**GEORGIA DOT RESEARCH PROJECT 22-24**

Final Report

# POST-LET ENVIRONMENTAL ANALYSIS AND PERMITTING FOR ALTERNATIVE DELIVERY PROJECTS


**Office of Performance-based Management and Research**

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16. Abstract

This report presents a guidebook for the management of environmental risk in the post-let phases of alternative delivery projects. Common challenges to environmental analysis and permitting are presented, in addition to a series of best practices and opportunities to promote efficient outcomes within the context of public-private partnerships, including design-build delivery. Through a multimethodological approach of expert interviews, case studies, performance data analysis, and a 'policy delphi' panel, the report synthesizes quantitative and qualitative insights about the nature of environmental risk and its effective management. Particular attention is paid to the similarities and differences in perspective throughout the interorganizational delivery network, spanning state transportation agencies, environmental regulatory agencies, and private design and build firms. The report highlights the importance of interorganizational alignment on three key vectors of project risk: NEPA Reevaluation, Environmental Permitting, and Environmental Commitments. Implementation deliverables from the report include logical flow models depicting the multiple pathways of effective environmental management, and an "Environmental Risk Matrix" to assess project- and portfolio-level exposures to different risk factors. Taken together, the report aims to assist public and private project managers in delivering innovative, efficient projects while preserving environmental obligations under NEPA and coordinating laws.

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# POST-LET ENVIRONMENTAL ANALYSIS AND PERMITTING FOR ALTERNATIVE DELIVERY PROJECTS

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## SI* (MODERN METRIC) CONVERSION FACTORS

### APPROXIMATE CONVERSIONS TO SI UNITS

| Symbol | When You Know | Multiply By | To Find | Symbol |
|---|---|---|---|---|
| | | **LENGTH** | | |
| in | inches | 25.4 | millimeters | mm |
| ft | feet | 0.305 | meters | m |
| yd | yards | 0.914 | meters | m |
| mi | miles | 1.61 | kilometers | km |
| | | **AREA** | | |
| $in^2$ | square inches | 645.2 | square millimeters | $mm^2$ |
| $ft^2$ | square feet | 0.093 | square meters | $m^2$ |
| $yd^2$ | square yard | 0.836 | square meters | $m^2$ |
| ac | acres | 0.405 | hectares | ha |
| $mi^2$ | square miles | 2.59 | square kilometers | $km^2$ |
| | | **VOLUME** | | |
| fl oz | fluid ounces | 29.57 | milliliters | mL |
| gal | gallons | 3.785 | liters | L |
| $ft^3$ | cubic feet | 0.028 | cubic meters | $m^3$ |
| $yd^3$ | cubic yards | 0.765 | cubic meters | $m^3$ |
| | | NOTE: volumes greater than 1000 L shall be shown in $m^3$ | | |
| | | **MASS** | | |
| oz | ounces | 28.35 | grams | g |
| lb | pounds | 0.454 | kilograms | kg |
| T | short tons (2000 lb) | 0.907 | megagrams (or "metric ton") | Mg (or "t") |
| | | **TEMPERATURE (exact degrees)** | | |
| °F | Fahrenheit | 5 (F-32)/9<br>or (F-32)/1.8 | Celsius | °C |
| | | **ILLUMINATION** | | |
| fc | foot-candles | 10.76 | lux | lx |
| fl | foot-Lamberts | 3.426 | $candela/m^2$ | $cd/m^2$ |
| | | **FORCE and PRESSURE or STRESS** | | |
| lbf | poundforce | 4.45 | newtons | N |
| $lbf/in^2$ | poundforce per square inch | 6.89 | kilopascals | kPa |

### APPROXIMATE CONVERSIONS FROM SI UNITS

| Symbol | When You Know | Multiply By | To Find | Symbol |
|---|---|---|---|---|
| | | **LENGTH** | | |
| mm | millimeters | 0.039 | inches | in |
| m | meters | 3.28 | feet | ft |
| m | meters | 1.09 | yards | yd |
| km | kilometers | 0.621 | miles | mi |
| | | **AREA** | | |
| $mm^2$ | square millimeters | 0.0016 | square inches | $in^2$ |
| $m^2$ | square meters | 10.764 | square feet | $ft^2$ |
| $m^2$ | square meters | 1.195 | square yards | $yd^2$ |
| ha | hectares | 2.47 | acres | ac |
| $km^2$ | square kilometers | 0.386 | square miles | $mi^2$ |
| | | **VOLUME** | | |
| mL | milliliters | 0.034 | fluid ounces | fl oz |
| L | liters | 0.264 | gallons | gal |
| $m^3$ | cubic meters | 35.314 | cubic feet | $ft^3$ |
| $m^3$ | cubic meters | 1.307 | cubic yards | $yd^3$ |
| | | **MASS** | | |
| g | grams | 0.035 | ounces | oz |
| kg | kilograms | 2.202 | pounds | lb |
| Mg (or "t") | megagrams (or "metric ton") | 1.103 | short tons (2000 lb) | T |
| | | **TEMPERATURE (exact degrees)** | | |
| °C | Celsius | 1.8C+32 | Fahrenheit | °F |
| | | **ILLUMINATION** | | |
| lx | lux | 0.0929 | foot-candles | fc |
| $cd/m^2$ | $candela/m^2$ | 0.2919 | foot-Lamberts | fl |
| | | **FORCE and PRESSURE or STRESS** | | |
| N | newtons | 0.225 | poundforce | lbf |
| kPa | kilopascals | 0.145 | poundforce per square inch | $lbf/in^2$ |

* SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380. (Revised March 2003)

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## LIST OF ABBREVIATIONS

| | |
|---|---|
| AASHTO | American Association of State Highway and Transportation Officials |
| ACM | Alternative Contracting Method |
| ATC | Alternative Technical Concept |
| BIC | Build Improvement Concepts |
| BMP | Best Management Practice |
| CAP | Corrective Action Plan |
| CD | Collector-Distributor |
| CE | Categorical Exclusion |
| CID | Community Improvement District |
| CWA | Clean Water Act |
| DB | Design-Build |
| DBA | Design-Build Agreement |
| DBB | Design-Bid-Build |
| DBF | Design-Build Finance |
| DBT | Design-Build Team |
| DDI | Diverging Diamond Interchange |
| DNR | Department of Natural Resources |
| EA | Environmental Assessment |
| EAR | Elevated Access Ramps |
| ECM | Environmental Compliance Manager |
| EIA | Environmental Impact Analysis |
| EMS | Emergency Management System |
| EPD | Environmental Protection Division |
| ERIT | Environmental Resource Impact Table |
| ESA | Environmentally Sensitive Area |
| ESB | Environmental Survey Boundary |
| ET | Environmental Team |
| FEIS | Final Environmental Impact Statement |

| | |
|---|---|
| FHWA | Federal Highway Administration |
| FONSI | Finding of No Significant Impact |
| FWS | Fish and Wildlife Service |
| GDOT | Georgia Department of Transportation |
| GEC | General Engineering Consultant |
| GSWCC | Georgia Soil and Water Conservation Commission |
| MOA | Memorandum of Agreement |
| NEPA | National Environmental Policy Act |
| NIA | Noise Impact Assessment |
| NOAA | National Oceanic Atmospheric Administration |
| NOI | Notice of Intent |
| NOV | Notice of Violation |
| NPC | North Perimeter Contractors, LLC |
| NPDES | National Pollutant Discharge Elimination System |
| NPS | National Park Service |
| NTP | Notice to Proceed |
| OAD | Office of Alternative Delivery |
| OES | Office of Environmental Services |
| PDP | Plan Development Process |
| PI | Project Identification Number |
| PIC | Principal in Charge |
| PM | Project Manager |
| PMC | Program Management Consultant |
| PMT | Project Management Team |
| PPP | Public-Private Partnership |
| PS&E | Plan Specifications and Estimations |
| RFC | Request for Qualifications |
| RFC | Release for Construction |
| RFP | Request for Proposal |
| RFQ | Request for Qualification |

| | |
|---|---|
| RID | Reference Information Documents |
| ROW | Right of Way |
| RSP | Reevaluation Support Package |
| SBV | Stream Buffer Variance |
| SCDOT | South Carolina Department of Transportation |
| SME | Subject Matter Expert |
| SRB | Savannah River Bridge |
| STA | State Transportation Agency |
| T&E | Threatened and Endangered Species |
| USACE | United States Army Corps of Engineers |
| USACE SAS | United States Army Corps of Engineers Savannah District |
| USACE SAC | United States Army Corps of Engineers Charleston District |
| VDEQ | Virginia Department of Environmental Quality |
| VDHR | Virginia Department of Historic Resources |
| VDOT | Virginia Department of Transportation |
| VDRPT | Virginia Department of Rail and Public Transport |
| WECS | Worksite Erosion Control Supervisors |
| WOTUS | Waters of the United States |

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## EXECUTIVE SUMMARY

This report is offered as a guidebook for the management of post-let environmental risks in alternative delivery projects for the Georgia Department of Transportation (GDOT). Projects delivered through alternative contracting methods (ACMs) must satisfy the same legal requirements for environmental protection and monitoring as projects delivered through traditional contracting, but they must do so while navigating higher degrees of uncertainty and a broader coalition of public and private partners. Alternative delivery introduces complexity to the post-let phase: however, it also facilitates a flexibility of managerial approach that can attenuate the most severe environmental risks. Researchers pursued a broad, multimethodological investigation to develop logical flow models of post-let processes, distill common challenges related to environmental risks, and present strategic opportunities for effective management.

Three major categories of post-let environmental risk emerged in the research:

1. Reevaluation under the National Environmental Policy Act (NEPA).
2. Acquisition and modification of environmental permits.
3. Preservation of environmental commitments made by the public owner.

While each of these risk categories is colored by the specific context of a project's location and typology, experts interviewed for this project contended that mediating interorganizational dynamics was the most salient risk exposure for alternative delivery projects. Ensuring the alignment of expectations within and between project actors proved to be a consistent theme for successful risk mitigation. A summary of findings is presented below.

## NEPA REEVALUATION AS AN EXPECTED OUTCOME

The process of finalizing the NEPA document is more complex in alternative delivery settings compared to traditional, design-bid-build settings. Because a project's design is not finalized at the time of procurement, the NEPA document—though formally approved—can in practical terms only be considered a preliminary document. As the post-let phase proceeds, design changes initiated by the private partner will result in changes to the forecasted environmental impact, and **NEPA reevaluations will emerge as a normal and expected course of action**. Interviewed subject matter experts (SMEs) from diverse organizational backgrounds, both public and private, concurred that at least one NEPA reevaluation should be anticipated for alternative delivery projects. Depending on the size and complexity of the project, multiple reevaluations may be warranted as portions of the design are sequentially completed. In this way, a simple count of the number of reevaluations is not an appropriate measure of performance for environmental risk management; rather, **a count of anticipated versus unanticipated reevaluations** should be considered as one proxy for the sophistication of post-let planning and execution.

Forecasting the necessity and magnitude of a NEPA reevaluation resulting from a given bundle of design changes will depend upon a variety of geographical and regulatory factors. The most advanced design-build contractors will not only anticipate the need for reevaluation and allocate the appropriate resources but also take advantage of the concurrency of design and construction to extract extra efficiencies from the reevaluation process. For example, the reevaluation for a straightforward early works package like clearing and grubbing might be expedited to allow this activity to proceed, even as more complex design elements are finalized. If a project contains a bridge element, the design-builder might choose to address the reevaluation in a separate submission from the roadway approaches, which by comparison may face fewer

resource-based requirements (e.g., assessments of stream impacts). The point of emphasis should be the intentionality of the design-builder, who assesses the needs of the project against the anticipated legal and administrative requirements and charts a reevaluation course accordingly. The pursuit of concurrent reevaluations may enable a defensive redundancy in which delays to one area of the project do not impede the forward progress of the project overall. In contrast to a traditional delivery project, where NEPA reevaluations are considered disruptive to the project schedule, the scheduling of multiple reevaluations for major projects may therefore reflect a *higher* degree of managerial competence.

## PROACTIVE MANAGEMENT OF NEPA AND PERMITTING REQUIREMENTS

Anticipating the number and nature of post-let reevaluations is challenging, and the emergence of an unanticipated NEPA reevaluation can still pose a serious risk to project success. SMEs from GDOT, its management consultant, and private contractors all identified ambiguities in the stated "triggers" of reevaluation and recounted examples of interorganizational disagreement on alternative delivery projects. If a design-builder is expecting to be granted expedited approval of a design submission but GDOT determines a full reevaluation is required, the resulting discrepancy can have cascading impacts on project schedule and budget. Alignment can prove even more challenging if there is a divergence of expectations held by out-of-state practitioners participating in the Georgia context for the first time; standard environmental laws may be implemented differently according to regional norms, and the coordinating state and federal agencies may lack familiarity with the alternative delivery process.

In conversation with 43 SMEs and through examination of multiple case studies in diverse contexts, the researchers identified a number of managerial best practices to address challenges related to the post-let planning.

1. Guidance documentation specifying the type and threshold of design changes eligible for expedited approval may be clarified and distributed to potential bidders during the procurement phase.

2. Advanced clarification of design boundaries can facilitate the strategic formulation of critical path scheduling that is evaluated as part of selection and then collaboratively deliberated during post-award kickoff meetings.

3. Early participation of environmental experts provides an opportunity for the owner to "force the question" of how the design-builder intends to phase the pursuit of environmental approvals.

4. The participation of representatives from agency partners like the Federal Highway Administration (FHWA) allows for a further clarification of expectations.

5. The "reevaluation support package" (RSP) protocol on recent alternative delivery projects ensures the completeness of reevaluation documentation and streamlines the approval of post-let design submissions.

With these considerations in mind, the researchers developed an Environmental Risk Matrix to be used as an alignment tool between public and private partners for assessing the risk exposures on a given project.

## ENVIRONMENTAL COMMITMENTS AS "BOTTOM-UP" RISK EXPOSURE

NEPA reevaluation and permitting modification may be understood as "top-down" risk exposures, wherein design choices initiated by the design-builder precipitate the need for additional analyses and administrative approvals. By contrast, environmental commitments may be framed as a "bottom-up" risk exposure that manifests on the ground during post-award construction phases. Formulated and agreed to by the owner during project development phases, commitments can span

a broad collection of resources and third-party interest groups; for example, the owner might commit to limit stream turbidity to within a legal threshold, to avoid disturbance of sensitive ecological habitat, or to maintain public access to recreational resources. Critically, while these pledges are committed to by the owner agency, the actor fulfilling them is the private design-build entity contracted to deliver the project. SME interviewees emphasized the importance of ensuring continuity of understanding with respect to the safekeeping of commitments, particularly among the subcontractors and consultants hired by the design-builder. As the worksite labor force expands and churns, environmental compliance managers should consistently communicate expectations, actively monitor for violations, and employ resource-based trainings as needed. Even minor violations can escalate into major disruptions like a project shutdown if the contractor does not demonstrate a concerted effort to achieve compliance. The utilization of simple management tools such as a “tracker” spreadsheet can provide an effective means of commitments preservation over the life of a project.

# CHAPTER 1. INTRODUCTION

## BACKGROUND

To date, 48 states have authorized alternative contracting methods (ACMs) to deliver large-scale infrastructure projects (Design-Build Institute of America 2024). ACMs or alternative delivery promise performance gains in terms of schedule and cost mainly through bundling design finalization and construction activities into a single contract (Whittington 2012). For state transportation agencies (STAs) to fully realize the potential benefits of alternative delivery, they need to understand and adjust to differences between traditional and alternative project delivery systems (Ashuri, Mostaan, and Hannon 2013).

One area that can potentially benefit from realignment of organizational resources is post-let environmental analysis and permitting (Hannon, Mostaan, and Ashuri 2014). Environmental processes often lie on the critical path of a project, and managing environmental risks and streamlining environmental processes have been important agendas in traditional delivery (An et al. 2018; Mistur et al. 2021). However, existing evidence on how post-let environmental risks affect project performance in alternative delivery remains relatively sparse in academic literature, government documents, and industry reports.

One reason for limited evidence is that practitioners perceive the magnitude of environmental risk to be significantly lower for alternative delivery compared to traditional delivery. Many subject matter experts (SMEs) interviewed for this report (see appendix A) ranked environmental risk as the highest or second highest for traditional delivery but ranked it lower for alternative delivery when compared to utilities, geotechnical, or right of way risks. Another reason is that post-let environmental processes are understood as more of a compliance issue and less as a risk that needs to be managed. This perspective was also repeatedly confirmed with many SMEs

who found it surprising that the research team used the term risk to characterize post-let environmental processes in alternative delivery.

However, an assessment of post-let environmental risks and their management is particularly relevant in a national market context defined by increasing incongruence between public and private sector willingness to pursue alternative delivery projects. Notable contracting firms like Granite and Skanska have publicly stated significant reluctance to pursue new lump-sum alternative delivery projects after experiencing high-profile losses (Korman 2022; Rubin and Powers 2019). Perceptions of excessive risk transfer, including environmental risks, are an oft-cited cause behind this reduction in private sector interest. Anticipated increase in national public expenditure on transportation alternative delivery projects from $53 billion to $81 billion from 2021 to 2025 following the passage of the 2021 Infrastructure Investment and Jobs Act (IIJA) further highlights the need for the analysis of delivery method selection on the management of post-let environmental risks (Design-Build Institute of America and FMI Consulting 2023).

## OBJECTIVES

This report intends to serve as a guidebook for Georgia Department of Transportation (GDOT) staff to effectively mitigate and manage environmental risks in the post-let phase of alternative delivery. By identifying risks and recommending best practices that can potentially improve cost and schedule outcomes, it seeks to assist GDOT administrators in the structuring and administration of future alternative delivery endeavors. Specifically, the guidebook explains the risks and best practices related to National Environmental Policy Act (NEPA) reevaluations, environmental permitting and approvals, and environmental commitments.

## TYPES OF POST-LET ENVIRONMENTAL RISKS

Before discussing the details of post-let environmental risks in alternative delivery, it is important to lay out the differences between traditional and alternative delivery and their implications for managing environmental risks. Alternative delivery is a procurement contracting method for transportation projects that combines design and construction phases into a single contract, most notably through an arrangement known as "design-build" (DB). The public owner agency develops a preliminary project design, typically to 30 percent completion, and solicits the submission of lump-sum bids from private partners for the right to complete design and construction. This alternative procurement strategy departs from traditional delivery, which utilizes a design-bid-build (DBB) methodology with separated contracts. Vesting a single private entity with the responsibilities to both design and construct an asset creates opportunity for efficiency gains to be realized through the streamlining of schedules and resources (Whittington 2012).

Procuring a project with incomplete design generates significant challenges, however. As the responsibilities performed by the government in traditional delivery are transferred to the private partner, so too are the attendant risks of failure (Hannon, Mostaan, and Ashuri 2014). Although there is limited evidence on how post-let environmental risks affect project performance, earlier studies have well documented the challenges of individuals and organizations transitioning from a traditional to an alternative delivery mindset and the adjustments STAs and regulatory agencies have made with the introduction of alternative delivery (Hess 2007; Kucharski and Spellecacy 2014; AASHTO 2005; Pesesky et al. 2019; Ashuri, Mostaan, and Hannon 2013).

The main difference between post-let environmental processes in alternative and traditional delivery is that environmental approvals are not finalized at the time of letting the project. In other words, pre-let NEPA approval is by nature tentative (Whittington 2012). In the post-let phase of

an alternative delivery project, the private partner completes both design and construction elements of a project. As private partners finalize design, pre-let NEPA approvals often undergo reevaluations (Ashuri, Mostaan, and Hannon 2013). While NEPA reevaluation has been acknowledged as a potential post-let environmental risk, research on the relationship between NEPA reevaluations and project performance is extremely limited (Hannon, Mostaan, and Ashuri 2014; Lin 2021).

Managing post-let environmental processes in alternative delivery is difficult because it is an innovation developed within a mature environmental policy and implementation context (Hess 2007); many of the rules and regulations developed to manage traditional DBB projects have been adapted for alternative delivery (GDOT OES 2021). This creates challenges because the public owner agency often remains as the official correspondent or signatory on environmental documents and permit applications while the private partner initiates and provides documentation on a significant portion of these processes (Ashuri, Mostaan, and Hannon 2013). Regulatory agencies generally have a strong preference to not directly speak with the private partner, and the coordination of regulatory agencies, the public owner agency, and the private partner can present significant challenges to on-time and on-budget project delivery (Hess 2007).

Project managers (PMs) can better locate and manage risks by separating post-let environmental processes into three workflows: NEPA reevaluations, environmental permitting and approvals, and environmental commitments. While these processes are not mutually exclusive, they are relatively discrete workflows that introduce different sets of risks to project delivery. The utility of our conceptualization has been confirmed in our interviews with SMEs (see chapter 3), which is crystalized in our logic model (see chapter 2). The post-let environmental risk matrix

introduced in chapter 4 is also based on the separation of post-let environmental processes into these three workflows.

