Council on Environmental Quality Report to Congress on the Potential for Online and Digital Technologies to Address Delays in Reviews and Improve Public Accessibility and Transparency under 42 U.S.C. 4332(2)(C)

Delivered to Congress, as directed in Section 110 of the National Environmental Policy Act of 1969, as amended.

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Table of Acronyms

AI	Artificial Intelligence
API	Application Programming Interface
ATO	Authority to Operate
BLM	Bureau of Land Management
BPRI	Bipartisan Permitting Reform Implementation Rule
CEJST	Climate and Economic Justice Screening Tool
CEQ	Council on Environmental Quality
CERT	Centralized Environmental Review Tracker
CITAP	Coordinated Interagency Transmission Authorizations and Permits
DOE	Department of Energy
DOI	Department of the Interior
DOT	Department of Transportation
EA	Environmental Assessment
EIS	Environmental Impact Statement
eMNEPA	Electronic Management of NEPA
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ETDM	Efficient Transportation Decision Making
FERC	Federal Energy Regulatory Commission
FedRAMP	Federal Risk and Authorization Management Program
FHWA	Federal Highway Administration
GIS	Geographic Information System
GSA	General Services Administration
HUD	Department of Housing and Urban Development
IPaC	Information for Planning and Consultation
LLM	Large Language Model
NARA	National Archives and Records Administration
NEPA	National Environmental Policy Act
NOI	Notice of Intent
NRCS	Natural Resource Conservation Service
NPS	National Park Service
NTIA	National Telecommunications and Information Administration
OMB	Office of Management and Budget
PALS	Planning, Administrative Review, and Litigation System
PEPC	Planning, Environment and Public Comment
PHMSA	Pipeline and Hazardous Materials Safety Administration
PRA	Paperwork Reduction Act
RRS	Regulatory Request System
ROD	Record of Decision
USCG	United States Coast Guard
USDS	United States Digital Service
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service

1 Executive Summary

The Biden-Harris Administration is committed to carrying out Federal environmental review and permitting processes that are effective, efficient, and transparent. This will help accelerate delivery of well-designed and well-built infrastructure projects, provide predictability and timeliness for project sponsors and stakeholders, ensure that Federal decisions are grounded in science and the best available information, and help deliver projects that meet the needs and priorities of communities. The Biden-Harris Permitting Action Plan sets forth the Administration's efforts to achieve these objectives.[1] The National Environmental Policy Act (NEPA), as amended by the Fiscal Responsibility Act of 2023, directs the Council on Environmental Quality (CEQ) to study opportunities to improve the NEPA process through the use of technology and report to Congress.[2] This report summarizes CEQ's study of those opportunities in response to Congress's direction and includes recommendations for potential technology development that could support NEPA reviews and environmental permitting for Federal agencies.

Technology has tremendous potential to increase the efficiency and effectiveness of agency NEPA and permitting practices, better serve the public, agencies, and applicants; improve agency responsiveness and decision making by project sponsors and reviewing agencies; reduce delay; and improve environmental and community outcomes. To realize those benefits, agencies need a minimum level of NEPA-related technology capacity, additional technology staff, and a coordinated government-wide digital strategy for NEPA and related permitting processes that builds upon and implements the recommendations in this report. Agencies should also consider how to apply resources in a way that ensures a consistent, strategic, long-term investment in NEPA-related technology. Over the past year, CEQ has met with technology experts inside and outside the Federal Government, and received dozens of demonstrations of software systems to analyze the technology landscape for NEPA and permitting processes. What CEQ discovered is a diverse ecosystem of software and technology with isolated user bases and siloed systems. CEQ also found pockets of innovation, and significant enthusiasm among NEPA practitioners for modernized software applications and development practices that optimize workflows and improve the experience and process for stakeholders. In this report, CEQ provides recommendations on how to improve NEPA technology to achieve the vision of interoperable agency systems and a unified user experience for agency NEPA practitioners, applicants, and the public.

Technology and the NEPA Process

The NEPA process includes different levels of review, and agency technology needs vary based on the type of NEPA review the agency is conducting. Some technology tools, such as those used for case management and project tracking, collaboration and document sharing, and applicant interactions, can help agencies improve their handling of all levels of NEPA reviews. These tools help agencies track and manage project reviews, share and co-edit documents with other agencies involved in the review, and

[1] Biden-Harris Permitting Action Plan to Rebuild America's Infrastructure, Accelerate the Clean Energy Transition, Revitalize Communities, and Create Jobs (May 22, 2022), https://www.whitehouse.gov/wp-content/uploads/2022/05/Biden-Harris-Permitting-Action-Plan.pdf.

[2] For the purposes of this report, CEQ interprets the use of the term "Permitting Portal Study" in section 110 of NEPA to mean that this study, while focused on the NEPA process, should also consider the ability of a potential portal to serve the needs of agencies conducting other permitting processes concurrently with NEPA, as is often the case for complex NEPA reviews.

communicate with applicants. Agencies may also need to develop specialized tools focused on specific processes. For instance, a tool that automates parts of the screening and review process for actions that do not involve other agencies or require a public comment process, while beneficial to the agency, would have little utility for actions that involve multiple agencies and public comment processes.

By taking a systems-level approach to understanding NEPA and permitting processes and the technology used at different stages of these processes, we can see a more complete picture and better comprehend how multiple processes function interdependently. This perspective can help CEQ and agencies design software systems according to the needs of each component process while facilitating the functionality of the system as a whole. The current technology landscape for NEPA and permitting has many independent software tools operating more or less in isolation from one another.

CEQ recognizes the need for modern technology platforms that provide agency staff, applicants, and the public with the functions described in the E-NEPA provision.[3] CEQ acknowledges that ultimately, a unified NEPA and permitting experience for Federal agencies, applicants, and the public should be considered the goal; however, to achieve that goal, CEQ recommends taking interim steps to improve existing systems and enable interoperability of those systems. CEQ recommends supporting agency-specific efforts with the potential to integrate with other systems, while also developing the necessary data standards to allow for interoperability between these systems and future development of shared services for NEPA and permitting that can deliver a unified user experience for applicants and the public.[4] This report finds that the most critical steps in achieving a more unified experience are to increase the interoperability of systems and the use of shared data. Based on consultation with experts, CEQ has identified the following approach as one that could advance that model: 1) creating a data standard and taxonomy for NEPA; 2) developing a common architecture for interoperable agency systems; 3)

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[3] The functions of the "unified permitting portal" outlined in section 110 of NEPA are those that would
(1) allow applicants to—
    (A) submit required documents or materials for their project in one unified portal;
    (B) upload and collaborate with the applicable agencies to edit documents in real-time, as required;
    (C) upload and display visual features such as video, animation, geographic information system displays, and three-dimensional renderings; and
    (D) track the progress of individual applications;
(2) include a cloud based, digital tool for more complex reviews that would enhance interagency coordination in consultation by—
    (A) centralizing, across all necessary agencies, the data, visuals, and documents, including but not limited to geographic information system displays, other visual renderings, and completed reports and analyses necessary for reviews;
    (B) streamlining communications between all necessary agencies and the applicant;
    (C) allowing for comments and responses by and to all necessary agencies in one unified portal;
    (D) generating analytical reports to aid in organizing and cataloguing public comments; and
    (E) be accessible on mobile devices;
(3) boost transparency in agency processes and present information suitable for a lay audience, including but not limited to—
    (A) scientific data and analysis; and
    (B) anticipated agency process and timeline.

[4] An example of a shared service, discussed further in section 2.5.1, is Regulations.gov, which is a common platform used by many agencies for rulemaking publication, public comment receipt, and docketing functions. Shared services are an efficient means of providing capabilities to individual stakeholders (i.e., the public, agencies, applicants) while achieving improved economies of scale, and preventing duplicative siloed development.

supporting agency adoption of shared NEPA data standards and architecture through iterative development of new and existing NEPA and permitting applications; and 4) automating the exchange of data among agency systems to provide a unified experience. Successful development and implementation of this approach would both improve the permitting process and enable future shared services that could further the goal of achieving a more unified technology platform.

This approach will provide near-term benefits while mitigating risks. It will also allow CEQ and Federal agencies to better understand the needs of agencies in terms of level and scope of review and type of action that a future shared services platform should be designed to accommodate. CEQ's analysis found that attempting to build a single government-wide solution that includes all of the NEPA functions without an incremental approach would risk repeating past failures associated with procuring a large software system to meet a variety of needs within and across Federal agencies, as discussed in Section 2.5. To avoid those pitfalls, this report identifies steps that could be taken in the near term, with the goal of leveraging technology to provide immediate improvements in the permitting process, while also laying the necessary foundation of data standards, interoperable systems, and shared data that could eventually enable a unified technology solution.

Summary of Study's Key Findings

Through its study of NEPA technology, CEQ identified four practices that lead to successful software delivery that agencies should integrate into current and future NEPA and permitting software development, as well as three practices that create risk and can reduce the likelihood of success. Successful software projects employ consistent best practices, including:

- **Agile decision making:** Successful software projects value collaboration and adapting to changing needs and requirements rather than rigid processes and adherence to a plan.
- **User-centered design:** Successful software is software that users want to use. User-centered design involves identifying the functions that users (e.g., agency NEPA staff, applicants, cooperating agencies, and the public) most need to achieve their various objectives, rather than having the software development team make assumptions about the needed features.
- **Continuous iterative development and deployment:** Successful software projects continuously add or improve features necessary to satisfy user requirements, and continue user research through interviews, user observations, and embedded analytics to understand how to improve the tool. Modular and adaptable software designs can support this iterative development approach.
- **In-house technology expertise:** Successful software projects ensure that agencies have the in-house expertise needed to define software development requirements, evaluate proposals, and serve as advocates with technology contractors for the needs of the agency environmental review staff and other end users. For agencies that are developing software in-house or acquiring services from outside vendors, the role of in-house agency technology staff is critical to ensure the software will meet the needs of users.

CEQ has also identified certain practices that can contribute to unsuccessful software development results, including:

- **Waterfall decision making:**[5] Risk may be added to software development by making the key product decisions upfront without opportunities to revisit as development proceeds.
- **Scope creep:** Risk may be added to software development by adding features to a software project in an attempt to accomplish many goals simultaneously, leading to added costs and delays.
- **Function-centered design:** Risk may be added to software development by building a tool that meets functional requirements without looking at the needs and workflow of end-users, reducing the likelihood that the project will accomplish its goals. For instance, a public engagement website developed through function-centered design may contain all of the necessary content, but could lack the appropriate interface and user experience that would actually make the website useful to the intended audience.

During the course of the E-NEPA study, CEQ met with agencies that had immediate needs to develop new software to better manage their NEPA and permitting processes. Following those conversations, agencies pursued an agile, iterative development process that resulted in applications developed in-house or with existing contract support, and deployed initial products within a matter of weeks. This model of development prioritizes quickly launching a "minimum viable product"—one with enough features to perform a needed function so that the development team can receive early user feedback to validate the design choices, without overdeveloping the initial feature set before receiving feedback from users. This concept is core to "agile" development and allows the development team to quickly fix what is not working and add new features that are identified by users. In conversations with experts, they identified that this method of development is preferable to "waterfall" development, where product design choices are made in early phases of development and not revisited during subsequent stages. CEQ recommends that agencies continue to use agile development to build new and improve existing software for NEPA and permitting processes while providing strategic vision for building an interconnected distributed application framework and data fabric that delivers a unified experience to applicants and the public.

Two recent examples of NEPA-related software tools highlight the value of in-house technology staff and a user-centered agile approach to development. The U.S. Department of Agriculture's Rural Development relied on in-house technology staff to develop the Centralized Environmental Review Tracker (CERT), a tracking tool developed in two months using a low-code development platform. The Department of Energy (DOE), in support of the new Coordinated Interagency Transmission Authorizations and Permits Program (CITAP), and a team of developers at the National Renewable Energy Laboratory, followed a user-centered agile approach to build and quickly deploy the CITAP applicant portal that went live on May 31, 2024, concurrent with the effective date of the new CITAP regulations.

Building the Future of NEPA and Permitting Technology

This report recommends consideration of steps to transform the existing siloed agency systems into an interoperable framework of applications. A foundational step to enable this transformation is the

[5] Waterfall decision making outlines required system functions at the outset of a project and development work proceeds by moving sequentially through a series of steps. Waterfall methodology is less adaptable as decisions made in each step are carried throughout the process rather than being reconsidered as new information comes to light.

development of a common data standard and taxonomy for NEPA and permitting data, which is a critical element to unlocking the potential of systems to share information. In addition to the development of a data standard and NEPA taxonomy, agencies should also consider the needs of other stakeholders, such as project proponents and the broader public, as they update and develop systems used in NEPA and permitting processes. In addition to tools developed by individual agencies, CEQ recommends investigating which types of tools would benefit from development as cross-agency shared services by an agency well-positioned to host such services. As the data standard is implemented and agency systems are updated, agencies would have the opportunity to look for ways to connect their existing systems. This could allow for a number of improvements, including the ability for cooperating agency systems to view applicant data submitted to a NEPA lead agency, for the public to find information on open comment periods and public hearings for multiple agencies in a common viewer, and for agencies to collaborate with each other in real-time on document editing and comment reviews. Implementing a data standard and linking agency systems would move Federal agencies toward a government-wide NEPA and permitting system.

Figure 1: *Past practices and future envisioned state to be achieved through incremental steps.*

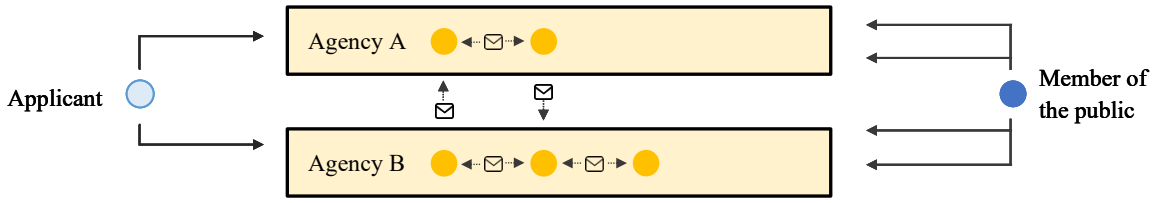
Past practices: Siloed data and multiple redundant applications

Applicants submit similar data to multiple agency systems for one project.

Agency systems do not automatically share data. Agencies typically maintain independent systems to manage NEPA workflows and features, including:

- Application intake
- Agency workflows
- Map services
- Public comment intake
- Document publishing
- Public engagement

The public uses multiple systems to get project updates, view documents, and submit comments.

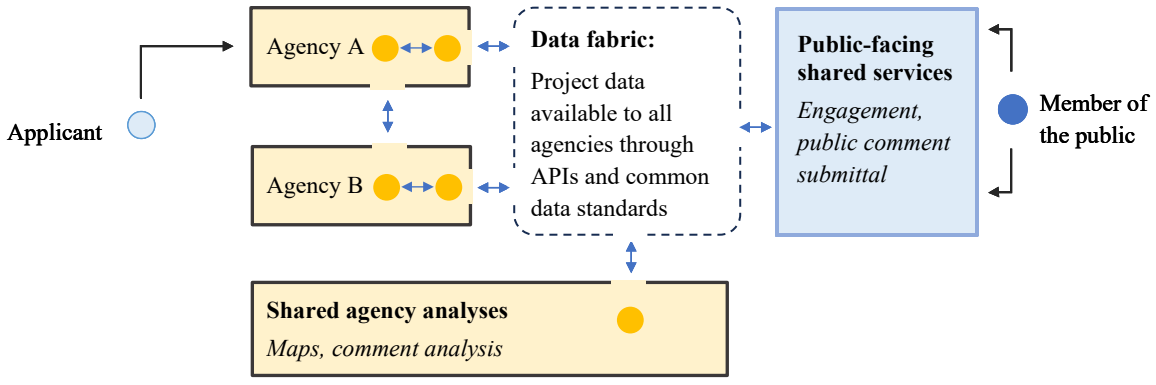


Vision: Shared data across distributed applications

Applicants submit project information to one agency system.

Agency systems exchange data about projects using automated tools like APIs. The shared data support agency workflows for common needs, including mapping and public comment analysis.

The public uses shared services to meet their needs, like engagement, viewing documents, and commenting.



2 Introduction

2.1 Background

On June 3, 2023, President Biden signed into law the Fiscal Responsibility Act of 2023 (Public Law 118-5), which amended the National Environmental Policy Act (NEPA) and added section 110, "E-NEPA." Section 110 of NEPA directs the Council on Environmental Quality (CEQ) to study and report to Congress "on the potential for online and digital technologies to address delays in reviews and improve public accessibility and transparency under [section 102(2)(C) of NEPA], including, but not limited to, a unified permitting portal that would" perform certain functions described in the statute, which this report details in section 2.5.[6] For the purposes of this report, CEQ interprets the use of the term "Permitting Portal Study" in section 110 of NEPA to mean that this study, while focused on the NEPA process, should also consider the potential of a portal to serve the needs of agencies conducting other permitting processes concurrently with NEPA, as is often the case for complex NEPA reviews.[7] Accordingly, this report refers to the NEPA and permitting processes as a term inclusive of both, and discusses systems that are used for NEPA or permitting processes.

2.2 The National Environmental Policy Act

NEPA[8] requires Federal agencies to consider the environmental effects of their proposed actions in their decision-making processes and inform and engage the public in that process. Section 101 of NEPA sets forth a national policy to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which humans and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.[9] Section 102 of NEPA directs agencies to interpret and administer Federal policies, regulations, and laws consistent with NEPA's policies.[10] NEPA also created CEQ, which issues NEPA implementing regulations to facilitate agency compliance with NEPA.[11]

To comply with NEPA, agencies determine the appropriate level of review of any major Federal action—an environmental impact statement (EIS), environmental assessment (EA), or categorical exclusion (CE).[12] If a proposed action is likely to have significant environmental effects, the agency must prepare an EIS and document its decision in a record of decision (ROD).[13] If the proposed action is not likely to have significant environmental effects or the effects are unknown, the agency may instead prepare an EA,

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[6] 42 U.S.C. § 4336d(a), (Pub. L. 91–190, title I, §110, as added Pub. L. 118–5, div. C, title III, §321(b), June 3, 2023, 137 Stat. 44).
[7] The term "permitting" as used in this report is intended to cover a broad range of Federal permits, authorizations, consultations, and other processes typically required for the approval of federally funded or authorized activities.
[8] 42 U.S.C. §§ 4321 *et seq.*
[9] 42 U.S.C. § 4331(a).
[10] 42 U.S.C. § 4332.
[11] 40 C.F.R. Parts 1500–1508.
[12] 40 C.F.R. § 1501.3.
[13] 42 U.S.C. § 4332(2)(C), 4336(b)(1); 40 C.F.R. Part 1502, § 1505.2.

which involves a more concise analysis and process than an EIS.[14] Following the EA, the agency may conclude that the action will have no significant effects and document that conclusion in a finding of no significant impact (FONSI), or conclude that that action is likely to have significant effects and therefore requires preparation of an EIS.[15] Finally, under NEPA and the CEQ regulations, a Federal agency can establish CEs—categories of actions that the agency has determined normally do not significantly affect the quality of the human environment, individually or in the aggregate—in their agency NEPA procedures.[16] In determining whether a categorical exclusion covers a proposed action, the agency must evaluate the proposed action for extraordinary circumstances, which are factors or circumstances that indicate a normally categorically excluded action may have a significant effect. If the extraordinary circumstances demonstrate that the proposed action does not fit within the categorical exclusion, the agency must prepare an EA or EIS.[17]

2.3 How can Technology Improve the Efficiency and Effectiveness of NEPA?

Federal agencies already make extensive use of technology to improve the efficiency and effectiveness of NEPA and permitting processes, though there is significant room for improvement with respect to interoperability, automation of processes, data-sharing, and other areas. The existing tools used by agencies (discussed in detail in section 3 of this report) fulfill a variety of functions, many of which section 110 of NEPA identifies, including: applicant portals, collaboration platforms, Geographic Information System (GIS) applications, project tracking, comment analysis and response, and publication and filing systems. While these existing tools provide vital services, CEQ's study found that they can be improved upon to provide better experiences for applicants, the public, and agency staff. Adoption of new technology, however, is slowed by factors such as complex contracting requirements, resource allocation, and a lack of technology expertise within many agencies.

2.3.1 Accelerate Innovation through Interoperability and Data Standards

While Federal agencies already use a variety of digital applications, they rarely can connect with each other, hindering their effective use across agencies and the collection of information from applicants. Common data standards would help improve the current ecosystem of applications by allowing them to act as a distributed framework and build toward a unified technology solution. In a distributed framework, each application has some but not all the functions required to complete the NEPA process, but sharing data across these applications allows the process to move forward in a fashion that would be similar to a single unified tool. When using a distributed framework, information enters the system through one application and can then be shared among different applications and data repositories, to create a data "fabric" of information that is accessible across systems but not necessarily stored in a single data repository or application. A data standard and fabric would also allow agencies to design future tools with greater functionality. Just as all agencies follow CEQ's NEPA regulations to implement NEPA and have their own NEPA procedures tailored to their programs and activities consistent with those regulations, agency NEPA and permitting software systems should have some set of common data fields and features

[14] 40 C.F.R. § 1501.5.
[15] 40 C.F.R. § 1501.6(a).
[16] 42 U.S.C. § 4336e(1); 40 C.F.R. §§ 1501.4, 1507.3(c)(8), 1508.1(e).
[17] 40 C.F.R. §§ 1501.4(b), 1508.1(o).

to allow for interoperability, even as the systems have certain fields and features that are specific to that agency. This interoperability would improve NEPA and permitting processes by increasing the efficiency of communication among agencies, applicants, and the public, which can reduce delays, improve data consistency, and increase the effectiveness of public engagement. Interoperability would also create the necessary pre-conditions to enable consideration of further steps to develop technology to integrate permitting across the government.

