Stage 2 Alternatives Analysis

California Department of Technology, SIMM 19B.2 (Ver. 3.0.7, 02/28/2022)

2.1   General Information

1. Agency or State Entity Name: **3600 - Fish and Wildlife, Department of**

   If Agency/State entity is not in the list, enter here with the organization code.

   California Department of Fish and Wildlife

2. Proposal Name: California Natural Diversity Database (CNDDB) Master Observation Database System (MODS)

3. Department of Technology Project Number (0000-000): **3600-078**

4. S2AA Version Number: **Version 1**

5. CDT Billing Case Number: **Click or tap here to enter text.**

   Don't have a Case Number? Click here to get one.

2.2   Submittal Information

1. Contact Information

   Contact Name: Beth Jackson

   Contact Email: Beth.Jackson@wildlife.ca.gov

   Contact Phone: 916 9952105

2. Submission Type: New Submission

   If Withdraw, select Reason: Choose an item.

   If Other, specify reason here: Click or tap here to enter text.

   Sections Changed if an update or resubmission: (List all the sections that changed.)

   Click or tap here to enter text.

   Summary of Changes: (Summarize updates made.)

   Click or tap here to enter text.

3. Attach [Project Approval Executive Transmittal](#) to your email submission.

4. Attach [Procurement Assessment Form](#) to your email submission.

5. Conditions from Stage 1 Approval (Enter any conditions from the Stage 1 Business Analysis approval letter issued by CDT or your AIO):

Click or tap here to enter text.

2.3	Baseline Processes and Systems

1. Current Business Environment (Describe the current business environment of which the effort will be understood and assessed in 500 words)

California Natural Diversity Database (CNDDB) is among the largest, most comprehensive databases of its kind in the world. Assembled over the past forty plus (40+) years, it contains thousands of records on California's rarest plants, animals, and natural communities. It is California's "Natural Heritage Program" and is part of an international and nationwide network of similar programs, all using similar methodology.

The goal of the CNDDB Program is to provide the most current information available on the state's most imperiled elements of natural diversity and to provide tools to analyze these data. The data helps drive informed conservation and management decisions, aids in the environmental review of projects and land use changes, provides baseline information helpful in recovering special status species, and supports research projects.

The CNDDB Program staff work with a multitude of internal and external partners to maintain current lists of special status species that are tracked in the system, as well as an ever-growing database of spatially mapped Element Occurrences (EO) for these species. The EO is the primary method of maintaining special status species data in CNDDB. EOs do not contain point observation data, rather, an EO is a spatial representation of an area where a species is, or was, present. The textual aspect of the EO includes site characteristics, habitat, number of occurrences, threats, etc. Using multiple applications, CNDDB houses EOs and source data (original data in various formats) in database tables, spatial and digital files, network shared folders, and physical file cabinets.

In a typical year, thousands of people collect species data in California, resulting in thousands more data submissions to the CNDDB. This data is accepted in a variety of formats via a variety of different channels. Data formats the CNDDB Program receives include electronic submissions on our Online Field Application Form, paper/scanned forms, PDF field forms, digital data within a spreadsheet, reports, Access databases, Geographic Information System (GIS) shapefiles, and more. Data submitted outside of the Online Field Application Form are submitted via email or postal delivery and contain multiple species and multiple observations. The data review and incorporation process is in-depth and lengthy.

Because accuracy of the CNDDB products is critical to conservation and management decision making, standard and methodical processes are used in creating or updating EOS, as well as for quality control (QC). The QC process involves a second program staff member reviewing all data input and mapping done by the initial program staff who create/update an EO record. The EO creation/update process does not store spatial points or much of the qualitative data evaluated to create records, making the QC more time consuming. Because the CNDDB methodology is so

complex, new program staff require lengthy training and practice before they can become proficient with all the various processes and applications used to update/maintain the system. Depending on the duties of the staff, this can range from several months to a year.

Due to complex processes, antiquated system functions, and a lack of resources, CNDDB has developed a considerable amount of unprocessed data. This backlog contains records/data submitted to CNDDB that have never been reviewed by program staff to determine if they can be incorporated. Approximately twenty (20) years of animal and plant data exist in the backlog.

In summary, the program lacks standardized, efficient, and technologically current methods for managing and updating this large complex dataset. CNDDB lacks features and capacity to capture, store, update and share observation point data, or incorporate data into CNDDB in a timely manner. The program is also underfunded and lacks the staff capacity to handle the ever-increasing submission of imperiled species data.

Attached is the High-level Data Flow Diagram of CNDDB:

Section 2.3.1 Data Flow Diagram.svg

Not available reason: NA

2. Technical Context (Describe the technical environment of which the effort will be understood and assessed in 500 words)

Technical environment is detailed in the High-Level Data Flow Diagram, Detailed Data Flow Diagrams and Technical Narrative. All documents are attached. To understand the Technical Context, start with the High- Level Data Flow Diagram and Detailed Data Flow Diagram and refer to the Narrative Document for the descriptive information about each process.

Attachment :

Section 2.3.1 Data Flow Diagram.svg;

Section 2.3.2 Detailed Data Flow Diagrams.pdf;

Section 2.3.2 Detailed Data Flow Diagram D225.1.pdf

Section 2.3.2 Detailed Data Flow Diagram D225.2.pdf

Section 2.3.2 Detailed Data Flow Diagram D225.3.pdf

Section 2.3.2 Detailed Data Flow Diagram D225.4.pdf

Section 2.3.2 Detailed Data Flow Diagram D225.5.pdf

Section 2.3.2 Detailed Data Flow Diagram D225.6.pdf

Section 2.3.2 Detailed Data Flow Diagram D225.7.pdf

Section 2.3.2 Detailed Data Flow Diagram D225.8.pdf

Section 2.3.2 Detailed Data Flow Diagram D225.9.pdf

Section 2.3.2 Detailed Data Flow Diagram D225.10.pdf

Section 2.3.2 Detailed Data Flow Diagram D225.11.pdf

Section 2.3.2 Detailed Data Flow Diagram D225.12.pdf

Section 2.3.2 Detailed Data Flow Diagram D225.13.pdf

Section 2.3.2 Technical Narrative.docx

Not available reason: NA

3. Data Management (Enter the information to indicate the data owner and custodian of the current system, if applicable.)