**NEPA Reevaluations**

Securing NEPA approval is the most significant environmental assignment of any major transportation project. Before it may proceed with its "preferred" action, the sponsoring government agency (e.g., GDOT) is tasked with shepherding an analysis of the environmental impacts resulting from a range of policy alternatives. The nature of alternative delivery necessitates some level of reevaluation; preliminary NEPA approvals are secured with project design at just about 30 percent completion, so private partners must seek reapprovals subject to their design modification and finalization (Kucharski and Spellecacy 2014; Perez, Giordano, Rino, and Thompson, Jennifer 2013). Specifically, significant changes to the environmental impacts resulting from a project's altered design must be evaluated by environmental oversight agencies to ensure the preservation of environmental public values such as conservation and the avoidance of excess harm to human and natural communities (US Department of Transportation 2019).

***Anticipated Reevaluations Are Neutral Events***

Most reevaluation needs can be identified in advance through early coordination between the private partner, the public owner agency, and regulatory agencies. A best practice is to have early communication on triggers and thresholds for reevaluations as well as to establish protocols for handling changes in impacts (Kucharski and Spellecacy 2014; Perez, Giordano, Rino, and Thompson, Jennifer 2013). In addition, a post-award transition plan that includes retaining key environmental personnel from the pre-let phase can help streamline environmental processes in the post-let phase (Kucharski and Spellecacy 2014). STAs with NEPA assignment status from the

Federal Highway Administration (FHWA) have been found to handle coordination more smoothly because these STAs have more discretion on dictating the terms of how to handle reevaluations (Pesesky et al. 2019).

Anticipated reevaluations generally do not pose a significant risk to overall project performance because they can be incorporated into the overall project schedule early in the project. The environmental compliance manager (ECM) hired by the private partner is the key person who acts as a liaison between design and construction teams to minimize impacts of environmental approvals caused by design changes (Kucharski and Spellecacy 2014; AASHTO 2005; Pesesky et al. 2019). The ECM is also the main point of contact between the public owner and the private partner on environmental issues. Therefore, requiring a highly skilled ECM can enable environmental processes to be strategically scheduled such that they do not pose a significant risk to project delivery.

### *Unanticipated Reevaluations Are Disruptive Events*

Reevaluations that were not anticipated are most likely to pose a significant risk to project delivery. When unanticipated reevaluations arise, they disrupt the project schedule because they are processes on the critical path that were unaccounted for. Unanticipated reevaluations can be caused by a variety of reasons, ranging from misalignment of expectations to natural disasters. Disagreement between the private partner, the public owner, and regulatory agencies on the triggers of reevaluation or the threshold for what constitutes a significant impact can result in schedule delay and cost overrun (Lin 2021).

### *Reevaluations Create Additional Workload*

The number of reevaluations can range from a handful to over 100 when no-change reevaluations are included (see chapter 3). This creates additional workload for the public owner and regulatory agencies and should be prepared for in advance. Approval processes are an often-cited bottleneck, and STAs have increased their reliance on consultants and have sponsored liaison funded positions at key regulatory agencies to streamline review of environmental documents (Mistur et al. 2021; FHWA 2009). GDOT also sponsors liaison funded positions in agencies such as the U.S. Army Corps of Engineers (USACE), the U.S. Fish and Wildlife Service (FWS), the National Park Service (NPS), and the Georgia Department of Natural Resources (GA DNR) Environmental Protection Division (GA EPD) to prioritize document approvals for GDOT.

## Environmental Permits and Approvals

Similar to NEPA approval, before construction may proceed, private partners must secure the many permits that result from environmental laws at the federal and state level. A single project may require application for dozens of permits, particularly if the alignment intersects with vulnerable resources such as rivers, streams, and wetlands. The allocation of permit acquisition responsibility differs by state, project, and permit; some states require the private partner to acquire all permits, whereas other states pursue preliminary permits and require the private partner to solicit approval for permit modification following final design (Hannon, Mostaan, and Ashuri 2014; AASHTO 2005; Hess 2007). GDOT follows a hybrid approach. The state transfers responsibility for certain items like stream buffer variances to the private partner but takes the initiative on others, such as wetland mitigation credits, allowing the private partner to procure more in the event that design changes render them necessary.

Securing all necessary permits requires extensive coordination across a complex network of public and private actors (Hess 2007). Delays to this process can severely impact project cost and schedule performance, particularly to the extent they are on the critical path of construction timelines. To mitigate this risk and increase partner confidence, GDOT's Programmatic Technical Provisions provide the "Agency Review and Issuance Time Period" associated with each permit. In the event a reviewing governmental agency (e.g., USACE) fails to issue a ruling in the allotted period, the private partner may be eligible for schedule relief. Nevertheless, environmental permit management presents a major risk to successful delivery and demands significant resources to coordinate effectively. Recommended best practices are well-written requests for proposals (RFPs) with detailed requirements for environmental commitments and coordination between STAs, regulatory agencies, and the private partners, and acquisition of critical permits by STAs (AASHTO 2005).

**Environmental Commitments**

In the course of securing preliminary NEPA approval for a project, GDOT must commit to various measures to avoid, minimize, and mitigate environmental damages to both human and natural communities. These commitments are gathered in a document called the Environmental Commitments Table (ECT; also known in Georgia as the "Greensheet"). In the later construction and operational phases of the project, the private partner must honor these commitments made by the owner in the project development phase. Examples of commitments include pledges to utilize erosion control instruments, monitor for vulnerable wildlife (e.g., spawning fish), or maintain accessibility to pedestrian recreational facilities. These commitments may be preserved, supplemented, or slightly amended in the post-let phase, depending on the scope of project changes implemented by the private partner.

Such commitments to avoid, minimize, and mitigate environmental damages are present in traditional delivery infrastructure projects as well, and the procedure to monitor and uphold them is not dramatically changed in alternative delivery contexts. Nevertheless, failure to uphold environmental commitments can precipitate severe penalties to project cost and schedule. Even faithful adherence to commitments—halting construction activity in the event of an endangered species, for example—can trigger unanticipated costs. Given the size and complexity of alternative delivery projects, the possibility for smaller scale complications from environmental commitments to "bubble up" into high-impact problems merits their further consideration as post-let environmental risks.

STAs employ an Environmental Management System (EMS) to monitor the implementation of environmental commitments made in the NEPA process. EMS refers to quality assurance procedures for environmental compliance, including written protocols, recordkeeping, reporting, training, and auditing. Regulatory agencies are more likely to reduce their level of intervention and oversight based on their confidence in the implementation of an EMS by STAs (The Louis Berger Group, Inc, McVoy Associates, LLC, and Kober 2019). GDOT also implements an EMS through its digital project management platforms such as ProjectWise and eBuilder. However, its digital project management platforms currently function more as a document repository and less as a tracking system. This curtails GDOT's ability to monitor environmental performance and systematically evaluate its alternative delivery portfolio (see chapter 2 and appendix E).

## ROADMAP

This guidebook distills findings from SME interviews; three in-depth case studies; review of academic literature, government documents, and industry reports; and expert panel feedback on

construction of a post-let environmental risk matrix to assist GDOT staff in their efforts to manage post-let environmental risks in alternative delivery. When not properly managed, post-let environmental risk can cause significant cost and schedule overrun, which may lead private partners to avoid presenting bids for future alternative delivery projects. Accurate assessment and mitigation of post-let environmental risk therefore enhances the ability of STAs to search for partners for alternative delivery projects and to effectively deliver critical infrastructure.

Chapter 2 presents logic models to describe post-let environmental risk management. The logic model crystalizes our findings in a series of visuals to explain to GDOT staff that

- NEPA reevaluations are a natural part of alternative delivery;
- for larger projects, NEPA reevaluations are often strategically bundled and sequenced to minimize disruption to the construction timeline;
- NEPA reevaluations, environmental permitting and approvals, and environmental commitments are discrete processes with significant overlap; and
- the current data generation process curtails GDOT's ability to monitor and manage environmental performance.

Chapter 3 describes post-let environmental processes in greater detail and analyzes challenges and opportunities for environmental risk management. We integrate our findings from

- interviews with 43 SMEs across the country;
- case studies of the I-20 at Savannah River Bridge Replacements, Transform I-285/SR-400, and Transform I-66 Outside the Beltway (Virginia DOT [VDOT]) projects; and
- a review of GDOT and other government documents.

This section unpacks the complexities of the project delivery network, describes how pre-let inputs pose challenges and opportunities for post-let activities, and identifies current challenges and potential opportunities for environmental management in GDOT's alternative delivery program.

Chapter 4 introduces the post-let environmental risk matrix. The risk matrix was initially developed as a tool to evaluate GDOT's alternative delivery program; however, feedback from an expert panel suggest that the risk matrix can be a useful tool to align key stakeholders throughout the life cycle of a project.

Chapter 5 summarizes our main findings into a single table, and the appendices include the research methodology (appendix A), detailed case study analyses (appendix B, appendix C, and appendix D), an assessment of GDOT's environmental data management protocol and performance (appendix E), as well as our interview protocol (appendix F) and survey instrument (appendix G).

# CHAPTER 2. LOGIC MODELS FOR ENVIRONMENTAL RISK MANAGEMENT PROCESSES

Synthesizing input from the literature, agency documentation, and interviewee experiences, the researchers developed logic flow models to visually represent the environmental risk management process in alternative delivery settings for GDOT.

The logic models include three primary stakeholder groups:

| | |
|---|---|
| Owner's Team: | GDOT and its representatives, including program management consultants (PMCs), and general engineering consultants (GECs). |
| Delivery Team: | DB firm and its subconsultants. |
| Regulatory Agencies: | State and federal agency partners, including the FHWA, USACE, and GA DNR. |

The relationship between the three is fundamentally collaborative. The Owner's Team initiates the project, develops preliminary designs, conducts initial environmental impact analyses (EIAs), and manages procurement. The Delivery Team then handles detailed design, construction, and sometimes maintenance, ensuring adherence to environmental guidelines and securing necessary reapprovals. Federal and state Regulatory Agencies oversee compliance with environmental laws, review documents, and provide essential checks and balances to minimize the project's environmental impact.

## MODEL 1: ENVIRONMENTAL RISK MANAGEMENT IN THE POST-LET PHASE

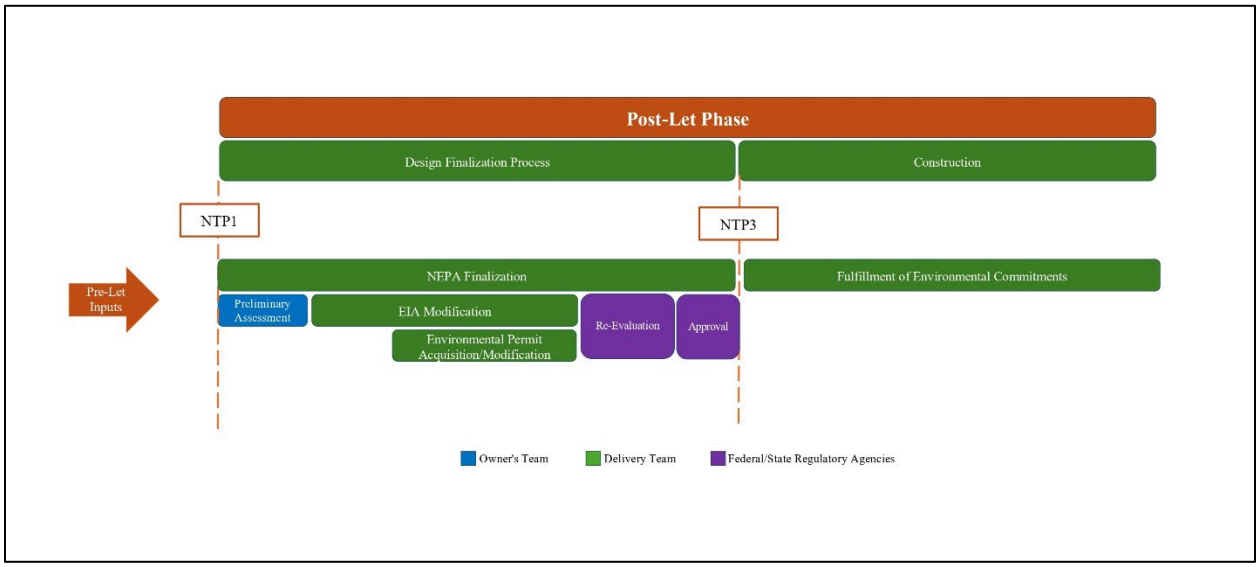


**Figure 1. Flowchart. Model 1: Environmental risk management in the post-let phase.**

Model 1 (figure 1) details environmental processes in the post-let phase, outlining the key steps and interactions between relevant stakeholders. The model visually depicts the interplay between two critical processes happening simultaneously in the post-let phase: (1) Design Finalization and (2) NEPA Finalization. Furthermore, it depicts the fulfillment of design-specific environmental commitments following the initiation of construction.

*Design Finalization:* The Delivery Team refines and completes the project design. This phase involves detailed engineering work to ensure the design meets all project specifications and regulatory requirements. Final design is submitted upon Owner issuance of Notice to Proceed 2 (NTP2).

*NEPA and Permit Finalization*: In parallel, the Delivery Team coordinates with the Owner's Team to assess whether proposed design changes merit modifications to EIAs and a formal NEPA reevaluation. Reevaluation considerations proceed for all design changes (in Model 1: Preliminary Assessment).

- If the design changes implicate a sufficiently minor change to the magnitude of the environmental impact, the Owner's Team may choose to grant a No Change NEPA Reevaluation, requiring a minimal update to the EIA.
- If design changes implicate more than a minor change to the magnitude of environmental impacts, the Owner's Team will not grant a No Change Reevaluation, and the Delivery Team must conduct a detailed EIA of the changed design.
- Simultaneously, pursuant to any changes implicated by the developing design, the Delivery Team prepares new environmental permit applications along with modifications to existing permit applications.
- Upon internal approval, the Owner's Team submits the updated EIAs and permit applications to the relevant federal and state Regulatory Agencies for final review and approval to ensure compliance with environmental standards.

This assessment of the suitability of a No Change Reevaluation may be segmented according to the design and construction phasing submitted by the Delivery Team. These and other considerations are presented in further detail in Model 2, and in chapter 3 (see Pathways to NEPA Reevaluations).

*Construction*: After the Delivery Team obtains the requisite environmental approvals and permits, the Owner's Team will issue a Notice to Proceed 3 (NTP3) and a Release for Construction (RFC) for the reevaluated design elements. The Delivery Team must ensure that all construction activity adheres to the environmental commitments specified during the approval and permitting process, including the obligation to monitor and report compliance and noncompliance.

## MODEL 2: CONCURRENT PATHWAYS OF POST-LET ENVIRONMENTAL MANAGEMENT

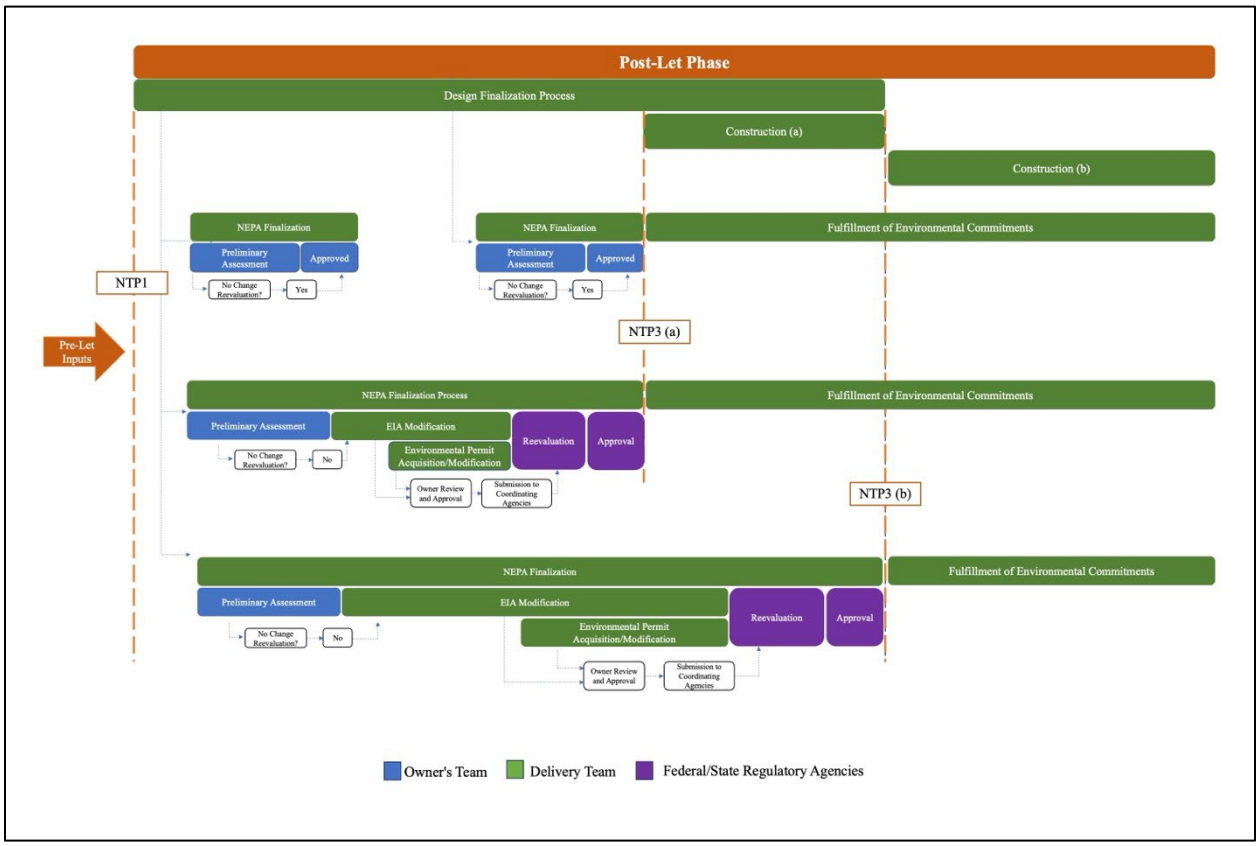


**Figure 2. Flowchart. Model 2: Concurrent pathways of post-let environmental management.**

Model 1 provides a baseline depiction of the logic flow of post-let environmental risk management for alternative delivery projects, reflecting the processes and procedures outlined in GDOT programmatic documentation (GDOT OES 2021). This notwithstanding, SME interviews revealed significant variation in Delivery Team approaches to NEPA reevaluation sequencing and a measure of uncertainty with respect to "thresholds" to satisfy No Change Reevaluation requirements.

To this end, Model 2 (figure 2) depicts the post-let phase with greater detail and represents the sum distillation of researchers' investigations of post-let environmental risk management in

Georgia. The model incorporates the diversity of strategic scheduling approaches, the simultaneity of reevaluation processes, and the bifurcation of reevaluation "pathways" according to a No Change designation. Some preliminary considerations are presented below and supplemented in the discussion of SME interview evidence in chapter 3.

*Bundling of Design Components*: In Model 1, the Delivery Team bundles all design changes and finalizations into a single reevaluation package that is assessed by the Owner's Team for "No Change" status and processed accordingly. In contrast, Model 2 presents a more nuanced depiction that reflects the iterative and multitracked approach often witnessed in GDOT's alternative delivery portfolio.

Significant schedule efficiencies may be realized through the strategic bundling of design elements. Design elements that undergo no revision, or very minor revision, may be bundled together in expectation of a speedy No Change Reevaluation process facilitated by the Owner's Team. These elements might share a similar geography or technical scope. By grouping such design changes together in a "reevaluation support package" (RSP), the process may be expedited and result in a quicker RFC for the indicated section. Many No Change RSPs may be submitted and processed for a single project.

Similarly, design elements that are anticipated not to receive No Change status may be bundled into an RSP for a more intensive calculation of changes to the initial EIA. Resource-specific simulations (e.g., noise, air, traffic) must be remodeled, permits may require modification, and new or modified Notices of Intent (NOI) may be issued, inviting lengthy public commentary. Notably, in contrast to the No Change pathway, these documents must be submitted to the relevant state and federal agencies for reevaluation and reauthorization. The involvement of external agencies opens the potential for lengthy delay from a variety of sources.

*Strategic Scheduling*: In consultation with the Owner's Team, the Delivery Team may choose to initiate and submit multiple RSPs at different times. This may be done strategically to coordinate early works packages and phased construction. Reevaluation work is performed simultaneously across RSPs. In Model 1B, construction is divided into two phases: NTP3(a) and NTP3(b). The former combines multiple No Change Reevaluations with a full reevaluation of moderate length, whereas the latter comprises a single reevaluation of greater length. For bundling to proceed effectively, the Delivery Team and Owner's Team must align expectations with respect to the threshold for granting a No Change Reevaluation.