At present, however, there are no existing guidelines for such common fields and features, so each agency defines what its systems should do and what data they should track. Agencies would benefit from a more uniform data environment such as through publication of an open data standard and a NEPA taxonomy that agencies can then incorporate into the design of their systems. A taxonomy—that is, a classification of data types and their relationships—would establish a framework for how information should be structured for NEPA processes and systems. Agencies building applications using this taxonomy could then implement a common approach to capture project details, environmental resource categories analyzed, other permits required, stakeholder engagement conducted, data sources used, and other key data points while still maintaining data security with modern approaches to maintaining data and system integrity. This data governance would accelerate development and improvement of applications and drive effective and efficient processes and outcomes.

Recommended Development and Implementation:

To advance interoperability and data sharing among agency systems, CEQ recommends the following development and implementation steps:

1. **Create NEPA Taxonomy and Data Standards:** This involves research to assess NEPA data, processes, content, and applications to help define the core requirements of the data standard, including data types, relationships, and values. In order to develop a data standard that allows for the sharing of information between systems a NEPA taxonomy, or classification system, is needed. Designing the taxonomy would involve classifying components of the NEPA review process, including: the level of review (e.g., CE, EA, EIS), type of review (e.g., programmatic, adoption), stage of review (e.g., scoping, draft, final, decision, post-decision), alternative identification, decision type (e.g., selecting an alternative for action in the ROD), and project type (e.g., infrastructure sector, such as transportation or transmission, or land management).[18] A NEPA taxonomy could define all of these components with uniform values that agencies could further customize to meet the needs of their specific processes and systems.

2. **Develop Common Architecture:** This involves collaborating with agencies to map the NEPA taxonomy to an architecture and data model that agencies can then use as a standard for implementing interoperability in new and existing platforms. This would also involve identifying requirements to allow agency systems to communicate through Application Programmatic

[18] CEQ, *A Citizen's Guide to the National Environmental Policy Act; Having Your Voice Heard* (Jan. 2021), https://ceq.doe.gov/get-involved/citizens_guide_to_nepa.html.

Interfaces (APIs).[19] The NEPA taxonomy and data standard could then be communicated to agencies through a playbook or guidance document that contains technical requirements, a discussion of system design, and other implementation suggestions to support interoperability.

3. **Agencies Adopt Shared NEPA Data Standards and Architecture:** This involves coordination with and among agencies to incrementally update existing systems or design new systems to implement the NEPA taxonomy and data standards and common architecture. Individual agencies may upgrade their systems on different timelines, but CEQ could develop guidance that allows early adopters or agencies in an upgrade cycle to incorporate data standards and modern architecture that will allow those systems to share data with other systems that have adopted the data standard. This work should proceed incrementally, starting with a small group of agencies that are best positioned to implement the data standard in new or existing software systems before expanding to a larger group of agencies. When planning for software investments, agencies should consider building capacity to support a software product over the lifetime of the tool, rather than treating the development as a project with a one-time investment followed by minimal operations and maintenance costs.[20]

4. **Agency Systems Exchange and Share Data:** This involves agencies making the data in their systems available for NEPA applications across the Federal Government through a data "fabric" and testing the use of interoperable applications. Agency experiences in this step can inform iterative updates to the data standards and common architecture, and expansion of these tools to additional agency systems. These steps should be implemented through an incremental and iterative process to help demonstrate the value of interoperable systems to agencies and to provide valuable user feedback for future versions of the data standard and common architecture. An initial "version 1.0" of the NEPA data standard should be developed and implemented with a small set of agency partners whose systems are at the appropriate stage of development to deploy the data standard. The data standard and common architecture could then be updated as needed and implemented with additional agency systems.

This iterative approach would minimize disruptions while the capacity for sharing information expands across the NEPA ecosystem. There are dozens of agency systems that could be interconnected through the use of APIs, though initial use cases can be built around a few systems to allow for incremental development.

Once implemented, the NEPA taxonomy and data standard and common architecture would allow agency systems to communicate through APIs and to share information about projects and review processes through a data fabric. For example, a lead agency portal that receives project information submitted by an applicant could transfer that information to cooperating agency systems, information on public hearings or meetings and comment periods could be aggregated from multiple agencies and be displayed in a single portal, and project status could be automatically updated to systems for all agencies involved in a

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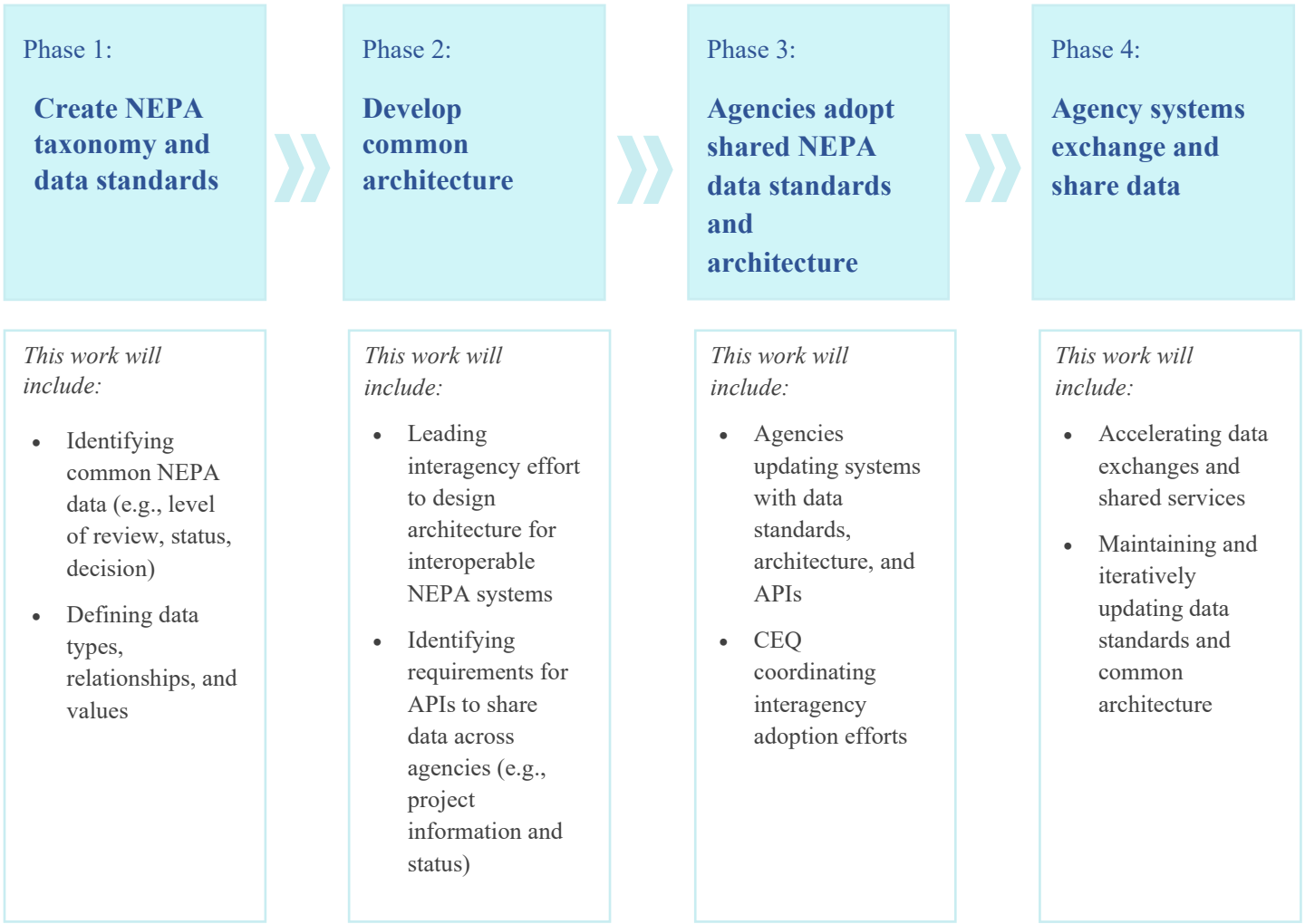
[19] An API is a software intermediary that allows two applications to talk to each other by providing a set of rules and instructions for how to exchange information. Modern software applications rely on APIs to exchange information at different levels of architecture, from microservices within an application to system-to-system communication.
[20] See *Project vs Product Funding*, Jennifer Pahlka (June 3, 2024), *https://www.eatingpolicy.com/p/project-vs-product-funding*.

project review. This system-to-system communication would increase the pace of innovation as information can be transferred and leveraged by many agency systems, reducing wait times between steps in the permitting process, avoiding duplicative data entry, and increasing consistency.

Figure 2: *Key steps to move from siloed data to data sharing*



2.3.2 Develop New Tools

CEQ found that agencies can benefit from support as they develop the tools necessary to support a unified portal. This support includes financial assistance, information exchange, guidance on system design, and technical assistance. CEQ has met with over 40 technology teams and other interested stakeholders from Federal and state government agencies, academia, nonprofit organizations, and the private sector to study existing technology, understand user needs, and subject matter expertise. Interagency collaborations, prize competitions, or other opportunities can support the development of new tools. Agencies will need sufficient expertise to continue building and maintaining the tools necessary to build a successful distributed framework of NEPA and permitting applications.

Agencies are already taking steps to facilitate the development of innovative technology to improve NEPA and permitting processes. For example, the U.S. Department of Agriculture's Rural Development

relied on in-house technology staff and a low-code development platform to create the Centralized Environmental Review Tracker (CERT) tool. The CERT tool is used to track environmental reviews across Rural Development programs, support regulatory compliance, streamline reporting requirements, and create a more standardized and efficient environmental review process. Additionally, the Department of Energy (DOE), in support of the new Coordinated Interagency Transmission Authorizations and Permits Program (CITAP), and a team of developers at the National Renewable Energy Laboratory, followed a user-centered agile approach to build and quickly deploy the CITAP applicant portal. The portal went live on May 31, 2024, concurrent with the effective date of the new CITAP regulations. The DOE and National Renewable Energy Laboratory team created an initial tool focused on the project proponent and lead agency user roles and permissions for interstate transmission applications that require environmental review and compliance, and are expanding the tool iteratively to include new features for other users, such as cooperating agencies. The DOE team plans to complete the expansion of features by the end of fiscal year 2024.

The Federal Permitting Improvement Steering Council (Permitting Council) has also made $30 million in funding available to agencies specifically for the development of software related to NEPA and permitting processes. The initial investment, announced in April 2024, provided 11 Federal agencies an average of $2.3 million each, with awards ranging from $300,000 to $6.5 million. (Section 4.2.3 provides a list of projects that have received Permitting Council funding.) Additionally, the Department of Transportation (DOT) has launched a $750,000 challenge grant competition, dubbed the Modernizing NEPA Challenge. DOT will award individual prizes of up to $50,000 for submittals that create an interactive web-based NEPA document to improve accessibility and public engagement or deploy a web-based collaboration platform that increases the efficiency of interagency review of draft NEPA documents. Examples of other tools that have been launched in the last year include the U.S. Army Corps of Engineers Regulatory Request System (discussed in section 3.2.1), DOE's CITAP Portal (discussed in section 3.2.1), DOE's PolicyAI tool (discussed in section 3.3.2), and the National Telecommunication and Information Administration's (NTIA) Permitting and Environmental Information Application (discussed in section 3.2.7).

To help support agencies as they develop new technology, update existing tools, and identify potential shared services, CEQ, the Office of Management and Budget (OMB), and the Permitting Council held an Environmental Permitting Technology and Data Summit last year (discussed in Section 2.4.2 of this report) and have established an interagency working group focused on NEPA and Permitting Technology. These forums strengthen communication between agencies, promote shared learning and information exchange, and build a community of practice around NEPA and permitting technology development.

2.3.3 Amplify Best Practices

Building on the work of standardizing NEPA and permitting data and incubating the development of new tools, CEQ and other agencies would share information about existing best practices across the Federal government to promote efficient and effective NEPA and permitting processes through the use of technology. As agencies continue to innovate and develop new tools, there is value in collecting this information and sharing it as a resource for examples of effective technology development practices, how tools can improve agencies public engagement, automate workflows, and increase collaboration. This would raise awareness of innovative approaches, share lessons learned, and help spread successful

strategies for digital transformation. As mentioned above and discussed further below, the development of a playbook or guidance document could also serve as a means to share information related to the NEPA taxonomy and data standard and how agencies can integrate them into new and existing agency tools.

Agencies can learn from each other about making existing NEPA and permitting best practices even more effective through the use of technology. One best practice that was featured at the Environmental Permitting Technology and Data Summit (discussed in section 2.4.2) is the U.S. Fish and Wildlife Service's (USFWS) integration of programmatic consultations under the Endangered Species Act (ESA) into its Information for Planning and Consultation (IPaC) tool. USFWS has developed determination keys, which are logically structured sets of questions designed to assist users in determining if a project qualifies for a pre-determined consultation outcome based on existing programmatic consultations or internal USFWS standing analyses. If a project requires a consultation for which USFWS has created a determination key, and the circumstances of the project allow it to satisfy the requirements of the determination key, then the IPaC system will generate a USFWS concurrence letter instantly. This process provides consistent and transparent outcomes and significantly reduces the time to complete consultation for qualifying projects.

Agencies could likely apply similar approaches to the USFWS determination key process in IPaC to other processes, including certain CEs under NEPA and certain programmatic approaches for other laws. Such a CE-related or programmatic approach would need to have discernible criteria that dictate the outcome of the review in order to build logic-based workflows around these existing processes. Many agencies already use checklists to ensure appropriate reviews for CEs. The criteria in these checklists, for instance, whether certain resources exist in a project area (e.g., wetlands or endangered species), and if the action may have adverse effects on those resources, could be converted into programming logic in the tool. Agency subject matter experts would assist with the development of such a tool to ensure that the correct result would occur under a variety of circumstances. Once developed, these tools could have automated workflows that can improve the agency review process by simplifying the user interface, autocompleting basic project information from other data sources, saving completed records to document management systems, transmitting documents for potential secondary review, and communicating to applicants. Such tools would be useful for actions that are likely to have few or no environmental effects, and help agency staff process these reviews more quickly, freeing them up for work on projects with greater potential for significant effects.

Managing and ensuring compliance with pre-application processes is another best practice that agencies could integrate into software tools by design. Pre-application processes are widely regarded as an efficient means of ensuring early project coordination among agencies and applicants while the proposal is still under development. This requires potential applicants to engage early with all agencies involved in NEPA and permitting processes, which an integrated applicant portal, collaboration platform, GIS screening tool, and case management software could facilitate. By designing tools with pre-application processes in mind, agencies can help guide applicants through the necessary information requirements, quickly identify missing information, and facilitate interagency coordination and early public engagement. For example, DOE has launched an applicant portal associated with its CITAP program. The CITAP program features a pre-application process modeled after the Federal Energy Regulatory Commission's (FERC) pre-filing process, both of which require applicants to file a number of resource reports. By designing an applicant portal specifically for this program, DOE is able to guide applicants through the requirements of the pre-application process. After the initial launch of the portal, DOE is planning to develop new

features, including the ability for the system to transfer applicant-submitted materials to cooperating agency platforms for their review.

2.4 CEQ's NEPA and Technology Study

Over the past 12 months CEQ conducted the study called for by section 110 of NEPA. This study builds on CEQ's ongoing focus on NEPA and technology. In particular, the Biden-Harris Permitting Action Plan prioritized the use of technology in agency NEPA and permitting processes, and CEQ has been leading that work in coordination with OMB and the Permitting Council. The following sections provide information about CEQ's activities that inform this report.

2.4.1 Discovery Sprint

Beginning in March 2023, CEQ, OMB, the Permitting Council, and the U.S. Digital Service (USDS) conducted a discovery sprint—a method to quickly build a common understanding of the status of a complex organization or system—to identify: 1) challenges in the NEPA and permitting processes that may have connections with technology; 2) benefits of solving these challenges; and 3) strategies that could be applied to bring about these solutions. As part of this sprint, CEQ held over 30 meetings with and received demonstrations from Federal and state agencies, international government agencies, academics, private sector software firms, and non-governmental organizations, to discuss existing tools and opportunities for improvement. Some systems stood out as potential models for other agencies to follow, such as the Environmental Protection Agency (EPA) Pesticide Program's use of a customer relationship management platform to serve as a case management solution (discussed in section 3.2.3) and the USFWS' IPaC tool, which automates aspects of the ESA section 7 consultation process (discussed in section 3.3.1).

In between meetings and tool demonstrations, CEQ, OMB, the Permitting Council, and USDS met regularly to discuss what we learned from these discussions and to further develop our understanding of the problems that technology can address in the environmental review and permitting process. To better understand the impact of solving these problems, we defined the value that improved technology solutions would provide to inform product planning and guide our next steps, such as increased efficiency through information sharing and automation and improved effectiveness through higher quality data and more consistent community engagement. Lastly, we identified potential solutions to the challenges that agencies have encountered and linked them to the benefits that new or improved technology would achieve, taking into account agencies' readiness to implement these solutions, the level of effort required for each, and the appropriate sequencing of multi-step solutions.

One outcome of this discovery sprint was a decision to convene environmental- and technology-focused agency staff, along with those outside of government, to share knowledge, cultivate a community of practice, and build momentum toward technological solutions. We launched this convening at the Environmental Permitting Technology and Data Summit, discussed in the section 2.4.2, and a new interagency working group on NEPA and permitting technology continues this convening.

2.4.2 Environmental Permitting Technology and Data Summit

On October 24, 2023, CEQ, OMB, and the Permitting Council held the first-ever Environmental Permitting Technology and Data Summit at the White House and the headquarters of the General Services Administration (GSA).[21] This event convened Federal and state agency staff, nonprofits, academia, and industry leaders from the environmental and technology sectors to discuss how software and other tools can deliver more effective and efficient environmental reviews, and inform CEQ's E-NEPA study. Summit participants discussed innovative, successful software deployment for NEPA and permitting processes within government agencies, the need for improved software to enable more effective and efficient environmental reviews, and potential next steps for the Biden-Harris Administration's effort to modernize the technology agencies use to conduct environmental reviews and other permitting processes.

As part of the summit, the Permitting Council announced it would make $25 million of Inflation Reduction Act funds available for agencies to modernize permitting-related software and technology and spur innovation to advance the Biden-Harris Administration's permitting strategy. This funding announcement reflects the Administration's commitment to ensuring that Federal environmental reviews and permitting processes are effective, efficient, and transparent, guided by the best available science to promote positive environmental and community outcomes, and shaped by early and meaningful public engagement and input.

During the summit, an opening plenary session laid out a vision for using technology and data to improve environmental reviews, and, in particular, highlighted two stories of the successful development of digital tools at the USFWS and EPA. Participants attended breakout sessions on cybersecurity, implementation of shared services across Federal agencies, funding and staffing of permitting software delivery initiatives, and technology's role in more effective and efficient environmental reviews.

During the summit, participants were able to see demonstrations and learn more about the development and use of the following tools:

- USFWS's IPaC[22]
- The Bureau of Land Management's (BLM) ePlanning[23]
- The Federal Railroad Administration and Federal Highway Administration's (FHWA) Permitting Dashboard API
- The National Renewable Energy Laboratory's Regulatory and Permitting Information Desktop (RAPID) Toolkit[24]

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[21] CEQ, Readout of the Environmental Permitting Technology and Data Summit (Oct. 27, 2023), https://www.whitehouse.gov/ceq/news-updates/2023/10/27/readout-of-the-environmental-permitting-technology-and-data-summit/.
[22] https://ipac.ecosphere.fws.gov/.
[23] https://eplanning.blm.gov/eplanning-ui/.
[24] https://openei.org/wiki/RAPID.

- Virginia Department of Environmental Quality's Permitting Enhancement and Evaluation Platform[25]
- Florida DOT's Efficient Transportation Decision Making (ETDM) Environmental Screening Tool[26]
- The Pipeline and Hazardous Materials Safety Administration's (PHMSA) Bipartisan Infrastructure Law Grant Environmental Assessment App
- The U.S. Forest Service's (USFS) Enterprise Land Management System
- The U.S. Army Corps of Engineers' Regulatory Request System[27] and Regulatory In-lieu fee and Bank Information Tracking System[28]
- Washington State's WISAARD:[29] Washington Information System for Architectural and Archeological Records Data
- The University of Arizona's NEPAccess[30] project
- The Climate and Economic Justice Screening Tool (CEJST), created by CEQ[31]
- Wildfires.org TurboPlan[32]

2.4.3 18F Path Analysis

CEQ engaged the GSA Technology Transformation Services' Office of 18F (18F) to provide its technical expertise in advising CEQ on its work to prepare the study required by section 110 of NEPA. 18F is a GSA team of designers, software engineers, strategists, and product managers who collaborate with other agencies to fix technical problems, build products, and improve public service through technology. Since 2014, GSA's 18F has worked with Federal, state, and local agencies to improve the user experience of government. 18F supports government agencies developing software using agile development methodologies through all phases of project lifecycles, including initial discovery and framing.