Data Owner Name: Carie Battistone

Data Owner Title: CNDDB Supervisor

Data Owner Business Program area: CNDDB

Data Custodian Name: Joseph Vondracek

Data Custodian Title: Research Analyst

Data Custodian Technical area: Data Management

Security - Data Classification and Categorization Yes

Security - Privacy Threshold & Impact Assessment. Yes

4. Existing Data Governance and Data

a) Do you have existing data that must be migrated to your new solution?

Answer (Unknown, Yes, No): Yes

If data migration is required, please rate the quality of the data.

Select data quality rating: Significant issues identified with the existing data.

b) Does the Agency/state entity have an established data governance body with well-defined roles and responsibilities to support data governance activities?

Answer (Unknown, Yes, No): Yes

If Yes, include the data governance organization chart as an attachment to your email submission.

See CNRA-ISP_10_Cyber_Security_Governance_Policy.pdf as an attachment

c) Does the Agency/state entity have data governance policies (data policies, data standards, etc.) formally defined, documented, and implemented?

Answer (Unknown, Yes, No): Yes

If Yes, include the data governance policies as an attachment to your email submission.

Attached: CNRA-ISP_16.1_Data_Classification.pdf;

CDFW_ITPL_21-03_Physical_and_Environmental_Security_Policy.pdf;

CNRA-ISP_10.2_Security_Variance_Management.pdf,

CNRA-ISP_16.1_Data_Classification.pdf

d) Does the Agency/state entity have data security policies, standards, controls, and procedures formally defined, documented, and implemented?

Answer (Unknown, Yes, No): Yes

If Yes, attach the existing documented security policies, standards, and controls used to your email submission.

Attached: CNRA-ISP_10_Cyber_Security_Governance_Policy.pdf

e) Does the Agency/state entity have user accessibility policies, standards, controls, and procedures formally defined, documented, and implemented?

Answer (Unknown, Yes, No): Yes

If Yes, attach the existing documented policies, accessibility governance plan, and standards used to the email submission.

Attached: CDFW_ITPL_20-01_Acceptable_Use.pdf

5. Security Categorization Impact Table

Consult the SIMM 5305-A Information Security Program Management Standard - Security Categorization Impact Table. : SIMM-5305_A_2018-0108.pdf

Attach a table (in PDF) that categorizes and classifies the agency/state entity's information assets related to this effort (e.g., paper and electronic records, automated files, databases requiring appropriate protection from unauthorized use, access, disclosure, modification, loss, or deletion). Each information asset for which the agency/state entity has ownership responsibility shall be inventoried and identified.

Attached: CNRA-ISP_16.1_Data_Classification.pdf

6. Security Categorization Impact Table Summary

Consult the SIMM 5305-A Information Security Program Management Standard - Security Categorization Impact Table : SIMM-5305_A_2018-0108 .pdf to provide potential impact levels of the following areas:

Confidentiality: Low

Integrity: Low

Availability: Low

7. Technical Complexity Score: 3.3

Attached Section 2.3.7 CNDDB MODS SIMM_45_Appendix_C_2016_0506 Complexity Assessment.xlsx with Business and Technical Complexity sections completed to the email submission

2.4	**Requirements and Outcomes**

At this time in the project planning process, requirements and outcomes should be documented and indicative of how the Agency/State Entity envisions the final solution. This shall be accomplished either in the form of mid-level requirements (predictive methodology)/business capabilities or representative epics and user stories (adaptive methodology) that will become part of the product backlog. The requirements or representative epics and user stories must tie back to the Objectives detailed in the Stage 1 Business Analysis. Regardless of which tool/method is used, an understanding of the following, at a minimum, must be clearly articulated:

- Functional requirements
- Expected user experience(s)
- Expected system outcome
- Expected business operations (e.g., How do you envision operations in the future?)
- Alignment to the project's objectives identified in Stage 1
- Product ownership (e.g., Who owns these requirements?); and
- Verification of need(s) fulfillment (e.g., How will success be measured?)

Attached: Midlevel Requirements: Section 2.4 CNDDB MODS Midlevel_Solution_Requirements.xlsm

2.5	**Assumptions and Constraints**

Relevant assumptions and constraints help define boundaries and opportunities to shape the scope and complexity of the project.

Assumption:

1. Design and development of tools, modules and system are based but not limited the alternative solutions in defined stage 2.
2. Data migration is assumed part of implementation.

   Description/Potential Impact: If considering other solution outside those identified in Stage 2 Alternative solution, schedule, scope and budget may be impacted. All considerations and communications need to be discussed, documented and identified. Final decisions should be made by the business leadership.

Constraint: Consideration of applications and systems that are not already in full development. Full unprocessed digital data migration.

Description/Potential Impact: Consideration of applications and systems that are not already in full development is not identified as a viable solution due to several unknowns and other agencies may cause dependency to the project that has limited budgetary timeline

Due to the amount of data backlog (digital), full migration may not be possible during the project implementation.

2.6 Dependencies

Dependencies are elements or relationships in a project reliant on something else occurring before the function, service, interface, task, or action can begin or continue.

Dependency Element: Budgetary timeline

Dependency Description: The funding allocated for this project concludes June of 2026.

2.7 Market Research

Market Research (CDT Market Research Guidelines) determines whether products or services available in the marketplace can meet the business needs identified in this proposal. Market Research can also determine whether commercial practices regarding customizing/modifying products or tailoring services are available, or even necessary, to meet the business needs and objectives of the business.

Before undertaking a Market Research approach. Contact your PAO Manager to schedule a collaborative review to review planning to date and discuss the procurement approach.

1. Project Management Methodology: **Predictive Approach (Waterfall)**

2. Procurement approach recommended: **Standard Procurement**

3. Market Research Approach

Stakeholder requirements were collected and where possible described at the most suitable level of modularization. As the requirements were collected and described, some subjective judgement was applied in the recording and scoping of each of these requirements. Some of the considerations applied were:

'Is this requirement properly defined in that it can be implemented independently of other requirements?'