Although Model 2 depicts reevaluation and construction in two phases, Delivery Teams may choose to segment projects into more phases as needed to expedite completion of construction. This crystallizes the importance of proactive scheduling for environmental reevaluations. An adept Delivery Team can anticipate the duration of reevaluation pathways and optimize the schedule to facilitate early works construction during the finalization of more rigorous design elements. A multi-path reevaluation plan furthermore provides operational redundancy and insurance; in the event of unexpected delay to the reevaluation of a segment, mobilized labor may be reallocated to alternative segments granted approval. Altogether, while **at least one NEPA Reevaluation should be anticipated for alternative delivery projects**, the flexibility of the approach results in a **lower acuity of environmental risk** if properly managed.

*Data Generation Through Post-Let Processes*: Data related to environmental management processes will be generated for each of the elements depicted in Model 2. Depending on the element in question, the data will be generated and governed by different members of the distributed public–private network activated to deliver these projects. For example, when a Delivery Team submits an RSP to the Owner's Team, this triggers a digital timestamp to begin a

contractually specified duration of review. The dates and contents of all such interorganizational communication are captured by digital project management platforms specified by the Owner's Team. These platforms likewise host data generated through the fulfillment and enforcement of environmental commitments, such as measurements of turbidity in impacted waterways. At time of writing, there are two primary digital platforms in use—ProjectWise and eBuilder—which tend to be favored by different organizational user bases and utilized for different tasks at different phases. This distributed nature of post-let environmental processes can complicate the comprehensive management of data. A fuller discussion of data practices, challenges, and opportunities is available in appendix E.

## MODEL 3: ENVIRONMENTAL MANAGEMENT FROM PRE- TO POST-LET

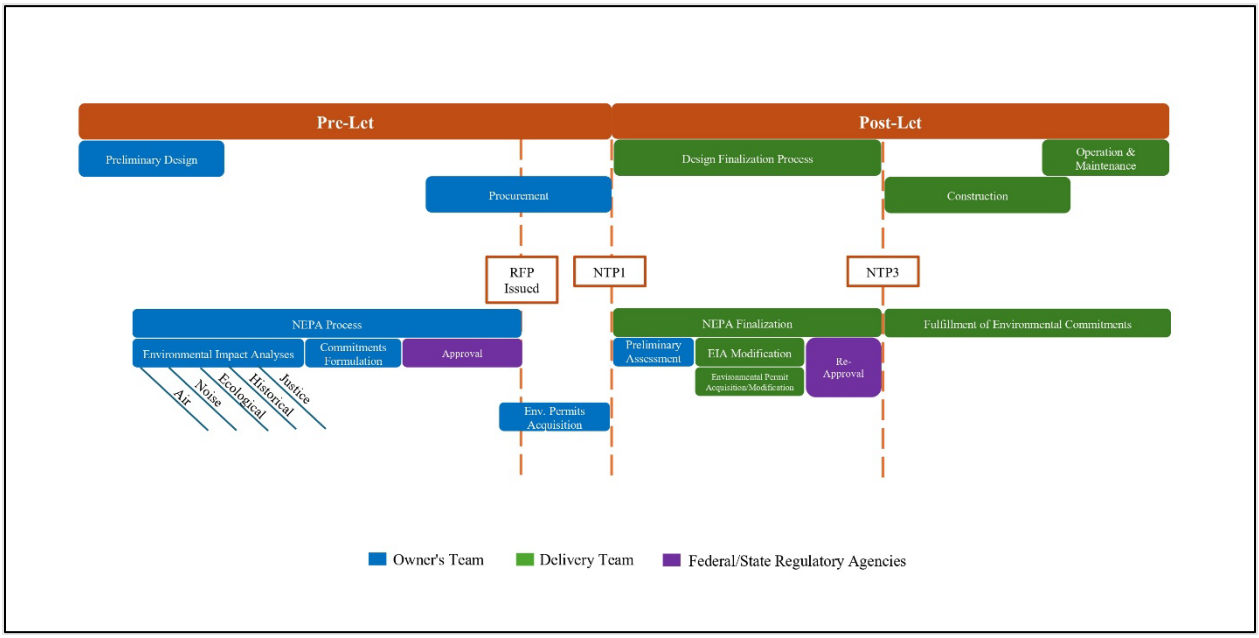


**Figure 3. Flowchart. Model 3: Environmental management from pre- to post-let.**

Model 3 incorporates environmental processes beginning in the pre-let phase of alternative delivery projects. Inclusion of the pre-let phase is critical because the decisions and approval

activities in that phase directly shape the universe of changes permitted during post-let design finalization and construction.

**Pre-Let Environmental Approval Process**

GDOT standard practice is to attain NEPA approval in advance of project procurement. The resource EIAs performed for this document are based on the preliminary design developed for procurement documentation. In this phase, impacted resources are cataloged on an Environmental Resource Impact Table (ERIT), and the attending Commitments are formulated and cataloged on a project Greensheet. Owner-initiated permits are also secured at this time. These documents are incorporated into the larger NEPA document, and they are reviewed and approved by the relevant federal and state regulatory agencies.

A comprehensive approach to both pre-let and post-let phases of the environmental approval process is crucial for successful project delivery in alternative contracting settings. Owner's and Delivery Teams must coordinate extensively to ensure continuity of documentation and resource commitments during the handoff process that occurs during procurement.

# CHAPTER 3. POST-LET ENVIRONMENTAL MANAGEMENT: PROCESSES, CHALLENGES, AND OPPORTUNITIES

Leveraging evidence from SME interviews and alternative delivery project documentation, this chapter explores common challenges and opportunities for post-let environmental risk management. The researchers engaged 43 SMEs occupying diverse roles throughout the delivery network in semi-structured interviews. These interviews were categorized as either (1) general or (2) related to one of the three case studies examined for the report. Of 43 total SME interviewees, 19 were general interviews and 24 were case study interviews. A total of 25 SMEs came from the private sector and 18 from the public sector. The range of professional perspectives among SMEs allowed for a holistic exploration of risks and management strategies in the alternative delivery context.

The synthesis of interview data presented below is organized according to the reoccurring themes found in the logic model of post-let environmental processes (figure 2). Generally speaking, the anonymized naming convention for SMEs referenced in the report corresponds to the order in which they were interviewed. A larger discussion of the SME selection process, organizational distribution, and interview methods can be found in appendix A. Additionally, a full report of each case study can be found in appendix B, appendix C, and appendix D, respectively. The three case studies included in this report in order of appearance are (1) I-20 at Savannah River Bridge Replacements, (2) Transform I-285/SR-400, and (3) Transform I-66 Outside the Beltway.

## DELIVERY NETWORK CHARACTERISTICS

### The Project Delivery Network

As outlined in the logic models (see figure 1, figure 2, and figure 3), post-let environmental processes for alternative delivery projects is carried out across a network of actors that can be broadly compartmentalized into the Owner's Team (GDOT Office of Alternative Delivery [OAD], GDOT Office of Environmental Services [OES], PMCs, and GECs), the Delivery Team (the private partner and its subcontractors), and state and federal agencies (e.g. FHWA, GA EPD, USACE). These organizations are formally linked through a hierarchical approval chain, and understanding the nature of the relationships between organizations provides important context for the GDOT OAD PM, who is ultimately responsible for aligning actors across the entire network to ensure on-schedule and on-budget project delivery.

The Owner's Team can be further divided into (1) GDOT OAD and OES and (2) their representatives, the PMCs and the GECs. The OAD PM oversees the project as the Principal in Charge (PIC); the OES approves environmental documents submitted by the design-builder and acts as a liaison with external actors for seeking NEPA reevaluation approvals, submitting major permitting applications, and upholding environmental commitments. The expansion of GDOT's alternative delivery portfolio has led to increased delegation of tasks to the PMC and the GEC, and OAD and OES staff oftentimes play much more of just an advisory role (SME #1, SME #2, SME #9, SME #10, SME #33). Removed from most of the day-to-day activities, OES focuses on larger issues that can potentially cause major disturbances across GDOT's portfolio, such as coordinating with external agencies on tricolored bats (SME #2).

The "internal Project interface with PMC and GEC" (GDOT 2022, 1–22) makes up the Project Management Team (PMT), the unit that works as the owner's representative for a project.

The PMC assumes the role of the PMT PM, serving as the OAD PIC's "eyes and ears for day-to-day management" (SME #10). The PMC has a programmatic agreement to serve as extensions of the OAD and the OES staff across GDOT's alternative delivery program, and most interactions between GDOT and the Delivery Team are mediated by the PMT (SME #2, SME #25). As extensions of the OES staff, the PMC also does an initial review of environmental documents prepared by the GEC and the Delivery Team (SME #1, SME #13).

The GEC is typically hired on a per-project basis and acts as the first point of contact for the Delivery Team's ECM, produces most environmental documents, and often coordinates with state and federal agencies on behalf of GDOT OES (SME #11, SME #22, SME #33). Although GECs are GDOT's consultants, to GECs "the OES is the PMC" (SME #33), as the PMC acts as "true support service extensions of the OES staff" for alternative delivery projects and reviews the environmental documents prepared by the GECs (Interoffice Memo 2022; SME #21). With the expanded role of the PMC, it has become increasingly rare for GDOT OES staff to directly engage with GECs or DBTs (SME #2, SME #33).

The Delivery Team, also referred to as the Design-Build Team (DBT), comprises the Design Team, Construction Team, and its Environmental Team (ET). The ECM leads the ET, the contractor's unit responsible for environmental delivery. The ECM assists the DBT PM to strategically phase production of design plans and construction schedules by "divid[ing environmental] clearances into very simple, medium, and the more complicated,…and identify…low hanging fruit[s] that [don't] require much … additional documentation and review" (SME #2).

In this capacity, the ECM acquires permits for which the design-builder is the applicant (e.g., National Pollutant Discharge Elimination System [NPDES] Construction General Permit)

and submits changes in environmental impacts to the PMT, which are then used by the GEC to prepare environmental documents for reevaluations and securing permits for which GDOT is the applicant (e.g., Section 404 Permits and Georgia Stream Buffer Variance) (SME #2, SME #13). ECMs who have experience working in GDOT OES or as a GEC generally understand the processes and needs of the Owner's Team better and are able to skillfully guide the DBT PM to integrate environmental clearances into the overall project schedule (SME #2, SME #33)

During the construction phase, the ECM's role is similar to traditional delivery and primarily focuses on monitoring compliance of environmental commitments (SME #2, SME #13, SME #29). The ECM hires SMEs as subconsultants on a need basis to perform environmental analyses (e.g., archaeology, aquatic survey) and oversees worksite erosion control supervisors (WECS) and other on-site staff to ensure environmental commitments are being met (SME #2, SME #29). The ECM maintains a log of environmental commitments and submits monthly Environmental Compliance Reports to the PMT, handles complaints, prepares for inspection by GDOT and external agencies, and negotiates commitments with other stakeholders, such as residents or businesses near the project site (SME #2, SME #29).

Common third-party actors include FHWA (for federally sponsored projects); state and federal regulatory agencies that relate to permits, commitments, and affected environmental resources; and local governments where the project site is situated. Other stakeholders include the broader public, Community Improvement Districts (CIDs), Native American tribal governments, etc.

**Similar Tasks But Different Arrangements to Traditional Delivery**

A key distinction between traditional and alternative delivery projects is that the steering wheel for design finalization and securing the environmental clearances that follow is in the hands of the

contractor in the latter. In alternative delivery, a general practice for the Owner's Team is to not "lead or prescribe the Design-Builder" (SME #2). This is to enable more flexibility for the contractor and safeguard GDOT from potential liabilities (SME #2, SME #9, SME #13). While GDOT may still be the official signatory for the NEPA document and the applicant for some major permit applications (e.g., Clean Water Act [CWA] Section 404 permit), it is primarily the responsibility of the Delivery Team to start a permit application or a reevaluation package (SME #2, SME #9, SME #13). This requires shifting from a command-and-control approach to a "teach, coach, and mentor" approach (SME #9).

Despite this difference, post-let environmental delivery for alternative delivery projects comprises similar tasks as DBB or traditional projects. The work generally follows what is outlined in the Plan Development Process (PDP) (GDOT 2024). For example, the *Design-Build Manual* states that the NEPA process "to identify, complete, and obtain approvals for the appropriate environmental document for a Design-Build project is identical to the process for a traditional Design-Bid-Build project" (GDOT 2022).

However, the faster pace of an alternative delivery project requires more attention by the OAD PIC on concurrently managing environmental processes and other disciplines such that the project can stay on schedule, scope, and budget. A senior GDOT OAD PM with extensive experience in both traditional and alternative delivery projects described his work as the "10 red ball theory," highlighting that while managing alternative delivery projects has the same elements to DBB projects, it requires the maneuvering of "throwing up red juggling balls and needing to know where they are and when they'll come down" (SME #9).

**Highly Formalized Relationships with Contractors**

Although alternative delivery is often described as a "partnership," there is a gap between GDOT, the "owner's consultants" (PMC and GEC), and the contractors in their perceptions of how much the relationship is based on mutual trust and understanding. One way in which GDOT and many STAs try to forge partnerships and build rapport between key actors for a project is through a co-located office. For larger projects, GDOT mandates a co-located office where key personnel from both the Owner's Team and the Delivery Team work together. From the viewpoint of a GDOT PIC, co-located offices "[bring] all…disciplines together….[and promote] informal happening all the time" to smooth work across disciplines and also between the PMT and the DBT (SME#15). However, PMCs and contractors view their relationship with each other and with federal and state agencies to be highly formal (SME #13, SME #16, SME #24).

Environmental documents almost never being initially approved by the PMT reveal the highly formalized relationship between the PMT and the DBT (SME #2, SME #13, SME #16, SME #17). Contractors who have witnessed GDOT's increased reliance on consultants recall that GDOT used to be more willing to help the contractor proceed with suggested changes, whereas "consultants are pushing that risk back 100 percent on the onus of the design-builder" (SME #16, SME #17). Along similar lines, a PMC explained that to protect GDOT and the PMC from potential liabilities, their practice is to never make official and unofficial recommendations to the contractor before receiving the environmental document (SME #13).

The highly formalized relationship further extends to between the DBT and federal and state agencies that grant approvals for NEPA reevaluations and permits. Agencies like FHWA, USACE, and GA EPD rarely communicate directly with the DBT contractors seeking their approval (SME #18, SME #24, SME #33, SME #34). This can create inefficiencies in which the

contractors have to guess what the regulatory agencies are looking for, resulting in increased review rounds and schedule (SME #24). Though less common in Georgia, SMEs from other states shared that STAs are willing to actively coordinate communication with federal or state agencies and facilitate face-to-face meetings when necessary (SME #28, SME #24, SME #39).

### Capacity Constraints to Third-Party Review

There are concerns regarding GDOT's and external agencies' capacity to review environmental documents on time. Contractors believe that PMCs and GECs are trying to "buy time" (SME #16, SME #17), and a former OES staff member explained that GDOT uses the stipulated review period to their advantage when a large number of environmental documents are submitted simultaneously by sending back environmental documents to the contractor (SME #2). To streamline document approval, GDOT has increased its reliance on consultants and now sponsors additional positions in key external agencies such as the USACE, FWS, NPS, and GA EPD (SME #21, SME #27). For example, GDOT currently sponsors four positions in GA EPD that handle only GDOT projects (SME #31).

## PRE-LET INPUTS

Pre-let environmental processes affect post-let project delivery because they constrain the contractor's choice of design alternatives and construction means and methods. OAD and PMC PMs who have experienced both the pre-let and post-let phases agree that pre-let activities provide a sense of how environmental processes will unfold in the post-let phase (SME #9, SME #10). Therefore, it is important to understand how characteristics of pre-let environmental delivery can potentially streamline or complicate a project.

GDOT's current policy is to secure the initial NEPA document and permits with low risk of modifications before letting the project (GDOT 2022). The NEPA document sets the scope of geographical boundary for activities through the environmental survey, identifies required permits, and estimates maximum impacts of a project. This information is crystalized in the ECT (i.e., Greensheet) (GDOT 2012).

## Pre-Let Challenges

### *Constraints to Design and Construction Innovations*

Environmental commitments that place significant restrictions on design and construction can stifle contractors from submitting alternative technical concepts (ATCs) that can potentially add value to the project (SME #33). The initial NEPA document approved in the pre-let phase includes GDOT's environmental commitments to external federal and state agencies. These place limits to design alternatives and construction means and methods that the contractor can pursue. The choice to submit an ATC can potentially have massive impacts in the post-let phase, as ATCs that alter environmental commitments will trigger a reevaluation.

Balancing environmental and engineering goals is especially important for larger and more complex projects that can potentially benefit more from innovations. This is because contractors generally avoid pursuing an ATC or design change that could risk more than a routine reevaluation (SME #3, SME #20). In the words of one design-builder, "the juice" (benefits) must be worth the "squeeze" (risks and costs) (SME #20). From the perspective of a DB contractor, ATCs are rarely approved; when approved, they are almost always conditionally approved to shield owners from risk (SME #20). STAs assume that "the design-build team will accept the risk and responsibility for that reevaluation" (SME #23). A senior design consultant spoke about weighing the risk of a reevaluation when deciding whether to submit an ATC:

*[W]e're going to go through a risk analysis of that ATC...If it's a minor ATC and there's a high risk of a reevaluation… that's an easy decision: we're not going to do that. But if it's a big deal, a big cost-saving thing, or...some great benefit to the project, it may be worth taking a little more risk on doing it. However, the [schedule] risk can be pretty high… if we think it's going to take 60 days or 90 days to get a reevaluation approved and it turns out to be 9 months...and if it's on the controlling critical path of the project, that's a risk we probably are not going to take," (SME #18).*

While STA officials offer guidance to design-builders about the potential environmental impacts of ATC submittals, interview evidence suggests they do not perceive ATC reevaluation risks in the same way as design-builders. For example, a South Carolina DOT (SCDOT) alternative delivery PM stated that reevaluations "are not bad things" and generally are "not very time consuming… [Reevaluations] may get added to a risk register... [but are] generally rated pretty low and the cost or impact is generally pretty small to a project" (SME #22). Respondents from other states such as Arizona (SME #12) and Virginia (SME #39) shared similar perspectives. Divergent perspectives between STAs and design-builders about ATC risk calculations may result from STAs not having viewed the ATCs that were considered by design-builders but discarded out of concern for their excessive schedule risk.

***Environmental Survey Boundaries and Uncleared Resources***

Inadequate sizing of environmental survey boundaries (ESBs) can impact project workflows by restricting the area where contractors can work. A GDOT staff member who has experience working in both OES and OAD explained that on past projects, OES was unable to negotiate for larger survey boundaries to account for "worst case" scenarios (SME #5). On these projects, the

survey area was too narrow. For example, a design-builder mentioned that constrained survey boundaries made it difficult to operate machinery such as cranes (SME #16). Improper sizing of ESBs during the pre-let phase can lead to post-let problems such as delayed construction and reevaluations.

GDOT's current practice is to set an ESB 100 ft beyond the right of way (ROW) in order to account for changes in impact due to design finalization in the post-let phase (GDOT 2019). However, there can be uncleared environmental resources within the ESB such as environmentally sensitive areas (ESAs) and "freeze zones" in which all activities are prohibited. Requesting changes in impacts or environmental commitments in ESAs or removing freeze zone designations are particularly thorny suggestions that would open up a formal reevaluation (SME #33). Because all activities are restricted in freeze zones and changing impacts in ESAs trigger a formal reevaluation, this can disincentivize contractor-led innovations (SME #33).

Another related challenge to environmental surveys is the re-delineation of environmental resources. Delineation refers to the physical survey work, which identifies environmental resources such as streams and wetlands. Similar to ESBs, re-delineation of environmental resources can ripple into post-let problems, such as triggering a reevaluation. If the design-builder finds a deviation from what was determined in the initial delineation, the resource boundaries are re-delineated. This can potentially alter environmental commitments and trigger a formal reevaluation. Given that re-delineation is only required once every 5 years (SME #3), this risk is not common but emerges as especially important for "legacy projects" that were developed in the past and resurfaced for later delivery. If legacy projects transition from DBB to DB, re-delineation may be overlooked, resulting in delays (SME #33).

## Pre-Let Opportunities

### *Early Interagency Coordination*

Developing clear and comprehensive contract documents that outline the environmental requirements, constraints, and performance standards for a project can help minimize the risk of design changes that impact critical resources. By providing unambiguous guidance and expectations, project owners can help the design-builder develop solutions that balance environmental compliance with efficiency and avoid the need for extensive reevaluations and approvals in the post-let phase. The need for such clarity was apparent in both of the Georgia case studies included in this report. On the Transform I-285/SR-400 project, documentary discrepancies regarding the maximum permissible noise barrier height resulted in a need for reevaluations (see appendix C). On the I-20 at Savannah River Bridge Replacements (SRB) project, differences in interstate requirements for best management practice (BMP) materials resulted in unanticipated post-let expenditures (see appendix B).

Additionally, improved communication between federal agencies, especially FHWA, and design-builders can improve vetting of design and ATC submittals and lessen the chance of unanticipated reevaluations. A DB contractor identified communication with federal lead and coordinating agencies during the procurement as an area for improvement to help prescreen designs and ATC plans (SME #18). ATCs and novel designs can provide significant benefits to a project, but they also create a risk of lengthy and laborious reevaluations. If the project design team could access and easily communicate with the federal agency during procurement, the risks from this stage of project development could be reduced and more creative design elements could be implemented.

