise application development, and

> having better oversight on the quality and construction of both internal and vendordeveloped code.

- **Procedures and workflow:** A standardized project approach and process for request intake, prioritization, assignment, and tracking is generally lacking, beyond data management tickets that are tracked in Solar Winds. Support and small project requests come in through a variety of channels and are often based on prior working relationships. A better process is needed and would provide the benefits of streamlining service delivery, incorporating opportunities for feedback and validation, and quantifying work performed. Additionally, more standardization is needed related to system administration and deployment activities.
- Workforce: The Enterprise GIS team is generally well-staffed, but current staff has been largely focused on data management. Outside of the Enterprise GIS team, investment in GIS varies widely across departments. Several business areas have made investments in dedicated GIS positions, while others are lacking and require additional support from the Enterprise GIS team. Departments with heavy demand for GIS and would benefit from more dedicated GIS positions, but the Enterprise GIS team should also incorporate the capacity to support departmental requests and provide coordination and guidance to departments seeking to leverage geospatial technology. In addition, many departmental GIS users at all levels seek further training.
- **Governance:** The City's Enterprise GIS program lacks a standard governance structure. An established governance structure with citywide representation is needed.

## **Recommendations**

This section outlines six objectives and associated sets of actions based on the assessment findings. They are categorized into the core areas that make up an enterprise GIS implementation (Figure 9) and align with the overall vision and strategy of the Enterprise GIS team. Collectively, these address current gaps in the Enterprise GIS program. It is intended that the program be reassessed regularly as actions are completed. Regular reassessment is necessary to ensure the program's vision and strategies align with organizational goals and actions support desired outcomes (Figure 10).



## Figure 10: Enterprise GIS strategic planning process

The initial objectives and associated action plan are aimed at addressing gaps in the Enterprise GIS program, specifically the centralized resources managed by the Enterprise GIS team to support citywide GIS initiatives. Departmental GIS needs assessments and alignment of enterprise priorities will follow in a future phase as an improved citywide governance structure is adopted.

#### Strategic Objectives

Based on input from the user community and the growth areas highlighted by the URISA model a set of actions have been identified for the Enterprise GIS program. Assessment areas from the GIS Capability Maturity Model are provided in parenthesis after each action.

**Data objective:** Shift data focus beyond basic data consolidation and quality and toward support for integration, applications, and analytics.

- a. Conduct data discovery efforts within departments that have already migrated GIS data into the enterprise but still have additional internal data, starting with Planning and DOT. (EC3)
- b. Broadly assess system integrations that are currently integrating business data into GIS. Where appropriate, ensure that data is going into the enterprise databases, where it can be of potential value for multiple use cases. (EC3)
- c. Encourage engagement of departmental data stewards through monthly reporting and regular communication. (EC4)
- d. Establish a minimum standard for metadata. (EC6)
- e. Add metadata for all data in the enterprise repository. Going forward, require metadata for all new data. (EC6)
- f. Classify data to differentiate public data from internal or otherwise business-sensitive data. (EA21)

- g. Leverage a storage application for Enterprise file-based GIS data that does not belong in Spatial Database Engine (SDE), including imagery, project-level data that is not LGIM-compliant or not enterprise-quality, etc. (EC3)
- h. Explore options for collaborating with the County to streamline base map maintenance.
- i. Establish a plan for capture and maintenance of critical datasets to support EOC operations. (EC3)
- j. Establish a relationship with the County for recurring capture of imagery, LiDAR, DEM/DSM, and building footprints. These are highly valued across the enterprise and essential to support emergency operations. (EC10, EC23)
- k. Develop a plan for incorporating or providing access to integrated business data to support geospatial analytics.

**Infrastructure objective:** Increase the redundancy, reliability, and security of the Enterprise GIS server platform. Continue to incorporate capacity for new system components that support broader accessibility of GIS tools and analytical capabilities within the context of a fiscally responsible and well-managed system.