'*Is this requirement properly defined in that it can be properly scoped in Stage 3 without extensive decomposition'*

'*Is this requirement properly defined in that it does not over constrain the implementation details'*

'*Is this requirement properly defined in that it is not obvious or trivially satisfied regardless of solution details or recommendations'*

The set of business requirements was generated and reviewed and revised with the input of the core CNNDB program project team as well as being subject to review and comment by the broader CNDDB program team.

The business requirements were used to develop of set of logical enhancements to the CNDDB. The criteria used here was that a specific enhancement would:

- satisfy one or more business requirements

- that the business requirements were related in the sense that implementing the enhancement would necessarily require considering all of its constituent requirements

- the enhancements could be implemented independently in the solution space, potentially allowing a combination of solution approaches to satisfy the full set of business requirements.

- The enhancements could be implemented modularly in time, allowing features to be implemented piecemeal over time without necessarily interrupting continued operation of the program.

These enhancement groups were defined independently. Once broken into logical 'enhancements', implementation options for each of the enhancements were researched, with at least three options for each being documented and described. As much as possible, the documented solution options are non-trivially unique, easily procured, and reasonable from a cost and complexity standpoint.

Each of the options in the solution space were analyzed against three metrics:

- Effort – Regarding how much customization the tool requires to satisfy the deliverable

- Cost – The level of cost associated with adapting the solution satisfy the deliverable

- Maintainability – Regarding how well the solution can be maintained

For details regarding the metric utilized, please refer to deliverable Section 2.7.3 Evaluate_Enhancements.pdf

Several methodologies were utilized in then the development of market research artifacts.

For MOTS or COTS items, *internet research* was the primary methodology used to existence, availability, and characteristics of proposed solutions. Where possible, this internet research was performed not as a survey of marketing material but as an access point to manuals, API's, technical documentation or architecture diagrams, or case studies. In this respect, the methodology was internet research methodology was akin to analysis of *published literature*.

In some cases vendor presentations were utilized to augment or support the research or to further illustrate what a solution might look like in practice.

Another methodology employed was *collaboration with other agencies/state entities or government entities*. The specific problems and improvements sought by the CNDDB program are not wholly unique and have been to varying degrees solved by similar agencies in other states. Video conference calls were held with several State Natural Heritage Programs and

demonstrations and descriptions of their solutions were presented and discussed along with qualitative feedback regarding benefits and challenges to their solutions.

The market research phase form this project was approximately 6 months in the period starting April 18, 2022 and concluding October 21st. Passive market research and broad exploration of the solution space occurred for the first 4 months, and the detailed market artifact collection and examination occurred for the remaining 2 months.

4. Market Research Artifacts

Attached: Market Research artifacts: Section 2.7.4 Market Research Artifacts

2.8   Viable Alternative Solutions

The CDT expects Agencies/state entities to conduct a thorough analysis of all feasible alternatives that will meet the proposal's objectives and requirements. Agencies/state entities should provide at minimum the three (3) most viable solutions, one (1) of which could be leveraging and/or enhancing the existing solution (if applicable).

1. **Viable Alternative Solution #1**

Name: Non-ESRI Cloud Solution

Description: This solution provides a complete rebuild to a majority of the CNDDB systems and processes using open source and Azure solutions. It utilizes QGIS, Google Maps, a mobile designed web app, and Microsoft Azure solutions. It forgoes existing programs that CNDBB does not fully control for new programs whenever possible.

Why is this a viable solution?

This solution avoids all ESRI ArcGIS products. It describes how the CNDDB would supply their own solutions separately even from other department owned solutions.

Advantages

QGIS 3.x is the main software solution for the sourcing of information and manipulation of geospatial data. It is open-source software with a significant history and community behind it. It would connect to a single database. The benefits of open-source software include no licensing costs and access to application code itself.

Goggle Maps API would provide the backbone to visual public data access. Both output and input can be handled by the API. Department development and control of these processes would allow for a wide range of future enhancements. This also provides the department with the most control over application scale.

Azure Cosmos DB is an ideal solution for handling large document workloads. It can provide the backbone for collecting and host raw data files and the curated information compiled from them. Adopting this architecture would reduce long term maintenance issues with raw public data. It would also simplify third party integration by reducing schema matching dependencies.

Azure Automation Services is a catchall for a series of tools hosted on Azure. These include non-technical Azure logic apps and code driven Azure functions. These services can handle the movement, automated processing, and reporting of data throughout the system. These processes can be both technical and non-technical in nature. This allows multiple SMEs to be directly involved in the system. The department or individuals can develop solutions and distribute them to other users.

Azure AD provides a central security framework and management tool for handling data, processes, and environments.

Disadvantages

This solution's main detriment is the implementation cost, training, and maintenance of the system. It uses both new technologies and unfamiliar programs. While these may be ideal solutions for a brand-new office the CNDDB would be throwing out existing institutional knowledge and resources to adopt them. This is the only solution that would require an additional technical resource to maintain the system. QGIS is an established product that would handle much of the geospatial workload. But all the other systems would have to be built from the ground up and integrated with the solution.

Approach

Increase staff – new or existing capabilities: Yes

Modify the existing business process or create a new business process: Yes

Reduce the services or level of services provided: No

Utilize new or increased contracted services: No

Enhance the existing IT system: No

Modify Statute/Policy/Regulations: No

Please Specify: NA

Create a new IT system: Yes

Other: Choose Yes or No. Specify: Click or tap here to enter text.