### *Onboarding for New Entrants to Georgia or Alternative Delivery*

An onboarding process for new entrants to Georgia or alternative delivery projects can help reduce knowledge gaps and improve workflows for post-let environmental delivery (SME #33, SME #29). A prime example of this gap is illustrated in the quotes of a design-builder who said that "the NEPA process is more of a GDOT-led process" (SME #29). This contradicts our general finding that the steering wheel for an alternative delivery project is handed over to the contractor and that the contractor has to take the initiative to initiate changes to the NEPA approval (SME #2, SME #9, SME #13, SME #33).

Several key actors on the Owner's Team shared experiences in which the DBT was not familiar or competent with environmental processes (SME #13, SME #33), resulting in an environmental workflow that "was not planned well." A PMC shared numerous experiences in which design-builders were not able to phase environmental processes to streamline the project (SME #13). A GEC mentioned that it is rare for the DBT to deliver all the information needed to submit an application for Section 404 permits and stream buffer variances (SME #33).

Misalignment between the Owner's Team and the DBT for environmental delivery are more likely to occur with new entrants from out of state and abroad that are less acquainted with environmental processes in Georgia (SME #27, SME #29) as well as DBTs with limited or no experience in alternative delivery (SME #33). With the anticipated growth of GDOT's alternative delivery portfolio and plans to let large-scale projects, more new entrants from out of state and abroad will compete for contracts in Georgia. In addition, while the proportion of alternative delivery projects have rapidly grown in dollar value, most projects are still procured through traditional delivery. This makes it difficult to find competent PMs and environmental professionals with experience in alternative delivery (SME #33).

### *Provide a More Open Due Diligence Period*

Enabling a more open dialogue between the Owner's Team and the DBT during the due diligence period can help the DBT to raise concerns about uncleared resources and environmental commitments that place significant constraints on design alternatives and construction means and methods. It is often difficult for a contractor to challenge the assumptions and commitments in environmental documents even if it may add significant value to the project (SME #24). While some find it not as challenging to question environmental documents (SME #33), others are more careful (SME #24). A GDOT ecology section manager stated that GDOT and the DBT should view each other as part of the same team and recognize that what hurts the contractor hurts GDOT as well (SME #1).

### *Flexible and Generous Estimations to Environmental Impacts*

The motivation behind making the ESB larger than the ROW is to allow for more flexibility for contractors. In addition to having a larger survey area, maximum environmental impacts are estimated in anticipation of change in impacts during design finalization (SME #33). This is "to reduce the need for resurveys for minor [changes]" (GDOT 2023, 5). As a result, most alternative delivery projects reduce total impacts (SME #16, SME #24, SME #33).

Despite this, GDOT's current approach to ESBs has limitations because not all resources within the ESB are cleared. Reevaluations may still occur for minor changes if the initial NEPA document did not account for construction needs like access roads and laydown yards (SME #24, SME #33). Additional impacts that occur in an ESA, regardless of how minor, may trigger a reevaluation if they necessitate a change in environmental commitments (SME #33).

According to a design-builder, "giving [the contractors] more space to work before it becomes a change is the easiest solution" (SME #16). Other states have more flexible and generous

approaches to estimating environmental impacts that are aligned with this idea. One example is South Carolina's NEPA box in which the study area was enlarged from 50 acres to 250 acres and all environmental resources were cleared for categorical exclusions (CEs) (SME #22). This gave design teams "the ability to maneuver and reduce that risk of having to do [reevaluations] because those impacts have already been evaluated" (SME #22). Another example is Virgina's case-by-case approach. Instead of standardizing the ESB, Virginia takes each case individually to assess appropriate survey boundaries and identify which environmental resources need to be cleared (SME #41).

## NEPA REEVALUATION AND POST-LET ENVIRONMENTAL PERMITTING

### Pathways to NEPA Reevaluations

Given that alternative delivery procurement proceeds with an incomplete design, the exact environmental impacts resulting from the eventual infrastructure asset are unknown at the time a NEPA decision is returned. It is therefore understood that design elements added or modified in post-let phases must be evaluated or reevaluated for their expected impacts to environmental resources. Specifically, the magnitude of anticipated impacts must be assessed in comparison to those impacts approved in the initial NEPA and permitting processes completed during the pre-let project phase. According to a memorandum of agreement (MOA) between GDOT and FHWA, "the purpose of the project reevaluation process is to ascertain whether the original NEPA decision document or a subsequent reapproval of that document is still valid, considering potential changes in the project that may have occurred since the previous approval(s)" (FHWA and GDOT 2016).

Depending on the magnitude of the change in impacts, however, and the design bundling and scheduling strategies initiated by the Delivery Team, a NEPA reevaluation may follow one of several pathways, namely, "No Change" and "Change" reevaluations (figure 2). GDOT and

FHWA maintain an MOA to empower GDOT with the "programmatic consultation" to issue reapprovals for routine design changes (FHWA and GDOT 2016). Although some post-let changes involve the implementation of major design innovations, like ATCs, many more are "minor scope changes," like an alternation to the length of turning lanes or the alignment of a stormwater culvert. The MOA states that "FHWA has determined that these minor scope changes would not require supplemental documentation and the environmental document and resultant project decision would still be valid."

In the event a Change Reevaluation is required, networkwide understanding of protocol is critical to ensuring a streamlined process. Although GDOT ultimately assumes signatory responsibility for each reevaluation submitted to state and federal partners, those constituent documentation and analyses are generated by a collaboration between DBT and PMT environmental experts, with commentary and approval checkpoints along the way. Interviewed SMEs from across the delivery network provided insights about a chain of production and approval: analyses from resource-specific subconsultants (e.g., ecology, archeology) are assembled by the Delivery Team, then vetted by the PMT, which synthesizes the formal document for GDOT to review before final submission to regulatory partners. Collectively, this submission represents the project-sponsoring agency (GDOT) appealing to its NEPA lead agency for its pre-award decision document to be preserved in the face of the proposed changes. If the reevaluation appeal is deemed meritorious, the decision document will be reapproved. This documentary approval chain is depicted in figure 4.

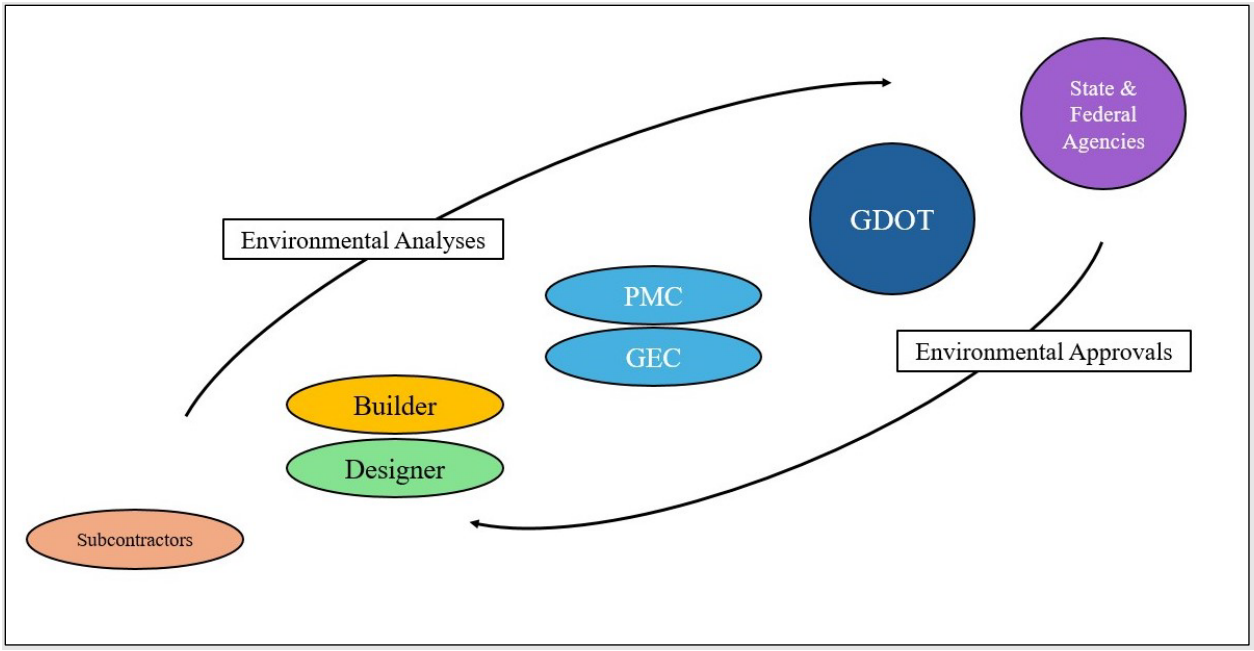


**Figure 4. Flowchart. Chain of approval for environmental documentation.**

Significant schedule efficiencies may be realized from strategic bundling and scheduling of design reevaluations. If a Delivery Team identifies one set of design elements in conflict with environmentally sensitive areas (ESAs) and another without conflict, then it may bundle the two sets separately to expedite delivery of the latter while working to gain clearance of the former. Critically, therefore, **NEPA reevaluations are normal and not inherently negative, and a simple count of NEPA reevaluations is not an adequate measure of environmental performance** for a given project.

## NEPA Reevaluation and Permitting Challenges

### *Ambiguous Eligibility Standards for "No Change" Reevaluation*

The applicability of expedited reapproval is subject to conditions. Certain classes of design change may or may not be eligible for No Change status, depending on the interaction with other environmental variables. For example, bridge pier locations and numbers may be changed without

triggering a full reevaluation, only so long as the impacted stream contains no protected species or designated or proposed critical habitat. More broadly, the MOA stipulates that design changes must implicate "No changes to environmental commitments." This standard highlights the critical interplay between the survey boundaries, the resource analyses and commitments formulated during pre-let phases, and the flexibility of scope changes permitted during post-let phases. A more expansive "NEPA box" approved for more conservative (i.e., larger) environmental impacts may facilitate a more permissive post-let approval process, because DBT-initiated changes will be less likely to increase the overall level of impact. This proactive approach to pre-award approval efforts was documented in both Georgia and Virginia (SME #13, SME #41).

A large survey boundary does not guarantee expedited reapproval, however, emphasizing the importance of aligned expectations between the Owner's Team, Delivery Team, and regulatory agencies about the threshold of impacts to qualify for a No Change Reevaluation. GDOT contracts stipulate that the Delivery Team must make the first assessment of No Change eligibility, but a number of the conditions outlined in the MOA require considerable professional discretion to employ. For example, one condition requires that proposed design changes "do not warrant Type I noise analysis update, and no changes will occur to noise abatement measures considered likely." The standard of change to warrant a full noise analysis, however, can vary from state to state and project to project; multiple private sector SMEs contended that the post-let approval process in Georgia was more stringent compared to projects in regional peers like Tennessee, South Carolina, Virgina, or Texas (SME #4, SME #20, SME #21, SME #39, SME #41). In contrast to the "sandbox mentality" described in those states, wherein design-builders are given broad license to make minor design modifications inside the approved boundary, SMEs recounted how even minor changes to alignments and elevations inside GDOT's NEPA box were considered grounds for full

reevaluation. Cross-jurisdictional differences in the adjudication of environmental triggers are rendered starker in bi-state projects like the SRB project (see Aligning Expectations Across the Approval Chain in appendix B). SMEs from GDOT OAD and OES indicated that these differences elevate the urgency of Delivery Team education, particularly for those partners entering the Georgia market for the first time (SME #18, SME #27).

***Halting Approval of Environmental Impact Analyses***

Although figure 4 depicts a smooth flow of documentation up the authority chain and a smooth flow of approvals flowing down, in practice this process can be much more halting. PMC staff (SME #13, SME #14) stated that it was "typical" for environmental documentation to go through several cycles of submission, comment, and rejection before acceptance. Delivery Team design SMEs (SME #17) concurred, though they added that additional cycles of comment and rejection can emerge from the linkage between the PMT and GDOT staff, adding additional time to the process. The metaphor that emerged from SME conversations is one of "ping-pong"—documents volleyed back and forth between delivery partners up and down the approval chain.

This process is heavily formalized, with DBT submission of a formal document triggering a contractually obligated timely response from the Owner's Team. For example, on the I-16/I-95 Interchange Project, Table 4.1 of the Technical Provisions specifies the "Government Entity Approval Time Frame," granting GDOT 30 days and 14 days to review Environmental Document Reevaluation for the first and second submissions by the DBT, respectively. In the event GDOT (or any indicated state or federal agency) fails to respond within the designated time frame, the Delivery Team may be entitled to relief. It should be emphasized, however, that an obligation to *respond* is distinct from an obligation to *approve* an environmental submission from the Delivery Team. Multiple DBT SMEs maintained that GDOT and the PMC are often slow to give a formal

response, waiting until the end of the allotted time frame. Comments made on the Delivery Team's request reset the timeframe in which the Owner's Team must formally respond in any subsequent submission, resulting in a lengthy back-and-forth cycle that can take months to resolve (SME #17, SME #28). The SMEs contended that some comments failed to "add value," instead focusing on minor formatting preferences.

### *Intra- and Interorganizational Communication Silos*

Communication bottlenecks within the delivery network were a frequently cited cause of schedule delays among SMEs. One DB contractor SME recounted the delays that may result from communication breakdowns between design, construction, and environmental staff within the Delivery Team (SME #20). SME #13 emphasized the high variance in DBT approaches to planning for iterated NEPA approval and construction. Rarely is NEPA the driving force in team discussions; rather, receiving RFC for *engineering* components is treated as the gate of highest importance. If design choices are vetted purely from an engineering perspective without consideration of the implication to environmental approvals, however, elevated impacts or incursions into previously protected resources can precipitate unanticipated reevaluation. This phenomenon is distinct from the kinks in the approval chain already described; misalignment of expectations and communication across *intraorganizational* silos results in avoidable delay.

From an interorganizational perspective, private sector SMEs emphasized the challenges posed by a lack of direct interaction with regulatory agencies in Georgia. For example, a PM for the SRB project (see Coordinating Across Jurisdictions in appendix B) attributed delay to an inability to communicate with the USACE: "We were probably a good 6 months into the design until we knew the actual foundation sizes to start preparing the necessary documentation to submit to GDOT for them to submit to the Corps, because we couldn't deal directly with the Corps…

which was an extreme bottleneck on this project, given that you had two districts you had to deal with" (SME #24). Conversations with SMEs from GA DNR indicated a similar dynamic; because GDOT is the signatory on the permit and not the Delivery Team, GA DNR staff do not engage with DBT staff directly, and indeed do not draw much distinction between traditional and alternative delivery methods (SME #31). An interviewee from GDOT OES (SME #27) indicated that such responses may reflect limitations in the understanding of alternative delivery methodologies and the post-let modifications they inherently require.

## NEPA Reevaluation and Permitting Opportunities

### *Clearer "No Change" Eligibility Standards for Alternative Delivery Settings*

Although the nature of alternative contracting involves expansive revisions to design, not all of these changes will implicate significant changes to the magnitude of environmental impact. Given SME comments regarding the ambiguity of the eligibility threshold for No Change Reevaluation, therefore, clarification of language in the "programmatic consultation" MOA between GDOT and FHWA may facilitate improved outcomes for design scheduling and bundling within Delivery Teams. A senior environmental SME for GDOT's PMC noted that the MOA does not make specific mention of GDOT's authority within alternative delivery contexts (SME #13) and felt that such an addition would improve performance. SMEs with a major DB contractor agreed with the suggestion and indicated that not all parties within Delivery Teams were aware of the MOA (SME #16, SME #17). A senior administrator for OES indicated there may be flexibility for GDOT to assert its authority to issue "No-Change" determinations more broadly and streamline post-award administration, a sentiment that was echoed by practitioners with experience in other states (see Reduce Formal Reevaluations for Minor Changes in appendix B). Broader dissemination of

the agreement, supplemented with a treatment of applicability in alternative delivery settings, may improve post-let planning and execution.

***Proactive NEPA and Permit Scheduling***

A nimble Delivery Team may anticipate the division of design elements granted No Change Reevaluation and divide the remaining into multiple reevaluations according to their expected duration and its desired construction phasing. A successful project may therefore have a multitude of anticipated reevaluations. This is particularly true for complex "major" projects spanning multiple sensitive resources. A strategic, multi-tracked strategy to reevaluation, consistent with the depiction in Model 2 (figure 2), was reflected in the comments of one private design consultant for a major interchange project in the Atlanta region:

> *"During the procurement process, we try to assume we have at least one NEPA reevaluation per segment of the project. Then we try—with some major asterisks—to lay out the design schedule, and we have our early works identifying where we want to start construction and where we think we can get the RFCs as quick as possible. We identify those areas based on environmental resources first." (SME #17).*

In this way, purposeful segmentation of environmental reevaluations may reflect familiarity with Georgia requirements and a sophistication of managerial response. The same design SME reflected: "I anticipate reevaluation because of the way the requirements are set up. If your construction limits change on the project, whether it's an increase in impacts or a decrease in impacts, it still has to be reported, and still goes through the same process" (SME #17). A DB contractor shared a similar sentiment, stressing the need to "evaluate your sequence and schedule

of works and how you prioritize your design submittals... progress as quickly as you can what is needed for one of these environmental permits, and then do the rest" (SME #28).

From an Owner's Team perspective, the RSP protocol developed by the PMC for the Transform I-285/SR-400 project (see Proactive Reevaluation and Permitting Protocol in appendix C) may provide a means to formalize and routine these sentiments across the broader network of ACM participants. The RSP communicates clearly the assembly of all documents necessary for a successful Change Reevaluation, thereby lowering the incidence of incomplete information and the "ping-pong" cycles of revision and correction that follow. Submission of the RSP initiates the formalized approval procedure inside the eBuilder platform, preserving the nature and timing of reevaluation participation.

***Facilitating Intra- and Interorganizational Communication***

Consistent communication must be maintained within the Delivery Team to ensure clarity of understanding with respect to the duration and phasing of reevaluation and construction. Environmental staff can evaluate when lengthy reevaluation might be triggered, collaborating with design and construction teams to strategically time design submissions and ensure compliance with Owner and regulator requirements. A senior DB contractor SME described hosting regular meetings to facilitate a liaison between design and construction staffs, with diverse subdisciplinary experts (e.g., environmental, utilities, geotechnical) in each firm weighing the relative costs and benefits of a proposed design change.

Similarly, GDOT PMC staff described implementing techniques to stimulate consideration of interconnected environmental, design, and construction processes within the Delivery Team. An Environmental Manager for the PMC (SME #13) stressed the importance of Environmental Kickoff Meetings and the "45 Day Meeting." These managerial interventions "force the question"

to the Delivery Team, namely: "What is your plan for environmental reevaluation?" During the meetings, the interdisciplinary staff of the Delivery Team present their schedule to finalize design and the attending reevaluations. SME #13 found that some Delivery Teams fail to consider NEPA's interaction within the broader timeline of design finalization, and thus benefited from a programmatic intervention to facilitate the intra-team conversation. The complementary effectiveness of the kickoff meetings together with the RSP protocol is one of the "lessons learned" from recent projects in GDOT's Major Mobility Investment Program (MMIP).

To better understand these dynamics, and the specific points of concern for the reapproval process, private sector SMEs consistently advocated for increased interaction with the NEPA lead and coordinating agencies. Although federal statutes are universally applied and state statutes often resemble one another, a design engineer for the SRB project emphasized the broad latitude regulatory agencies command to emphasize different elements therein: "[You can find out] through those coordination meetings what they're really going to look at. What [do] they really want to see when we submit the application so you might avoid a lengthy review and comment and resubmittal process" (SME #24). One design engineer SME contended that Owner efforts to facilitate proactive conversations with regulatory agencies during the procurement and early design phases could yield significant time savings in later phases: "It's great to have over-the-shoulder kind of sessions… In Georgia and in almost every state I worked in on the regulatory enforcement side... if you can get somebody to put eyes on it for anything that might be missed or is just glaringly obvious, you can save everybody so much time to get it right the first time" (SME #29). SME interviewees with experience in Virginia affirmed the usefulness of such cross-governmental collaborative conferences to align post-let expectations in alternative delivery settings (SME #41, SME #42).

## ENVIRONMENTAL COMMITMENTS

SMEs from both the Owner's Team and the Delivery Team identified environmental commitments as a risk factor meriting careful consideration. Commitments are formulated during pre-let project development, revised as part of NEPA reevaluation in post-let design finalization, and executed and enforced during construction.

Commitments-based risk materializes most acutely in this last component—enforcement—particularly from coordinating regulatory agencies, revealing incompliance that results in schedule delays and monetary fines. A process flowchart for commitments enforcement is provided in figure 5. This flowchart was developed through an analysis of documentation from the EPD of the GA DNR on the Transform I-285/SR-400 project, but it may be adapted to visualize the implementation of commitment activities across a range of resources interacting with a project. It traces pathways of commitments outcomes resulting from inspections from the relevant enforcement authority. Regardless of resource, the preferred outcome is the same: DBT compliance with environmental commitments specified in the NEPA document.