- a. Redesign the Enterprise GIS server environment. Incorporate redundancy and high availability components. Replace physical servers with VMs. (EC8, EC9, EC10, EC12)
- b. Standardize server builds by separating system and data drives. (EA8)
- c. Build out a staging environment. (EC8, EC9)
- d. Incorporate improved system monitoring for core services. (EA7, EA8, EA9)
- e. Standardize data publication processes, maintenance windows, and afterhours support. Incorporate internal procedures for change control and upgrades. Define ITD and GIS responsibilities, including how to access ITD resources for event management. (EA8, EA9)
- f. Work with ITD on disaster recovery planning. (EC12)
- g. Evaluate options for a publication database environment (GIS data warehouse) that can handle role-based permissions to support non-public data. (EC7)
- h. Add capabilities for handling sensitive data (PII, CJIS, and PCII), including infrastructure provisions and background checks for DBAs and GIS Administrators.
- i. Complete setup, test, and support the EOC GIS infrastructure. (EC12)

**Software and applications objective:** Leverage the Enterprise Agreement to provide broader access to GIS tools for users at all levels. Effectively manage the Enterprise Agreement to position the Enterprise GIS program for continued success beyond the initial agreement term through collaborated deployment. Along with growth for the platform, look to standardize solution deployment patterns.

- a. Support well-managed implementation of the Esri EA. (EC11, EA18)
- b. Consolidate ArcGIS Online footprint into a single organization.
- c. Develop and carry out a phased implementation plan for ArcGIS Portal that includes broad communication and user training. (EA2)

- d. Establish guidelines for use of ArcGIS Online versus ArcGIS Portal, and migrate content from ArcGIS Online to Portal.
- e. Develop a set of standard map templates and layer files, allowing users to more easily find and use enterprise data.
- f. Document ownership for all supported applications in the Maps Gallery. (EC15)
- g. Establish a standard update schedule and responsibilities for applications in the Maps Gallery. Seek and incorporate feedback from the application owners as appropriate. (EC15)
- h. Establish standardized solution deployment patterns and align future efforts accordingly. Standardize use cases for various toolsets based on general requirements. (EC14)
- i. Establish application development specifications for vendors and increase oversight and ownership for vendor-supported solutions, starting with the Datamark Address Portal. Ensure delivery of source code. (EC14, EA5, EA16)
- j. Establish a shared source control repository (EC15, EA5).
- k. Establish product ownership/support/enhancement structure for custom solutions, beginning with the Service Locator. (EC15, EA5)
- 1. Implement ArcGIS Insights on-premises and pilot with relevant City programs, supporting data integration and workbook construction to meet business requirements. Possible pilots include Beautify San José and EOC.
- m. Plan and lead the phased transition from ArcGIS Desktop to ArcGIS Pro.

**Procedures and workflow objective:** Expand GIS coordination and streamline intake and delivery of GIS project requests.

- a. Establish procedures for managing, approving, and tracking software requests under the EA with a focus on meeting demand through responsible use and coordinated access. (EC11, EA18)
- b. Establish a standard project methodology and process for intake, prioritization, and tracking of GIS project requests. The process should include mechanisms for the evaluation of service delivery. (EA1, EA3, EA4, EA6)
- c. Continue to develop and promote consistent application branding standards for ArcGIS Online and Portal. To ensure a consistent look and feel across applications, the Enterprise GIS team is responsible for standardizing application layouts, color schemes, and logos/icons, while application owners control the data and tool configuration. (EC14)
- d. Incorporate capacity for supporting departmental requests, including time-sensitive or complex projects. Evaluate projects based on priority and value in addition to the level of effort. (EA1, EA4)
- e. Standardize and increase the frequency of email communications around outages and other day-to-day operational impacts. (EA9)
- f. Increase communication through the publication of regular SharePoint news posts and articles. (User survey)

- g. Measure customer satisfaction and quality of service provided by the Enterprise GIS team through user group feedback and questionnaires. (EA3, EA4, EA13, EA15)
- h. Track departmental requests and project work (beyond data management requests and break/fix issues).
- i. Continue to integrate the MAD with city business systems. Gain a broad understanding of systems and seek opportunities to integrate GIS into business systems where it will add value.