Architecture Information

Business Function(s)/Process(es): Data Collection, Bulk Data Collection

Business Function(s)/Process(es): Mobile / Offline Data Collection Tool

Business Function(s)/Process(es): Source Tools, Source QC Tool, EO Tool, EO QC Tool

Business Function(s)/Process(es): Public Layer Display Tools – EO Data and New Observation Data

Business Function(s)/Process(es): Distributed and Published Layer Files, Other Distributed and Published Data

Business Function(s)/Process(es): NatureServe Biotic Integration

Business Function(s)/Process(es): Future Third Party Integrations

Business Function(s)/Process(es): API and Database (COTS)

Business Function(s)/Process(es): API and Database (Custom)

Business Function(s)/Process(es): Taxa Tool

Business Function(s)/Process(es): Admin Module

Business Function(s)/Process(es): Data Automation

Conceptual Architecture

Conceptual Architecture as an email attachment: Section 2.8 Viable Solution 1 Architectural Information.docx

COTS/SaaS/Cloud Technology or Custom: Custom

Name/Primary Technology: .Net 6

COTS/SaaS/Cloud Technology or Custom: COTS/SaaS/Cloud Technology

Name/Primary Technology: QGIS 3

COTS/SaaS/Cloud Technology or Custom: Custom

Name/Primary Technology: Google Maps

COTS/SaaS/Cloud Technology or Custom: Custom

Name/Primary Technology: Public Data Mapping Tool

COTS/SaaS/Cloud Technology or Custom: Custom

Name/Primary Technology: Biotics, Cosmo DB

COTS/SaaS/Cloud Technology or Custom: Custom

Name/Primary Technology: Script

COTS/SaaS/Cloud Technology or Custom: COTS/SaaS/Cloud Technology

Name/Primary Technology: Azure Active Directory, Azure Cosmos DB, Azure SQL, QGIS 3

COTS/SaaS/Cloud Technology or Custom: Custom

Name/Primary Technology: .Net 6 integrated with Azure Automation Services

COTS/SaaS/Cloud Technology or Custom: Custom

Explain Existing System Interfaces: External data input uses a custom web interface (Online Field Survey Form) using ASP.NET and ArcGIS Survey123. ArcGIS Online used to extract Survey123 data. The database entries are creating using a front-end tool developed in .NET known as "CNDDB Forms". Many other functions (e.g., Element sync, nightly updates/exports/extracts, BIOS integration, internal report generation, Quad map creator) performed manually using SQL, Python and C# scripts, ArcGIS Toolbox Model Builder. RareFind Web Application, an Internet application that allows robust querying and reporting CNDDB data, uses .NET execution environment. BIOS Map Viewer Web Application, a web-based map viewer that allows basic geospatial viewing and querying of CNDDB data, uses .NET execution environment. QuickView, a tool within BIOS Map Viewer Web Application, uses .NET execution environment. Element ranking and maintenance is integrated with NatureServe's Biotics using external processes.

Explain New System Interfaces: QGIS 3.x will be the main software solution for the sourcing of information and manipulation of geospatial data. Goggle Maps API would provide the backbone to visual public data access. Azure Cosmos DB will be the backbone for collecting and host raw data files and the curated information compiled from them. Azure Automation Services will handle the movement, automated processing, and reporting of data throughout the system. Azure AD will provide a central security framework and management tool for handling data, processes, and environments. Data collection tools will be developed in .Net 6 (Custom). Biotics integration will use custom script to move data in between Biotics and Cosmos DB. Taxa and Admin tools will be a .net 6 application integrated with azure automation services (custom). Data automation will use Azure automation services (custom).

Data Collection and Bulk Data Collection – Integrated data capture web form developed in .Net 6 (Custom). This application will be used by the public and internal staff to upload observations and other information to the department. It will provide a google map interface to select specific location/s and taxa. It will allow the uploading of files that can potentially contain taxa information, bulk observations, or other non-mapped information. It will provide the user with the ability to track their source record over time to see it flow through the departments various processes. This will be an external web-based app available to anyone, with optional OAuth login to allow tracking of submitted data. It will integrate with a public API layer.

Public Layer Display Tools - This public data mapping tool will utilize Google Maps (custom). Both the public and staff will use this data interface. This option gives CNDDB full control over the presentation of map data. This allows CNDDB staff to avoid limitations presented by working with other offices in the department. It can be combined with the Source Tool and public API to provide significant resources to users, joining data view and data collection into an integrated tool, using an OAuth login to provide additional permission-based data mapping.

Distributed and Published Layer Files, Other Distribute and Published Data - This will be integrated into the public data mapping tool described above (custom) along with a Mailchimp account (COTS) for distribution of data. CNDDB staff will have complete control over the distribution of data and avoid limitations presented by working with other offices in the department. The public

and staff will take advantage of the OAuth login system to access and subscribe to data. This system will integrate with the public API and Source Tool.

Data Center Location of the To-be Solution: Agency/state entity operated by agency/state entity

If Other, specify: NA

Security

Access:

Public: Yes

Internal State Staff: Yes

External State Staff: Yes

Other: Yes Specify: Curated Experts

Type of Information (Select Yes or No for each to identify the type of information that requires protection. See the SAM Section 5305.5 for more information.)

Personal: No

Health: No

Tax: No

Financial: No

Legal: No

Confidential: Yes

Other: Yes Specify: Statute/Policy/Regulation required Public Access

Protective Measures (Select Yes or No to identify the protective measures used to protect information.)

Technical Security: Yes

Physical Security: Yes

Backup and Recovery: Yes

Identity Authorization and Authentication: Yes

Other, specify: Document Temporary Physical Security

Total Viable Alternative #1 Solution Cost (copy from FAW – Summary tab, cell AL50):

Total Proposed Cost: $6,061,116

Agency/state entity operated by agency/state entity

2. Viable Alternative Solution #2

Name: ARCGIS Online Cloud Solution

Description: This solution provides a complete upgrade to a majority of the CNDDB systems and processes using ARCGIS online as the backbone. It utilizes ArcGIS Online, ArcGIS REST API, and a custom applications built using ArcGIS App Studio and ArcGIS App Builder. It forgoes existing department programs that CNDBB does not control for ArcGIS online solutions whenever possible.

Why is this a viable solution?

This solution is a full update to the existing system, using a proprietary third party (ArcGIS Online) that the department has experience with.

Advantages

ArcGIS Online provides the backbone from which all work is done. This cloud-based solution allows CNDDB to forgo department resources. Maintenance and performance of the system is handled by ERSI. This directly handles the public distribution of visual data. ESRI is the largest company in the geospatial field and has significant resources CNDDB can access for development, support, and other needs. Maintenance for this solution would be around one personnel year.