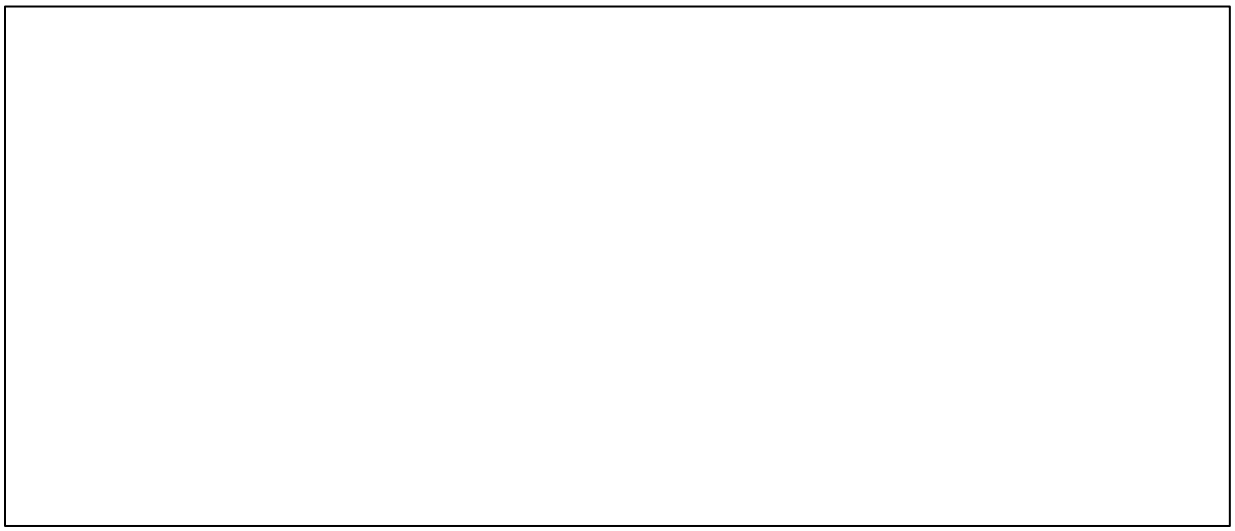

**Figure 5. Flowchart. Process flow for the enforcement of environmental commitments.**

Agency inspections may arise from a number of inciting events and proceed according to multiple timelines. A GA EPD program manager (SME #36) described performing "random" ad hoc inspections to project sites, aiming to observe everyday conditions and DBT practices. Inspections may also be provoked by self-summary reports submitted by DBTs or by citizens' complaints reporting infractions to agency hotlines. Many inspections, including those precipitated by a complaint, result in a finding of compliance with environmental commitments.

A GA EPD district director (SME #34) described the "tiers of enforcement actions" that may proceed in the event an inspection determines noncompliance with a permit or commitment, or if a self-summary report indicates clear noncompliance. With increasing severity, the agency will document the finding with a "letter of noncompliance," then a notice of violation (NOV), and will indicate to the DBT the remediating actions required to achieve compliance. These will be followed with subsequent visits to the violation site to re-inspect for corrective action. If the DBT is found to be in continued noncompliance, additional NOVs may be issued. The DBT and agency may join in a consensual agreement known as a "consent order," outlining specific sequences of corrective action and escalating consequences if not abided. These may include monetary penalties, administrative orders to halt construction activities, and even legal proceedings in Superior Court. The DBT may also initiate a voluntary work stoppage to limit further damages and demonstrate a willingness to achieve compliance. These dynamics, as well as a contextualized example of escalating enforcement, are provided in the case study of the Transform I-285/SR-400 project (see Summary of Commitments Activity in appendix C).

## Environmental Commitments Challenges

### *Design and Construction Phases Conflicting with Commitments*

Although commitment risks are most visible in the construction phase, SME interviewees emphasized the challenges stemming from multidimensional interactions between construction, design, and pre-let NEPA activities. The environmental commitments formulated and approved during project development set the baseline against which all subsequent design changes and construction activities are assessed. Although post-let changes to design and impacts would ideally abide by these established commitments, SMEs shared examples of the cost and schedule delays that can accrue if the commitments are broached or require modification. As the entity responsible for anchoring the initial set of commitments in the NEPA document, an STA can calibrate these strategically according to the environmental risks of the worksite, the completeness of design at procurement, and the expectations of DBT means and methods. Finding a balance between preserving environmental conditions and hamstringing a DBT's ability to innovate and operate can be challenging.

Post-let changes to design that change or renege on commitments can trigger additional reviews and approvals. For example, a GDOT OES administrator (SME #21) described how a commitment might be made to avoid a particular environmentally sensitive habitat like a streambed. If a DBT proposes an ATC to alter the location of a bridge pier that offers significant cost savings but conflicts with the prior commitment, then the cost savings will need to be weighed against the significant investments to seek environmental reapproval. A GDOT OAD program manager (SME #15) described how iterative design changes in the same location can provoke iterative reevaluations, particularly if specific subdisciplines like ecology, archaeology, or noise are implicated. Noise commitments can prove especially vexing in DB projects if changes to

roadway alignment prompt changes to the number and positioning of noise barriers, and by association the number and exposure of sensitive noise receptors. If design is repeatedly revised over the course of post-let finalization, the number of commitments-based reevaluations may balloon. This risk may be understood as DBT limitations to strategy and comprehensiveness in the design phase "triggering" a reevaluation through conflict with an established environmental commitment.

This risk association can also manifest in the construction phase: contractor deviation from design can result in noncompliance that necessitates a reevaluation or permit modification. Projects may be especially vulnerable to these risks when the DBT operation expands to include subcontractors less familiar with limitations established in earlier phases. An ECM SME recounted construction workers placing riprap 3 ft beyond the footprint indicated by the design plans (SME #29). Although the workers may have assumed it was a harmless use of leftover material, it precipitated "hours and hours of time to do the permit modification." To address these challenges, DBTs have pursued different interventions such as the enrollment of worksite staff in resource-based certification programs (see appendix C) and the utilization of commitments-tracking spreadsheets (see appendix B).

Similarly, SME #15 emphasized the complexity and risk of stakeholder management during construction phases. In the process of NEPA document preparation, some commitments may be made to important entities in the surrounding community, e.g., schools, hospitals, or religious institutions. Although these entities do not command formal authority like a regulatory agency, DBTs must preserve commitments not to impede their operations. Clear communication of commitments expectations, both between and within public–private partners, emerged as a critical bulwark against costly infractions.

# CHAPTER 4. POST-LET ENVIRONMENTAL RISK MATRIX

In an effort to evaluate the relationship between environmental risks and project outcomes across the portfolio of GDOT alternative delivery projects, a risk matrix was developed to assist post-let environmental management. A risk matrix is a simple and efficient way to inform decision-makers about the risks facing an organization, a program, or a project (Aven 2017). Risk matrices map the likelihood and impact ratings for risk items, and ratings are generally operationalized using a Likert scale. The magnitude of each risk item is the product of likelihood and impact rating, which can be partitioned into risk exposure zones (e.g., a heatmap) such as high, medium, and low (Keetley and Goldstein 2021).

Whereas risk matrices are often used in construction to forecast project-specific risks (Qazi and Dikmen 2021), the primary purpose of our risk matrix is a retrospective programmatic evaluation of GDOT's alternative delivery portfolio. A key limitation of using a project-level risk matrix to assess program-level risks is that risk items are specified in extensive detail for every subdiscipline. For example, the environmental risk matrix used by developers for the Texas DOT's IH 635 Managed Lanes project zooms into unique features of the project, which curtails its applicability to a wider range of projects (LBJ Development Partners, n.d.). As a result, the research team had to identify program-level risk items through extensive SME interviews (see chapter 3) and review of the academic literature, government documentation, and industry reports (see chapter 1).

## HOW TO USE THE RISK MATRIX

The post-let environmental risk matrix aims to assist GDOT's efforts to realign its resources to enhance performance of its alternative delivery program. To that end, the risk matrix can be

utilized in at least three ways. Firstly, following its primary purpose, the risk matrix can be utilized as a tool to periodically evaluate GDOT's alternative delivery program. This can help identify where additional resources need to be allocated and monitor changes in performance. The results introduced in this chapter are the first attempt toward this endeavor.

Secondly, it can supplement GDOT's existing project risk matrix to forecast project-level risks for individual projects and in aggregate. Our risk matrix does not zoom in to project-specific risks but rather focuses on general work processes related to post-let environmental delivery. Elucidating such risks may potentially add value to supporting high-level strategies for project management as well as providing common patterns of risk materiality across GDOT's alternative delivery portfolio.

Thirdly, it can be used as a training tool for new PMs. GDOT's recent restructuring of the alternative delivery program will bring on board PMs at the District Offices to work as post-let PMs. At training venues, such as the implementation workshop for this research project, the risk matrix can be used by PMs and other professionals new to alternative delivery to efficiently catch up with alternative delivery.

## POST-LET ENVIRONMENTAL RISK ITEMS

The identification of programmatic environmental risk items was guided by the post-let logical flow models that emerged from interviews with SMEs and a literature review (see chapter 2). It is important to note that most SMEs are not accustomed to thinking about program-level performance and tend to consider environmental risks per project based on each subdiscipline. Nonetheless, the aggregation of SME interviews revealed a set of common challenges and opportunities that cut across GDOT's alternative delivery program (see chapter 5).

Following our analysis of SME interviews and archival evidence presented in chapter 3, risk items were categorized as: NEPA Reevaluation, Permitting & Approval, and Environmental Commitments (see table 1). Reevaluation processes often encompass changes or noncompliance in permitting and approval as well as environmental commitments; however, each component has distinctive elements that warrant separate attention. A preliminary version of the risk matrix was shared with OAD and OES in July 2024, and a feedback meeting was held before deploying the risk matrix for further calibration and seeking feedback from the broader expert community in Georgia. Following Michigan DOT's approach, each risk item can be rated on a scale of 1 to 3 for likelihood, cost impact, and schedule impact (Keetley and Goldstein 2021).

**Table 1. Post-let environmental risk matrix.**

| NEPA Reevaluation Risk Matrix | | | |
|---|---|---|---|
| | **Likelihood** | **Impact (Budget)** | **Impact (Schedule)** |
| Unanticipated Reevaluation | | | |
| Sequencing Disruption | | | |
| Environmental Impact Analyses Submission | | | |
| NEPA Reclassification | | | |
| **Permitting & Approval Risk Matrix** | | | |
| | **Likelihood** | **Impact (Budget)** | **Impact (Schedule)** |
| Section 7 Approval (NOAA involved) | | | |
| Section 7 Approval (NOAA not involved) | | | |
| 404 Permit (individual) | | | |
| 404 Permit (regional/national) | | | |
| Stream Buffer Variance | | | |
| Section 106 Approval | | | |
| 4(f) Approval | | | |
| **Environmental Commitments Risk Matrix** | | | |
| | **Likelihood** | **Impact (Budget)** | **Impact (Schedule)** |
| Public Relations | | | |
| Endangered Species | | | |
| Noise | | | |
| Erosion/Sedimentation | | | |
| Historical/Archaeological | | | |
| Environmental Justice | | | |
| Hazardous Materials | | | |

**Table 2. Glossary of terms.**

| | | |
|---|---|---|
| NEPA Reevaluation Risks | **Unanticipated Reevaluation** | The initiation of a NEPA reevaluation not accounted for in the project schedule. |
| | **Sequencing Disruption** | Risks pertaining to the interplay of sequencing reevaluations for environmental analyses and construction activities. |
| | **Environmental Analyses Approval Process** | Risks pertaining to the environmental analyses and documentation performed in service of reevaluation. |
| | **NEPA Reclassification** | Reclassification of a project's NEPA class of action; e.g., from Environmental Assessment (EA) to Environmental Impact Statement (EIS). |
| Permitting & Approval Risks | **Section 7 Approval** | Risks pertaining to acquisition and modification of approval under Section 7 of the Endangered Species Act. |
| | **404 Permit** | Risks pertaining to acquisition and modification of permits under Section 404 of the Clean Water Act. |
| | **Stream Buffer Variance** | Risks pertaining to acquisition and modification of approval and variances for construction activities by stream resources. |
| | **Section 106 Approval** | Risks pertaining to acquisition and modification of approval under Section 106 of the National Historic Preservation Act. |
| | **4(f) Approval** | Risks pertaining to acquisition and modification of approval under Section 4(f) of the Department of Transportation Act. |

**NEPA Reevaluation Risks**

NEPA reevaluation risks refer to risks associated with the interorganizational dynamics regarding documentation and approval processes. These are distinct from discipline-specific risks in that they are general work processes that cut across all environmental disciplines. NEPA reevaluation risks can be operationalized into the following, as described in table 2.

As previously identified in the logic model, a key task for private partners in alternative delivery projects is to forecast how changes in design elements will be folded into reevaluation packages and ensure that they do not interrupt the critical path (SME #2, SME #13). Design

finalization almost always invokes a NEPA reevaluation, additional permit acquisition or modification, and sometimes changes to environmental commitments (Ashuri, Mostaan, and Hannon 2013). These tasks are typically initiated by the private partner, but many of these documents are ultimately owned by GDOT, and communication with regulatory agencies or stakeholders are therefore mediated through GDOT and its consultants. Such a work environment may lead to variation among key stakeholders along the chain of approval in expectations and understandings of environmental documentation and approval processes, which can potentially materialize as points of delay (SME #21, SME #27).

**Permitting and Approval Risks**

Permitting and approval risks are those that are associated with legally required permits and approvals under NEPA. These processes often occur in parallel with reevaluations, and documentations for permits and approvals are typically folded into reevaluation documents. However, each major type of permit or approval requires individual attention as our research findings suggest that each regulatory agency has distinct requirements creating a unique set of challenges. For example, the USACE Savannah District is known for its stringent environmental documentation requirements for the Section 404 permit (SME #33). Major permits and approvals that are included were identified from SME interviews, a review of environmental legislation, and the OES Environmental Procedures Guidebook (GDOT OES 2024).

To streamline permitting and approval processes, STAs support hiring of "state transportation liaison funded positions" in key regulatory agencies (FHWA 2009). GDOT also currently funds positions in USACE, FWS, NPS, and GA EPD to staff-up reviewers that prioritize on GDOT projects (SME #21, SME #27). Better understanding performance of permitting and

approval processes can aid GDOT's efforts in deciding where to allocate resources for future transportation liaison funded positions.

### Environmental Commitment Risks

Environmental commitment risks are those that are related to construction-phase obligations GDOT has made with its stakeholders, including regulatory agencies, local governments, and the public. Environmental commitments are GDOT's "avenue to credibility" with external stakeholders, so OES tends to be conservative about making changes to environmental commitments made in the initial NEPA document (SME #21). Environmental commitments are categorized by each discipline in the ECT (i.e., Greensheet), and our risk matrix generally follows this structure.

Changes in existing environmental commitments are likely to disturb the project schedule as they re-open negotiations with key stakeholders. However, the private partner may insist on altering environmental commitments if they find it beneficial for project delivery. New environmental commitments are also added in the post-let phase as additional permits and approvals are secured and other stakeholders such as the public or businesses provide comments on final designs and construction plans. These changes altogether add impacts to overall project delivery.

## DEPLOYING AND CALIBRATING THE POST-LET ENVIRONMENTAL RISK MATRIX

### The Delphi Technique

The Delphi technique was employed to gather feedback on the utility of the post-let environmental risk matrix. The Delphi technique is a method to systematically analyze the perspectives of OAD,

OES, consultants, and private partners. It was originally conceived for forecasting and assessing policy alternatives (Turoff 1970). Since then, the Delphi technique has been widely used in public policy analysis such as defense, science and technology, education, and health (Linstone and Turoff 2011). Although not as common, the Delphi technique is also utilized in construction and engineering management (Ameyaw et al. 2016; Bhandari and Hallowell 2021), including development of performance indices in alternative delivery projects (Hu et al. 2016) and environmental planning (Yang et al. 2021).

The underlying principle of the Delphi technique is that forecasts from a panel of individuals organized in a structured and reflective manner are more likely to be accurate than one-time data collection events such as surveys and focus groups. The Delphi is conducted in multiple rounds in which respondents can respond anonymously as individuals, reflect on aggregations of the results of the panel, and then discuss the opportunities for convergence and divergence in views (Linstone and Turoff 2011).

The research team recruited an expert panel such that the diverse perspectives of key stakeholders were sufficiently represented. Our sample included seven key positions in a typical alternative delivery project in Georgia. Four positions from the Owner's Team include OAD PM, OES staff, PMC, and GEC; three positions from the DBT include Design Manager, DBT PM, and ECM. We further limited our recruitment criteria to those at middle or upper management to ensure that each expert has a comprehensive understanding of how environmental risks intersect with alternative project delivery and can provide program-level feedback for GDOT's alternative delivery portfolio. Permit- or resource-specific regulatory agencies were not included because their specialization limits them from engaging in broader discussions about post-let environmental risk.

Also, experts based outside of Georgia were not included, mainly because our SME interviews revealed significant variability in environmental processes across jurisdictions.

Based on these qualifications, an email invitation to participate in completion of the risk matrix was sent out to eight experts across seven positions, which included two OAD PMs. Seven respondents initially agreed to complete the risk matrix, three have participated in a follow-up interview to provide feedback (OAD PM, OES staff, and GEC), and two have completed the risk matrix (OAD PM and GEC). In addition to rating the risk items in the matrix, respondents were asked to provide reasons for the ratings, feedback on the overall structure of the risk matrix, and information on their cumulative experience in traditional and alternative delivery projects. The full survey can be found in appendix F. After respondents either completed or reviewed the survey, the research team conducted a follow-up interview to ask additional questions about the comments.

**Calibrating the Risk Matrix**

Follow-up interviews with experts revealed significant difficulty in anchoring the respondent's perspective at the program level and possibilities of knowledge gaps across positions. All respondents suggested that the risk matrix would be most beneficial as an alignment tool across key stakeholders at different phases of a project. Furthermore, respondents provided helpful feedback on calibrating ratings and improving the list of risk items.

The OAD PM and GEC shared that they had a project-level focus when completing the risk matrix, and the OES staff anchored the conversation around a project. This occurred despite the research team's careful efforts to guide the respondents to provide program-level feedback. Two series of email invitations and instructions for the survey all emphasized that the purpose of the risk matrix is to perform a program-level evaluation of GDOT's alternative delivery portfolio and asked the respondents to anchor their answers based on their "cumulative experience" in

alternative delivery. Nonetheless, all three respondents, who each have substantial experience across GDOT's alternative delivery program, found it difficult to complete the risk matrix with a program-level perspective.

The OAD PM and GEC differed in their self-rated ability to complete the survey and perception of the ability of respondents in other key positions to rate the environmental risk matrix. The OAD PM felt relatively confident with her responses and thought that all seven key positions should possess relevant knowledge to be able to complete the survey. In contrast, the GEC was unable to respond to cost impacts for several risk items and raised concerns that environmental professionals such as the GEC, PMC, and ECM might not be able to assess cost impacts. The GEC also noted that description of impacts could be further clarified because each respondent is likely to think about impacts to their organization rather than the project.

The OAD PM suggested intervals to calibrate ratings for likelihood and impacts. The two examples from Texas and Michigan that the research team had consulted for the development of the risk matrix used different rating systems. The Texas risk matrix used a scale of 1 to 3, had a high threshold for the lowest probability score (50 percent), and did not calibrate schedule and cost impacts (LBJ Development Partners, n.d.). Michigan DOT's risk matrix used a five-point Likert scale, had a lower threshold for the lowest probability score (15 percent), and used absolute dollar values and number of weeks for cost and schedule impacts (Keetley and Goldstein 2021). Both were not satisfactory because impacts need to take into account project size, and we could not find evidence behind the intervals for likelihood ratings. The OAD PM suggested the calibrations shown in table 3. The OES staff disagreed with these suggested ratings and insisted that even a 10 percent increase should be considered as extremely large (i.e., above a rating of 3 for cost

impact) if contract award is the benchmark. The OES staff also noted that the scale should differ according to the size of the project.

**Table 3. Suggested calibrations by OAD PM for likelihood and impact ratings.**

| Rating | Likelihood | Schedule | Cost |
|---|---|---|---|
| 1 | 0~25% | 0~10% | 0~10% |
| 2 | 26~50% | 10~25% | 10~25% |
| 3 | 51~100% | 25+% | 25+% |

The respondents provided various feedback on risk items and the structure of the risk matrix. The OAD PM and GEC highlighted that additional stakeholders often arise in the post-let phase, leading to additional environmental commitments. These may be businesses, religious facilities, or the public using natural resources for leisure. These types of commitments were added as "public relations." In addition, the GEC noted that permits and approvals can significantly vary by type and stakeholders involved. Specifically, the process of acquiring a Section 404 permit is vastly different based on whether it is an individual or a regional/national permit. Also, Section 7 approvals are generally more complex when the National Oceanic and Atmospheric Administration is involved. These subcategories were updated in table 1. Lastly, the SME from OES suggested that NEPA reevaluation risks should be placed at the bottom. The OES interviewee explained that misalignments in expectations on commitments and permitting culminate in unanticipated reevaluations and placing NEPA reevaluation risks at the bottom would help respondents systematically think about where there is a different opinion of when action needs to be taken.