One of the 18F team's first steps on a given project is to conduct a "path analysis"—a short engagement to survey the landscape, identify the scope of the problem to be addressed, and align all parties on a path forward. Conducting this type of analysis requires 18F to "coordinate with a broad range of stakeholders and end users, conducting interviews, and synthesizing complex organizational and technical problems into a cohesive story."[33] 18F conducted a path analysis for CEQ to assess technology related to the NEPA process, which included an examination of the associated NEPA and permitting processes. The goal of

[25] https://portal.deq.virginia.gov/peep-search.
[26] https://etdmpub.fla-etat.org/est/.
[27] https://rrs.usace.army.mil/rrs.
[28] https://ribits.ops.usace.army.mil/ords/f?p=107:2.
[29] https://wisaard.dahp.wa.gov/.
[30] https://www.nepaccess.org/.
[31] https://screeningtool.geoplatform.gov/en/.
[32] https://wildfires.org/services/turboplan.
[33] 18F, Product Management at 18F, Part 1: New Engagements, https://18f.gsa.gov/2018/12/04/product-management-at-18f-part-1-new-engagements/.

the path analysis was to help identify the most impactful opportunities for digital intervention in order to increase efficiency and effectiveness of the NEPA process. The 18F team consisted of senior experts in the fields of user-experience research and design, Federal procurement and acquisition, software engineering, and project management. 18F's technical expertise helped CEQ better understand potential solutions for NEPA technology generally and the specific requirements of a unified online capability or service. This report integrates the findings and recommendations from 18F's analysis (see Appendix 4).

2.5 Developing a Unified Permitting Portal

This section provides a recommended approach to developing the unified permitting portal outlined in section 110 of NEPA, focusing on specific recommendations that would reduce the risk inherent in the development of large software systems and those that would provide a unified portal experience through the development of a distributed application framework.

As required by Congress, CEQ's study explored approaches that would achieve each of the following goals, outlined in section 110 of NEPA—though not necessarily through a single software application:

1. Allow applicants to:
    a. Submit required documents or materials for their projects in one unified portal;
    b. Upload and collaborate with the applicable agencies to edit documents in real-time, as required;
    c. Upload and display visual features such as video, animation, geographic information system displays, and three-dimensional renderings; and
    d. Track the progress of individual applications;
2. Include a cloud based, digital tool for more complex reviews that would enhance interagency coordination in consultation by:
    a. Centralizing, across all necessary agencies, the data, visuals, and documents, including but not limited to geographic information system displays, other visual renderings, and completed reports and analyses necessary for reviews;
    b. Streamlining communications between all necessary agencies and the applicant;
    c. Allowing for comments and responses by and to all necessary agencies in one unified portal;
    d. Generating analytical reports to aid in organizing and cataloguing public comments; and
    e. Being accessible on mobile devices;
3. Boost transparency in agency processes and present information suitable for a lay audience, including but not limited to:
    a. Scientific data and analysis; and
    b. Anticipated agency process and timeline; and

4. Include examples describing how at least five permits would be reviewed and processed through this portal.[34]

The 18F path analysis and further study and engagement with stakeholders revealed risks associated with an attempt to build such a unified portal from scratch in a single, centralized effort. This section discusses in detail these risks and opportunities to mitigate them. The risks associated with building a unified portal for all agency NEPA processes are similar to those faced by other large-scale software projects and include long development timelines, change management associated with moving a large number of users to a new system, procurement challenges, and governance of a system used by multiple agencies with different authorities. At the same time, CEQ's study explored options for avoiding these risks by taking an iterative, distributed approach to ultimately achieve a unified portal. A collective effort among agencies to build interoperable and distributed applications, along with shared services where appropriate, is a less risky way to build towards a unified portal. This way if technical or user challenges arise, application developers can address them more quickly and at lower cost and ultimately strengthen the foundation of a unified portal.

2.5.1 Building a Unified Portal Experience through a Distributed Framework

Based on the study described in this report, CEQ recommends the development of a distributed framework of interconnected applications to achieve the functions outlined in section 110 of NEPA. This approach would minimize many of the risks discussed later, allow for rapid, incremental development, and allow for diversification of system requirements to meet different agencies' respective needs. Below are some of the key strategies and themes associated with such a distributed framework.

Distributed Application Framework

Cross-agency tools and capabilities will help improve the efficiency and effectiveness of the NEPA and permitting processes. Agencies can implement them through shared services and data to achieve the benefits of a unified portal while avoiding the challenges and risks discussed in section 2.5.2 below. A distributed application framework is an "ecosystem" of applications that communicate and interact. The functions of the overall system are distributed in different applications that generally serve specific users and communicate through a data fabric that allows interoperability without requiring a central platform for data. The applications communicate and share data in a way that facilitates capabilities for the overall ecosystem beyond those of individual applications. For example, a permitting system might include an application that supports document preparation and collaboration and another application that supports GIS analysis. The GIS application may supply maps and interactive geospatial data for the document preparation application, and the collaboration function may enable users to request GIS analyses.

Modern software delivery methods, including agile decision making, user-centered design, and continuous iterative development and delivery provide the basis for sound software development practices. Employing those techniques to scale existing and build new agency tools and develop and implement data standards and interoperable data fabrics can deliver many of the features outlined in section 110 of NEPA.

[34] These examples are provided in Appendix 3.

Agile Development

CEQ recommends using agile development methods for agencies that are developing NEPA and permitting software systems. An agile framework for project management is based on an iterative approach that prioritizes flexibility, collaboration, and flow of communication between all project collaborators. Working successfully through an agile framework development process requires a product manager who oversees the team's work and is empowered to adapt the team's goals and priorities as necessary. Following best practices in the private sector and in successful government IT projects, CEQ recommends the use of agile governance structures to coordinate across agency teams, within agencies, and among other stakeholders in NEPA and permitting processes at all levels of government.

User Research

Understanding the needs of users is central to successful software development. There are many users of NEPA and permitting related software tools (see discussion in section 3.1). User experience research and design, as a discipline, has become fundamental to successful software development. Whether the software being developed is a small tool intended for internal use at a single agency or an external facing tool with a diverse user base, understanding and designing for the needs of the user is critical.

User research is essential to ensuring a software product meets the needs of and is adopted by the intended users. The complex nature of the permitting process and the development of an effective cross-agency permitting tool would require substantial user research to understand the needs, workflows, existing systems, and goals of agency and public users for such a tool.

Continuous Iterative Development and Deployment

Through discussions with experts, CEQ found that continuous iterative development and deployment is the optimal approach for developing software that meets the needs of users in the NEPA and permitting processes. This approach minimizes risk and leverages valuable user feedback to solve real problems in the short-term, while paving the way for more complex systems. Iterative development of a product entails releasing it in phases, or "iterations," which allows for shorter development and testing cycles that build and improve on each other. This "start small" approach requires initially building and releasing a "minimum viable product," which is a working application with the smallest feature set needed to be usable, then deploying analytics to receive user feedback and improving the product in subsequent development and testing cycles. Incremental development, while sometimes having major definitional overlap with iterative development, refers to breaking down a project into smaller pieces, or "increments," and working on them separately. This can mean adding new features or functionality in subsequent phases.

The work that 18F conducted with CEQ in assessing a unified permitting portal included recommendations to use iterative and incremental software development to reduce the likelihood of failure associated with large, feature-rich projects. The 18F report asserts that software features needed in the Federal NEPA and permitting space are notably expansive and varied, each requiring substantial expertise and time for development. The 18F report states that, ideally, the first tools created in the journey to a unified portal would be narrowly scoped, targeted to have a measurable impact, and assist with our understanding of next steps in the iterative development process (see Appendix 5).

Iterative and incremental models often go hand-in-hand with a continuous-improvement approach to software development. Ultimately, an iterative and incremental model allows for an agile and adaptive integration of an ever-changing landscape of user needs while releasing a working product as soon as possible. In-house technology expertise, which is becoming more common as agencies realize its value, can help agencies design systems, vet contractor-developed code, and assist with implementation of new tools through user validation testing. If the tool is serving a real user need (e.g., making the job of NEPA staff across agencies more effective or easier), the result will be increased user trust and should help ease user concerns about changing existing processes and adopting new tools.

Enable Interoperability through Data Fabric

Realizing the goal of efficient, effective NEPA processes requires end-to-end digitization and optimization of services and capabilities for stakeholders. In a distributed framework, this means handing off information between different applications and data stores to create a "fabric" of information that is accessible across systems but not necessarily stored in a central data structure or application. Critically, across such systems, data standards and protocols for sharing information are necessary to unlock the transformation of processes and outcomes.

CEQ recommends defining data standards for agency or other applications, including a data architecture for the NEPA process and metadata for structured and unstructured data. These data standards could include an overall set of terms, definitions, and relationships in processes—called a taxonomy—for the NEPA process. The standards could also include specific metadata requirements for unstructured data, such as documents, structured data, such as tables or GIS data, and outcome-based metrics, such as key performance indicators that can optimize the process and improve efficiency and effectiveness. These standards would allow agencies to achieve the goals identified in section 110 of NEPA without moving to a centralized application structure. Such data standards could include:

- Process and concept ontology and taxonomy;
- Data format standards (e.g., machine-readable information formats);
- Data repository requirements;
- Key performance indicators measuring efficiency and effectiveness of the process;
- Legal or regulatory frameworks;
- Metadata for documents and supporting information;
- Unstructured document data;
- Structured/GIS data; and
- Artificial Intelligence (AI) models or other embedded machine learning systems.

Cross-Platform Information Exchange

An API is a software intermediary that allows two applications to talk to each other by providing a set of rules and instructions for how to exchange information. Modern software applications rely on APIs to

exchange information at different levels of architecture, from microservices within an application to system-to-system communication. As tools are modernized or built, these APIs can facilitate a data fabric and interoperability capability that would be critical to a unified portal concept. In particular, as data is standardized across agency platforms, as discussed above, then APIs can move data between agency systems to implement a distributed application framework and enable process and outcome optimization.

Knowledge and Process Management

Playbook

CEQ recommends further policy and governance development by providing data architecture and best practices in a "playbook" for agencies seeking to modernize or optimize their NEPA or other environmental permitting processes. This could be an opportunity to capture the lessons learned from agencies that have more experience delivering NEPA and permitting technology as well as a vehicle for communicating data standards. The playbook could include evolving content as digital transformation improves applications and data availability, supporting cross-agency collaboration and knowledge management that leverages agile development practices.

Cross-agency Shared Services

CEQ recommends evaluating the potential for shared services to enable cross-agency collaboration and accelerate key elements of a distributed application framework and data fabric. The development of shared services for NEPA and permitting systems, similar to existing shared services such as Regulations.gov and Grants.gov, could be an efficient means of providing capabilities to individual stakeholders (i.e., the public, agencies, applicants) while achieving improved economies of scale, preventing duplicative siloed development, and improving the overall ecosystem. For example, not all agencies would be sufficiently incentivized to aggregate all relevant NEPA geospatial data layers and curate them for use in individual NEPA reviews, though if this were done it would be very useful to many agencies as well as applicants and the public. Similarly, no one agency is likely to collect a large sample of NEPA documents from across the government and analyze them to develop a tool for assessing cumulative effects, even though such a tool would be useful to many agencies.

2.5.2 De-Risking the Development of NEPA and Permitting Technology

CEQ's study identified certain factors that would create significant risk in a large-scale development project and identified a path forward that de-risks a single-application approach with incremental, distributed development. This section discusses the considerations and challenges that would need to be accounted for in the development of a unified portal.

Project Scope and Scale

A cross-agency permitting system would need to define the range of environmental reviews that the system is designed to handle. Federal agencies complete tens of thousands of environmental reviews under NEPA each year in support of actions taken under numerous statutory authorities, from awarding financial assistance, to issuing permits, to developing and implementing land use plans, and more. The services required from a permitting tool would vary depending on the Federal role in the project; a cross-

agency NEPA and permitting tool or capability would need to define an initial scope of services and plan to scale up from initial limited deployment to full deployment.

Section 110 of NEPA requires CEQ to study certain features that could apply to a broad range of environmental reviews, such as transparency and collaboration features, and other features that are specific to applicant-driven NEPA reviews, which represent only a subset of NEPA reviews. The approach to building a cross-agency NEPA tool or capability would vary depending on whether it would cover only applications for Federal authorizations, federally funded activities, or all types of Federal activities and decisions subject to NEPA. Additionally, there would need to be a decision as to whether agencies would use the tool for all levels of NEPA reviews, or limited either to high-volume, low-complexity actions (such as those reviewed under a CE) or to low-volume, high-complexity projects (such as those requiring an EIS). Individual software applications that start with simpler processes and documents, such as CEs, would introduce less complexity and therefore minimize risk, since simpler processes are easier to develop software for than complex ones.

The requirements of a unified portal would be more substantial if such a tool were to be designed to handle all types of projects, since agencies may already be using systems, such as grant management systems, to manage aspects of federally funded projects and failure to integrate these separate systems could reduce efficiency. This could be mitigated by limiting the initial scope of such a tool if the platform is only used for applicant-initiated actions. However, other Federal actions requiring NEPA would not benefit from the platform's features, and this may drive divergence in NEPA practice since not all agency NEPA actions would need to conform to the requirements of the platform.

Other considerations related to scope and scale of NEPA-related software include differences in needs between agencies. Some agencies may need improved tools and data systems to handle a large number of relatively low-impact actions, while other agencies may need tools and data systems to handle a smaller number of very complex NEPA reviews.

Ownership and Governance

Another potential challenge of developing a single cross-agency NEPA portal is determining which organization would own and manage a unified Federal permitting portal and how it would be governed. CEQ does not currently have the capacity or technical experts to develop such a large program itself, and would need to partner with a digital service or agency with far greater capacity if it were to develop such a program. While such partnerships benefit the overall effort by providing additional capacity and capabilities, they also require additional logistics to effectuate the partnership, such as interagency agreements and other funding agreements.

Since CEQ does not have the technology resources that larger departments and agencies typically have under a Chief Information Officer, some form of interagency agreement would be necessary to provide CEQ with the capacity to deliver a unified portal. In the past CEQ has partnered with other agencies such as DOE to host web platforms such as NEPA.gov,[35] since DOE has the infrastructure already developed. In partnership with USDS, CEQ developed the CEJST tool and, OMB, together with CEQ, developed the Environmental Justice Scorecard. Both are now supported in partnership with the U.S. Department of the

[35] https://nepa.gov/.

Interior (DOI) and hosted on the Federal Geospatial Platform (Geoplatform.gov),[36] a project of the member agencies of the Federal Geographic Data Committee supported by DOI's Foundation Cloud Hosting Services. Similarly, the Permitting Council partners with DOT to host the Federal Permitting Dashboard.[37] In addition to these interagency partnerships, GSA conducts support for agency needs at scale, providing a variety of shared services[38] in areas such as information technology, electronic records management, financial and grants, cybersecurity, human resources, and acquisitions.

Systems necessary to deliver a unified NEPA and permitting tool would require significantly more support than the partnerships that help deliver NEPA.gov, the CEJST, or the Permitting Dashboard given the breadth of features and large number of agency users of such a platform. Those partnerships support platforms with relatively simple user interfaces and only periodic updates to data, whereas the unified permitting portal described in section 110 of NEPA would have multiple complex user interfaces, large amounts of data exchanged in real-time, and high-availability uptime requirements.[39] As noted in the 18F report, a project team working on a single application or service can cost $2 to 3 million per year (see Appendix 5); many such teams would be required to build the functionality needed for an integrated NEPA and permitting system, as well as platform and other overhead costs.

The type of support that would be required for a potential future single cross-agency NEPA portal needs a host agency that could provide the main technology services. This host agency may not necessarily have the subject matter expertise to design individual applications and would need the support of a sponsor agency, such as CEQ, to guide development and implementation. The sponsor agency (e.g., CEQ) and the host agency would need to coordinate closely with the agency users and balance and manage the interests of those agencies. In order to balance the interests of all users, the sponsor agency would need to establish a governance structure to ensure diverse agency viewpoints are accounted for during design and development. The sponsor agency would likely need to establish a steering committee or similar body to manage the input from the agency users. The project's scope and scale would have direct bearing on the number of agencies that would need to be involved in a governance structure.

Adoption and Change Management

Once a cross-agency platform is built and functioning, agencies would need to adopt the new portal for use. Agencies already use a variety of systems to manage aspects of the NEPA and permitting processes, and these systems were developed with their agency programs and authorities in mind. Some of these incumbent systems meet existing agency needs, and agencies might anticipate reduced efficiency in transitioning away from them. An additional challenge for some agencies is that their systems are integrated into other non-NEPA agency data systems.

A mandate for agencies to use a unified permitting portal alone may not achieve the desired outcome since the new platform is unlikely to fully replace all of the agency's existing system functions. This could slow adoption or, worse, result in a "swivel-chair" exercise where agency staff work day-to-day in

[36] https://www.geoplatform.gov/.
[37] https://permits.performance.gov/.
[38] https://ussm.gsa.gov/.
[39] Uptime requirements define how often a system must be available for use by end users, as opposed to downtime when a system is unavailable to users. For instance, a system with a 99.5% uptime requirement could only be unavailable for 7.2 minute per day or 1.83 days per year.

their agency's systems and then periodically turn to the cross-agency platform to duplicate the work. Ensuring adoption of a system by users is best done by integrating the system by design into the daily workflow of the user.

Moving large numbers of agency staff to a new and unfamiliar system would require active change-management. The transition would need to occur gradually, with beta versions of the platform released to small test groups to ensure the functionality meets users' needs.

Design Strategy, Timeline, and Funding

Outlining required system functions at the outset of a project without the ability to maintain flexibility as user input is received is a hallmark of the "waterfall" project development strategy. While waterfall design allows teams to set expectations ahead of time and work to develop a product by moving sequentially through a series of steps, it has a downside. Waterfall methodology is not adaptable throughout the process as decisions made in each step are carried throughout the process rather than being reconsidered as new information comes to light. Changes to design flaws or feedback from the end user cannot be incorporated during the production process. Teams in each part of a project may not interact frequently or at all, and the development process is not responsive to changes. For these reasons, many software developers have moved away from waterfall design strategy in favor of more flexible and collaborative processes such as agile methods.

Developing a unified portal with all the features described in section 110 of NEPA would likely take several years, without necessarily accounting for the adoption and change management timelines. Additionally, such a project would need dedicated funding and in-house technology expertise to oversee development and ensure any third-party contract support is delivering value. Large and expensive projects are less likely to achieve their objectives, as noted in an 18F report, which found that "[o]f government software projects that cost more than $6 million, only 13% succeed," but "of those that cost less than $1 million, 57% succeed."[40] While this may seem counter-intuitive, the lesson is that a smaller project carries less risk because the increment of development is small, unlike a larger, more complicated project. A development strategy that aims to build lean tools for initial launch, with a path to adding features as user feedback is received, allows the development team to learn what is needed, develop a new approach, and recalibrate while working toward broader goals and capabilities.

Cybersecurity

The purpose of the Federal Risk and Authorization Management Program (FedRAMP) is to increase agencies' adoption of and use of secure commercial cloud computing products and services.[41] To achieve this, FedRAMP provides a standardized, reusable approach to security assessment and authorization for cloud computing products and services, and makes that security information easily available to agencies. Agencies use this process and information to issue an "authority to operate," which is required in order

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[40] GSA, 18F, and 10x , *De-risking Government Technology: Federal Agency Field Guide* (Sept. 2020), at 13, https://guides.18f.gov/assets/derisking/dist/federal-field-guide.pdf (citing Hans Mulder and Jim Johnson, *Haze: Dutch Hearing on IT Projects* (Jan. 2015), https://www.researchgate.net/publication/337340117_Haze_Dutch_hearing_on_IT_projects).

[41] Cloud computing products and services refer to a range of digital solutions that allow users to store, manage, and process data over the internet instead of on local servers or personal computers.

for the agency to use a system. This approval process is specific to each agency using a system and, in the case of a unified portal, would require each agency's Chief Information Officer to issue an authority to operate for the system. Some permitting agencies (e.g., the U.S. Army Corps of Engineers) have more stringent security requirements than other agencies given the sensitive nature of their organization's missions and operations. The security of government systems is a preeminent concern in the development of any new tool, especially when data is being shared outside of the agency. CEQ included representatives from the Department of Homeland Security's Cybersecurity and Infrastructure Security Agency (CISA) in a panel presentation during our Environmental Permitting Technology and Data Summit to share lessons learned from CISA's experience working with existing Federal agency systems and how those lessons may assist agencies developing NEPA and permitting tools in making their systems more resilient to threats. The development of any new tools for the NEPA and permitting processes should include coordination with CISA.

Paperwork Reduction Act, Records Management, and the Privacy Act

The Paperwork Reduction Act (PRA) regulates the collection of information by Federal agencies.[42] In general, an agency may not collect information from 10 or more persons, or direct a third party to do so on its behalf, without first obtaining clearance from the Office of Information and Regulatory Affairs. Clearance for new approvals requires two Federal Register notices with 60- and 30-day public comment periods, although tools and exemptions exist that can expedite this approval process. The PRA's requirements could apply, subject to existing exemptions, both to collections of information that support the development of a unified portal (such as research and testing to design the user experience) and to collections of information that form part of the portal's functions (such as interactive questionnaires or other digital tools to collect information on a proposed action from stakeholders and the public). Early coordination with PRA experts at the Office of Information and Regulatory Affairs and within other agencies can help reduce potential delays that may result from the need to comply with the PRA.

Agencies can accelerate PRA clearance by making use of exceptions to and flexibilities under the PRA. For example, the PRA Fast Track Process expedites the review of certain information collections whose purpose is to obtain customer feedback. The PRA also does not apply to general, open-ended solicitations of comments from the public (provided that no person is required to supply specific information pertaining to the commenter, other than that necessary for self-identification, as a condition of the agency's full consideration of the comment) or to collections of information from federal agencies or employees (provided the agency collecting the information will not use it for statistical compilations of general public interest). Likewise, agencies may have already obtained clearance for certain information collections that they use in the NEPA process. While these clearances would facilitate the development of agency-specific tools, they are unlikely to suffice for the development of a unified portal.