Custom applications developed using ArcGIS App Studio connect to the online backbone to allow the development of sourcing, observation, and EO data. This provides a custom interface on top of a rich geospatial API.

Similar mobile applications developed in ArcGIS App Studio can be easily rolled out on a mobile environment. This is exactly what NatureServe has done to create Survey 123. Developing their own application would allow CNDDB to customize the solution to a greater extent.

Limitations

Not everything can be done online. The system would need to sync to a department database to provide certain enhancements. This local server would process the data using custom programs and scripts. It would then then send that data back online, to a third-party, or otherwise distribute it. The main processes that would be affected by this relationship would be administrative tasks, maintaining schema and taxonomy, and distribution of data.

Custom applications developed using ArcGIS App Studio will take more maintenance than using ArcGIS Pro as the geospatial manipulation tool. There may also be certain features that are better in Pro. ArcGIS Pro can connect directly to ArcGIS Online, thus becoming the solution of choice for those enchantment groups. This is discussed in Solution 3.

Detriments

Licensing is generally a benefit in cloud computing. But there is a specific issue that keeps this from being true in this case. ArcGIS Online is designed for hosting geospatial data and the cost structure reflects that. The department maintains a large collection of supporting documents

though. ArcGIS Online is extremely expensive when used as a document store. The cost will quickly become significant to the department as they move more and more legacy data into this solution.

Approach

Increase staff – new or existing capabilities: No

Modify the existing business process or create a new business process: Yes

Reduce the services or level of services provided: No

Utilize new or increased contracted services: Yes

Enhance the existing IT system: No

Modify Statute/Policy/Regulations: No

> Please Specify: Click or tap here to enter text.

Create a new IT system: Yes

Other: No Specify: Click or tap here to enter text.

Architecture Information

Business Function(s)/Process(es): Data Collection, Bulk Data Collection (Custom & COTS)

Business Function(s)/Process(es): Mobile / Offline Data Collection Tool

Business Function(s)/Process(es): Source Tool, Source QC Tool, EO Tool, EO QC Tool

Business Function(s)/Process(es): Public Layer Display Tools – EO Data and New Observation Data

Business Function(s)/Process(es): Published Layer Files, Other Published Data

Business Function(s)/Process(es): Distributed Layer Files and Other Distributed Data, NatureServe Biotic Integration, Future Third Part Integration.

Business Function(s)/Process(es): API and Database

Business Function(s)/Process(es): Taxa Tool

Business Function(s)/Process(es): Admin Module

Business Function(s)/Process(es): Data Automation

Conceptual Architecture

> Conceptual architecture is submitted as an attachment through email: Section 2.8 Viable Solution 2 Architectural Information.docx

COTS/SaaS/Cloud Technology or Custom: Custom

> Name/Primary Technology: ArcGIS Wed Appbuilder

COTS/SaaS/Cloud Technology or Custom: COTS/SaaS/Cloud Technology

> Name/Primary Technology: ArcGIS Online

COTS/SaaS/Cloud Technology or Custom: Custom

> Name/Primary Technology: ArcGIS AppStudio

COTS/SaaS/Cloud Technology or Custom: Custom

> Name/Primary Technology: Script, existing system

COTS/SaaS/Cloud Technology or Custom: COTS/SaaS/Cloud Technology

> Name/Primary Technology: ArcGIS Data Interoperability

COTS/SaaS/Cloud Technology or Custom: COTS/SaaS/Cloud Technology

> Name/Primary Technology: SQL DB

COTS/SaaS/Cloud Technology or Custom: Custom

> Name/Primary Technology: SQL DB

COTS/SaaS/Cloud Technology or Custom: Custom

> Name/Primary Technology: online automated processes

COTS/SaaS/Cloud Technology or Custom: Custom

> Name/Primary Technology: python scripts, and other methods

Explain Existing System Interfaces: External data input uses a custom web interface (Online Field Survey Form) using ASP.NET and ArcGIS Survey123. ArcGIS Online used to extract Survey123 data. The database entries are creating using a front-end tool developed in .NET known as "CNDDB Forms". Many other functions (e.g., Element sync, nightly updates/exports/extracts, BIOS integration, internal report generation, Quad map creator) performed manually using SQL, Python and C# scripts, ArcGIS Toolbox Model Builder. RareFind Web Application, an Internet application that allows robust querying and reporting CNDDB data, uses .NET execution environment. BIOS Map Viewer Web Application, a web-based map viewer that allows basic geospatial viewing and querying of CNDDB data, uses .NET execution environment. QuickView, a tool within BIOS Map Viewer Web Application, uses .NET execution environment. Element ranking and maintenance is integrated with NatureServe's Biotics using external processes.

Explain New System Interfaces: ArcGIS Online will provide the backbone from which all work will be done. Maintenance and performance of the system is handled by ERSI. Custom applications will be developed using ArcGIS App Studio to allow the development of sourcing, observation, and EO data.

Data Collection, Bulk Data Collection - Integrated data capture web form developed in ARCGIS Web Appbuilder (Custom) using ArcGIS Online (COTS). This application will be used by the public and internal staff to upload observations and other information straight to ArcGIS Online as restricted layers. It will allow the uploading of files that can potentially contain taxa information or observations.

It will provide the user with the ability to track their source record over time to see it flow through the departments various processes. This will be an external ArcGIS online app available to anyone, with login to allow tracking of submitted data. It will integrate directly with ArcGIS Online.

Public Layer Display Tools – This public data mapping tool will utilize ArcGIS Online (COTS) by defining different access to specific layers of data. Both the public and staff will use this data interface. This option gives CNDDB full control over the presentation of map data. This allows CNDDB staff to avoid limitations presented by working with other offices in the department. It can be combined with the Source Tool to provide significant resources to users, joining data view and data collection into an integrated tool.

Published Layer Files, Published Data - Data publishing will move from department web and ftp servers to ArcGIS Online (COTS). Both the public and staff will use this data interface. This simplifies and centralizes the location of data, benefiting both the public and administrators.