Lastly, all respondents recommended that the risk matrix has greater potential as an alignment tool between the Owner's Team and the DBT. While the OAD PM did not dismiss the

idea of a retrospective program-level evaluation, more interest was displayed toward applying it at the project level. According to our respondents, the risk matrix could be filled out at three critical moments that could greatly benefit from integrating environmental processes into the overall project timeline: before letting the project, right after the award, and at the kickoff meeting. The risk matrix could be used as an opportunity for GDOT and its private partner to calibrate their alignment and for GDOT to elaborate on the likelihood or impacts that certain design changes could have on the project.

# CHAPTER 5. CONCLUSION

This study provides guidance on the management of environmental risks for post-let alternative delivery projects. Leveraging a multimethodological approach of SME interviews, case studies, and archival data analysis, researchers identified an array of common processes, challenges, and opportunities for public and private partners to effectively manage risk. A selection of high-level themes is presented below, followed by an organization of findings with links to the respective report sections.

## FLEXIBILITY OF ALTERNATIVE DELIVERY CAN MEDIATE ENVIRONMENTAL IMPACTS TO SCHEDULE

By definition, alternative contracting involves the selection of private delivery partners before the completion of final design. While expediting procurement in this way can facilitate significant improvements to cost, schedule, and performance, it also typically triggers a need for reevaluation of environmental approvals in light of post-award changes to impacts. Impacts to cost and schedule can balloon quickly if a design-builder does not account for these hurdles.

Fortunately, the flexibility that emerges from pursuing design and construction concurrently can act as a mediating force against the most severe environmental risks. Nimble design-builders, empowered by owners, can strategically schedule post-let activities to ensure constant forward progress. Reevaluations for straightforward early works packages (e.g., clearing and grubbing) may be completed even as more complex design elements are finalized. Depending on the magnitude of the design changes invoked, NEPA reevaluations may proceed according to multiple “pathways” of GDOT and regulatory agency involvement. A disciplined, intentional approach to the development of these concurrent reevaluation packages emerges as a critical risk management practice.

## NEPA, PERMITTING, AND COMMITMENTS AS LARGEST CATEGORIES OF ENVIRONMENTAL RISK

Post-let environmental risks may be broadly organized into three categories: NEPA reevaluation, the acquisition and modification of environmental permits, and the fulfillment of environmental commitments. Though these risks are present in traditional DBB delivery, their interaction and modification in alternative delivery contexts require adapted management techniques; in the words of one GDOT SME, "alternative delivery personnel follow the same environmental rules as everyone else, but it's a different flavor coming at a different time" (SME #9). Pursuant to these risk categories, and through conversation with multidisciplinary SMEs in Georgia, logical flow models of environmental management processes were developed and are presented in chapter 2.

## THE PROMISE AND CHALLENGE OF INTERORGANIZATIONAL PARTNERSHIP

Though broadening the scope of private sector involvement can secure significant efficiencies for infrastructure delivery, it can also increase the exposure to interorganizational friction. State and federal agencies may be unaccustomed to the rhythm of post-let reevaluations inherent to alternative delivery projects. STAs may be unaccustomed to letting the design-builder take the lead on environmental processes, and they must learn how to accede to DBT initiative even as they assert their ultimate ownership over environmental documentation. For their part, design-builders must learn to navigate the preferences and protocols of public partners, which may vary considerably between regional jurisdictions. Coordination between these parties must occur "early and often" to maximize the efficacy of alternative delivery as a collective network.

**Table 4. Summary of challenges and opportunities for post-let environmental risk management in alternative delivery contexts.**

| Category | Challenges | | | Opportunities | |
|---|---|---|---|---|---|
| | Item | Discussion | | Item | Discussion |
| Pre-Let Inputs | Constraints to innovation | Ch3 | | Expansion to environmental survey boundary | Ch3 |
| | | | | | |
| NEPA & Permitting | Unanticipated NEPA reevaluations | Ch3 | | Clarification of standards | Ch3, AppC, AppB |
| | Delays to approval of environmental analyses | Ch3, AppC | | Reduction of formal reevaluations | AppB |
| | Reevaluation sequence planning | AppC, AppE | | Proactive scheduling at kickoff meetings | AppC |
| | | | | RSPs | AppC |
| | | | | | |
| Commitments | Construction phase violations | AppB, AppC, AppD | | Commitments tracker tool | AppB |
| | Interaction with design process | Ch3, AppB | | Preemptive shutdown of violations | AppC |
| | | | | Resource-based trainings | AppC, AppD |
| | | | | | |
| Interorganizational Dynamics | Communication silos | Ch3 | | Early interagency coordination | AppB |
| | Expectations misalignment | AppB | | Integrating DBT into agency discussions | Ch3, AppD, AppB |
| | | | | Onboarding new entrants | Ch3 |
| | | | | Pre-let personnel retention | AppB |
| | Organizational data access constraints | AppE | | Flexible partnering philosophy | Ch3, AppB |
| | | | | Data assimilation | AppE |

# APPENDIX A. RESEARCH METHODOLOGY

## ROADMAP

This research investigates environmental risk in alternative delivery settings, highlighting recurring challenges and common strategies to provide risk management recommendations to STAs. To identify common issues and strategies, this report employs a four-phased research methodology of (1) semi-structured SME interviews, (2) case studies, (3) performance data aggregation and assessment, and (4) construction of an environmental risk matrix.

### Subject Matter Expert Interviews

Assorted stakeholders participated in semi-structured interviews of two forms: (1) general and (2) case study related. In total, researchers interviewed 43 SMEs with experience spanning both public and private sectors and across a multitude of roles within the project delivery network. Several SMEs contributed experience across organizational boundaries. This diversity of perspectives facilitated a holistic exploration of the complex managerial and coordination processes involved. A snowball sampling methodology was used to assemble this pool of participants (figure 6). Of 43 total SME interviewees, 19 were interviewees discussing general themes related to environmental risk (table 5) and 24 were interviewees related to one of the three case studies examined for the report (table 6). The anonymized numbering of SMEs is consistent with the numbering scheme outlined in chapter 3. In figure 7, SMEs were assigned positions according to their professional role at the time of interviewing.

**Table 5. General SME delivery network positions.**

| Subject Matter Expert # | Delivery Network Position |
|---|---|
| SME #1 | STA Environmental |
| SME #2 | Design Consultant |
| SME #3 | Design-Build Contractor |
| SME #4 | Design Consultant |
| SME #5 | STA Alternative Delivery |
| SME #6 | Program Management Consultant |
| SME #7 | Design Consultant |
| SME #8 | Program Management Consultant |
| SME #11 | Design Consultant |
| SME #12 | Design Consultant |
| SME #16 | Design-Build Contractor |
| SME #17 | Design-Build Contractor |
| SME #18 | Design Consultant |
| SME #19 | Federal Agency |
| SME #20 | Design-Build Contractor |
| SME #21 | STA Environmental |
| SME #25 | Program Management Consultant |
| SME #26 | Program Management Consultant |
| SME #27 | STA Environmental |

**Table 6. Case study SME network positions.**

| Subject Matter Expert # | Delivery Network Position |
|---|---|
| SME #9 | STA Alternative Delivery |
| SME #10 | Program Management Consultant |
| SME #13 | Program Management Consultant |
| SME #14 | General Engineering Consultant |
| SME #15 | STA Alternative Delivery |
| SME #22 | STA Environmental |
| SME #23 | STA Alternative Delivery |
| SME #24 | Design Consultant |
| SME #28 | Design-Build Contractor |
| SME #29 | Design-Build Contractor |
| SME #30 | State Agency |
| SME #31 | State Agency |
| SME #32 | State Agency |
| SME #33 | General Engineering Consultant |
| SME #34 | State Agency |
| SME #35 | State Agency |
| SME #36 | State Agency |
| SME #37 | State Agency |
| SME #38 | State Agency |
| SME #39 | General Engineering Consultant |
| SME #40 | General Engineering Consultant |
| SME #41 | General Engineering Consultant |
| SME #42 | Design-Build Contractor |

**Savannah River Bridge** **Transform 285** **Virginia Outside the Beltway**

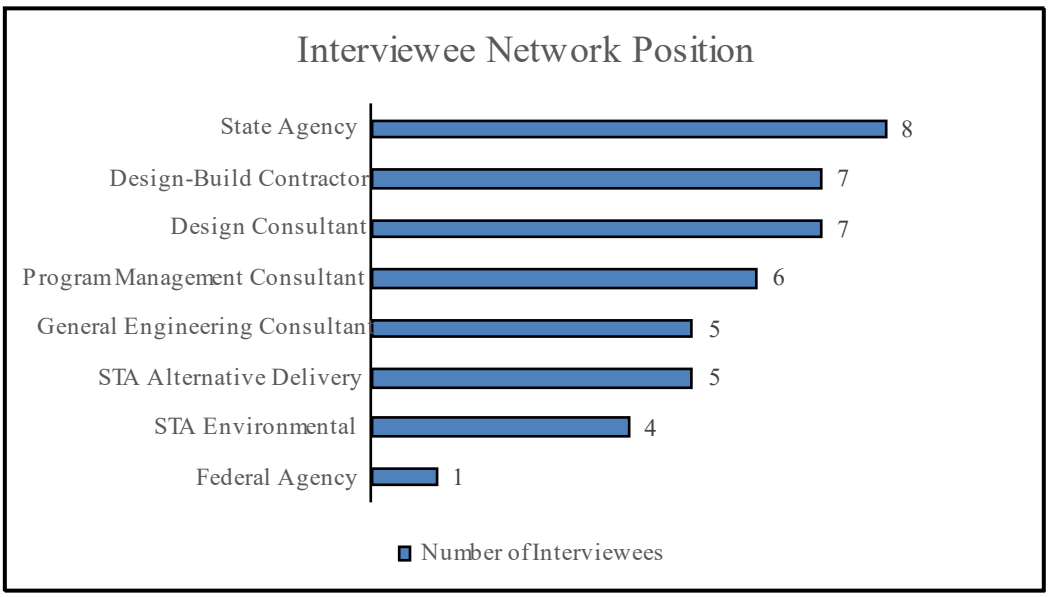


**Figure 6. Chart. Interviewee professional background.**

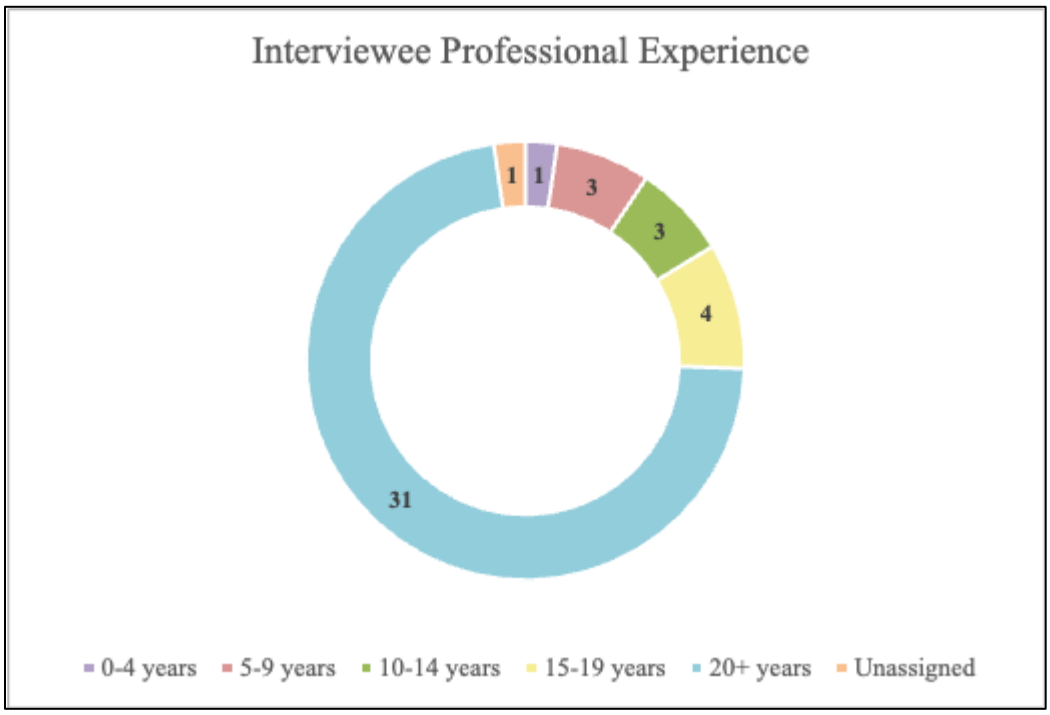


**Figure 7. Chart. Years of professional experience of interviewees.**

In the general interviews, researchers asked SMEs exploratory questions about environmental issues in the ACM setting. Interviewees were asked to list primary environmental responsibilities and risks in the post-let phase of ACM projects and explain how these differed from traditional delivery projects. Participants also were asked to rank environmental, geotechnical, and utilities risks in order of their potential to impact project success. Further, researchers inquired about the forecasting and planning processes for activities like permit acquisition and NEPA evaluation and discussed methods for performance measurement. General SME respondents drew upon their cumulative professional experience, including cross-organizational knowledge gained in prior positions across the delivery network. The case study interviews maintained a similar format and covered the major themes of the SME interview protocol. However, case study questions were also tailored to the specific project being studied. The smaller scope of case study interviews allowed for questions containing greater detail regarding the timing of environmental permitting and NEPA events. For instance, interviewees were asked to list the number of reevaluation packages submitted during a project and to distinguish how many were anticipated versus unanticipated events.

The interview protocol followed a semi-structured format, asking interviewees open-ended questions and following up with more specific questions depending on the response offered. In interviews with participants with unique knowledge of certain processes, researchers prepared personnel-specific questions. Throughout the interview process, researchers noted recurrent themes meriting greater discussion and incorporated additional questions into the protocol. A complete interview protocol is provided in appendix F. Insights gathered from SME interviews were supplemented with a review of project documents such as requests for qualifications (RFQs); requests for proposals (RFPs); technical provisions, and reference information documents (RIDs).

Interviews took place via Microsoft Teams video calls and lasted approximately 1 hour. The interviews were transcribed automatically by Microsoft Teams software and then manually cleaned and edited for accuracy and interviewee confidentiality. Once clean, the transcripts were uploaded to NVivo software and coded according to a logic model developed by the research team and described in chapter 2. The logic model provided a theoretical foundation through which information gathered from diverse respondents might be organized. The research team engaged in joint exercises to converge on a consistent protocol for coding interview transcripts according to the model. This strategic aggregation of responses facilitated the distillation of risk factors and best practices identified in this report.

**Case Study Analysis**

GDOT instructed researchers to examine several case studies to find best practices and lessons learned. Three case studies were selected in consultation with GDOT: the SRB and Transform I-285/SR-400 projects in Georgia and the Transform I-66 Outside the Beltway project in Virginia. The selection outside of Georgia was made based on a few key criteria, including location in the southeastern United States and procurement occurring not earlier than 2015 for a cost not lower than $500 million USD. The selection strategy aimed to capture a range of project experiences, reflecting characteristics of interest such as size, resource commitment type, and environmental complexity. Here, too, researchers sought a variety of public and private perspectives to understand the sequence of environmental actions from across the interorganizational partnership. Each case study includes information garnered from both SME interviews and official project documents. Researchers reviewed material from diverse sources, including STA procurement and contract documentation, agency inspection reports, and DBT project management tools. Through this

process, researchers developed an understanding of the structure and allocation of environmental management responsibilities between partners, in addition to performance measurement.

### Environmental Data Management and Performance

The research team endeavored to compile a list of environmental performance measures and generate a performance database for GDOT alternative delivery projects. Selected performance measures include the count and schedule of post-let NEPA reevaluations, the count and schedule of engagements for the acceptance process of environmental analyses, and the count of violations or stoppages related to environmental commitments. These data were housed across a combination of two digital project management platforms, eBuilder and ProjectWise. The researchers coordinated with GDOT SMEs to compile the available reevaluation data housed in ProjectWise Web Connections. Though at least one NEPA reevaluation was indicated in 30 of the 59 alternative delivery projects with ProjectWise records, limitations to data completeness and availability prompted researchers to focus on environmental processes and flows rather than performance. An analysis of data management protocol and performance implications is provided.

### Environmental Risk Matrix for Alternative Delivery

To achieve GDOT's instructed deliverable to "develop a risk matrix for environmental review in alternative delivery projects," the research team employed the Delphi technique to gather expert feedback on calibrating the risk matrix. The risk matrix was developed such that it might be used to assess environmental risk for a single project or across projects in GDOT's alternative delivery program.

The research team developed the risk matrix based on the three broader environmental risk categories identified in the logic model: NEPA reevaluation, environmental permitting and

approval, and environmental commitments. Each category was further specified into risk items identified from SME interviews and documentary evidence. An expert panel of eight middle- and upper-level managers with extensive knowledge of post-let environmental processes in alternative delivery was recruited. Three participants rated each risk factor according to their perceptions of likelihood and severity of impact and provided written and interview feedback of their ratings and areas for improvement. A post-let environmental risk matrix incorporating feedback from the expert panel is presented in chapter 4.

# APPENDIX B. CASE STUDY GA1: I-20 AT SAVANNAH RIVER BRIDGE REPLACEMENTS

## KEY TAKEAWAYS

- Balancing environmental and engineering goals during pre-let NEPA process eases the design-builder's management of environmental risks.
- Generous estimation of impacts and utilization of a NEPA box is a cost-effective way to not only reduce environmental reevaluations but also incentivize contractors to innovate.
- Early identification and coordination of differences in procedures and standards across jurisdictions contribute to on-schedule and on-budget delivery.
- Involving the design-builder in communications with federal and state agencies reduces review periods.

## 1. PROJECT BACKGROUND

The I-20 at Savannah River Bridge Replacements (SRB) project (figure 8) replaced and widened the existing I-20 bridges that cross over the Augusta Canal and the Savannah River. The bridges were originally built in 1964 and had fractures and weathering damage throughout the structures. The SRB project widened 1.8 miles of I-20 bridges from four to six lanes and made intersection improvements at each end, spanning approximately 2.4 miles from the western shore in Georgia (Georgia Welcome Center) to the eastern shore in South Carolina (West Martintown Road). It is the first bi-state DB project in Georgia, and GDOT was the leading agency for the project. The pre-let NEPA process occurred between 2016 and 2018, culminating in a CE (GDOT 2018). The project was let on October 19, 2018, to Superior Construction at $72 million (GDOT and Superior

Construction Company Southeast LLC 2018). Construction began in December 2019, and the project was nearing completion as of July 2024.