**Workforce objective:** Build an enterprise team capable of leading GIS coordination and implementation activities across the enterprise, supporting departmental requests, and building GIS capacity within the departments. Partner with departmental GIS staff to provide support and align enterprise activities.

- a. Leverage citywide access to free web courses and training seminars provided through Esri virtual campus and included with the City's software maintenance. (EC18, EA2, EA12)
- b. Build capacity to provide internal GIS application development services where they would add value. (EC15, EA5)
- c. Increase coordination to recognize and develop GIS opportunities that provide value within departments. This is needed more in some departments than others and should be done in coordination with departmental GIS staff. (EC20, EA2)

**Governance objective:** Implement Enterprise GIS governance and funding structure to help align GIS investments and priorities across the enterprise.

- a. As part of a formal Enterprise GIS governance structure, institute a technical GIS advisory or user group. Develop a strategy for each of the goals and objectives of the group and hold regular meetings. (EC19)
- b. As part of a formal Enterprise GIS governance structure, institute a GIS steering committee that has decision-making authority over initiatives to define the goals and objectives of the group. (EC19)
- c. Explore a shared funding model for the Enterprise GIS program with the ongoing budget to cover shared resources, including base map management; the Esri EA; the acquisition of recurring aerial imagery, LiDAR, and other derived datasets in partnership with the County or other agencies; and Enterprise GIS server infrastructure. (EC23)
- d. Update the Enterprise GIS strategic plan on an annual basis, including reassessment against the GIS Capability Maturity Model and consulting with departments.

## <u>Staffing</u>

The Strategic objectives outlined above broaden the scope of services provided by the Enterprise GIS team, as the team transitions beyond a historically Public Works and data-focused role into a more enterprise-focused coordination role. This transition is necessary to ensure that the City receives maximum return on its investment in geospatial technology.

Some changes in organization will be needed to accommodate the growing role and shifting focus of the Enterprise GIS team. These changes could include collaborating with the Human Resources Department and the ITD to align classifications with duties and responsibilities both on the Enterprise GIS team and department GIS staff. Figure 11 shows three functional areas that the team will fulfill. Initially, these functions will be handled with existing staff shifting focus or filling hybrid roles. The Spatial Data Integration (formerly tied to MAD) Information Systems Analyst (ISA) role will expand to support coordination and business analysis function. While still responsible for the MAD, this position will take a broader approach to spatial data integration as the MAD initiative moves into the maintenance phase. In the future, it is expected that a full-time GIS Specialist dedicated to the coordination and business analysis will also be necessary as GIS use continues to expand throughout the organization. However, initially, this will be handled through efforts to streamline data management workflows and reassign existing staff.

The existing Information Systems Analyst (ISA) position will continue to support infrastructure, development, and integration with support from a GIS Specialist. The infrastructure and development workload will grow considerably with the implementation of ArcGIS Portal, dedicated EOC infrastructure, and eventual analytics platform. The Enterprise GIS team should lead the growth of the citywide analytical skills and products to enable additional capacity to study the data and patterns to develop insights to influence decisions. With the need for the Enterprise GIS team to take a leadership role in application development and standardized deployment patterns, eventually, a dedicated development resource should be added to the team. This is not a role that can be filled by pooling or reassigning existing GIS Specialists. However, the role can take on work that was formerly contracted out and will contribute to standardized deployment patterns that positively impact sustainability and administration workload.



Figure 11: Enterprise GIS team functional organization

While the Enterprise GIS team does not currently have dedicated application development resources, there is a need going forward for the team to provide guidance and leadership in this area. Several departments are building and supporting custom GIS applications. In addition, contractors provide third-party application development services, and better standards are needed to guide their work. As a general policy, unnecessary custom solutions are avoided in favor of

more cost-effective out-of-the-box options, where available, but there are cases where custom applications are necessary and add value that justifies the effort. It is within the realm of responsibilities of the Enterprise GIS team to establish development and branding guidelines and standard solution deployment patterns and doing so would help to streamline custom application development across departments and vendors. When custom solutions are necessary, following standard patterns and practices will result in more sustainable, supportable solutions. Because a modern, up-to-date Enterprise GIS server platform is a core component of the City's Enterprise GIS, departments that build custom GIS applications and tools assume responsibility for supporting, testing, and maintaining these through regular platform upgrades.