Source Tools, Source QC Tool, EO Tool EO QC Tool - These tools will integrate a custom app using ARCGIS Web Appbuilder (Custom) with ArcGIS Online (COTS). Internal staff will use them to manipulate geospatial data.

API - The backend is an integration of ArcGIS Online (COTS) and SQL DB (COTS). Mapping and authentication are handled by ArcGIS Online, with some automated data processing and reporting with other agencies handled by the synced SQL DB. ArcGIS Data Interoperability (COTS).

Data Center Location of the To-be Solution: Agency/state entity operated by agency/state entity

If Other, specify: Click or tap here to enter text.

Security

Access:

Public: Yes

Internal State Staff: Yes

External State Staff: Yes

Other: Yes Specify: Curated Experts

Type of Information (Select Yes or No for each to identify the type of information that requires protection. See the SAM Section 5305.5 for more information.)

Personal: No

Health: No

Tax: No

Financial: No

Legal: No

Confidential: Yes

Other: Yes Specify: Statute/Policy/Regulation required Public Access

Protective Measures (Select Yes or No to identify the protective measures used to protect information.)

Technical Security: Yes

Physical Security: Yes

Backup and Recovery: Yes

Identity Authorization and Authentication: Yes

Other, specify: Document Temporary Physical Security

Total Viable Alternative #2 Solution Cost (copy from FAW – Summary tab, cell AL50):

Total Proposed Cost: $4,647,619

3. Viable Alternative Solution #3

Name: ARCGIS Enterprise Upgrade Solution

Description: This solution provides a partial upgrade and rebuild to a significant portion of the CNDDB systems and processes using an ARCGIS Enterprise backbone. It utilizes ARCGIS Enterprise, ARCGIS Pro, and existing resources. It utilizes existing department programs that CNDBB does not control when possible

Why is this a viable solution?

This solution is takes full advantage of ArcGIS Enterprise, a proprietary third party that the department has experience with.

Advantages

ArcGIS Enterprise provides the backbone from which all work is done. This is a department hosted solution for which they currently have a license. This solution can handle the distribution of public data through its own proprietary web server. ESRI is the largest company in the geospatial field and has significant resources CNDDB can access for development, support, and other needs. Maintenance for this solution would be less than one personnel year for CNDDB staff.

ArcGIS Pro with minimal customization connects to ArcGIS Enterprise to allow the development of sourcing, observation, and EO data. This provides a custom interface on top of a rich geospatial API.

This solution uses a modified Survey 123 for data collection. It uses BIOS for public layer display. It uses existing scripts and processes to distribute data. It takes advantage of current solutions whenever possible, simply modifying them to work with the new ArcGIS Enterprise backbone.

Comparisons

ArcGIS Enterprise has small but distinct advantages over ArcGIS Online. Data hosting is handled by the department. Pro has more features and will result in less maintenance than Appbuilder.

Using an industry leading third party will result is significantly less maintenance costs. This generally must be balanced against licensing costs, but the department already owns the license.

Detriments

This analysis defines the costs to CNDDB, not the department. This evaluation does not include the Enterprise license cost, or server maintenance costs. Thus, there is potentially a sunk cost fallacy to the department in this evaluation.

Approach

Increase staff – new or existing capabilities: No

Modify the existing business process or create a new business process: Yes

Reduce the services or level of services provided: No

Utilize new or increased contracted services: Yes

Enhance the existing IT system: No

Modify Statute/Policy/Regulations: No

Please Specify: Click or tap here to enter text.

Create a new IT system: Yes

Other: No Specify: Click or tap here to enter text.

Architecture Information

Business Function(s)/Process(es): Data Collection, Bulk Data Collection, Mobile / Offline Data Collection Tool

Business Function(s)/Process(es): Data Collection, Bulk Data Collection, Mobile / Offline Data Collection Tool

Business Function(s)/Process(es): Source Tool, Source QC Tool, EO Tool, EO QC Tool

Business Function(s)/Process(es): Public Layer Display Tools – EO Data and New Observation Data

Business Function(s)/Process(es): Published and Distributed Layer Files, Other Published and Distributed Data

Business Function(s)/Process(es): NatureServe Biotic Integration
Business Function(s)/Process(es): Future Third Party Integrations

Business Function(s)/Process(es): API and Database

Business Function(s)/Process(es): Taxa Tool
Business Function(s)/Process(es): Admin Module
Business Function(s)/Process(es): Data Automation

TIP: Copy and paste or click the + button in the lower right corner to add business processes with the same application, system, or component; COTS/Cloud Technology or custom solution; runtime environment; system interfaces, data center location; and security.

Conceptual Architecture

Conceptual architecture is submitted as an attachment through email**: Section 2.8 Viable Solution 3 Architectural Information.docx**

COTS/SaaS/Cloud Technology or Custom: COTS/SaaS/Cloud Technology

Name/Primary Technology: Survey 123

COTS/SaaS/Cloud Technology or Custom: COTS/SaaS/Cloud Technology

Name/Primary Technology: Survey 123

COTS/SaaS/Cloud Technology or Custom: COTS/SaaS/Cloud Technology

Name/Primary Technology: ArcGIS Enterprise Portal

COTS/SaaS/Cloud Technology or Custom: COTS/SaaS/Cloud Technology

Name/Primary Technology: ArcGIS Pro

COTS/SaaS/Cloud Technology or Custom: Custom

Name/Primary Technology: ArcGIS SDK

COTS/SaaS/Cloud Technology or Custom: COTS/SaaS/Cloud Technology

Name/Primary Technology: Department's in-house mapping display

COTS/SaaS/Cloud Technology or Custom: Custom

Name/Primary Technology: BIOS

COTS/SaaS/Cloud Technology or Custom: COTS/SaaS/Cloud Technology

Name/Primary Technology: ArcGIS Enterprise: ArcGIS Enterprise Portal, ArcGIS Server, ArcGIS Data Store