The Federal Records Act of 1950 (Records Act) directs the head of each Federal agency to establish and maintain an active, continuing program for the economical and efficient management of the records of the agency.[43] In particular, agency heads must make and preserve records that document the agency's

[42] 44 U.S.C. § 3501 *et seq.*
[43] 44 U.S.C. Chs. 21, 29, 31, and 33.

activities, and may only dispose of agency records in the manner that the Records Act and its implementing regulations direct.

The National Archives and Records Administration (NARA) issues government-wide General Records Schedules and approves additional records schedules specific to each agency. These documents specify how long an agency must retain a record, depending on its characteristics, and whether the agency must transfer the record to NARA after that time or may destroy it.

Before an agency could use a unified online portal to create or store Federal records, it would need to determine how to treat the records for purposes of the Records Act, including whether the agency has to preserve the records; if so, for how long; and how the agency must dispose of the records after that time. Depending on the circumstances, the agency's records schedules could require revision to account for the use of the portal. Furthermore, the agency would have to develop technical and administrative procedures to incorporate records that it creates or stores in the portal into its records management systems.

The Privacy Act of 1974 governs agencies' creation and use of "systems of records," which are groups of records in which the agency organizes information about individuals by name (or an equivalent identifying particular).[44] The Act limits the conditions under which an agency may disclose records from a system of records; entitles individuals about whom records are maintained in systems of records to access and request amendments to the records pertaining to them; and requires the agency to keep an accounting of disclosures of records, publish information about the system of records in the Federal Register, and comply with various other requirements.

If a unified online portal, or a part of such a portal, were to qualify as a system of records within the meaning of the Privacy Act, the agency controlling that system of records would become subject to these provisions of the Act with respect to the portal or the pertinent part.

Sensitive and Confidential Information

Environmental review under NEPA can involve information that is protected from disclosure under a variety of Federal laws that apply to all Federal agencies, including the Archaeological Resources Protection Act;[45] the National Historic Preservation Act;[46] and the Federal Cave Resources Protection Act.[47] In addition, some agencies are also subject to non-disclosure laws that are unique to those agencies, including laws related to sensitive resources of the National Park System,[48] and to certain Tribal cultural resources located on National Forest lands.[49] Agencies may also receive confidential business information from applicants, such as trade secrets or financial information, which is privileged and exempt from release under Exemption 4 of the Freedom of Information Act.[50] Finally, agencies also handle a variety of natural and cultural resources information that is sensitive and confidential, but is not specifically protected from public disclosure by any Federal law. Agencies have different policies and strategies for

[44] 5 U.S.C. § 552a.
[45] 16 U.S.C. § 470hh.
[46] 54 U.S.C. § 307103.
[47] 16 U.S.C. § 4304.
[48] 54 U.S.C. § 100707.
[49] 25 U.S.C. § 3056.
[50] 5 U.S.C. § 552(b)(4).

handling sensitive and confidential information, tailored to their missions and the types of projects they typically review. A unified portal would need to include features and policies that reflect these government-wide confidentiality provisions, while also accommodating agency-specific confidentiality provisions.

3 Understanding the Current NEPA Technology Landscape

CEQ met with dozens of agency teams to learn about the existing technology systems used to support NEPA and permitting processes. This section details the primary users of these systems and their roles in the NEPA and permitting process, as well as the various system types, their uses, examples of existing tools, and how these systems can be integrated into a distributed application framework.

3.1 Users of NEPA and Permitting Technology

Through our study of NEPA and permitting technology, CEQ has identified the following primary users of such technology. Understanding the needs of users is critical to building effective software. This brief summary is not a substitute for the robust user research needed when designing specific applications, but provides a general overview of how different users interact with the tools discussed in this report. Federal agencies should also ensure functionality of websites, software, and other resources and tools is accessible to and usable by all individuals, including individuals with disabilities.[51]

User	Role
Federal agency staff	Federal agency staff are responsible for conducting NEPA reviews, reviewing and rendering recommendations or decisions on permit applications, consulting with federally recognized Tribes, and soliciting and responding to public comments, among other duties. This can include managing the NEPA process, collaborating with other agencies on the development of a NEPA document and associated consultations, and engaging with Tribal, state, and local governments and agencies, any project applicant, other stakeholders, and the public. Federal agencies may serve as lead, joint lead, cooperating, and participating agencies in the NEPA process and accordingly will have varying degrees of involvement in a proposed action. Software such as case management, collaboration platforms, document management, comment assessment, automation, GIS applications, and other tools could be useful for Federal agency NEPA staff.
Federal agency leadership	Federal agency leadership provide oversight of NEPA and permitting processes, sign final environmental documents, develop policy, and are responsible for reporting on agency project status to a variety of stakeholders. Agency leadership would benefit from case management and project tracking tools.
Applicants and project proponents	Applicants and project proponents may be prospective recipients of Federal financial assistance or Federal permits or authorizations. Applicants and project proponents would benefit from applicant portals, GIS applications, collaboration platforms, and tracking systems. Applicants and project proponents may also hire contractors to assist with the preparation of NEPA and permitting related documents and would benefit from improved tools in much the same way.

[51] Section 508 of the Rehabilitation Act of 1973, 29 U.S.C. § 794d, requires Federal agencies to make information available in a manner that is accessible to those with disabilities.

Members of the public	Members of the public interact with the NEPA and permitting processes at various stages, typically during scoping, public meetings, and comment periods. The public would benefit from GIS applications, public engagement tools, project tracking systems, comment collection systems, and publication systems.
State and local agency staff	State and local agency staff conduct jurisdictional permitting and authorizations, serve as project applicants, and may serve as joint lead, participating, or cooperating agencies in the NEPA process. State agencies would benefit from case management, collaboration platforms, comment collection, automation, GIS applications, and other tools.
Federally recognized Tribes and Native Hawaiian Organizations	Federal agencies engage with federally recognized Tribes and Native Hawaiian Organizations regarding potential impacts to environmental and cultural resources, as part of both the NEPA and National Historic Preservation Act (Section 106) processes.[52] Additionally, in some cases, agencies must engage in government-to-government consultation with federally recognized Tribes. Some Tribes and Native Hawaiian Organizations may choose to use GIS applications, public engagement tools, project tracking systems, comment collection systems, and publication systems as part of their participation in the NEPA and Section 106 processes, if given the opportunity to do so. Tribal agencies may also serve as joint lead, cooperating, or participating agencies in the NEPA process.
Agency-directed contractors	Contractors supervised by Federal agency staff (i.e., those that are hired directly by agencies or through a third-party contracting arrangement where the applicant funds but the agency directs the contractor) assist with the NEPA process by supporting the agency in drafting NEPA analyses, reviewing comments, and other functions. Contractors would benefit from software such as case management tools, collaboration platforms, document management systems, comment assessment, automation, GIS applications, and other tools.

3.2 Existing Systems, Use Cases, and Emerging Trends

Many of the features identified for CEQ's study in section 110 of NEPA are already in use in parts of the Federal Government, state agencies, or the private sector. This section identifies existing software that perform functions identified in section 110 of NEPA and evaluates how to expand and improve the existing software to achieve a more unified cross-agency capability. We have categorized the core functions of relevant tools and software into nine categories:

- Applicant Portals,
- Project Tracking Systems,
- Case Management Tools,
- Comment Collection and Analysis Systems,

[52] *See* 54 U.S.C. § 302706(b) (requiring Federal agencies to consult with Tribes and Native Hawaiian Organizations in the Section 106 process).

- Public Engagement Tools,
- Collaboration Platforms,
- GIS Applications,
- Document Management, and
- Filing, Publication, and Submittal Systems.

While we have characterized the core functions and features of the existing systems into distinct categories, some tools may have multiple functions and therefore could fit under multiple categories. While this is not an exhaustive review of existing systems, it provides a representative overview of the types of tools in use.

3.2.1 Applicant Portals

Applicant portals are web-based tools for applicants (which includes project sponsors) to submit their required documents electronically. These portals—essentially interactive application forms—standardize agency information collection. In the portals, applicants upload required documents or materials and may collaborate with agencies to edit documents in real-time. Portals aid in improved review timelines and transparency.

Examples of Existing Applicant Portals

There are several existing applicant portals that Federal agencies are using, including these examples:

- **The U.S. Army Corps of Engineers' Regulatory Request System (RRS)**[53] is an online application portal that allows the public to submit permit applications and other information when requesting permission to dredge, fill, or conduct activities in jurisdictional wetlands and waters of the United States under the Clean Water Act. RRS users can submit individual permit applications, general permit pre-construction notifications, jurisdictional determination requests, and other information needed during the permit evaluation process using easy-to-follow online submission forms. Applicants will also be able to track the status of their requests using a user-friendly dashboard. RRS will benefit the applicant by eliminating the burden associated with preparing and mailing paper applications. It also reduces some of the effort associated with processing applications and data entry making the permitting process more efficient. The U.S. Army Corps of Engineers initiated a beta version of RRS in January 2024 and is working to expand RRS capabilities to accept joint permit applications as part of a second phase of the system's implementation, scheduled for December 2024.
- **PHMSA's Application Portal for Natural Gas Distribution Line Replacement** is an applicant-facing portal to collect documentation for NEPA reviews associated with grant-funded projects to replace leaking natural gas distribution lines. The system was designed around a PHMSA-prepared programmatic EA that analyzed "generic" natural gas distribution line replacement projects. Grant recipients provide additional site-specific information through the applicant portal. This information allows PHMSA staff to review a specific project, assess

[53] https://rrs.usace.army.mil/rrs.

whether it is covered by the programmatic EA, and conclude the NEPA process or identify where additional analysis is necessary.

- **DOE's CITAP Portal**[54] is a web-based portal that launched in the spring of 2024 to provide a streamlined Federal environmental review and permitting processes for qualifying transmission projects. This portal is used to share information that will inform Federal permitting agencies' authorization decisions and the final environmental review prepared by DOE.

An example of an applicant portal that is being used outside the United States is:

- **WindEurope's EasyPermits**[55] is a digital permitting solution developed collaboratively by Wind Europe, Amazon Web Services, and Accenture for use by European Union member states to have a standardized application submission process for wind energy infrastructure projects. The Wind Europe application was developed with applicant, agency staff, and public user profiles.

Integrating Applicant Portals into a Distributed Application Framework

Applicant portals play a vital role in a distributed application framework as they would serve as the primary means of collecting information from applicants. Agencies should design these tools to allow the transfer of information between agencies or to allow cooperating agencies to log into and access the information in the lead agency's system. When agencies are looking at developing applicant portals as part of the NEPA and permitting process, agencies should consider:

- **Increasing the use of applicant portals** across agencies, including shared or joint portals. Some agencies do not have applicant portals and instead rely on paper or fillable forms received via email. This requires data entry and other time-consuming work. Digital portals can improve data quality and consistency, and can unify the experience for applicants.

- **Educating applicants** through the design of the portal on what constitutes a complete application. Agencies should view applicant portals as an informal pre-application process and be intentional in the design of the portal to ensure applicants are providing all necessary information. For example, if an agency requires location information to process an application, they can integrate a GIS component to their portal so that applicants can either upload a geographic representation of the project or draw a polygon to identify their project location.

- **Leveraging submitted data** through back-end workflows. In addition to the applicant-facing portal, agency staff responsible for reviewing submitted information and completing NEPA reviews should have a platform in which they can review the submitted material, save comments, upload internal agency files, and submit reviewed materials for approval by their supervisors. These environments maximize the value of the consistent data that is automatically available to agency reviewers in the system.

[54] https://www.citap.gov/.
[55] https://windeurope.org/easypermits/.

- **Sharing data between agencies** since most large infrastructure projects require multiple agency reviews or authorizations. Allowing cooperating agencies to easily access information submitted by the applicant will save time and reduce duplicative requests for information.

3.2.2 Project Tracking Systems

The project-tracking tools currently in use by the Federal Government can play a critical role in facilitating the NEPA and permitting processes within and across agencies, as well as provide transparency to applicants, stakeholders, and the general public on project timetables. While some project tracking tools are publicly available, others serve as internal agency management systems and may contain sensitive data. Many of these latter tools reduce costs and save time at agencies performing otherwise time intensive project reviews, which require collection and analyses of large amounts of quantitative and qualitative project data to turn into a comprehensive document. Some of these tools centralize and standardize data for NEPA practitioners and some manage and automate certain workflows. Publicly available tools—like the Permitting Dashboard—tend to primarily serve for transparency and accountability purposes.

Examples of Existing Project Tracking Tools

There are many existing internal project tracking tools that are being used by Federal agencies, including these examples:

- **USFS's Planning, Administrative Review, and Litigation System (PALS)** is a web-based application, which is part of the USFS suite of NEPA-related tools known as the Electronic Management of NEPA (eMNEPA), that tracks the progress and documentation for all USFS NEPA actions, including: scoping, environmental analysis, decision documentation and documents associated with land management planning, administrative review, and litigation. PALS automates several report types, saving the USFS substantial resources by eliminating the previous manual process of preparing, publishing, mailing, and filing NEPA documents and by electronically responding to field data calls using PALS. Certain PALS information is made publicly available through the USFS Schedule of Proposed Actions[56], which allows users to filter by state and forest.

- **FHWA's Project and Program Action Information System[57] (PAPAI)** is an internal monitoring system that tracks progress on NEPA and related authorization actions between major milestones, and helps accurately determine the total processing time from initiation of an EIS or EA to the approval of the final ROD or FONSI. This information is used to update the Permitting Dashboard and for regular reports to agency leadership.

- **BLM's ePlanning**[58] is an application for creating, managing, sharing, and reviewing documents created in compliance with the Federal Land Policy and Management Act and NEPA. The public-

[56] https://www.fs.usda.gov/sopa/index.php.
[57] https://datahub.transportation.gov/Roadways-and-Bridges/Project-And-Program-Action-Information-System-PAPA/63pf-8mej/about_data.
[58] https://eplanning.blm.gov/eplanning-ui/home.

facing aspect of the application allows stakeholders to navigate BLM environmental reviews open for public comment as well as historic environmental review documentation through the "Find a Project" search bar and other navigable user interfaces on the webpage.

- **NPS's Planning, Environment and Public Comment (PEPC)**[59] system is a web-based application designed to track the progress of projects and document compliance with NEPA, the National Historic Preservation Act, and other laws; promote informed decision making by facilitating team collaboration; provide a platform for documents to be shared with the public for review and comment; and provide an internal tool for public comment analysis.

- **EPA's NEPAssist**[60] is a web-based application that draws environmental data dynamically from EPA's GIS databases and web services to provide screening of environmental assessment indicators for an area of interest defined by the user. NEPAssist employs a standardized, data-driven approach using consistent Federal, state, and local datasets.

Government-wide or interagency tracking tools are less commonplace than intra-agency tools. An example of an interagency tracking tool is the Permitting Dashboard,[61] which is an online tool that provides for management and oversight of permitting actions and reviews and enables Federal agencies, project proponents, and interested members of the public to track and coordinate the Federal Government's environmental review and authorization processes for large or complex infrastructure projects designated as covered projects under Title 41 of the Fixing America's Surface Transportation Act (FAST-41) and certain projects subject to Titles I, IX, and XI of the FAST Act (DOT projects).

Integrating Project Tracking Tools into a Distributed Application Framework

The current project tracking environment consists of a diverse ecosystem of bespoke systems with little interoperability. In many cases, agencies have not uniformly adopted project tracking tools and do not share tracking data or capabilities across agencies. The tools may not have been developed with user-focused design or achieved the level of interoperability and scale needed to reduce delays and improve the effectiveness in the collective NEPA and permitting processes, even though they may provide efficiencies for individual agencies. To move toward a distributed application framework, improvements to project tracking systems can center on the needs of Federal agency staff, applicants, state, Tribal, and local governments, or public users, and—for tools used by Federal agency staff—can be integrated into the daily workflow of the user. Many existing tracking systems require additional duplicative data-entry, referred to a "swivel-chair" process since the users conduct day-to-day work in one set of systems and periodically turn to the tracking system solely to input data. Data standards, improved metadata, and data interchange requirements to support a broader data fabric could also improve project tracking. Project tracking tools can also benefit from process- and outcome-oriented key performance indicators to optimize the experience of stakeholders and the impact of the overall process.

[59] https://parkplanning.nps.gov; https://pepc.nps.gov.
[60] https://www.epa.gov/nepa/nepassist.
[61] https://www.permits.performance.gov/.

3.2.3 Case Management Tools

Case management tools are used to structure the work performed by a particular agency or office and to track progress. In the NEPA and permitting context, agencies build these tools around the business rules or workflow for an agency's processing of a permit or environmental review. For example, a case management tool would allow a worker to conduct an intake review when it receives an application, assess whether the application meets the requirements, and enter it into the queue for review by others within the office. There may be multiple review cycles within a given office—for example, technical or legal reviews—consistent with the office's business rules. A benefit of a case management tool is the ability to assign reviewers to each stage in the process, manage application queues, collaborate across teams, build an administrative record, and use analytics to determine where the agency may need additional resources. Case management tools also provide staff with a common, centrally managed environment in which to conduct their work.

In most cases, the business rules that a case management tool follows already exist in the form of standard operating procedures or norms within an office. In order to deploy case management software that reflects these existing rules, agencies must document them through a service blueprint or similar documentation, which serves as a roadmap for the development team to program the software system. Case management tools are useful for offices with consistent processes, standardized work, and moderate to high volumes of applications. Implementing case management tools can help provide structure to permitting environments and streamline workflows dealing with multiple data inputs and various staff roles.

The function of case management tools can be solely or primarily internal to an agency. Some case management tools may serve additional functions such as interagency collaboration or applicant portals.

Examples of Existing Case Management Tools

There are several existing case management tools that are being used, or are under development, by Federal and State agencies, including these examples:

- **EPA's Pesticides Program Office** uses a case management tool to manage the lifecycle of the review process for pesticide registrations. While this regulatory process is not subject to NEPA, there are parallels between the two that make this a notable example. The EPA Pesticides Program Office's case management system handles an application from intake through processing to the decision, unifying the workflow for internal stakeholders, and facilitating compliance with statutory timelines. The system provides agency staff with a unified view into their work and office leadership have automated tracking and analytics, which they can use to inform staffing and other decisions.
- **USFS's Enterprise Land Management System** will replace and enhance the existing capabilities in the USFS suite of NEPA-related tools known as eMNEPA, which provides tracking, reporting, publication, and comment processing capabilities. The Enterprise Land Management System supports field staff through the standardization and automation of workflows for land management planning processes, NEPA review, monitoring, and adaptative management tracking. The system leverages geospatial capabilities to support improved environmental analysis and data validation.

- **Florida DOT's ETDM Environmental Screening Tool**[62] has been in use for over 20 years and provides stakeholders the opportunity for early input, involvement, and coordination. It also provides for early identification of potential project effects and informs the development of project scope prior to advancing to the project development and environment phase. The tool can create GIS reports, has both internal and external facing modules, and makes reports available on a public website.

- **Virginia Department of Environmental Quality's Permitting Enhancement and Evaluation Platform**[63] is a platform to bring transparency to the Department's permitting processes by providing current information about the critical steps and permitting schedules needed for permit approval. This platform provides users the ability to track and manage permitting and approval processes. The users include applicants, agents, the public, and agency staff.

Some examples of existing case management tools that are being used outside the United States are:

- **cBrain**[64] **F2 Digital Platform** is a platform that the Danish EPA used to digitize the permitting processes for their agency. The F2 platform has also been implemented for other government agencies outside of Denmark. This integrated software is designed for government processes and offers case management, process management, and knowledge management capabilities. F2 also includes a process builder tool that allows agency staff to create digital workflows for permitting processes without the need for software developers.

- **BeInformed**[65] is a Dutch software company that offers case management functions as well as features to model regulatory processes. Customers have used BeInformed for certain permitting processes and includes work management and context-driven processes as well as development of user-friendly tools.

There are also case management development platforms that are used in both the private sector and the Federal Government. Some of these include:

- **Salesforce** is a customer relationship software that includes case management modules. Agencies have used Salesforce as a case management tool for permitting and grant management processes.

- **Microsoft Power Platform** includes Power Apps, an application builder that agencies have used to develop case management tools and applicant portals.

- **Service Now** is an application development system that agencies have used to develop case management tools.

Integrating Case Management Tools into a Distributed Application Framework

Case management tools, especially when paired with process and knowledge management, can create a digital environment for agency staff to process applications and NEPA documents. More and more

[62] https://etdmpub.fla-etat.org/est/.
[63] https://portal.deq.virginia.gov/peep-search.
[64] https://cbrain.com/.
[65] https://www.beinformed.com/permitting-solutions/.

agencies are looking to develop some form of case management, and there is significant value in providing staff with one tool to manage the lifecycle of an action through the NEPA and permitting processes. A single software environment that contains all necessary information on a project is preferable to having agency staff managing project status in spreadsheets, saving files to various locations, and communicating with colleagues via email. Modern case management tools can be designed around the entire business process of an office so that staff do not need to move from system to system and instead can have all needed components of their work tightly integrated into a single workflow. Case management tools also create a data-rich record of administrative data on the efficiency and effectiveness of the processes the tools manage. These tools can be enriched with key performance indicators to simplify reporting on process efficiency and evaluate bottlenecks in performance or poor outcomes. Especially when paired with data analysis, case management tools can provide feedback for agencies to assess the performance of their processes and systems.

3.2.4 Comment Collection and Analysis Systems

The comment collection and comment analysis tools that the Federal Government uses play a critical role in facilitating and improving the environmental review and permitting process. Agencies use these tools to increase stakeholder engagement, improve data accuracy, increase public participation, facilitate faster and more informed decision making, and provide transparency to the public, among other things. Comment collection tools can enable one user to provide their comment, input, or information about a subject at hand, and allow another user to receive valuable information. Comment analysis can provide a suite of services such as management of comments, interactive mapping, sorting and tracking, and analyzing and responding to comments.