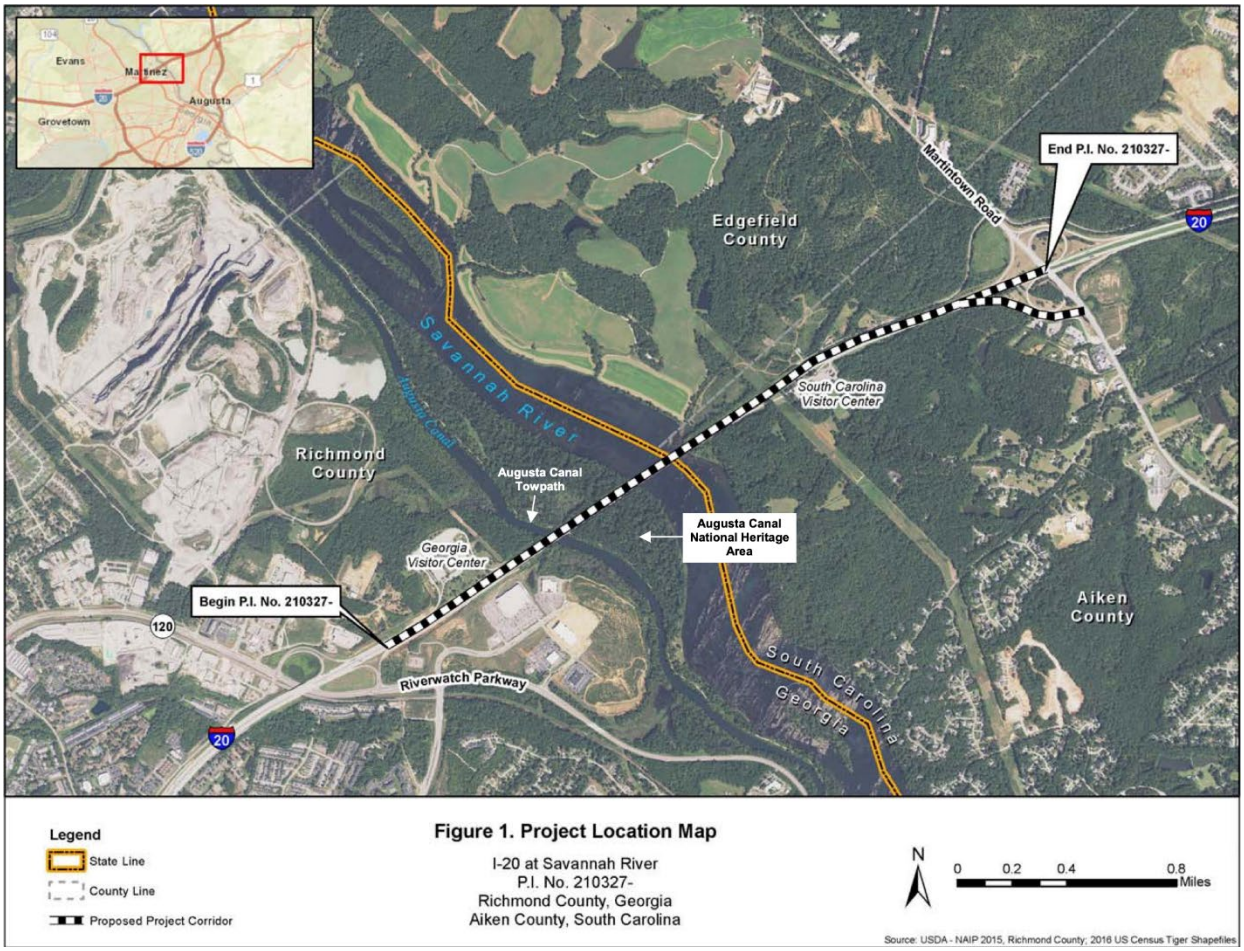


**Figure 8. Map. SRB project location. Source: GDOT 2018.**

## 2. DATA SOURCES

A range of sources was leveraged to triangulate findings on environmental performance for the SRB project. Data sources can be largely categorized into letting documents, NEPA reevaluation, environmental commitments, and SME interviews (table 7). A total of 2,540 pages of documents and 5 interviews with 7 SMEs who assumed key positions for environmental delivery of the SRB project serve as the main body of evidence for this case study.

**Table 7. Summary of documentation gathered for the SRB project.**

| Category | Source | Page/Hour |
|---|---|---|
| **Letting Documents** | Approved concept report | 365 |
| | Initial CE and commitments | 507 |
| | Signed contract | 1,292 |
| | Technical proposal by DBT | 72 |
| **NEPA Reevaluation** | Reevaluation #1 (approved February 13, 2020) | 61 |
| | Reevaluation #2 (approved August 5, 2020) | 41 |
| | Reevaluation #3 (approved November 5, 2020) | 39 |
| | Reevaluation #4 (approved January 20, 2022) | 109 |
| | Reevaluation #5 (approved December 4, 2023) | 41 |
| **Environmental Commitments** | DBT's commitments log and tracking sheet | 11 |
| | DBT's Environmental Compliance Report to GDOT (January 2024) | 2 |
| | Meeting minutes on robust redhorse mitigation between GDOT, PMC, FWS, GA DNR (October 28, 2021) | 15 |
| **Interview Note** | SME #9 (GDOT PM), SME #10 (PMC PM) | 1 |
| | SME #33 (GEC) | 2.5 |
| | SME #2 (DBT ECM) | 1 |
| **Interview Note and Transcript** | SME #2 (DBT ECM) | 1 |
| | SME #22 (SCDOT Environmental Program Manager) SME #23 (SCDOT Design Manager) | 1 |
| | SME #24 (DBT PM) | 1 |

## 3. PRE-LET ENVIRONMENTAL RISKS CASCADING INTO POST-LET PHASE

Pre-let inputs provide a precursor to post-let delivery, as identified in Logic Model 3 (figure 3). The SRB project exhibits two unique characteristics. First, it is by far the largest bi-state DB project that has been pursued by GDOT. Second, the shallow water of the Augusta Canal and presence of the robust redhorse, a state protected aquatic species, in the Savannah River and Augusta Canal required "environmental restrictions [that] were pretty significant on the project" (SME #24).

During the pre-let phase, these project characteristics elicited two sets of risks for environmental delivery: coordinating across jurisdictions and consultations on environmental commitments. These environmental risks later materialized during the post-let phase, resulting in schedule delay and additional cost.

### Coordinating Across Jurisdictions

As the first bi-state project, GDOT and PMC PMs had to not only meet the requirements of environmental authorities in Georgia but also their South Carolina counterparts, which required compliance to different standards and processes. The difference across the state lines were "night and day," according to both GDOT and PMC PMs (SME #9, SME #10).

For example, because two-thirds of the Savannah River and the Augusta Canal are under the jurisdiction of the USACE Savannah District (USACE SAS) and one-third of the Savannah River falls under the Charleston District (USACE SAC), the design-builder had to separately acquire CWA Section 404 permits from both districts; however, the two districts had different permit application forms and required different documentation levels, which was not anticipated by both the owner and the design-builder (SME #22, SME #24).

Another instance mentioned by OAD, PMC, and DBT PMs was on different BMPs between GDOT and SCDOT. Because SCDOT mandates steel posts for silt fences where GDOT mandates wooden posts, all the wooden posts on the South Carolina side had to be replaced with steel (SME #9, SME #10, SME #24).

Although there was awareness of some differences across state lines in the pre-let phase, additional differences were revealed during the post-let phase, and coordinating across state lines introduced additional complexity to governing post-let environmental delivery (SME #9, SME #10, SME #22, SME #23, SME #24, SME #33).

### Consultations on Environmental Commitments

The environmental commitments required by GA EPD placed constraints on the DBT's selection of construction means and methods (GDOT 2018; Superior Construction Company Southeast LLC and WSP USA Inc. 2018). Of the many endangered species identified, the presence of robust

redhorse was the most salient resource, and GA EPD prohibited work in the Savannah River from March 1 through July 1 due to the spawning of the species, which can be found in the Special Provision for Section 107 (GDOT 2018). To protect endangered aquatic species and allow travel for recreational use, the waterway also could not be entirely blocked. In addition, the shallow water of the Savannah River and its rocky bottom prevented the use of barges and traditional cofferdams (GDOT 2018).

Facing these constraints, the design-builder initially selected a water-filled, portable cofferdam system, also known as the AquaDam (Superior Construction Company Southeast LLC and WSP USA Inc. 2018). During the construction phase, the cofferdam system failed due to an upstream dam release in response to heavy rainfall. This development led to a series of Section 404 permit modifications, payment to GA EPD of an additional $200,000 in mitigation costs to relax environmental commitments stipulated in Special Provision 107, and three unanticipated reevaluations (Reevaluations #3, #4, and #5).

## 4. NEPA REEVALUATION AND ENVIRONMENTAL PERMITTING

### Summary of Reevaluations

A total of five formal reevaluations occurred for the SRB project (figure 9). Of these, only the first reevaluation was anticipated by the design-builder at the outset of the post-let phase. The design-builder viewed the project as "fairly straightforward because all the work was going to be within existing right of way" (SME #24), so a "one-shot" reevaluation for the final design package was pursued (see Logic Model 1 in figure 1). The second reevaluation primarily documented impacts to an uncleared ESA for an alternative access road, and the remaining reevaluations were mainly related to activities following the failure of the AquaDam system. A more detailed synopsis of

reevaluations for the SRB project is provided in Summary of NEPA Reevaluations for the SRB Project at the end of this appendix.

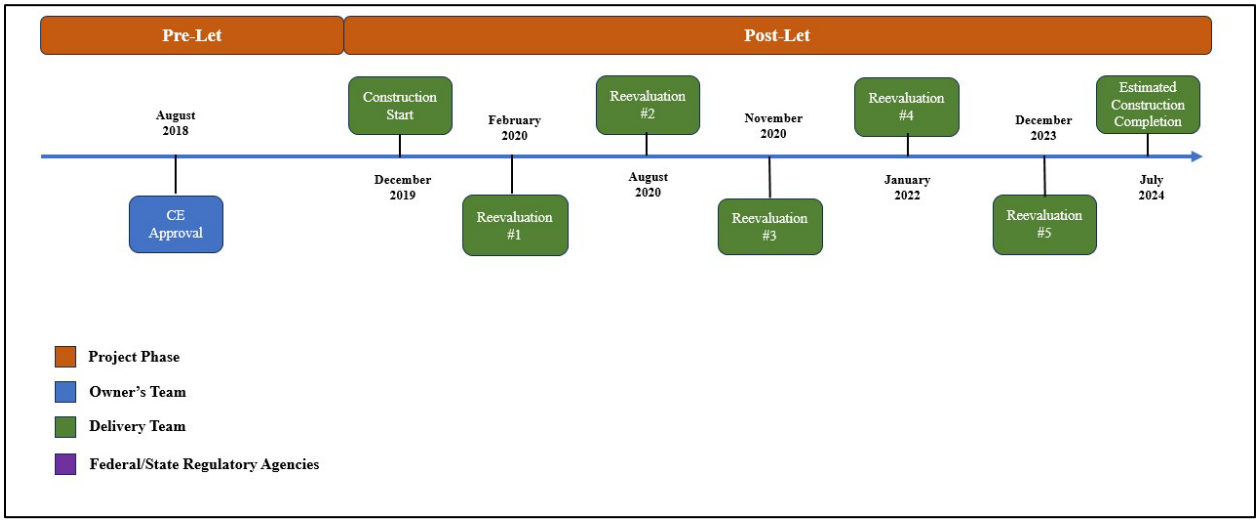


**Figure 9. Timeline. Reevaluations for the SRB project.**

## NEPA Reevaluation and Environmental Permitting Challenges

### *Aligning Expectations Across the Approval Chain*

Both the PMT and DBT expressed frustration about aligning expectations for submitting environmental documents, which contributed to delays in the reevaluation and permitting processes. The GEC mentioned that the DBT rarely provided all information needed to prepare NEPA documents and permitting applications (SME #33). This was in part because the contract was not clear about what is needed for change documentation. The SRB project experience led Arcadis, the GEC, to provide an updated contract form for future projects that more clearly articulates documentation requirements (SME #33).

The DBT PM pointed out that its inability to directly communicate with federal agencies, especially the USACE, "was an extreme bottleneck" and curtailed his team from providing on-time, high-quality documents in the initial submission (SME #24). "We had requested a

coordination meeting with the Corps, and [GDOT's consultants] denied" (SME #24). SME #24 additionally mentioned that "[GDOT]… typically won't allow [face-to-face meetings with FHWA]." Furthermore, the design-builder claimed that GDOT and the PMT had "never provided any documentation [on their consultation with USACE related to the failure of the AquaDam]" (SME #24).

The initial Section 404 permit application process that was part of the first reevaluation was the most salient example of misalignment, which "probably cost[ed] several months," according to the DBT PM (SME #24). At the time of letting the project, the USACE SAS and SAC were undecided on how to work out permits across states (SME #33), especially around whether a nationwide or regional permit would be issued for the Augusta Canal and whether GDOT would have to propose mitigation for the South Carolina side of the Savannah River (Reevaluation #1). The unresolved permitting application process from the pre-let phase resurfaced around the first reevaluation, and it took at least 18 days for the OES to coordinate with the two USACE districts and SCDOT during November 2019 on how to proceed with the permit applications (Reevaluation #1).

This delay affected the project schedule significantly because differences in "the application process and the documentation level…between the Savannah District and the Charleston District…was mind-blowing" (SME #22). SCDOT's Environmental Program Manager recalled that whereas the ecology report was 500 pages (or 53 MBs file size) for the Georgia side, it was only 30 pages (or 1 MB) for the South Carolina section (SME #22). Fortunately, the more stringent requirements of the Savannah District were not a major issue because the DBT was "very familiar with the requirements of the Savannah District" (SME #24). However, the DBT did not

have much prior experience "with the Charleston District…., which had different stipulations for their permits." (SME #24).

The DBT claimed that they "were led to believe by the contract documents that the permit would be secured through the Savannah District with consultation by Charleston and obviously in South Carolina" and that Charleston would not be issuing a separate permit (SME #24). While the research team understands this to be a misunderstanding by the DBT (GDOT and Superior Construction Company Southeast LLC 2018), it was nonetheless consistent with the shared expectation across the Owner's Team and the DBT that there would be identical application forms, which would be reviewed by each district. This is confirmed by SCDOT finding it "surprising…[the two districts] actually had different application forms" (SME #22).

***Additional Impacts to Uncleared Environmental Resources***

A key item for the second reevaluation was the need for a new access road to the Savannah River, which impacted Wetland 7. The DBT generally holds responsibility for clearance and permit acquisition outside of where GDOT has cleared within the ESB in the initial NEPA approval. Current GDOT practice is to set 100 ft beyond the ROW as the ESB to provide flexibility to the design-builder (GDOT 2019). However, the flexibility provided to the DBT is limited by ESAs with no anticipated impacts and freeze zones that prohibit any activities. Design-builders sometimes require the use of such uncleared areas for laydown yards or access roads (SME #33).

In the initial CE document, "it was assumed that access to the Savannah River in South Carolina would occur within the existing ROW" (Reevaluation #2). However, during preliminary construction activities, the design-builder found that access to the initially proposed access road location was not physically feasible. Accessing Wetland 7 anticipated 0.05 acres of impact and required coordination with the FWS and the USACE Charleston District to confirm mitigation

BMPs for two endangered species (relict trillium and wood stork) as well as Section 404 permit modification. Since the anticipated impact was less than 0.1 acre, no additional mitigation credits were required, and the Section 404 permit was re-issued to reflect changes.

### *Balancing Environmental and Engineering Goals*

The thorniest environmental risk was the failure of the AquaDam system due to "acts of nature and unexpected upstream dam releases" (Reevaluation #3). Interrupting the critical path, the event significantly delayed the project schedule, contributing to three additional reevaluations (Reevaluations #3−#5). When the DBT PM was asked what environmental risk in alternative delivery means to him, his immediate response was that it "scares the heck out of us on design-build," referring to the AquaDam failure and the unorganized Section 404 permitting process that the DBT had to navigate through (SME #24).

An added difficulty to the overall NEPA process was that the OES was still learning how to manage environmental processes for alternative delivery projects. OES was not accustomed to the design-builder taking lead in the NEPA reevaluations (SME #1), and OAD "had to fight hard to convince OES that alternative delivery personnel follow the same environmental rules as everyone else, but that it's a different flavor coming at a different time" (SME #9).

## NEPA Reevaluation Opportunities

### *Retain Key Personnel from Pre-Let*

Retaining key personnel from the pre-let phase enabled a smooth transition to the post-let phase (SME #9, SME #33). The decision to assign the same GEC and OAD PM enabled the owner's group to dampen the perilous impacts of the hurricane that resulted in the failure of the AquaDam system. Turnover generally impedes effective communication because rapport has to be built once

again (SME #9). The relationships and trust that the GEC and OAD PM had built across the project delivery network had helped smooth the NEPA reevaluation processes, especially during consultations on updating Section 107 to change the cofferdam system (SME #9).

### *Reduce Formal Reevaluations for Minor Changes*

In comparison to South Carolina, FHWA in Georgia seems to prefer formal reevaluations over programmatic or No Change reevaluations for minor changes. Coordinating with FHWA to select simpler processes for minor changes can streamline post-let environmental delivery. For example, Reevaluation #3 documented items that were determined to have no change in impacts. It documented the utilization of a hybrid cofferdam system that combines the AquaDam and a membrane-enclosed cofferdam as a remedy to the initial failure of the AquaDam system and a change in pavement design. The cofferdam utilized the same footprint as the original AquaDam system, and a No Change Memo was submitted for the pavement. The GEC initially pursued a programmatic reevaluation; however, FHWA required a full ecology addendum, resulting in a formal evaluation.

When asked about thresholds for reevaluations, SCDOT counterparts noted that minor changes in impact would not result in a reevaluation in South Carolina. “If we had analyzed an alternative that had 3 acres of impact and they needed 3.1 acres, [we are] probably not going [to] do a reevaluation for that. That might be something like a note to file or just document it as part of the permit process” (SME #22).

### *Increase Design-Builder Flexibility through a NEPA Box*

One advantage of alternative delivery is that contractors are provided with more opportunities to be innovative with their design and construction. Current GDOT guidelines for environmental

surveys seek this advantage by being generous in ESB and accounting for "maximum anticipated footprint" (SME #33). This almost always results in reducing impact, as in the case of the SRB project (SME #24, SME #33).

A "NEPA box" would enable GDOT to further incentivize contractors to be innovative by clearing all resources within a larger boundary. SME #22 shared his experience with utilizing the NEPA box, saying that it "gives teams the opportunity to work inside a massive study area. We identify all the resources, we clear that whole area for cultural, threatened and endangered species, wetlands, everything… Everything is accounted for. They just got to come in and lay out a final footprint." SCDOT was able to "get a better product and better competition" (SME #22). It could also potentially reduce concerns for reevaluations on minor impacts such as Wetland 7 from the second reevaluation.

***Involve DBT in Federal and State Agency Consultations***

Multiple contractors, including the DBT for the SRB project, pointed out the efficiency gains of directly communicating with FHWA or USACE to align expectations for environmental documents or permit applications (SME #17, SME #24). SME #24 had experiences in Alabama, Mississippi, Tennessee, and Arkansas, and he mentioned occasions where his team was able to have face-to-face meetings with the USACE and FHWA. The advantage of these meetings is that the DBT "can find out what the sticky wickets are, what they're really interested in, what level of documentation they're going to want to see." This helps the DBT "avoid a lengthy review and comment, and resubmittal process" (SME #24).

## 5. ENVIRONMENTAL COMMITMENTS

### Environmental Commitments Challenges

#### *Different Standards for Different Jurisdictions*

BMPs for silt fence posts differed between Georgia and South Carolina. This information was not communicated to the DBT in advance because GDOT and SCDOT were not aware of it. The DBT also assumed that it would be complying with GDOT standards because GDOT was the lead agency (SME #24). By the time the DBT had already installed wooden posts, following Georgia standards, SCDOT ordered a change to steel posts on the South Carolina side (SME #9, SME #10, SME #24). Similar occurrences were found in drafting mitigation plans for permitting applications with state and federal agencies (Reevaluation #1).

### Environmental Commitments Opportunities

#### *Acting as a Partner (and not as a Regulator)*

One important insight from SME #1, GDOT's Ecology Section Manager, is that actions that hurt the contractor hurt GDOT. Viewing GDOT's relationship with contractors as a partnership, "I try to operate as a lubricant for the whole machine to keep working." Updates to Section 107 in the fourth reevaluation was such a display of partnership by GDOT. While the DBT assumed full risk for delays associated with the failure of the AquaDam because it was a contractor-selected means and methods (SME #1, SME #24), the owner's group spearheaded negotiations with GA EPD and South Carolina DNR to relax mitigation measures for the robust redhorse. GDOT also offered to fund a $200,000 study on robust redhorse in the Savannah River in exchange for "allowing cofferdam work in daylight hours during March 1 through July 1" (GDOT 2021).

### *Early Coordination on Jurisdictional Differences*

The SRB project could have run more smoothly had there been more active dialogue to understand differences across state lines. The owner's group was aware of differences across state lines. SCDOT was also cognizant that the two USACE districts "just don't coordinate very well together" from their prior experience working simultaneously with the two USACE districts for a project (SME #22). Formally surfacing these differences prior to letting the project could have provided crucial information for both the owner's group and the DBT for better environmental delivery.

### *Commitments Tracker*

Apart from the mitigation requirements for the robust redhorse, there were no significant challenges for environmental commitments. The ECM effectively oversaw environmental commitments throughout the project, regularly documenting compliance and acting on time in emergencies such as heavy rainfalls in collaboration with the local community (SME #2, SME #24).

The ECM introduced a best practice, which he calls the "commitments tracker," that was used to effectively manage the "very large number of commitments" (SME #2). The commitments tracker is an expansion of the ECT (i.e., Greensheet) to keep the DBT aligned with GDOT's environmental goals. As a former GDOT OES staff member, SME #2 witnessed the initial implementation of the Greensheet, which was developed about 22−23 years ago in response to a contractor that did not follow reporting protocols when it "accidentally dropped the beam in the water."

The commitments tracker provides a one-stop shop for the ECM by "listing everything that we're supposed to be doing, who's supposed to be doing it, the status the last time we updated,

[and etc.]," which allows him to easily compile them together for monthly Environmental Compliance Reports that are submitted to the PMT (SME #2). Table 8 is an example of the commitments tracker that SME #2 provided.