COTS/SaaS/Cloud Technology or Custom: COTS/SaaS/Cloud Technology

Name/Primary Technology: ArcGIS Data Store

COTS/SaaS/Cloud Technology or Custom: COTS/SaaS/Cloud Technology

   Name/Primary Technology: ArcGIS Enterprise addon

COTS/SaaS/Cloud Technology or Custom: Custom

   Name/Primary Technology: .Net 6 application integrated with ArcGIS Data Store

COTS/SaaS/Cloud Technology or Custom: COTS/SaaS/Cloud Technology

   Name/Primary Technology: ArcGIS Workflow Manager

Explain Existing System Interfaces: External data input uses a custom web interface (Online Field Survey Form) using ASP.NET and ArcGIS Survey123. ArcGIS Online used to extract Survey123 data. The database entries are creating using a front-end tool developed in .NET known as "CNDDB Forms". Many other functions (e.g., Element sync, nightly updates/exports/extracts, BIOS integration, internal report generation, Quad map creator) performed manually using SQL, Python and C# scripts, ArcGIS Toolbox Model Builder. RareFind Web Application, an Internet application that allows robust querying and reporting CNDDB data, uses .NET execution environment. BIOS Map Viewer Web Application, a web-based map viewer that allows basic geospatial viewing and querying of CNDDB data, uses .NET execution environment. QuickView, a tool within BIOS Map Viewer Web Application, uses .NET execution environment. Element ranking and maintenance is integrated with NatureServe's Biotics using external processes.

Explain New System Interfaces: ArcGIS Enterprise provides the backbone from which all work is done. ArcGIS Pro with minimal customization connects to ArcGIS Enterprise to allow the development of sourcing, observation, and EO data. This provides a custom interface on top of a rich geospatial API. This solution uses a modified Survey 123 for data collection. It uses BIOS for public layer display.

Data Collection, Bulk Data Collection, Mobile / Offline Data Collection Tool - Survey 123 (COTS) will provide federated data to the department, which can be used by both the public and internal staff. ArcGIS Enterprise Portal supports significant data mining, analysis, and integration tools (COTS), which can be used by internal staff to process bulk data. These tools integrate with ArcGIS Database, a SQL DB backend.

Source Tool, Source QC Tool, EO Tool, EO QC Tool - These tools will integrate an ArcGIS Pro (COTS) with limited customization using the ArcGIS SDK (custom). Internal staff will use them. They will integrate with ArcGIS Enterprise.

Public Layer Display Tools – EO Data and New Observation Data - Public Layers will continue to be passed to BIOS, the departments in house mapping display system (COTS). BIOS is an ArcGIS Online solution and the federated exchange of data between systems will be similar to the existing, but simplified, process (custom). Both the public and staff will use this data interface.

Data Reporting

Published and Distributed Layer Files, Other Published and Distributed Data - Data distribution will continue to use the same processes, now pulling from the ArcGIS Server as

opposed to the current server (custom). This system will continue to integrate with other department systems such as Zipped Shape Files, Web and FTP Servers, and Exchange. NatureServe Biotic Integration

This will be developed as part of the solution to automate and improve the existing process.

Future Third Party Integrations - ArcGIS Enterprise has significant export and data manipulation features. It is an ideal environment for future development.

API and Database - ArcGIS Enterprise is an integrated system, with a web adapter (ArcGIS Enterprise Portal), a server (ArcGIS Server), and a data store (ArcGIS Data Store). It is a complete solution for web, API, database, and file management (COTS).

Taxa Tool - This tool will be an ArcGIS Enterprise addon (COTS) administered by staff using ArcGIS Pro (COTS).

Admin Module - The admin module will be a .net 6 application integrated with ArcGIS Data Store (custom). Internal admin staff will use it to track administrative data and produce reports It will integrate with ArcGIS Enterprise using ArcGIS Enterprise Portal.

Data Automation - ArcGIS Workflow Manager (COTS) provides multiple tools to automate data processing and workflows, and integrate different federated and third party systems. Workflows can be created using solutions of varying complexity, allowing subject matter experts control over data processing. The federated data layer of ArcGIS Enterprise will integrate with third party GIS data.

Data Center Location of the To-be Solution: Agency/state entity operated by agency/state entity

> If Other, specify: Click or tap here to enter text.

Security

> **Access**:

>> Public: Yes

>> Internal State Staff: Yes

>> External State Staff: Yes

>> Other: Yes Specify: Curated Experts

> **Type of Information** (Select Yes or No for each to identify the type of information that requires protection. See the SAM Section 5305.5 for more information.)

>> Personal: No

>> Health: Choose Yes or No.

>> Tax: No

>> Financial: No

Legal: No

Confidential: Yes

Other: Yes Specify: Statute/Policy/Regulation required Public Access

Protective Measures (Select Yes or No to identify the protective measures used to protect information.)

Technical Security: Yes

Physical Security: Yes

Backup and Recovery: Yes

Identity Authorization and Authentication: Yes

Other, specify: Document Temporary Physical Security

Total Viable Alternative #3 Solution Cost (copy from FAW – Summary tab, cell AL50):

Total Proposed Cost: $5,087,483

2.9   Project Organization

Project planning includes the process of identifying how and when specific labor skill sets are needed to ensure that the proposed project has sufficient staff with the appropriate knowledge and experience by the time the project moves into execution. All staff identified in the following sections should be included in the Financial Analysis Worksheet to be completed in Section 2.12.

1. Project Organization Chart:

   Attached: Section 2.9 CNDDB MODS Project Organizational Chart.pdf

2. Is the department running this project as a matrixed or projectized organization?

   Projectized

In each of the following sections, provide a concise description of the approach to staffing the proposed project including contingencies for business/program, IT, or administrative areas to maintain ongoing operations in conjunction with the proposed project.

1. Administrative

   CNDDB, GIS and Biographic Data Branch (BDB), Data Technology Division (DTD) and Procurement and Project Management leaderships.

2. Business Program

   Business Program includes subject matter experts (SMEs) from CNDDB, CNDDB and Biographic Data Branch (BDB) leadership.

3. Information Technology

Tools, modules and system development will be provided by vendor(s) identified from the procurement process. IT support will be identified from Data Technology Division (DTD)

4. Testing

Tester will be identified from the CNDDB Team according to their expertise.