Having a public comment system can help agencies organize comments more rapidly and ensure that they address all substantive comments. By automating the process of sorting and organizing large volumes of comments, more agency staff time is available to review and address substantive concerns raised in comments. A public comment system can:

- Sort, track, summarize, and analyze comments, making it much more efficient to respond to the comments;
- Identify and categorize form letters separately from other comments; and
- Automate and help resolve comment response editing and approval from multiple reviewers, like policy leaders, legal counsel, and subject matter experts.

Examples of Existing Comment Collection and Comment Analysis Tools

There are several existing comment collection and comment analysis tools that are being used by Federal agencies, including these examples:

- **Regulations.gov**[66] is a comment collection system that allows members of the public to participate in the rulemaking processes of Federal Government agencies. The system allows the public to view comment opportunities, search for regulatory materials, and submit comments on

[66] https://www.regulations.gov/.

Federal Register notices, including proposed rules. In addition, users can create a custom download of document metadata from the site by agency, docket, or document. Regulations.gov has a companion comment analysis tool for Federal agencies that is part of the Federal Docket Management System and performs functions such as de-duplication of comments.

- **BLM's ePlanning**[67] allows online review and comment of BLM planning and implementation projects. A user can submit comments and upload files while a public participation or comment period is open. This tool has a commenting portal and some project tracking functions. BLM developed the ePlanning system over 15 years ago and is in the process of updating the platform technology to allow for future upgrades that will add new features and improve security. The future improvements will improve the public side of ePlanning, such as increased use of geospatial maps, and the back-end, including more case management functions and public comment analysis.

- **NPS's PEPC**[68] system allows members of the public to view and download project information including NEPA documents, public meeting announcements, and associated project links. The public can also enter comments on documents open for public comment using a web-based form. The internal site[69] provides system users a variety of tools to assist with public comment analysis, including the identification of form letters, categorization of comments, and preparation of reports that support responding to substantive comments.

- **FERC's eLibrary**[70] is a record information system for FERC's electronic documents. It allows a variety of users, including FERC license applicants, intervenors in FERC proceedings, and the public to access docket records, including NEPA documents, and to file comments on Commission proceedings via the eFile portal.

- **USFS's Comment Analysis and Response Application** is a web-based tool for comment analysis launched in 2012 and is part of the eMNEPA suite of tools. The system features a public comment form, a public reading room, and an internal portal to allow the USFS to centralize digital and hardcopy comments, deduplicate letters, parse and code comments, group comments for a single response, draft responses, and report on comment metrics. These capabilities will be replaced and enhanced in the Enterprise Land Management System.

There are additional private sector tools for processing comments that are frequently used when contractors support Federal agency NEPA processes. These systems include WSP's Comment Sense, ICF's Comment Works, and Environmental Science Associate's Comment Tracker and Smart Comment. These tools' specific feature sets vary, but generally allow for collection, tracking, tagging, sorting, filtering, and reporting on comments.

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[67] https://eplanning.blm.gov/eplanning-ui/home.
[68] https://parkplanning.nps.gov.
[69] https://pepc.nps.gov.
[70] https://elibrary.ferc.gov/eLibrary/search.

Integrating Comment Collection and Comment Analysis Tools into a Distributed Application Framework

Comment collection and comment analysis tools provide considerable benefit to reduce agency workload. For agencies that prepare a large volume of NEPA documents, they may see value in developing their own tools to handle comment processing so that they can build specialized features unique to their agencies, but agency-specific tools could also exchange common data with other systems. Agencies that perform fewer NEPA analyses may be better served by tools like Regulations.gov or third-party comment processing. Nevertheless, there could be a role for a government-wide NEPA comment processing tool that allows public comment submittal from multiple platforms, including mobile, commenter generated metadata, AI-powered sorting and tagging, back-end analysis and reporting of comment themes and topics, and improved public access in languages other than English and for people with disabilities.

3.2.5 Public Engagement Tools

Public and stakeholder engagement is a required and critical part of NEPA and permitting processes and facilitates more efficient and effective reviews when initiated early and done meaningfully. Web-based engagement tools that the Federal Government is using play a critical role in facilitating and improving the permitting process. These typically take the form of either (1) tools that agencies use to better communicate with public stakeholders, Tribes, other agencies, or (2) tools that agencies use to identify where and how to conduct effective public engagement. Ultimately, it is on-the-ground dialogue between Federal agencies and affected communities that defines effective engagement. Though engagement is largely a human effort, technology has an important role in mapping, developing, and facilitating it. For example, during the COVID-19 pandemic, public health restrictions and guidelines on social distancing led to a reduction of in-person gatherings, which in turn increased agency use of virtual public involvement. A variety of tools and platforms exist to conduct webinars and social media engagement.

Examples of Existing Public Engagement Tools

There are several existing public engagement tools that are being used by Federal agencies to identify communities and improve outreach, including these examples:

- **FHWA's Virtual Public Involvement Toolkit**[71] is a helpful resource with examples of effective virtual public involvement approaches. Virtual public involvement is a strategy to augment traditional in-person community and public engagement during NEPA and permitting processes. Virtual public involvement includes online meetings or webinars with video and telephonic participation options, social media campaigns, and other online outreach.
- Agencies may use the **CEJST** and **EJScreen** tools discussed in section 3.2.7 to formulate public engagement strategies based on potentially affected communities or populations.
- **The U.S. Department of Housing and Urban Development's (HUD) Tribal Directory Assessment Tool**[72] assists users in identifying the federally recognized Tribes for consultation in the National Historic Preservation Act Section 106 process. The database is the only publicly

[71] https://www.transportation.gov/grants/dot-navigator/virtual-public-involvement-toolkit-vpi.
[72] https://egis.hud.gov/TDAT/.

available Federal database that provides information on counties where Tribes have current and ancestral interest. The system provides Tribal contact information for initiating National Historic Preservation Act Section 106 reviews.

Additionally, some project applicants also use public engagement tools, through either informational project websites or web-based NEPA documents, including these examples:

- **AECOM's Plan.Engage**[73] tool provides an interactive, GIS-integrated website for EIS and EA documents to improve stakeholder engagement.
- WSP's digital environmental impact assessment tool used for the Looe Harbour Flood Defence Scheme for Regeneration[74] project includes a portal for stakeholders to provide feedback on the project directly to the project developer ahead of their environmental impact assessment document preparation.

Web-based NEPA documents for individual project proposals are designed to help users gain an understanding of what the environmental review will cover through a navigable user interface with engaging and interactive texts, visuals, and integrated geospatial information. These web-based environmental review documents improve accessibility compared to standard publication formats such as PDF documents. The web-based NEPA documents are easier to interact with on smartphones, making the document accessible to more people. These tools can also enable users to dig in deeper to a document without having to navigate to a separate appendix and submit comments on a specific area within the document. This commenting function on web-based NEPA documents can make agencies' jobs easier too, since the system can tell the agency where in the document the user was when they made their comment. This can save the agency time sorting comments into categories.

Integrating Public Engagement Tools into a Distributed Application Framework

Public engagement is an important part of the NEPA process, particularly with respect to providing opportunities for meaningful public engagement of people and communities with environmental justice concerns. Technology can assist with agency public engagement and help fulfill the requirements of Executive Order 14096, *Revitalizing Our Nation's Commitment to Environmental Justice for All*, such as providing timely opportunities for members of the public to share information or concerns and participate in decision-making processes.[75] Public engagement tools can also benefit from focused development implementing principles found in Executive Order 14058, *Transforming Federal Customer Experience and Service Delivery to Rebuild Trust in Government*.[76] Such tools can keep pace with rapidly evolving communication channels and methods of outreach. Large language models (LLMs) and generative AI may also aid these tools in generating content and collecting responses, especially including outreach and engagement across language and disability barriers (see section 3.3.2 for more discussion on potential applications of AI). One additional area to consider for improving the interconnectedness of public engagement tools is Notify.gov, a service that allows Federal, state, and local governments administering federally funded programs to send text messages to individuals. At a minimum, Notify.gov likely has

[73] https://www.planengage.com/.
[74] https://pinpointgis.wsp.com/portal/apps/experiencebuilder/experience/?id=545225ee0a8b4cc6bc64e6e29e96aa46.
[75] 88 Fed. Reg. 25251 (Apr. 26, 2023).
[76] 86 Fed. Reg. 71357 (Dec. 16, 2021).

lessons learned regarding public outreach that could be valuable to learn from, and it is possible that the Notify.gov service could have applicability for public engagement in the NEPA process.

3.2.6 Collaboration Platforms

Agencies use collaboration platforms in the NEPA and permitting processes to allow two or more individuals, typically from Federal or other government agencies, to jointly edit documents, view and comment on files, and otherwise manage work associated with the review process. These tools, for example, can allow for concurrent review of NEPA documents, rather than sequential reviews. An additional value of a collaboration platform can be to allow staff within an agency or cross-agency (cooperating agencies) to view other staff or agency comments in real time, rather than waiting for a transfer of the information. In addition to review and commenting, other types of information that NEPA practitioners may want to collaborate on include geospatial data and interactive maps of project areas.

Many agencies already use collaboration tools, but there is an opportunity to improve the systems or expand their user base. For example, agencies may want to leverage web-based applications to centralize, share, and review documents. To maximize the benefits of these tools, agencies should prioritize the implementation of the same or complimentary platforms. If incorporated into agency workstreams, these tools can improve real-time collaboration between agencies, stakeholders, and contractors.

Many agencies use commercial off-the-shelf software to collaborate on documents, which include common productivity platforms as well as more specialized products. One issue that impedes collaboration is that many of the tools used by most agencies work well for collaborating *within* an agency, but present significant barriers in practice when attempting to collaborate with others *outside* of the agency. In order to allow cross-agency or applicant collaboration on agency systems, the agency often needs to have its Chief Information Officer's office credential outside users, which may be administratively burdensome or prohibited by cybersecurity policies.

Examples of Existing Collaboration Tools

There are some common collaboration tools being used by Federal agencies, including these examples:

- **SharePoint** is used on-premises or in the cloud as a collaborative platform that integrates with messaging functionality. Agency users can collaborate on reviewing documents and have shared access to document storage.
- **Google Docs** is a cloud-based platform used to create, collaborate, and store online documents in real time, and integrates with Google Docs Editors Suite.
- **ArcGIS** is a cloud-based mapping and analysis solution and a desktop application, which can be used to make maps, to analyze data, and then to share and collaborate.

Examples of existing custom collaboration tools that are being used by Federal and state agencies are:

- **FHWA's Interagency NEPA and Permitting Collaboration Tool**[77] is a web-based collaboration tool that aids project managers and teams throughout the NEPA process for surface

[77] https://inpct.fhwa.dot.gov/.

transportation projects. It provides a single platform to manage the development of environmental documents and facilitate real-time collaboration and interagency reviews.

- **Florida DOT's ETDM Environmental Screening Tool**[78] was developed in response to Federal statutory provisions affecting environmental reviews for surface transportation projects.[79] ETDM accomplishes major transportation project planning with early and continuous state and Federal agency participation, efficient online managed environmental review, and meaningful dispute resolution mechanisms.

Integrating Collaboration Platforms into a Distributed Application Framework

There are many opportunities for the improvement in the area of collaboration platforms. When designing collaboration platforms for a distributed application framework, there are some opportunities to improve collaboration at a few key points in the NEPA and permitting process, including:

- **Early Reviews:** Sharing early drafts of the purpose and need statement, descriptions of the affected environment, or alternatives section of an EIS through a secure web-based platform that allows collaboration between lead, joint lead, cooperating, and participating agencies, consultants, and, where appropriate, applicants.
- **Data:** Sharing geospatial data, especially data delineating the project boundaries and analysis area, with agencies for verification through interactive maps and the ability for cooperating or participating agencies to securely comment, and share geospatial data with the public to improve engagement and better communicate project effects.
- **Iterative/Internal Reviews:** Distributing drafts of the NEPA and permitting documents with agencies through a secure, web-based platform, and allow the agencies to comment directly in the document (rather than compiling comments into a spreadsheet).
- **Document Centralization:** Compiling all documents that cooperating agencies need to review in a single, web-based location that is available for the duration of the project, including a history of comments and responses.

These tools can also embed metadata early in the document preparation process so that components of permits and reports become structured, labeled, and tagged, for machine-readable formats, contributing to the overall data fabric and simplifying tracking and analysis.

3.2.7 GIS Applications

GIS applications can help NEPA practitioners understand and visualize a potential project site and the resources, community make up, existing infrastructure, and natural features in the location. These tools can help lead to better project development as more information about an area can inform better design and site specificity. Understanding and visualizing potentially impacted resources, communities, and

[78] https://etdmpub.fla-etat.org/est/.
[79] Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users Act, Pub. L. 109-59, 119 Stat. 1144, Title VI – Project Delivery.

other features of an area early on in project development is important to an efficient and effective NEPA process by anticipating potential barriers or delays, designing a project in the best way for a specific place, and finding the alternatives that mitigate damages or maximize the benefits of a project.

GIS tools allow applicants or agency staff to screen for initial assessments of impacts to help select a project location or to help determine the appropriate level of NEPA review. Initial screening is typically accomplished using GIS platforms, such as ArcGIS, with data "layers" that show where projects overlap with elements of the built and natural environment around them. Some GIS tools have been developed to allow specific types of initial assessments in a more accessible and streamlined platform for users who are not GIS experts. Some GIS tools screen for specific resource impacts such as endangered species habitat, while other GIS tools allow the use of multiple data layers to screen for many resource impacts at once.

Examples of Existing GIS Applications and Screening Tools

There are many existing GIS applications and screening tools developed by Federal and state agencies, including these examples:

- **GeoPlatform**[80] is a shared service project of the member agencies of the Federal Geographic Data Committee supported by DOI's Foundation Cloud Hosting Services that provides access to approximately 100,000 open geospatial data assets via a suite of highly available geospatial data, services, applications, and community tools. GeoPlatform also provides FedRAMP authorized cloud hosting geospatial data, application, and services.
- **USFWS's IPaC**[81] is a publicly available mapping tool that allows users to see if ESA-listed species, critical habitat, or other natural resources are or may be impacted by a proposed action in a specific geographic area.
- **DOI's Strategic Hazard Identification and Risk Assessment Project**[82] is a tool that aggregates datasets for hazards, such as wildfire or drought, land, assets, natural resource, infrastructure, etc. and allows users to identify risks and hazards for the interested geographic areas.
- **EPA's NEPAssist**[83] is a publicly available GIS viewer with certain NEPA-related data layers, such as habitat data, wetlands, and floodplains, preloaded with the ability to add other layers.
- **NTIA's Permitting and Environmental Information Application**[84] is an application to help Federal broadband grant recipients and subgrantees identify and understand the types of permits they will need and to plan routes for their broadband deployments.
- **Oregon Renewable Energy Siting Assessment Mapping and Reporting Tool**[85] contains data layers that are relevant to potential renewable energy development, including military use impacts, endangered species habitats, community demographics, renewable energy potential, and

[80] https://www.geoplatform.gov/.
[81] https://ipac.ecosphere.fws.gov/.
[82] https://www.doi.gov/emergency/SHIRA.
[83] https://www.epa.gov/nepa/nepassist.
[84] https://www.arcgis.com/apps/instant/portfolio/index.html?appid=c7906b72e14045bf9fa6fe9addd469a0.
[85] https://www.oregon.gov/energy/energy-oregon/Pages/ORESA.aspx.

other factors. Users can screen specific geographic areas for potential concerns and generate a report outlining the findings.

- **The Climate and Economic Justice Screening Tool[86] (CEJST)**, created by CEQ, is a geospatial mapping tool to help Federal agencies identify disadvantaged communities that are marginalized by underinvestment and overburdened by pollution. This tool has an interactive map and uses datasets that are indicators of burdens in eight categories: climate change, energy, health, housing, legacy pollution, transportation, water and wastewater, and workforce development. The tool highlights disadvantaged census tracts across all 50 states, the District of Columbia, and the U.S. territories. A community is considered disadvantaged if it is: (1) in a census tract that meets or exceeds the threshold for at least one of the tool's categories of environmental, climate, or other burdens and is at or above the associated socioeconomic threshold, or (2) on land within the boundaries of a federally recognized Tribe. Federal agencies are using the tool to help identify disadvantaged communities that benefit from certain Federal programs, including those that are part of the Justice40 Initiative, which sets a goal that 40 percent of the overall benefits of certain Federal climate, clean energy, and other investments flow to disadvantaged communities that are marginalized by underinvestment and overburdened by pollution. Agencies are also using the CEJST where a statute directs resources to "disadvantaged communities."[87]

- **EPA's EJScreen**[88] is an environmental justice mapping and screening tool that provides a nationally consistent dataset and approach for combining environmental and demographic socioeconomic indicators. EJScreen users choose a geographic area and the tool then provides demographic socioeconomic and environmental information for that area.

Examples of public and private GIS applications and tools are:

- **QGIS**[89] is a free open-source tool that is used to create maps and conduct analysis of geospatial information.

- **ArcGIS** is a commercially available tool that is used to create maps and conduct analysis of geospatial information.

- **Blumen Systems**[90] is a commercial web application that allows project proponents to upload shapefiles and receive customized reports based on data layers from Federal and state sources.

An example of a GIS application and screening tool that is being used outside the United States is:

- **The Danish Environmental Portal**[91] is a tool developed by a consortium of Federal, regional, and municipal Danish governments powered by the commercial cBrain platform that allows users

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[86] https://screeningtool.geoplatform.gov/.
[87] *See generally* Executive Office of the President, M-23-09, Addendum to the Interim Implementation Guidance for the Justice40 Initiative, M-21-28, on using the Climate and Economic Justice Screening Tool (CEJST) (Jan. 27, 2023), https://www.whitehouse.gov/wp-content/uploads/2023/01/M-23-09_Signed_CEQ_CPO.pdf.
[88] https://www.epa.gov/ejscreen.
[89] https://www.qgis.org/en/site/index.html.
[90] https://www.blumensystems.com/.
[91] https://miljoeportal.dk/english/.

to search by geographic area for relevant data within the search boundary such as ecological data and data on other projects in the area, and to generate a report outline with relevant information.

Integrating GIS Mapping Tools into a Distributed Application Framework

A data fabric concept and implementation could significantly enhance GIS workflows by accessing existing data repositories such as GeoPlatform and enabling data sharing among many applications without requiring a centralized data store. Since there are so many useful GIS tools, having the tools and their data accessible and organized in a data fabric could help practitioners access and understand different applications and exchange GIS data. There are also examples of comprehensive GIS web applications that have been designed for use by one agency or department that may be applicable to other agencies as well and could reduce the duplication of work by sharing tools between agencies. Some GIS tools could also be further developed to incorporate workflow automation tools to improve the functionality by taking screening results and producing an automated report or decision.

3.2.8 Document Management

Many agencies use document management systems to manage documents throughout their lifecycle—from creation to organization, storage, review, publication, and ultimately disposal or retention. Proper document management helps agencies to comply with the requirements of law and agency policy.

Agencies typically carry out document management for NEPA and permitting activities using the agency's primary document management system, though some agencies employ additional tools to manage certain processes that the agency's primary document management system cannot accommodate. For instance, agencies often require systems that allow them to make NEPA documents publicly available, receive and manage public comments, and collaborate with other agencies to prepare and edit documents, functionality which may not be available in the agency's primary document management system. Additionally, agency document management systems for NEPA and permitting processes must accommodate large technical files containing renderings, geospatial data, and other material.

There are a variety of digital tools that can aid in document management by consolidating documents into a central library, facilitating internal organization, and otherwise supporting successful workflow management and overall project tracking.

Examples of Existing Document Management Systems

Federal agencies use a variety of document management systems including Microsoft SharePoint, Google Drive, Box, Amazon Web Services, Microsoft Azure, and Google Cloud Services. Three examples of existing custom document management systems that are being used by Federal agencies are:

- **USFS's Pinyon**[92] tool uses Box to host NEPA documentation and enables the agency to share that information publicly.

[92] https://usfs.box.com/.

- **BLM's ePlanning**[93] is an application for creating, managing, sharing, and reviewing documents that BLM creates pursuant to the Federal Land Policy and Management Act and NEPA. The ePlanning system allows BLM to collaboratively create and develop textual, graphical, and geospatial information in a collaborative team-based environment that uses workflow management technologies. This site also enables the public to search documents by geographic location, project resource type, or project year.

- **EPA's EIS Database**[94] is a searchable database of Federal EISs, containing electronic records of all EISs submitted to EPA since 2012. The database also includes EPA's comments on the EISs pursuant to section 309 of the Clean Air Act,[95] which directs EPA to review each EIS prepared by a Federal agency.

- **NPS's PEPC**[96] system allows generation of documents in support of compliance with NEPA, the National Historic Preservation Act, and other laws. Documents are generated from web form entries into the application, streamlining and standardizing these outputs for signature and inclusion in the project file. Additionally, PEPC allows for the upload or linking of supporting documentation, including assessments, maps, and agreements.

Integrating Document Management Systems into a Distributed Application Framework

Agencies can make their NEPA and permitting processes timelier and more efficient by making effective use of document management tools to create, share, collaborate, and organize documents. While general tools can be valuable, agency users can face challenges working across agencies because of incompatible versions, access controls, or limited collaboration features. For important cybersecurity reasons, agencies typically prohibit users outside the agency from accessing their general document management systems. Therefore, agencies that seek to cooperatively develop draft NEPA and permitting documents may benefit from the development of standalone systems that allow for real-time collaboration, reflects the specific requirements of the NEPA and permitting processes, and minimizes the potential cybersecurity risks. Document management systems, especially those built to specific requirements for NEPA and permitting, can be critical in creating, organizing, storing, or sharing metadata to enable a broader data fabric.