#### Governance

Although the Enterprise GIS program has traditionally been user-driven, it currently lacks a formal governance structure. Having a functional governance structure in place is critical to the City's continued advancement with geospatial technologies, as good governance will help to set the future direction of the program, ensure alignment of investments with the organizational mission and departmental priorities, and drive business outcomes.

A simple two-tier governance structure is recommended to complement the Enterprise GIS team. Both should have broad representation from stakeholder departments throughout the City.

- 1. A technical advisory group made up of GIS professionals will direct governance activities associated with GIS operations and provide recommendations to the steering committee.
- 2. A GIS steering committee made up of management-level personnel will provide business approval of strategic investment decisions. The Assistant Public Works Director and a representative from Chief Information Officer will lead the steering committee and ensure alignment with technology and innovation governance.

Collectively, these two groups will act as a system of control to coordinate decisions associated with the City's geospatial investments. The Enterprise GIS team fits within this structure as the operational arm responsible for leading the implementation, advancement, and support of those investments.

Alongside the governance structure, several working groups have formed and met on an asneeded basis to support the delivery of services and dissemination of information across the enterprise. These groups are led by the Enterprise GIS team and serve specific functional needs that align with the team's approved work plan.

• Enterprise GIS Change Control Board: In alignment with ITD's change control process, this group reviews GIS infrastructure and platform changes that have a citywide impact and require approval, notification, and/or coordination of participants prior to implementation. The goal of this group is to improve coordination and minimize disruption while maintaining modern, stable Enterprise GIS systems.

- ArcGIS Online/Portal Administrators Group: With the implementation of the Esri EA, the City will maintain a consolidated ArcGIS Online organization and a single enterprise Portal. The federated content and user licensing on each platform will be managed by a group of departmental GIS staff with administrative rights focused on supporting their respective departments. This group brings those administrators together to deal with content standardization, administration procedures, and platform-level policy issues associated with successful distributed administration.
- GIS User Group: This is a broad group of citywide GIS users extending beyond dedicated GIS staff and Including analysts, planners, and engineers across departments that use GIS technology. This group meets on an as-needed basis to gather feedback and share broad updates on the enterprise GIS program and is intended to supplement the communication channels of departmental GIS leads within their departments. An annual GIS Day event and potential internal training opportunities are additional functions of this group.



Figure 12: Enterprise GIS governance and working groups

## **CONCLUSION**

Approval of this recommendation will affirm the direction, service priorities, and current strategic initiatives of the City's GIS program.

## **EVALUATION AND FOLLOW-UP**

This memorandum will not require any follow-up from staff.

## **CLIMATE SMART SAN JOSE**

The recommendation in this memo has no effect on Climate Smart San José energy, water, or mobility goals.

## PUBLIC OUTREACH

This memorandum will be posted on the City's website for the May 6, 2021, Committee Agenda.

### **COORDINATION**

This memo was coordinated with the City Attorney's Office, City Manager's Budget Office, Office of Civic Innovation, and Information Technology Department.

#### **COMMISSION RECOMMENDATION**

No commission recommendation or input is associated with this action.

## FISCAL/POLICY ALIGNMENT

This recommendation is consistent with the City Council-approved budget strategy to effectively manage the City's technological resources to enable and enhance the delivery of City Services and projects.

## <u>CEQA</u>

Not a Project, File No. PP17-009, Staff Reports, Assessments, Annual Reports, and Informational Memos that involve no approvals of any City action.

/s/ MATT LOESCH, P.E. Assistant Director of Public Works

For questions, please contact Matt Loesch, Assistant Public Works Director, at 408-975-7381.