5. Data Conversion/Migration

This will a combine effort from the identified vendor(s), CNDDB SMEs, DTD support team.

6. Training

Training will be provided by the vendors and some key staffs that have been involved with the project development. Target audience for training will be CNDDB staff and broader stakeholder group.

7. Organizational Change Management

OCM training will be part the deliverable in Stage 3 and will be planned and implemented by the project core team and the program leadership.

8. Resource Capacity/Skills/Knowledge for Stage 3 Solution Development

This narrative should include the experience level and quantity of procurement, contract management, and budget staff who will be responsible for the Stage 3 Solution Development.

Stage 3 will be contracted with a vendor who has expert level experience on preparing Request for Proposal (RFP), SOW and detailed requirements. CNDDB SMEs and the Core Team that have the program expertise to provide detailed requirements and investigate in detail the viable solutions identified in Stage 2. Contract and budget staff support will be provided by IT Governance and Support Branch (ITGSB)

2.10   Project Planning

1. Project Management Risk Assessment

Updated Project Management Risk Score: 1.5

Attached : Section 2.10.1 CNDDB MODS SIMM_45_Appendix_A_2016_0506 PM Risk Assessment.xlsx

Is your project charter approved by the designated Agency/state entity authority and available for the Department of Technology to review? **Choose**: 'Yes,' 'No,' or 'Not Applicable.' If 'No' or 'Not Applicable,' provide the artifact status in the space provided.

Project Charter (Approved): Yes

Status: Approved

Attached : Section 2.10.2 CNDDB MODS Project Charter v.1.0

2. Project Plans

Are the following project management plans or project artifacts approved by the designated Agency/state entity authority and available for the Department of Technology to review? **Choose**: 'Yes,' 'No,' or 'Not Applicable.' If 'No' or 'Not Applicable,' provide the artifact status in the space provided.

Note: For Low to medium complexity and cost projects, discuss with your PAO manager the option of submitting a Master Project Management Plan in place of individual plans.

Attached: Section 2.10.2 CDFW Project Management Plan CNDDB MODS.docx

Scope Management Plan (Approved): Yes

 Status: In Project Management Plan

Communication Management Plan (Approved): Yes

 Status: In Project Management Plan

Schedule Management Plan (Approved) : Yes

 Status: **In Project Management Plan**

Procurement Management Plan (Approved): Yes

 Status: In Project Management Plan

Requirements Management Plan (Approved): Yes

 Status: In Project Management Plan

Stakeholder Management Plan (Draft): Yes

 Status: In Project Management Plan

Governance Plan (Draft): Yes

 Status: In Project Management Plan

Contract Management Plan (Draft): Yes

 Status: Done

 Attached: Section 2.10.2 CDFW Contract Management Plan CNDDB MODS.docx

Resource Management Plan (Draft): Yes

 Status: In Project Management Plan

Change Control Management Plan (Draft): Yes

 Status: In Project Management Plan

Risk Management Plan (Draft + Risk Log): Yes

Status: Done

Attached: Section 2.10.2 CDFW Risk Management Plan CNDDB MODS.docx

Issue and Action Item Management Plan (Draft + Issue Log): Yes

Status: Done

Attached: Section 2.10.2 CDFW Issue Management Plan CNDDB MODS.docx

Cost Management Plan (Approved if planning BCP approved): Yes

Status: In Project Management Plan

3. Project Roadmap (High-Level)

Attach a high-level Project Roadmap showing remainder of planning phase and transition into execution phase to the email submission.

a) Planning Start Date: 3/1/2023

b) Estimated Planning End Date: 7/15/2023

c) Estimated Project Start Date: 10/20/2023

d) Estimated Project End Date: 6/12/2026

2.11   Data Cleansing, Conversion, and Migration

If in Section 2.3 (above) the answer to the question "Do you have existing data that must be migrated to your new solution?" was marked "Yes," please complete this section.

The California Department of Technology recommends having a Data Consultant start data cleansing, conversion, and migration activities as soon as possible.

Identify the status of each of the following data activities. If "Not Applicable" is chosen, explain why the activity is not applicable or if "Not Started" is chosen, explain when the activity will start and its anticipated duration:

1. Current Environment Analysis: In Progress

    This is ongoing and part of what the vendors for Stage 2 will produce.

2. Data Migration Plan: Not Started

    The CNDDB Program does not yet know what our preferred solution is. One potential solution being assessed is to leave the data as-is but augment it, which would mean that data migration is not necessary.

3. Data Profiling: In Progress

   For this purpose, we interpret data profiling as the process of examining/analyzing existing data to understand its structure, relationships, data quality, etc. This is ongoing and part of what the vendors for Stage 2 will produce.

4. Data Cleansing and Correction: Not Applicable

   The CNDDB data is constantly QCed as part of regular processing. It doesn't need to be cleansed or corrected. For the most part, the source data is corrected when it is processed by staff, so this activity is applicable to it.

5. Data Quality Assessment: Not Applicable

   The CNDDB data is constantly QCed so its quality doesn't need to be assessed.

6. Data Quality Business Rules: Completed

   There are current rules that the CNDDB Program staff follow when entering and updating data.

7. Data Dictionaries: In Progress

   This is ongoing and part of what the vendors for Stage 2 will produce.

8. Data Conversion/Migration Requirements: In Progress

   The CNDDB Program specified that existing data needs to be migrated/accommodated in any future system. Details on how to achieve this still needs work.

2.12   Financial Analysis Worksheets

Attach F.2 Financial Analysis Worksheet(s) to the email submission.

End of agency/state entity document.

Please ensure ADA compliance before submitting this document to CDT.

When ready, submit Stage 2 and all attachments in an email to ProjectOversight@state.ca.gov.

2.13   Department of Technology Use Only

Original "New Submission" Date: 1/6/2023

Form Received Date: 1/6/2023

Form Accepted Date: 1/6/2023

Form Status: Completed

Form Status Date: 4/13/2023

Form Disposition: Approved

Form Disposition Date: 4/13/2023