3.2.9 Filing, Publication, and Submittal Systems

NEPA and the CEQ regulations require public engagement in agency decision making.[97] This type of public engagement can take many forms, including mailing lists and social media outreach, to effectively communicate with the intended audience. The CEQ regulations also require certain documents be filed with certain agencies or in certain publications, for instance Notices of Intent must be published by the agency in the Federal Register and draft and final EISs must be filed with EPA for publication of a notice of EIS filed in the Federal Register.[98] Filing, publication, and submittal systems aggregate NEPA

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[93] https://eplanning.blm.gov/eplanning-ui/home.
[94] https://cdxapps.epa.gov/cdx-enepa-II/public/action/eis/search.
[95] 42 U.S.C. § 7609.
[96] https://pepc.nps.gov.
[97] *See* 42 U.S.C. § 4332; 40 C.F.R. § 1501.9.
[98] *See* 40 C.F.R. §§ 1502.4(e); 1506.9, and 1506.10(a).

documents and make them available to the public in one place, facilitating public commenting, and generally improving transparency. Certain government-wide systems, such as the Federal Register, are used by all Federal agencies for particular NEPA-related filings, while other systems are used for all agency-specific NEPA filings. These systems have some common capabilities, including allowing agencies to upload one or more documents and make those documents available to the public to view. Some filing and publication systems may also integrate project tracking systems or commenting portals that list a schedule of upcoming dates (see discussion in sections 3.2.2 and 3.2.4). In some cases, the metadata associated with each project may be minimal—only the agency name and date of filing—or more robust, such as geocoded data on the project location.

Examples of Existing Filing, Publication, and Submittal Systems

There are some existing government-wide document filing and publication systems that are being used by Federal agencies, including these examples:

- **The Federal Register**[99] allows members of the public to see notifications from Federal agencies on actions including NEPA-related notifications. The website is designed to make it easier for the public to understand the regulatory process and to participate in government decision making by publicizing information on a consolidated platform. EPA publishes a weekly "Notice of Availability" of EIS documents submitted to EPA's e-NEPA filing system in the Federal Register. The publication of EPA's Notice of Availability in the Federal Register starts the comment period for a draft EIS.

- **EPA's e-NEPA Filing System**[100] is the way agencies file draft and final EISs with EPA, as required by CEQ's NEPA implementing regulations.[101] Agencies upload and submit their EIS documents to EPA's e-NEPA system and EPA is responsible for filing EISs with the Federal Register. Agency submissions to EPA include 508-compliant[102] PDF copies of either draft or final EISs. The submitted documents are then visible in the public-facing EPA EIS database, which contains electronic records of all EISs submitted to EPA since 2012 as well as EPA comment letters on EISs.

- **Regulations.gov**[103] was designed to increase public participation in the regulatory process by enabling public access to regulatory materials and removing logistical barriers to participation. The system allows the public to view comment opportunities, search for regulatory materials, and submit comments (see additional details in section 3.2.4). Documents related to each regulation can be found together on a project page.

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[99] https://www.federalregister.gov/.
[100] https://www.epa.gov/nepa/environmental-impact-statement-filing-guidance.
[101] 40 C.F.R. § 1506.9.
[102] Section 508 of the Rehabilitation Act of 1973, 29 U.S.C. § 794d, requires Federal agencies make information available in a manner that is accessible to those with disabilities. This includes NEPA documents, and the PDF versions submitted to EPA must be machine readable and contain alternate text for images and graphics to allow visually impaired readers to understand the content.
[103] https://www.regulations.gov/.

- **USFS's PALS**, part of the eMNEPA suite of tools, features an e-File capability to allow users to file documents directly into EPA's filing system without having to create an account with the EPA. This feature will be replicated in the new Enterprise Land Management System.

Additionally, two examples of existing agency-specific document filing and publication systems are:

- **BLM's ePlanning**[104] allows online public review and comment on BLM NEPA documents. The website also includes a search engine to search by location, resource type, year, and other factors. Each project has a well-defined landing page where all related documents can be easily found.
- **FERC's eLibrary**[105] allows the public to search for documents submitted to and issued by FERC since 1981, including NEPA-related documents. Documents in the eLibrary can be searched for by docket number.
- **NPS's PEPC**[106] tool allows the public to view and download project information and comment on NPS NEPA documents. The website allows members of the public to search for documents by keyword, park, state, document status, document type, project type, or level of NEPA review.

Integrating Filing, Publication, and Submittal Systems into a Distributed Application Framework

Filing, publication, and submittal systems can be improved with data management and tracking best practices. For example, there are currently no government-wide filing systems for all agency EAs, CEs, or RODs, though some agencies publish notices of availability for RODs or EAs in the Federal Register. Some agencies maintain publicly accessible databases that include a wide array of NEPA documentation, including CE determinations, EAs, and EISs, but many do not. Similarly, EISs are not published directly in the Federal Register; rather, agencies publish a notice of availability and link to access the full document. This requires additional effort to find project-related information since many steps are required before being able to search through the EIS itself. Because CEQ's regulations require agencies to "make available documents, relevant notices, and other relevant information for use by agencies, applicants, and interested persons," and require that "[t]he website or other such means of publication shall include . . . a list of environmental assessments and environmental impact statements that are in development and complete"[107] demand for publication systems may increase.

Additionally, the searchability of such systems that do exist could be improved. EPA's system only allows users to search for the title of the document and not for text appearing within the full PDF of the EIS document. The Federal Register can also be difficult to search, specifically for NEPA-related documents. The NEPAccess platform developed by the University of Arizona created a way to make EIS documents searchable and geographically searchable down to the county level (see additional details in section 3.3.2), but the public search functions of the NEPAccess application ceased as of May 2024. Improving the capture of metadata would allow for better functionality of these filing, publication, and submittal systems by allowing improved search usability and support a broader data fabric architecture.

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[104] https://eplanning.blm.gov/eplanning-ui/home.
[105] https://elibrary.ferc.gov/eLibrary/search.
[106] https://parkplanning.nps.gov.
[107] 40 C.F.R. § 1507.4(a).

Filing and publication systems could be improved through implementing standardized data. For instance, public engagement efforts could be improved by capturing consistent and uniform information on public involvement opportunities (e.g., duration of the comment period, instructions for submitting comments, location, date, and time for public meetings or hearings) and displaying that information in a centralized user-friendly format. Once this information is captured in a standard machine-readable format it could be centralized into one system via an API so that members of the public could go to a single website to see all available information on public engagement opportunities for NEPA-related actions.

3.3 Cross-cutting Tool Features

In addition to the types of tools discussed above in section 3.2, CEQ has identified two important cross-cutting features that do not belong to any single category of tools. These are workflow automation and AI. The sections below provide some context and examples for how these technologies may play a role in the development of a distributed application framework.

3.3.1 Workflow Automation

Workflow automation tools can help streamline environmental reviews and decision making. Workflow automation tools use software that follows set rules and guidelines that enable users to produce preliminary documents, support decision making, or even authorize certain actions under carefully controlled processes. These tools can integrate other tools such as GIS screening tools and use their data and results to automate or prepopulate reports, NEPA documents, or decisions. Workflow automation tools can help speed up project timelines and reduce workload in the process of drafting documents.

Some workflow automation tools are GIS-based where a user uploads a shapefile or draws area boundaries, and the tool generates information and reports from that information. Automation tools may also perform other functions, such as assisting with the development of documents based on user inputs to a series of questions. Some tools run pre-programmed database queries on a defined area to rapidly assess impacts, helping to expedite reviews with few or no impacts or identify where further analysis may be needed for more complex projects. Automation helps free up staff time to process more projects in less time and to focus limited staff resources on projects with greater effects. Workflow automation tools build upon the function of basic screening tools by incorporating some form of programming logic that either produces a report, creates a draft document, or renders a decision based on user inputs.

Examples of Existing Workflow Automation Tools

There are some existing workflow automation tools that are being used by Federal agencies, including these examples:

- **USFWS's IPaC**[108] is a publicly available mapping tool allowing users to see if a project may impact a listed species, critical habitat, or other natural resources. The tool helps streamline the ESA Section 7 consultation process. For certain pre-defined activities subject to previously completed programmatic consultations, agencies may generate an instant concurrence letter using

[108] https://ipac.ecosphere.fws.gov/.

IPaC's Determination Key feature. Determination Keys are questions that USFWS designed to assist users in determining if a project qualifies for a pre-determined consultation outcome.

- The **Natural Resource Conservation Service (NRCS) and West Virginia University's Kentucky Interagency Coordination Tool**[109] is specific to Kentucky and allows users to run reports on an outlined geographic area of interest and generate a report with relevant information. The tool can provide a report on potential impacts, benefits, and mitigation potentials for a variety of resources including endangered species, wetlands, cultural resources, air quality, and more.
- **Wildfires.org TurboPlan**[110] is a platform to help accelerate actions for wildfire prevention and fuels treatment by reducing review time. The platform allows users to upload GIS information about the project and answer prompted questions to produce prepopulated standardized templates for NEPA documents. While GIS is an important component of analysis, the tool can function in other capacities independent of GIS. The tool helps users visualize potential conflicts for land areas, map projects, and determine the appropriate level of NEPA review.

Integrating Workflow Automation Tools into a Distributed Application Framework

Workflow automation tools can help elevate the usefulness of screening tools and GIS tools and maximize user efficiency. Not all screening tools and GIS tools take the step of producing automated reports or decisions, but some could be maximized to include automation features. It is important to include user feedback in the development of such tools to ensure they meet the needs of the user.

3.3.2 Artificial Intelligence

AI tools broadly encompass traditional large-scale analysis and machine learning techniques that work with structured or unstructured data and now "foundation" models, including LLMs, that significantly expand the ability of systems to interact with unstructured data and natural language. AI has the potential to make significant contributions in Federal NEPA and permitting processes in most of the functional areas discussed above in section 3.2. Agencies should carefully consider application of AI to NEPA using the frameworks of Executive Order, 14110, *Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence*,[111] and OMB Memorandum M-24-10, *Advancing Governance, Innovation, and Risk Management for Agency Use of Artificial Intelligence*.[112]

Executive Order 14110 also directed DOE, in consultation with CEQ, the Office of Science and Technology Policy, and other agencies, to develop a report describing the potential for AI to improve planning, permitting, investment, and operations for electric grid infrastructure and to enable the provision of clean, affordable, reliable, resilient, and secure electric power to all Americans. In this report,

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[109] http://kict.mapwv.org/.
[110] https://wildfires.org/services/turboplan.
[111] 88 Fed. Reg. 75,191 (Nov. 1, 2024), https://www.whitehouse.gov/briefing-room/presidential-actions/2023/10/30/executive-order-on-the-safe-secure-and-trustworthy-development-and-use-of-artificial-intelligence/.
[112] M-24-10 (Mar. 29, 2024), https://www.whitehouse.gov/briefing-room/presidential-actions/2023/10/30/executive-order-on-the-safe-secure-and-trustworthy-development-and-use-of-artificial-intelligence/.

AI for Energy,[113] DOE provides a more in-depth discussion of AI applications, including permitting. In alignment with that report, this section outlines potential use cases of AI in the NEPA process, particularly cutting-edge large language and foundation models, and discusses existing applications of AI, such as natural language processing.

On April 29, 2024, DOE announced the VoltAIc initiative to use AI to help streamline siting and permitting at the Federal, state, and local level. As part of that initiative, DOE is investing $13 million to build AI-powered tools to improve siting and permitting of clean energy infrastructure and has partnered with Pacific Northwest National Laboratory to develop PolicyAI,[114] a policy-specific large language model test bed that will be used to develop software to augment NEPA and related reviews. The PolicyAI research team is investigating potential uses of AI in the NEPA and permitting process, including extracting and organizing unstructured data, natural language processing, analyzing structured data to identify key performance indicators, and comment analysis and categorization.

Under 15 U.S.C. § 9401(3) and Executive Order 14110, AI is "a machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations, or decisions influencing real or virtual environments. AI systems use machine- and human-based inputs to perceive real and virtual environments; abstract such perceptions into models through analysis in an automated manner; and use model inference to formulate options for information or action."

AI can include automated reasoning through traditional methods, which have focused primarily on quantitative or structured data with limited natural language processing, or new capabilities and tools in machine learning, which can include tools like LLMs (e.g., OpenAI's ChatGPT, Google's Gemini, Anthropic's Claude, and Meta's Llama) and other foundation models that can work with a broad array of inputs and outputs. With the significant progress in this area over the last several years, AI can now inform complex qualitative reasoning and decision support working with natural language and other media in addition to quantitative analysis and structured inquiry.

AI generally builds a model or representation based on historical or synthetic data in a training dataset, then applies this "learning" to new inputs or data. AI systems can work with many types of data including structured (e.g., tabular or time-series data) and unstructured (e.g., text, documents, images). The success of AI systems relies on data quality and accessibility, model structure and performance, and the nature of the use case.

Potential Applications of AI in NEPA and Permitting Processes

LLMs and large multi-modal models, which can work with images and other types of data as well as text, have the potential to significantly improve text and data dependent processes such as environmental reviews and permitting reviews. As further outlined in DOE's AI for Energy report, the limitations of these models require that any development and use of them for key government functions proceed with caution, research, and validation. The highest-value use-cases for AI models in their current state involve

[113] U.S. Department of Energy, AI for Energy (April 2024), https://www.energy.gov/sites/default/files/2024-04/AI%20EO%20Report%20Section%205.2g%28i%29_043024.pdf.
[114] https://www.pnnl.gov/projects/policyai.

models with different capabilities, such as natural language processing or analysis, working together and retrieving information from controlled data repositories.

There are a few key opportunities for such AI to assist in permit processing and environmental reviews. These applications, summarized here and in DOE's AI for Energy report, include:

- **Bulk Data Extraction and Organization:** Characteristics of project development and permitting timelines are generally difficult to retrieve and are not represented in existing structured datasets; in particular, timelines and characteristics of projects or processes that are most effective and efficient can be extracted from unstructured data by AI tools.
- **Process Improvement:** Paired with data from bulk data extraction and organization, foundation models or other AI systems that link key performance indicators on process and outcome with comprehensive planning system data may be able to infer which elements of the NEPA process work efficiently and effectively and which result in delays or otherwise degraded outcomes.
- **Comment Processing:** As discussed in section 3.2.4, applications in this area have been under development or in use for over a decade but advances in LLMs can advance comment analysis with more extensive natural language processing to help organize comments for agency staff to review. Improving the sorting and processing of public comments has the potential to save weeks or even months of time on the most complex projects by allowing agency staff to focus on comment analysis and response drafting.
- **LLM Co-Pilots with Retrieval Augmented Generation:** AI support for drafting documents, permits, and other text with curated documents and datasets to draw from, for agency staff revision and completion, could improve the efficiency of document generation as well as the effectiveness of the process.
- **Automated Application Completeness Checks:** This includes developing functionality that allows application materials received by a central portal, including draft environmental resource reports, to be automatically reviewed for completeness. This has the potential to reduce wait times or errors in submissions; for example, a project developer could be notified sooner after submitting information about anything that is missing from their application and could prevent overall delays in the timeline.
- **Designing Training Tools:** Training for roles in the NEPA and other permitting processes could be improved by tailored retrieval augmented models that can provide natural language interfaces to complex legal, technical, and regulatory environments and more flexible training environments for different user roles.

Examples of Existing AI Tools

There are a few existing AI tools that are being used outside the Federal Government that relate to environmental review and permitting processes, including these examples:

- **Academic AI Tools:** Academic institutions have contributed to projects applying machine learning or other AI techniques to the NEPA and permitting processes. In particular, the

NEPAccess[115] project, launched by the University of Arizona, used data science to help modernize the NEPA process with a natural language search process. NEPAccess created a publicly available, innovative knowledge and discovery platform utilizing the largest single repository of NEPA documents. It created advanced search tools, georeferencing capabilities, mechanisms to assess public engagement, and access to NEPA information across agencies, project types, regions, and industry sectors. The public search functions of the NEPAccess application ceased as of May 2024.

- **Private Sector AI Tools:** Private industry has developed tools that are used by agencies or other stakeholders, often with specific AI use-cases that apply cutting-edge technology in the ways described above. For example, Symbium[116] uses machine logic to fully automate the permitting process for solar and other energy efficiency projects in jurisdictions in California. The work is centered on citizen and government interactions, building codes, and automating permits. Other examples include Shovels.ai,[117] Paces,[118] and Blumen,[119] all of which provide value to stakeholders through innovative AI applications.

- **International AI Tools:** Examples include the Danish tool cBrain,[120] which aims to digitize environmental permitting and developed a system to fully digitize the application and case management solutions for the Danish EPA. The team is developing additional AI models on environmental impact assessment data in compliance with all data protection regulations. BeInformed,[121] with offices in the Netherlands, United Kingdom, and United States, provides a similar tool to help simplify permitting procedures in a variety of markets. Artificial Intelligence for Environment & Sustainability[122] (ARIES), developed by researchers at the Basque Centre for Climate Change, is an integrated, open-source modelling platform for environmental sustainability, for researchers to contribute data and models to web-based repositories.

Integrating AI into a Distributed Application Framework

Data across and within agencies is often dispersed across multiple locations, making it challenging to access for both developing models and operating them. Without high-quality data, AI is ineffective or even counterproductive. To resolve this challenge, it is critical to invest in the development of data architecture and standards in a distributed data fabric framework. This will facilitate machine readability and interoperability of information across agencies to support AI applications moving forward.

Human oversight and review remain indispensable for quality assurance, process control, and performance feedback in the application of AI tools by Federal agencies in NEPA and permitting processes. Any agency implementing AI capabilities must include "appropriate safeguards against fraud, unintended bias, discrimination, etc." to be consistent with Executive Order 14410's civil rights

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[115] https://www.nepaccess.org/.
[116] https://symbium.com/.
[117] https://www.shovels.ai/.
[118] https://www.paces.com/.
[119] https://www.blumensystems.com/.
[120] https://cbrain.com/.
[121] https://www.beinformed.com/permitting-solutions/.
[122] https://aries.integratedmodelling.org/.

provisions. For example, in order to use AI to analyze public comments received on a Federal permitting action or rulemaking, qualified human reviewers must be responsible for reviewing and certifying that the AI tool delineated and categorized each comment correctly and consistently and that no comments were omitted. With the help of AI, this categorization process may require less time to complete but will still require human involvement. Such human-in-the-loop AI-powered processes could enable Federal agency staff and other users to allocate a larger proportion of time to higher-level tasks where critical reasoning skills, value judgments, and other human-centered capabilities are more valuable and more necessary.

4 Building the Future of NEPA and Permitting Technology

4.1 Understanding the Needs of the Users: Offering Carrots, Not Sticks

Successful software is software that users want to use. The principles of agile development focus on ensuring that users' needs are met, but software alone cannot draw users to systems without ways to incentivize adoption and participation. In particular, tools should provide benefits for users that balance any adjustments to their routine or additional reporting or data requirements. Often, in business and government contexts, this is accomplished at the user level by building tools that help staff do their jobs more easily, such as "wizards" that automate routine and mundane tasks. Notably, these user benefits are not always aligned with more strategic objectives, such as the overall effectiveness of systems or reporting and accountability requirements. Developing new digital solutions must be done carefully to ensure strategic needs are met in ways that benefit users.

Tools designed with the primary goal of helping NEPA and permitting staff do their jobs more efficiently and effectively can simultaneously serve other secondary needs such as capturing data to help agency leadership monitor overall program performance or populating public facing tools that facilitate public involvement or project tracking. One example of a successful tool that assists "front-line" NEPA and planning staff with their work includes Wildfires.org's TurboPlan. The platform allows users to input GIS layers and answer prompted questions to produce prepopulated standardized templates for NEPA documents. While GIS is an important component of analysis, the tool also can function in other capacities independent of GIS. The tool helps users visualize potential conflicts for land areas, map projects, and determine the appropriate level of NEPA review. The end result is NEPA and planning documents that are ready for supervisor review and approval. Similar "wizard" type tools that assist users with conducting their work and automate processes will have additional benefits since it will allow agencies to capture that information as structured data and transfer it to tracking systems or other portals.

4.2 Incubating the Development of New Tools

Organizations, including Federal agencies, must foster innovation and continually incubate the development of new tools as well as support the improvement of existing tools. The transition to a distributed application framework of interoperable tools will require the establishment of a NEPA data standard and taxonomy, the development of new tools through partnerships and technical assistance, and communication to agencies on successful software implementation strategies and examples of NEPA-related software tools. CEQ, with agency partners, can leverage such a playbook document to promulgate data and metadata standards and overall guidance for application interaction. In addition, Federal agencies require real and sustained support to build out the necessary tools with appropriate user research and iterative development that is needed for success.

There are multiple opportunities for CEQ, with agency partners, to incubate new tools and technology. CEQ can ensure high-quality, accessible, and timely training by developing materials for staff and applicants. In addition, CEQ can help ensure interests beyond the Federal agencies are included when new software is being developed for the NEPA and permitting processes by seeking input from Federal, state, Tribal, and local agencies, applicants, and the public. A few specific suggestions on incubating new tools are described in the sections below.

4.3.1 Leveraging Academic Partnerships

Academic partnerships present significant opportunities for developing new tools since academic institutions' strengths complement those of Federal agencies and private sector firms. Two universities in particular—the University of Arizona and West Virginia University—have built tools specific to the NEPA process.

- **The University of Arizona's NEPAccess[123]:** Through funding from the National Science Foundation, the NEPAccess platform, created by the University of Arizona, developed searchable access to over 20,000 EISs dating back to the 1970s. The project used natural language processing and relied on graduate and undergraduate student researchers to add metadata and train machine learning tools to make EIS documents geographically searchable down to the county level. The public search functions of the NEPAccess application ceased as of May 2024.
- **NRCS and West Virginia University's Kentucky Interagency Coordination Tool[124]:** This tool was developed for the NRCS Kentucky office and allows users to run reports on an outlined geographic area of interest, answer certain questions about the projects, and receive a PDF report identifying potential impacts, benefits, and mitigation potentials.

Both of these tools represent innovative approaches to making NEPA more efficient and effective, and partnerships with academic institutions should be pursued. For instance, CEQ and other Federal agencies could formalize working relationships with academic institutions where their missions and research objectives align with those of CEQ and Federal agencies. In addition to creating useful tools for the NEPA process, these partnerships would also help train a future workforce on NEPA and technology, which could help Federal agencies that have identified recruitment as a persistent challenge to the completion of environmental reviews.

4.3.2 Improving NEPA Knowledge through Training

Building on its previous work conducting training in partnership with organizations like the National Association of Environmental Professionals and Duke University's Nicholas School of the Environment, consistent with the direction in the Inflation Reduction Act, CEQ is expanding its approach to enabling government-wide Federal agency staff to participate in effective and timely training in the requirements and best practices of NEPA review. More and better trained Federal staff would ease staffing burdens, avoid unnecessary delays in an environmental review process, and improve the overall applicant, stakeholder, and public experience. CEQ provides a repository for NEPA guidance and other job aids at NEPA.gov, which CEQ is reviewing for updates to facilitate successful implementation of the recent updates to the NEPA implementing regulations. As the agency responsible for promulgating the NEPA implementing regulations, CEQ is uniquely positioned to lead the Federal Government in its understanding of the requirements of those regulations and the preparation of Federal staff to address those requirements in real-world scenarios.

[123] https://www.nepaccess.org/.
[124] http://kict.mapwv.org/.

4.3.3 Bolstering IT Solutions to Advance Permitting Efficiency

Recognizing the importance of innovative IT tools and solutions to measurably improve the Federal environmental review and permitting process, the Permitting Council made a portion of the $350 million provided to the Permitting Council in the Inflation Reduction Act available for investments to develop and modernize Federal IT tools to help agencies increase effectiveness, efficiency, and timeliness in the environmental review and permitting process. The Permitting Council received over $77 million in requests from Federal agencies. In April 2024, the Permitting Council announced $30 million to fund 13 proposals, all related to permitting needs for infrastructure projects. After an internal review process, the Permitting Council awarded the following projects:

- Advisory Council on Historic Preservation: $750,000 for a centralized GIS database.
- U.S. Department of Agriculture's Rural Development: $1.9 million for an application portal that will determine if submissions qualify for CEs earlier in the application process.
- USFS: $3 million for a digital entry point for special use authorization requests that will be a unified electronic permitting interface for the public.
- NTIA: $2.6 million for a digital system to guide applicants through initial questions for a CE.
- DOE: $6.1 million for DOE's AI pilot, to encode and pre-process regulatory documents and train LLMs (goal is to assist other agencies).
- Department of Homeland Security's U.S. Coast Guard (USCG): $500,000 for development of an online Bridge Permit Application System.
- USCG: $300,000 to improve and expedite NEPA reviews for bridge permits.
- USCG: $323,000 for mathematical waterways risk models to improve the Navigation Safety Risk Assessment.
- HUD: $760,000 to improve the government-wide Tribal Directory Assessment Tool of current contact information for Tribes, including a map-based query function.
- DOI: $6.5 million for an AI-based tool for public comment analysis and response.
- USFWS: $3 million for new tools and features for ECOSphere system that will facilitate automation and improve consistency in species consultations.
- DOI's Bureau of Ocean Energy Management: $4.41 million dedicated for an info management system for the renewable energy program to improve efficiency of leasing and permitting.
- DOI's Bureau of Indian Affairs: $385,000 for a feasibility study for a system to process right-of-way applications.

Contracts and grants are the traditional government funding instruments, but prize competitions and other award programs can also serve as a mechanism to fund and scale NEPA and permitting tools. Prize competitions are unique compared to other types of Federal agreements because they are designed to

solve for immediate problems. Examples are listed below. This is not an exhaustive list but provides a handful of cases that can be useful when developing solutions for future programs.

CEQ has collaborated with agencies as they have expanded the use of innovative technology for NEPA and permitting processes, including:

- **DOT's Modernizing NEPA Challenge**[125] is a prize competition conducted by DOT to accelerate the adoption of innovative NEPA technology. The $750,000 competition will promote the use of interactive and collaborative web-based tools to make NEPA documents more accessible and transparent, while also saving time in the review process. Individual prizes of up to $50,000 will be available for awardees that create interactive web-based NEPA documents to improve accessibility and public engagement or deploy web-based collaboration platforms that increase the efficiency of inter-agency review of draft NEPA documents.

Additional examples of programs that promote innovative technology include:

- **GSA's Technology Modernization Fund**:[126] The Technology Modernization fund is an innovative funding vehicle, authorized by the Modernizing Government Technology Act of 2017, that gives agencies additional ways to deliver services to the American public more quickly, better secure sensitive systems and data, and use taxpayer dollars more efficiently.

- **GSA's 10x**:[127] The 10x program at GSA solicits ideas from Federal employees on ways government digital experiences can be better, easier, or more accessible for the public. In 2022, 10x received 181 ideas and selected 25 ideas for further vetting. Of those 25 ideas, seven were approved for funding. Past 10x projects include Login.gov, Notify.gov, and the U.S. Web Design System.

- **Department of the Air Force Mission Execution Excellence Program:** The Mission Execution Excellence Program is an innovation incentivization program that rewards Air Force units for implementing best practices with rebates and awards, including financial awards, for high-performing units. It pairs this incentive structure with simplified data collection systems and automated data analysis, linking best practices in energy efficiency and innovation with a data pipeline that can provide real-time feedback to units on their performance. This allows units to provide bottom-up innovation in process and technology with streamlined reporting and immediate (financial) benefits to the unit and to the warfighter. The program is in its second full year and has distributed approximately $10 million in rebates and awards while saving the Air Force over $20 million in energy costs.

- **X Prize**:[128] This is an effective innovation program in the private sector. The mission is to bring about "radical breakthroughs for the benefit of humanity through incentivized competition" and motivate individuals, companies, and organizations to develop ideas and technologies. This is a 4-year competition that includes a 6-month team registration period, 18 months for solution

[125] https://www.challenge.gov/?challenge=modernizing-nepa-challenge.
[126] https://www.gsa.gov/technology/government-it-initiatives/technology-modernization-fund.
[127] https://10x.gsa.gov/.
[128] https://www.xprize.org/.

development, and 15-month field testing period. While this is a private sector organization, the Federal Government could replicate parts of this approach.

Federal agencies have prize programs to solve other challenges. For example, DOE uses prize programs[129] frequently as a flexible funding mechanism to develop innovative solutions to problems and invest in American entrepreneurs and innovation.

4.3 Establishing a Data Fabric and Data Standards

In a distributed framework with many stakeholders, applications, and information systems, efficient processes require clear, organized data that can be exchanged and universally accessed. As discussed in section 2, this means handing off information between different applications and data stores to create a "fabric" of information that is accessible across systems but not necessarily stored in a central data structure or application.

CEQ could provide guidance and data standards, including for metadata in NEPA documents, that centralize governance of data while enabling agencies and other stakeholders to implement their own systems and processes. The data standards would include multiple levels of requirements, from defining overall taxonomy and ontology to specifying machine-readable information formats. CEQ could also support agencies by providing expertise and guidance as new systems are developed to encourage or require data interchange technologies like APIs that enable accessibility of information between tools. Finally, with agency partners, CEQ could collect and analyze high-level performance information to provide feedback to inform continuous improvements to data governance as well as the efficiency and effectiveness of the NEPA process.

A data fabric can also leverage partnerships and best practices with NEPA stakeholders. The 18F Path Analysis notes that the existing EPA metadata for filed EISs only includes title, author, subject, and keywords. The following is a list of potential metadata fields and descriptions that could be tracked as part of NEPA reviews:

- **Unique identification number:** Each EA and EIS must have a unique ID that could then be used to track the project across multiple agency systems. CEQ's NEPA implementing regulations finalized on May 1, 2024 require agencies to include a unique ID on all documents associated with an EIS or EA.[130]

[129] https://www.energy.gov/eere/funding/eere-prizes-and-competitions.
[130] Specifically, the CEQ NEPA implementing regulations, at 40 C.F.R. § 1502.4(e)(10), require notices of intent include "a unique identification number for tracking purposes, which the agency shall reference on all environmental documents prepared for the proposed action and in any database or tracking system for such documents." Additionally, 40 C.F.R. § 1502.11(g) requires that the cover sheet for an EIS include "the identification number included in the notice of intent." Similarly, for EAs the rule includes a provision at 40 C.F.R. § 1501.5(c)(4) requiring agencies to "provide a unique identification number for tracking purposes, which the agency shall reference on all associated environmental review documents prepared for the proposed action and in any database or tracking system for such documents."

- **Standardized NEPA taxonomy:** A standardized taxonomy for project details, environmental resource categories analyzed, other permits required, stakeholder engagement conducted, data sources used.
- **Level of NEPA review:** Whether a project is being reviewed as either an EIS, EA, or CE.
- **Document type:** The purpose of preparing the NEPA document, whether for a legislative proposal, programmatic action, or single project.
- **Project type:** The type of project (e.g., infrastructure, resource management, rulemaking), as applicable.
- **Geospatial information:** Project location area and the boundaries of resource study areas for specific resource categories.
- **Public engagement metadata:** Include public engagement opportunities as metadata for EIS or EA documents and related materials to include public outreach methods, dates and locations of public meetings, number of people in attendance at each meeting, and number of comments received during scoping and during draft and final review.
- **Supporting data, documents, and analyses:** Additional information pertaining to consultant data, documents, and analyses.

4.4 Major Recommendations

In addition to the recommendations made throughout this report, CEQ provides the following recommendations on the development of NEPA technology systems. For future NEPA and permitting related technology work, CEQ recommends a human-centered design approach to inform the development of future software for NEPA and permitting processes. Agencies should also look at their overall NEPA and permitting process, using techniques such as value-stream mapping, to determine which points in the process, if improved, would have the largest effect on overall process improvement. This process includes receiving feedback from users in order to define the user needs, which inform business needs and lead to continuous, iterative development and deployment. Ultimately, a human-centered design approach will enable the delivery of a set of actionable outcomes validated by the permitting agencies and provide a better outcome.

To achieve the vision of interoperable agency systems and a unified user experience for applicants and the public, the actions that CEQ recommends for future collaborations with agency partners are:

- **Data and Content Standards:** Conduct an extensive review of existing applications and data modeling research, develop a taxonomy for NEPA and permitting processes, and map the architecture and data models to ensure mapping can be leveraged in tools relying on current databases and future data fabric architecture.
- **Leverage Geospatial Information:** Identify opportunities to collect and curate geospatial data associated with NEPA reviews to assist with future analyses, reduce the need for additional studies, and aid in cumulative effects analysis.

- **Playbooks:** Create user-friendly documentation (guidelines, templates, and playbooks) in plain language, support the information architecture (including web and graphic design elements), build and deploy the playbook as an interactive website, identify agencies performing a high volume of NEPA and permitting actions and assess the how they conduct their processes.
- **Training Materials:** Produce multi-format and effective training materials.
- **Scaling Collaboration Tools:** Conduct an audit of available collaboration tools and methods for each agency, confirming constraints, and identifying opportunities to scale, for both the research and engineering perspective.
- **Academic Partnerships:** Identify academic institutions to create working relationships that will serve as necessary partners.
- **Incubating Concepts and Tools**: Facilitate and enable new concepts of operations and tools that support the NEPA process from CEQ's role in policy, governance, and oversight.

Appendices

Appendix 1: Definition of Technology Terms

Agile Development: An approach to software development that emphasizes incremental development and frequent reassessment of and adaptation to project requirements and solutions. It focuses on keeping the process lean and creating minimum viable products that go through a series of iterations based on continuous feedback.

Application Programming Interface (API): A set of rules and protocols for building and interacting with software applications. An API allows different software programs to communicate with each other to exchange data and functionalities.

Artificial Intelligence (AI): A machine-based system that, for a given set of human-defined objectives, can make predictions, recommendations, or decisions influencing real or virtual environments. Artificial intelligence systems use machine- and human-based inputs to perceive real and virtual environments; abstract such perceptions into models through analysis in an automated manner; and use model inference to formulate options for information or action.

Cloud-based: Services or resources that are available on demand over the internet from off-site computing servers.

Continuous Iterative Development: Development and testing that continues throughout the software lifecycle of the project. Each iteration is reviewed by stakeholders and improved upon with feedback in subsequent iterations.

Data Fabric: An architecture and set of services that provide consistent data across application endpoints without requiring a central data store. This often involves clear data standards, enabling services like data brokers, and a federated or distributed application framework.

Data Model: A framework that organizes elements of data and standardizes how they relate to one another and to properties of the real-world entities.

Data Standard: The rules by which data are described and recorded, including applicable metadata and rules or protocols for interacting with data and its relationship with real-world entities.

Discovery Sprint: A time-limited effort used to discover information that helps to better understand the challenges facing an organization or group of users and define the scope for further work.

Distributed Application Framework: An "ecosystem" of applications that process information across multiple systems, generally sharing data through application programming interfaces (APIs). Applications or services within a distributed framework perform some but not all functions of the entire system.

Foundation Model: An artificial intelligence model that is trained on broad data; generally uses self-supervision; contains at least tens of billions of parameters; is applicable across a wide range of contexts; and that exhibits, or could be easily modified to exhibit, high levels of performance at complex tasks. The term includes large language and large multi-modal models.

Geographic Information System (GIS): A framework for gathering, managing, and analyzing data rooted in the science of geography. It integrates many types of data and can analyze spatial location and organize layers of information into visualizations using maps and 3D scenes.

Interoperability: This refers to the ability of different systems, devices, applications, or products to connect and communicate in a coordinated way, without effort from the end-user.

Large Language Model (LLM): A type of artificial intelligence model designed to understand, generate, and translate human language.

Metadata: Data that provides information about other data, which can include information about the content, format, source, and context.

Minimum Viable Product: An application introduced with basic features that consist of the minimum features required to be functional or useful to users. The purpose of a minimum viable product is to test product theories and gauge user response for future product development.

Structured Data: Any data that resides in a fixed field within a record or file. This includes data contained in relational databases, spreadsheets, and other tabular formats.

Taxonomy: An organizational scheme that provides a structured classification system for information, often in a hierarchical form.

Unstructured Data: Information that either does not have a pre-defined data model or is not organized in a specific manner and often includes text documents, emails, social media posts, and multimedia files.

User Experience: The overall experience of a person using a product such as a website or a computer application, especially in terms of how easy or pleasing it is to use.

User-Centered Design: An iterative design process in which designers focus on the users and their needs in each phase of the design process. This approach calls for involving users throughout the design process through a variety of research and design techniques so as to create highly usable and accessible products for users.

Waterfall Development: A sequential process, often used in software development, where work progresses through the phases of conception, initiation, analysis, design, construction, testing, deployment, and maintenance, without iteration or revisiting work done in previous phases.

Appendix 2: Existing Federal Agency NEPA-related Software Systems

Table 1: *Existing Federal agency technology systems discussed in E-NEPA report*

Name	URL (if available)	Agency	Agency Component
CARA - Comment Analysis and Response Application	N/A	Department of Agriculture	U.S. Forest Service
CITAP - Coordinated Interagency Transmission Authorizations and Permits Portal	https://www.citap.gov/	Department of Energy	All components
E-Planning	https://eplanning.blm.gov/	Department of the Interior	Bureau of Land Management
ECOS - Environmental Conservation Online System	https://ecos.fws.gov/ecp/	Department of the Interior	U.S. Fish and Wildlife Service
EIS Database and e-NEPA Filing System	https://cdxapps.epa.gov/cdx-enepa-II/public/action/eis/search	Environmental Protection Agency	All components
Federal Permitting Dashboard	https://www.permits.performance.gov/	Federal Permitting Improvement Steering Council	N/A
IPaC - Information for Planning and Consultation	https://ipac.ecosphere.fws.gov/	Department of the Interior	U.S. Fish and Wildlife Service
NEPAssist	https://www.epa.gov/nepa/nepassist	Environmental Protection Agency	Office of Federal Activities, NEPA Compliance Division
Permitting and Environmental Information Application	https://nbam.maps.arcgis.com/apps/instant/portfolio/index.html?appid=c7906b72e14045bf9fa6fe9addd469a0	Department of Commerce	National Telecommunications and Information Administration
PALS - Planning, Appeals, and Litigation System	https://conservancy.umn.edu/handle/11299/211669	Department of Agriculture	U.S. Forest Service

Name	URL (if available)	Agency	Agency Component
PEPC- Planning, Environment and Public Comment	Public-facing site https://parkplanning.nps.gov Internal site https://pepc.nps.gov	Department of the Interior	National Park Service
Permitting Dashboard Application Programming Interface	N/A	Department of Transportation	Federal Railroad Administration, Federal Highway Administration
Pinyon	https://usfs-public.app.box.com/v/PinyonPublic/folder/157627932228	Department of Agriculture	U.S. Forest Service
RAPID - Regulatory and Permitting Information Desktop Toolkit	https://openei.org/wiki/RAPID	Department of Energy	National Renewable Energy Laboratory
RRS - Regulatory Request System	https://rrs.usace.army.mil/rrs	Department of Army	U.S. Army Corps of Engineers
SOPA - Schedule of Proposed Actions	https://www.fs.usda.gov/sopa/	Department of Agriculture	U.S. Forest Service
Kentucky Interagency Coordination Tool	http://kict.mapwv.org/	Department of Agriculture	Natural Resources Conservation Service
INPCT - Interagency NEPA Permitting & Collaboration Tool	https://www.environment.fhwa.dot.gov/pubs_resources_tools/env_tools/INPCT/default.aspx	Department of Transportation	Federal Highway Administration
PAPAI – Project and Program Action Information System	https://datahub.transportation.gov/Roadways-and-Bridges/Project-And-Program-Action-Information-System-PAPA/63pf-8mej/about_data	Department of Transportation	Federal Highway Administration
ELMS - Electronic Land Management System	N/A	Department of Agriculture	U.S. Forest Service

Name	URL (if available)	Agency	Agency Component
CJEST – Climate and Economic Justice Screening Tool	https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5	Council on Environmental Quality	N/A
RIBITS – Regulatory In-Lieu Fee and Bank Information Tracking System	https://ribits.ops.usace.army.mil/	Department of Army	U.S. Army Corps of Engineers
TDAT – Tribal Directory Assessment Tool	https://egis.hud.gov/TDAT/	Department of Housing and Urban Development	N/A
SHIRA – Strategic Hazard Identification and Risk Assessment Project	https://www.doi.gov/emergency/SHIRA	Department of the Interior	Office of Emergency Management; U.S. Geological Survey
Application Portal for Natural Gas Distribution Line Replacement	N/A	Department of Transportation	Pipeline and Hazardous Materials Safety Administration
Virtual Public Involvement Toolkit	https://www.fhwa.dot.gov/innovation/everydaycounts/edc_6/virtual_public_involvement.cfm	Department of Transportation	Federal Highway Administration
ELibrary	https://elibrary.ferc.gov/eLibrary/	Federal Energy Regulatory Commission	N/A

Appendix 3: Examples of Permits Processed through a Unified Portal

The examples below show how five permits could move through the NEPA process in a distributed application framework, using connected applications in different functional areas. In some cases, existing agency applications could serve these functions, but in many cases the required shared services or data fabric are not yet in place for a unified experience.

Figure 1: *Past practices versus envisioned state to be achieved through incremental steps*

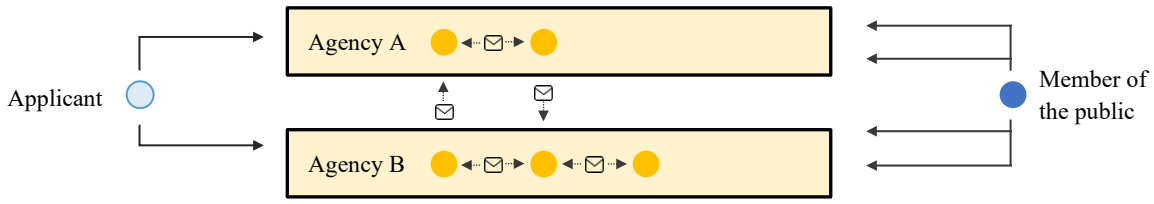
Past practices: Siloed data and multiple redundant applications

Applicants submit similar data to multiple agency systems for one project.

Agency systems do not automatically share data. Agencies typically maintain independent systems to manage NEPA workflows and features, including:

- Application intake
- Agency workflows
- Map services
- Public comment intake
- Document publishing
- Public engagement

The public uses multiple systems to get project updates, view documents, and submit comments.

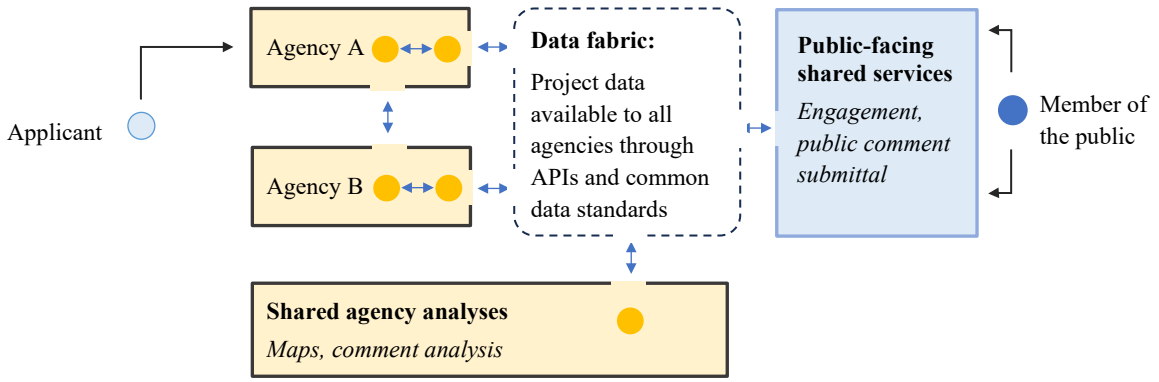


Vision: Shared data across distributed applications

Applicants submit project information to one agency system.

Agency systems exchange data about projects using automated tools like APIs. The shared data supports agency workflows for common needs, including mapping and public comment analysis.

The public uses shared services to meet their needs, like engagement, viewing documents, and commenting.



These are illustrative examples for the reader and are, in some cases, examples of ideal or best-case scenarios for moving through the NEPA process. The system architectures and the ways the tools interact are likewise illustrative and do not represent actual applications or architecture or optimized ways they would connect or interact. These examples show how IT systems would support the processes, but are not prescriptive or exhaustive.

As described in Chapter 3, the types of systems that are used in these examples are:

- Applicant Portals
- Case Management Tools
- Comment Collection and Analysis Systems
- Public Engagement Tools
- Collaboration Platforms
- GIS Applications
- Document Management Systems
- Filing, Publication, and Submittal Systems
- Workflow Automation

Example 1: Federal Land Management Agency Right-of-Way Application for Renewable Energy Generation

Entities Involved

- Project proponent
- Agency 1
- Resource agency A
- Resource agency B
- State, Tribal, and local Governments
- General public

This example involves a proposal by a **project proponent** for a renewable energy generation project located on Federal lands managed by **agency 1**, a Federal land management agency.[1]

[1] Because CEQ does not administer specific permitting programs, the examples in this Appendix include permits from hypothetical agencies that are based on actual permitting regimes. This approach illustrates the utility and application of the online and digital technologies described in this report without creating any implication that the examples illustrate technologies currently in use by specific agencies or interpret those agencies' authorities.

Pre-Application Phase

In this example, the online and digital technologies described in this report come into play long before the start of the NEPA process, when the **project proponent** accesses a ***GIS Application*** administered by **agency 1** to help it identify a proposed site for its generation project. Using this application, the **project proponent** identifies a site on Federal lands that does not include habitat for any special status species or other known sensitive resources, and is located close to existing transmission capacity. The site includes wetlands that are subject to Federal jurisdiction under Section 404 of the Clean Water Act. The ***GIS Application*** generates a list of environmental issues and resources that may be relevant, and directs the **project proponent** to resources that can guide the project proponent through the process.

After identifying the project site, the **project proponent** visits **agency 1**'s website to learn about requirements for obtaining a right-of-way (ROW). The website directs the **project proponent** to **agency 1**'s ***Applicant Portal,*** where the project proponent can import project information, including the proposed location of the project, from the ***GIS Application***. Through the ***Applicant Portal***, the **project proponent** contacts an **agency 1** representative, who provides the **project proponent** the application materials for a ROW, and creates an entry for the project in **agency 1**'s ***Case Management Application***.

The **project proponent** begins working on its ROW application, which includes resource studies for the resources identified by the ***GIS Application***. During this time, **agency 1** invites the **project proponent** to use **agency 1**'s ***Public Engagement Portal***, which helps the proponent reach out to relevant **state, Tribal, and local governments** and members of the **general public** to share information about the project and solicit suggestions about ways to meet the community's environmental and economic needs. The relationships that the **project proponent** develops through these engagement efforts result in the **project proponent** developing a detailed community benefits agreement, and securing the participation of Tribal and county economic development agencies as partners in the proposed project.

Application Review Phase

The **project proponent** then files an application with **agency 1** through the agency's ***Applicant Portal***. The portal routes the application to the agency's ***Workflow Automation Platform***, which determines that the application contains all the required information, updates the project status on the agency's ***Case Management Application***, and notifies the agency staff that the application is ready for completeness review. **Agency 1** staff reviews the application materials and determines that the application is complete, and updates the project's status in the agency's ***Case Management Application***.

The ***Workflow Automation Platform*** informs the agency staff that the proposal is likely to be eligible for review under an environmental assessment (EA), but is most likely not eligible for a categorical exclusion (CE). The automation platform also notifies **agency 1** staff that the proponent has requested to prepare the EA under the agency's supervision, in accordance with the agency's NEPA implementing procedures.

The ***Workflow Automation Platform*** also informs **agency 1**'s staff that the proposal is likely to require endangered species consultation with **resource agency A** and a Clean Water Act permit from **resource agency B**. Accordingly, **agency 1** invites **resource agencies A and B** to serve as cooperating agencies. Using a shared ***GIS Application*** that retrieves data from databases maintained by the relevant agencies, **agency 1** also identifies a number of **state, Tribal, and local government agencies** with jurisdiction by law or special expertise, and invites these agencies to serve as cooperating agencies. Because **agency 1**'s

Case Management Application interoperates through an API with these other agencies' own applications, the ***Case Management Application*** also serves the lead and cooperating agencies as a virtual ***Collaboration Platform***.

The **project proponent** begins developing a draft EA. Using the ***Applicant Portal***, the **project proponent** submits to the lead and cooperating agencies a draft purpose and need statement and reasonable alternatives (which consist of the proposed action and a no action alternative). The agencies review and approve these submissions, and the **project proponent** develops a full administrative draft EA. The lead and cooperating agencies review the administrative draft EA using the virtual ***Collaboration Platform*** and **agency 1** provides consolidated feedback to the **project proponent** through the ***Applicant Portal***. The platforms automatically preserve deduplicated copies of these administrative review materials in **agency 1**'s ***Document Management System***, for inclusion in the agency's decision file. Because the administrative draft EA is based on the resource reports that accompanied the application, and the proposal has been developed with input from **state, Tribal and local governments**, the agencies are able to conduct their independent reviews and approve the administrative draft EA expeditiously.

In parallel with the **project proponent**'s work on the draft EA, **agency 1** consults with **resource agency A**, and determines that the project would have no adverse effects on federally listed species or their critical habitat. The agencies' consultation is facilitated by their virtual ***Collaboration Platform*** and **resource agency A**'s ***GIS Application*** and ***Workflow Automation Platform***, which allow the consultation to conclude in a matter of weeks. **Agency 1** also consults with any Tribal Nations that would be directly affected by the proposal.

After the applicant finalizes the draft EA, **agency 1** publishes the document on its website using a shared ***Filing, Publication, and Submittal Portal***, and ***Public Engagement Platform*** to notify the **general public** and potentially affected entities of the document's availability. **Agency 1** accepts comments for 60 days through its ***Comment Collection and Analysis Platform***. At the end of the comment period, the collection and analysis platform provides the agencies and the **project proponent** a detailed report summarizing all the substantive comments submitted on the document, together with an appendix that contains the original comments.

The **project proponent** revises the EA based on the public comments, prepares responses to the comments, and submits the administrative draft final EA to the agencies, which review and revise the EA.

Decision Phase

The agencies finalize the EA, and **agency 1** prepares a finding of no significant impact (FONSI). **Agency 1** publishes the EA and the FONSI, and uploads the materials to its ***Case Management Application***. Based on review of these materials in their respective ***Case Management Application***, **resource agency B** determines that the project is eligible for approval under a nationwide permit, and **agency 1** decides to grant the ROW.

Agency 1 publishes its decision, along with the accompanying environmental documents, on its website; notifies the public through its ***Public Engagement Portal***; and maintains copies of the final materials in its ***Document Management System***, consistent with its records retention policies. **Agency 1** also informs the public of certain voluntary mitigation measures that the proponent has agreed to undertake in order to

minimize the environmental effects of the project, and shows the public where those mitigation measures will occur using the portal.

Example 2: Federal Funding Application for Direct Air CO_2 Capture

Entities Involved

- Project proponent
- Agency 2
- Resource agency A
- State, Tribal, and local governments
- General public

This example involves a proposal by a **project proponent** for a direct air CO_2 capture facility located on private land, for which the proponent is considering seeking funding from a Federal agency (**agency 2**).

Pre-Application Phase

In this example, the project's location is predetermined. Before deciding whether to seek Federal funding, the **project proponent** would like to know what the environmental review requirements associated with a funding application would be. In order to do so, the **project proponent** accesses **agency 2**'s ***GIS Application*** to identify known environmental resources and issues. Based on this review, the **project proponent** learns that its site is not likely to include habitat for any special status species, wetlands that are subject to Federal jurisdiction under Section 404 of the Clean Water Act, or other known sensitive resources. The ***GIS Application*** generates a list of environmental issues and resources that may be relevant, and directs the **project proponent** to relevant resources to guide it through the process, such as relevant statutes, regulations, and programmatic documents.

Next, the **project proponent** visits **agency 2**'s ***Applicant Portal***, which it uses to contact an **agency 2** representative. The representative provides the proponent the application materials for Federal funding, and creates an entry for the project in **agency 2**'s ***Case Management Application***.

The **project proponent** begins working on its funding application, which includes resource studies for the resources identified by the ***GIS Application***. During this time, **agency 2** invites the **project proponent** to use **agency 2**'s ***Public Engagement Portal***, which helps the developer reach out to relevant **state, Tribal, and local governments** and members of the **general public** to share information about the project and solicit suggestions about ways to meet the community's environmental and economic needs. The portal complements work that the **project proponent** has previously done to engage with the local community.

Application Review Phase

The **project proponent** then files an application with **agency 2** through the agency's ***Applicant Portal***. The portal routes the application to the agency's ***Workflow Automation Platform***, which determines that the application contains all the required information, updates the project status on the agency's ***Case***

Management Application, and notifies the agency staff that the application is ready for completeness review. **Agency 2** staff reviews the application materials and determines that the application is complete, and updates the project's status in the agency's ***Case Management Application***.

The ***Workflow Automation Platform*** informs **agency 2's** staff that the proposal is likely to be eligible for review under an EA, but is most likely not eligible for a CE. The platform also notifies the staff that the **project proponent** has not requested to prepare the EA.

The ***Workflow Automation Platform*** also informs **agency 2**'s staff that the proposal is likely to require informal endangered species consultation with **resource agency A**, and will not require any other Federal permits. **Agency 2** invites a number of **state, Tribal, and local government** agencies with jurisdiction by law or special expertise to serve as cooperating agencies, but these agencies decline.

Agency 2 prepares an EA based upon the information included in the **project proponent**'s application and other information obtained by the agency. Using the ***Applicant Portal***, which also functions as a ***Collaboration Platform***, **agency 2** shares an administrative draft EA with the **project proponent**, who provides feedback. The platform automatically preserves deduplicated copies of these administrative review materials in **agency 2**'s ***Document Management Platform***, for inclusion in the agency's decision file. **Agency 2** then finalizes the EA based on input received.

In parallel with its work on the EA, **agency 1** consults informally with **resource agency A**, and determines that the project is not likely to adversely affect federally listed species or their critical habitat. The agencies' consultation is facilitated by their virtual ***Collaboration Platform*** and their ***GIS Applications***, which allow the consultation to conclude in a matter of weeks.

Decision Phase

After **agency 2** finalizes the EA, it prepares and publishes a FONSI, and uploads the materials to its ***Case Management Application***. Based on the EA, the FONSI, and other materials that accompany them, **agency 2** decides to award funding to the **project proponent**. **Agency 2** publishes its decision, along with the accompanying environmental documents, on its website, using its ***Filing, Publication, and Submittal Portal***; notifies the **general public** through its ***Public Engagement Portal***; and maintains copies of the final materials in its ***Document Management System***, consistent with its records retention policies.

Example 3: Permit Applications for an Interstate Transmission Project

Entities Involved

- Project proponent
- Agency 3
- Tribe A
- State B
- State C
- Other state, Tribal, and local governments

- General public

Pre-Application Phase

This example involves a proposal from a **project proponent** for an interstate transmission project that is located primarily on Federal lands managed by **agency 3**, a Federal land management agency. The project would connect renewable energy generation facilities owned by **Tribe A** and located on that Tribe's lands, within **state B**, with urban demand centers located in adjacent **state C**. **Tribe A** is an investor in the transmission project, and **state C** is considering a request from the **project proponent** for state funding.

In this example, **agency 3**, **Tribe A**, **states B and C**, and the **project proponent** coordinate informally from the earliest stages of the project planning process. Early in this process, **agency 3** creates an entry for the project in its ***Case Management Application***. Using **agency 3**'s ***GIS Application***, the entities jointly identify a number of potential corridors for the transmission project, each with different technical, financial, and environmental advantages and disadvantages. **State C**'s transmission development agency asks to serve as a joint lead agency alongside **agency 3**, and to coordinate the Federal permitting process with the State's own environmental review process. **State B** and **Tribe A** both ask to serve as cooperating agencies. **Agency 3** also identifies a number of other Federal agencies with land management or regulatory responsibilities and **state, Tribal, and local governments** that may wish to serve as cooperating agencies, including other Tribes with present-day or ancestral lands located along the potential corridors.

Once the potential transmission corridors have been identified, the **project proponent** prepares a list of potentially relevant environmental issues and resources, based on information contained in **agency 3**'s ***GIS Application*** and on the proponent's engagement with the agencies and with local communities. The **project proponent** then begins preparing resource reports addressing these environmental issues and resources.

Agency 3 and **state C** determine that because their respective ***Case Management Applications*** use a common application programming interface (API), the developer will be able to submit all the required Federal and State application materials through **agency 3**'s ***Applicant Portal***, which will transmit the materials through the API to **agency 3** and **state C**'s ***Case Management Applications***. Although **state B** and **Tribe A** do not have their own ***Case Management Applications***, **Agency 3**'s use of an API allows **state B** and **Tribe A** to choose from a number of commercially available applications, each of which will allow them to share materials efficiently with **agency 3** and **state C**. Once **state B** and **Tribe A** select their preferred applications and license those applications, the Federal, State, and Tribal agencies are able to use their linked ***Case Management Applications*** as a virtual ***Collaboration Platform***.

Application Review Phase

Once the **project proponent** submits its application for a ROW across **Agency 3**'s lands through **agency 3**'s ***Applicant Portal***, along with the required resource reports, **agency 3**'s ***Workflow Automation Platform*** determines that the application is likely complete. **Agency 3**'s staff reviews the application, confirms that the application is complete, and notifies the **project proponent**. **Agency 3** prepares a notice of intent, which includes a unique identification number generated by **Agency 3**'s ***Case Management Application***, and publishes the notice in the *Federal Register*. The agencies use a shared service to publish the notice on a government-wide ***Filing, Publication, and Submittal Portal***, and initiate an

extensive public outreach campaign through an accompanying shared service on a ***Public Engagement Portal***. Public comments are received through **agency 3**'s ***Comment Collection and Analysis Platform***, which provides the agencies a detailed report summarizing all the substantive scoping comments, together with an appendix that contains the original comments.

Based on the **project proponent**'s resource reports, the information contained in the public scoping comments, and information they obtain from other sources, the agencies develop a set of discrete alternatives for the transmission project, and identify a preferred alternative, which is also the environmentally preferable alternative. The agencies then prepare an administrative draft EIS, which they review and revise using their virtual ***Collaboration Platform***.

Agency 3 publishes and distributes the draft EIS, following the same steps as for the notice of intent. In parallel, the Federal agencies complete consultations and analyses required under various Federal laws, which they coordinate and document through their ***Case Management Applications***. **Agency 3**'s ***Case Management Application*** automatically preserves deduplicated copies of the administrative review materials in the agency's ***Document Management Platform***, for inclusion in the agency's decision file. **State B** also completes analyses required under its own environmental review laws.

After the agencies publish the draft EIS, they again use the common ***Public Engagement Portal*** to solicit public comments, which they collectively analyze through **agency 3**'s ***Comment Collection and Analysis Platform***. The agencies review these comments, revise the EIS, and publish a final EIS.

Decision Phase

Based on the final EIS and other materials that accompanies it in the ***Case Management Application***, **agency 3** prepares and publishes a record of decision (ROD), and grants a ROW for the **project proponent** to build the transmission line. **Agency 3** maintains copies of these final materials in its ***Document Management System.*** **State B** decides to fund the project, and the other Federal agencies issue the required permits and authorizations.

Agency 3 publishes its decision, along with the accompanying environmental documents, on its website, using the ***Filing, Publication, and Submittal Portal***, and notifies the public through the ***Public Engagement Portal***. **Agency 3** also informs the public of certain voluntary mitigation measures that the developer has agreed to undertake in order to minimize the environmental effects of the project, and shows the public where those mitigation measures will occur using the agency's ***GIS Application***.

Example 4: Federal Funding Application for a Tribal Broadband Project

Entities Involved

- Tribe D
- Agency 4

Pre-Application Phase

This example involves an application by **Tribe D**, a federally recognized Tribe, to **agency 4**, a Federal agency, for funding to support a broadband project located on the Tribe's lands.

Before submitting its funding application, **Tribe D** collects information from **agency 4**'s ***GIS Application*** and other sources to determine that the broadband project would have minimal environmental effects. The Tribe obtains an application and submits it, along with the environmental information it collected, through **agency 4**'s ***Applicant Portal***.

Application Review Phase

Agency 4's ***Applicant Portal*** automatically creates an entry for the project in **agency 4**'s ***Case Management Application*** and directs the application materials to **agency 4**'s ***Workflow Automation Platform***. The automation platform determines that the application is complete, and identifies a CE that likely applies to the proposed project. The automation platform also determines, based on the information submitted by **Tribe D**, that the project is unlikely to involve extraordinary circumstances. The automation platform notifies **agency 4**'s staff that the application is ready for review through the agency's ***Case Management Application***.

Agency 4's staff reviews the application, and contacts **Tribe D** through the agency's ***Applicant Portal*** to confirm certain technical and financial information included in the application. The staff also reviews the environmental information, and after reviewing the proposed project location using the agency's ***GIS Application***, the staff coordinates a site visit with the Tribe's staff. The agency's ***Case Management Application*** automatically preserves the relevant materials in **agency 4**'s ***Document Management Platform***, for inclusion in the agency's decision file.

Decision Phase

After completing these due diligence steps, **agency 4** determines that the proposal is eligible for funding, that the CE applies to the proposal, and that no extraordinary circumstances exist. **Agency 4** then approves **Tribe D**'s application for funding.

Example 5: Permit Application for Riparian Habitat Restoration on Federal Lands

Entities Involved:

- State E
- Agency 5
- Resource agency A
- Tribal Nations

Pre-Application Phase

This example involves a proposal by **state E's** wildlife and natural resource agency to conduct riparian habitat restoration on Federal lands managed by **agency 5**, a Federal land management agency.

Before submitting its funding application, **state E** collects information from a variety of sources, including **agency 5**'s ***GIS Application***, on the proposed project's environmental effects. **State E** establishes that the proposed project would have minimal, short-term adverse effects on a number of

resources, including habitat for federally listed species, but would have much greater, long-term beneficial effects on the same resources. **State E** also discusses its proposal with **agency 5**, and with **resource agency A**, which is responsible for ensuring compliance with Federal endangered species laws.

State E obtains an application for a habitat restoration permit from **agency 5**'s website, and submits it, along with the environmental information it collected, through **agency 5**'s ***Applicant Portal***.

Application Review Phase

Agency 5's ***Applicant Portal*** automatically creates an entry for the project in **agency 5**'s ***Case Management Application*** and directs the application materials to **agency 5**'s ***Workflow Automation Platform***. The automation platform determines that the application is complete, and identifies a CE that likely applies to the proposed project. The automation platform determines that the project is likely to involve extraordinary circumstances, due to the presence of habitat for Federally listed species. The automation platform notifies **agency 5**'s staff that the application is ready for review through the agency's ***Case Management Application***.

Agency 5's staff reviews the application, and contacts **state E**'s staff through **agency 5**'s ***Applicant Portal*** to confirm certain technical and financial information included in the application. **Agency 5**'s staff also reviews the environmental information, and after reviewing the proposed project location using the agency's ***GIS Application***, the staff coordinates a site visit with **state E**'s staff agency and with staff from **resource agency A**. **Agency 5**'s ***Case Management Application*** automatically preserves the relevant materials in **agency 5**'s ***Document Management Platform***, for inclusion in the agency's decision file.

After completing these due diligence steps, **agency 5** determines that the proposal is eligible for a habitat restoration permit and that the CE applies to the proposal. The agency confirms that extraordinary circumstances exist due to the presence of habitat for Federally listed species.

Agency 5 consults with **resource agency A**, which determines that the project is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat. The agencies' consultation is facilitated by agencies' interoperable ***Case Management Applications***, which serve the agencies as a virtual ***Collaboration Platform***, and by their ***GIS Applications***, which allow the consultation to conclude in a matter of weeks. **Agency 5** also consults with any **Tribal Nations** that would be directly affected by the proposal.

Decision Phase

Following consultation with **resource agency A** and with any affected **Tribal Nations**, **agency 5** determines that the proposed action does not in fact have the potential to result in significant environmental effects notwithstanding the extraordinary circumstances, and documents this determination. The agency therefore approves **state E's** application for a habitat restoration permit. **Agency 5** publishes its decision, along with the accompanying environmental documents, on its website, using its ***Filing, Publication, and Submittal Portal***, and notifies the public through its ***Public Engagement Portal***.