**Table 8. Commitments tracker example.**

| Resource | Env. Document | Issue/Resource | Commitment | Phase | Implementation and Monitoring Action | Enforcement Agency/Timing | Compliance Status | Where to be found |
|---|---|---|---|---|---|---|---|---|
| Water Resources | Nov 19, 2021 Ecology Report Addendum | Open Water (OW) 1 | Relevant water resources are designated as an Environmentally Sensitive Area (ESA); please follow specification 107.23F. | Construction | The Contractor shall not enter, disturb, or perform any construction-related activities, other than those shown on the approved plan sheets within areas designated as ESAs (including ESAs or portions of ESAs not delineated with orange barrier fence). | Environmental Protection Division | Ongoing | Specification 107.23F |

## SUMMARY OF NEPA REEVALUATIONS FOR THE SRB PROJECT

### Reevaluation #1 (approved February 13, 2020)

The first reevaluation was an anticipated, one-shot reevaluation that reflected changes in environmental impacts due to design changes, ATCs, and construction technologies proposed by the design-builder. Because the project scope was "fairly straightforward because all the work was going to be within existing right of way," (SME #24, 2:33) the design-builder chose to not phase the reevaluation process. The important changes were (1) new pavement construction and widening and an unbonded concrete overlay for parts of existing pavement, which led to a minor change to the construction limits outside of ESAs; (2) bridge design optimization that reduced the number of bents; and (3) staged construction using a water-filled cofferdam for the Savannah River bridges and barges for the Augusta Canal bridge to ensure water flow, protect bedrock, and minimize impacts to endangered fish species. When compared to the initially approved CE, the

design-builder's design and construction plans significantly reduced impacts to the waters of the United States (WOTUS).

The reevaluation was approved 1 year and 4 months after letting. The long duration between letting the project and approval of the first reevaluation can be attributed to uncertainty of the Section 404 permitting process and a 7-month delay in design finalization. The late submission of the final design package was due to the design-builder looking at alternatives for the roadway sections to address the pavement sections, especially on the South Carolina side (SME #9). This appears to not be an extraordinary event as design-builders on average plan for 3 months to develop designs and another 3 months to estimate costs (SME #20).

**Reevaluation #2 (approved August 5, 2020)**

The second reevaluation primarily documents the design-builder's decision for a new access road to the Savannah River that would require impacts to Wetland 7 and additional changes to design that would further reduce impacts to WOTUS. At the time of letting the project, "it was assumed that access to the Savannah River in South Carolina would occur within the existing ROW." (Reevaluation #2). However, during preliminary construction activities, the design-builder found that access to the previously proposed access road location was not feasible. Accessing Wetland 7 anticipated 0.05 acre of impact and required coordination with the FWS and the USACE SAC to confirm mitigation BMPs for endangered species relict trillium and wood stork as well as Section 404 permit modification. Because the anticipated impact was less than 0.1 acre, no additional mitigation credits were required, and the Section 404 permit was re-issued to reflect changes.

**Reevaluation #3 (approved November 5, 2020)**

The third reevaluation primarily documents a plan to change to a combination of a water-filled cofferdam parallel to the river flow and a rock cofferdam perpendicular to the river flow in response to a failure in the water-filled cofferdam system for the Savannah River due to "acts of nature and unexpected upstream dam releases." In the event the water-filled cofferdam fails, the rock cofferdam can also be used parallel to the river flow. The water-filled cofferdam system was initially selected by the design-builder to protect bedrock, minimize impacts to endangered fish species, and streamline staged construction. The proposed rock cofferdam system places a membrane on the riverbed and wraps over the aggregate to protect the bedrock and prevent any loose material from entering the river.

**Reevaluation #4 (approved January 20, 2022)**

The fourth reevaluation primarily documents modifications to Section 404 permits caused by changes in the duration of cofferdam placement in the Savannah River and relaxation of construction activity restraints in the Savannah River. The remaining water-filled cofferdam system had failed, and the design-builder required flexibility for future cofferdam switches and anticipated an impact duration of greater than 1 year. The duration of impact was changed from short-term (less than 1 year) to reoccurring/permanent (more than 1 year), and additional mitigation credits were acquired by the design-builder. Accordingly, USACE SAS and SAC each reverified its regional permit. The cofferdam system was completely converted into a rock cofferdam. Section 107 previously restrained work in the Savannah River from March 1 to July 1 due to spawning of the robust redhorse. The restriction window was modified to nighttime hours to provide greater flexibility to the design-builder, and GDOT has committed to fund GA DNR research projects on the robust redhorse as a means of mitigation (GDOT 2021).

**Reevaluation #5 (approved December 4, 2023)**

The fifth reevaluation primarily documents extensions for the Section 404 Nationwide Permit and the South Carolina General Permit for Construction in Navigable Waters and updated commitments due to changes in federal and state listed species. Accordingly, commitments regarding wood stork and robust redhorse in Section 107.23H were deleted. Also, tricolored bats were added to the Effects Evaluation to reflect a recent proposal to enlist it as a federally listed endangered species; however, no additional mitigation measures were proposed because construction is nearly complete. Minor changes in mussel monitoring were updated to reflect the atypical frequency of mussel sweeps and relocations. Lastly, GA DNR's request for greater flexibility in utilizing the $200,000 in mitigation funding for the robust redhorse was documented.

# APPENDIX C. CASE STUDY GA2: TRANSFORM I-285/SR-400

## KEY TAKEAWAYS

- Repetitive revisions to post-let design can generate redundant and costly cycles of reevaluation and permit modification.
- Proactively staging design, reevaluation, and construction packages can streamline post-let delivery schedules and minimize delay.
- Preemptive shutdown of construction sites can help mitigate damages from environmental commitments violations**.**

## 1. PROJECT BACKGROUND

The purpose of the Transform I-285/SR-400 project (figure 10) is to reconstruct the interchange to increase capacity and alleviate congestion. The project is expansive and incorporates many elements, including: creation of barrier-separated collector-distributor (CD) lanes along I-285 and SR-400, reconstruction of existing ramps and bridges, construction of new flyover bridges, a diverging diamond interchange (DDI) at Ashford Dunwoody Road, and surface improvement to general purpose lanes. The project length is 4.3 miles west to east and 6.2 miles south to north.

The total project cost is estimated to be $803 million, with the design-build-finance (DBF) contract priced at $460 million. The project was awarded to North Perimeter Contractors, LLC (NPC), a DB subsidiary of Ferrovial Agroman. The contract was let in February 2016, and construction began in February 2017. The project reached substantial completion in May 2024.


**Figure 10. Map. Transform I-285/SR-400 project location. Source: GDOT (2015).**

## 2. DATA SOURCES

A range of sources was leveraged to triangulate findings on environmental performance for the Transform I-285/SR-400 project. Data sources may be broadly categorized into letting documents, NEPA reevaluation, environmental commitments, and SME interviews. A total of 2100 pages of documents were gathered from public-facing webpages, pre- and post-let NEPA folders inside of ProjectWise, and from records shared by SME interviewees. Five interviews were conducted with

thirteen SMEs assuming key positions across diverse organizational membership, including: GDOT OAD and OES, GDOT's PMT, NPC, and two different offices from GA EPD. A summary of documentary evidence collected for the case study is presented in table 9.

**Table 9. Summary of documentation gathered for Transform I-285/SR-400 case study.**

| Category | Source | Page/Hour |
|---|---|---|
| **Letting Documents** | DBF Agreement | 553 |
| | Initial FONSI and Commitments | 541 |
| | Technical Provisions for DBF Agreement | 138 |
| **NEPA Reevaluations** | Reevaluation #1 (Segment 1) | 12 |
| | Reevaluation #2 (Segment 2) | 11 |
| | Reevaluation #3 (Segment 1) | 84 |
| | Reevaluation #4 (Segment 2) | 69 |
| | Reevaluation #6 (Segment 2) | 13 |
| | Reevaluation #8 (Segment 1) | 30 |
| | Reevaluation #9 (Segment 2) | 64 |
| | Reevaluation #10 (Segment 2) | 64 |
| | Reevaluation #11 (Segment 2) | 67 |
| | Reevaluation #12 (Segment 1) | 51 |
| | Reevaluation #13 (Segment 1) | 38 |
| | Reevaluation #14 (Segment 1) | 48 |
| | Reevaluation #15 (Segment 2) | 39 |
| | Reevaluation #16 (Segment 2) | 81 |
| | Reevaluation #17 (Segment 1) | 89 |
| | Reevaluation #18 (Segment 1) | 44 |
| **Environmental Commitments Documentation** | GA EPD Consent Order 9014 | 26 |
| | GA EPD Consent Order 9063 | 26 |
| | GA EPD Inspection Report – 18 May 2021 | 6 |
| | GA EPD Inspection Report – 25 Aug 2021 | 3 |
| | GA EPD Inspection Report – 28 July 2022 | 3 |
| **Interview Note** | SME #13 (PMT Environmental Manager) SME #14 (PMT) | — |
| **Interview Note and Transcript** | SME #15 (GDOT PIC) | 00:57:55 |
| | SME #28 (DBT PM), SME #29 (DBT ECM) | 00:55:37 |
| | SME #30, #31, #32 (GA EPD Program Office) | 00:51:23 |
| | SME #34, #35, #36, #37, #38 (GA EPD District Office) | 00:50:56 |

## 3. NEPA REEVALUATION AND PERMITTING

### Bifurcated NEPA Documentation

A unique feature of the Transform I-285/SR-400 project is its combination of two individual NEPA documents, with distinct GDOT PI numbers, into a single DBF contract. Both were performed as EAs and individually received a Finding of No Significant Impact (FONSI). The first covers the interchange area, whereas the second addresses the SR-400 segment from Hammond Drive north to Spalding Drive. The second component is a legacy document, originally performed in the 1990s and then reevaluated with modified project scope and boundaries in 2015. Rather than restarting the NEPA process from scratch to combine the two PIs and risking significant schedule delay, GDOT opted to adapt the legacy FONSI and supplement with a second.

### Challenges

#### *Disjointed Reevaluation Approach in DBT*

Although this bifurcation of environmental documentation may have expedited the pre-let procurement timeline, case study evidence suggests it also significantly complicated reapproval processes in the post-let phase; changes to design required that analyses for *both* NEPA documents be updated to maintain validity of the original decisions. A traffic flow change in one segment might directly implicate a traffic flow change in the second segment, for example, precipitating a duplication of analyses and submissions under different PI numbers. GDOT and PMC staff further asserted that coordination of reevaluation in this bifurcated context was complicated by the organizational structure of NPC: as the contractual prime, Ferrovial hired separate engineering firms to design Segments 1 and 2 of the project.

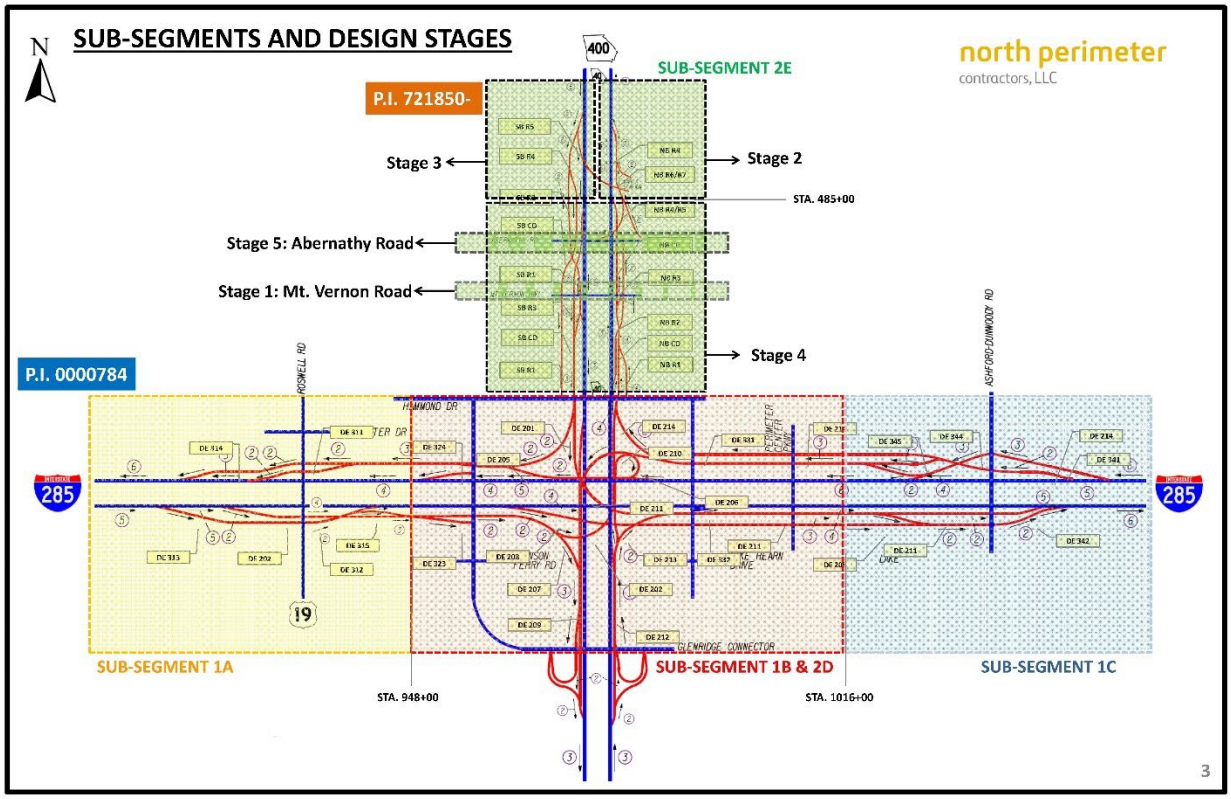


**Figure 11. Map. Segmentation of design approach for the Transform I-285/SR-400 project. Source: (GDOT, n.d., 400)**

As discussed in this report, significant schedule efficiencies may be realized through a strategic phasing of design and reevaluation. By bundling design submissions of a like type and like geography, Delivery Teams may secure RFC for early works packages while proceeding with reevaluation of more complex segments. NPC maintains a map on the project website (figure 11) detailing the subsegmentation of design, reapproval, and construction.

Although NPC segmented the project according to the above five subsegments, PMC interviewees (SME #13, SME #14) indicated that reevaluation proceeded simultaneously for all segments in an effort to secure approval and RFC at the same time. While NPC succeeded in securing reapproval for important early works packages (e.g., clearing and grubbing) that facilitated concurrent activity, the larger reapproval effort proved halting and suffered repetitive

reevaluations of the same geographic areas. An SME from GDOT OAD drew attention to the inefficiencies resulting from changing design and scheduling:

> *"There is a preliminary schedule that submitted with the proposal. The developer may or may not choose to follow that schedule. They may choose to revise it after the project is underway, and they may also change their approach to the phasing of the project. And if they do that, then that will impact very likely the reevaluations that will be needed for this particular project. NPC did not follow the original phasing plan or the original schedule, and as a consequence, with the constant changes there were constant reevaluations that were needed" (SME #15).*

This telling of the reevaluation process is borne out by the documentary record; NPC initiated18 post-award reevaluations across the two project segments. Some of this number may be explained by the legacy duplication of NEPA documents already described, as some changes in one segment required documentation in both documents. While four of these were No-Change and Programmatic reevaluations documenting the beginning of the post-let design process and other minor changes, however, the remainder documented iterative appeals of ranging size for the same location. A timeline of all known NEPA reevaluations executed for the project, including those performed pre-award by the Owner's Team, is presented in figure 12.

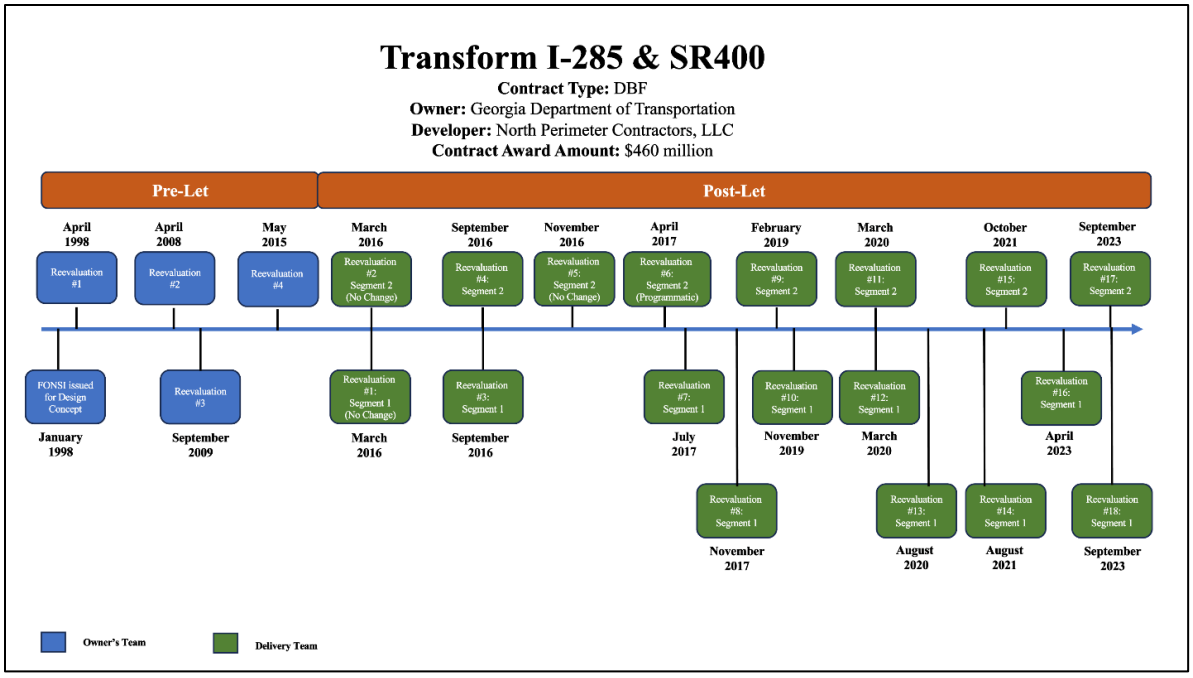


**Figure 12. Timeline. Pre- and post-let reevaluations for the Transform I-285/SR-400 project.**

Reevaluations #3 and #4, submitted concurrently in 2016 for Segments 1 and 2, respectively, represented efforts unremarkable for a large alternative delivery project and documented "minor horizontal/vertical adjustments to the proposed alignment as a result of design refinements" (Reevaluation #17, 2023). By contrast, Reevaluation #10 in 2019 resulted from a significant overhaul to interchange design that occurred years into the project and upended the prior reauthorizations. Multiple reevaluations in the following period resulted from related constructability reviews and expansions to the project footprint outside the ESB.

NPC SMEs held that retaining different design firms for the different segments did not impact the NEPA process, given that the information needed is a "very standard process within the industry," and that environmental engineers "all talk the same language" of federal approval (SME #28). At the same time, the SMEs noted the advantages to having design staff locally available to assess and address design problems that emerge in the field during construction phases,

noting “it will always be the case that you will want the designer to come out and stand there and look at what’s not working” (SME #29). This matched PMC perceptions; namely, that NPC’s utilization of an off-site, Texas-based design firm contributed to constructability concerns with the initial plan set and, eventually, its decision to pursue significant modification of interchange. In this way, disruptions to the design phase unrelated to the environmental approval process can nevertheless precipitate significant cost and delay in the latter.

Other reevaluations on the project emerged strictly from environmental sources. Highlighting the interplay between NEPA and coordinating environmental laws, Reevaluation #13 in 2020 resulted from a need to supplement existing permits under Section 404 of the CWA. Although the magnitude of impact to two perennial streams was unchanged, extensions to the duration of the impact necessitated modification to Section 404 Individual Permits. This narrative of repetitive permit modification resonated with the reflections offered by interviewed SMEs from NPC; in 2023, the DBT was pursuing its third Section 404 permit modification request for Segment 1 (SME #29). The SME noted the importance of conveying the in situ requirements of permits to the construction staff interfacing with the impacted resource. Though an erroneous placement of 2 feet of riprap may seem inconsequential to workers on the ground, the impacts to schedule can be significant if the infraction precipitates a permit modification.

### *Repetitive Reevaluations to Noise Impacts*

The construction of noise barriers along the length of the Transform I-285/SR-400 project for noise abatement purposes was included in the ECT submitted with the project Greensheet. Throughout the project, the noise barriers were subject to multiple design changes and were subsequently included in multiple reevaluations. Across the 18 reevaluations completed to date, noise barrier items were included in 11 reevaluations. Reevaluations primarily documented design changes,

such as height adjustments and updates to terrain conditions, and updates to the number of receivers and receptors as a result of the design changes. Although noise barrier design changes were anticipated early in the project (Reevaluations #3-4), many of the subsequent reevaluations to the noise barriers occurred after the large overhaul to the interchange layout already described. After the project design was revised in Reevaluation #10, all noise barriers were reevaluated to determine the final locations and heights based on the new design. The design changes in Reevaluation #10 continued to impact noise items in subsequent reevaluations. Most noise barriers had more than one design change or reassessment. Table 10 shows how many times each noise barrier was included in a reevaluation.

**Table 10. Summary of noise barrier inclusions in NEPA reevaluations.**

| Reevaluation Number and Date | Noise Barrier Number | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | #1 | #1a | #1b | #2 | #2a | #2b | #3 | #4 | #5 | #5a | #5b | #6 | #7 | #8 |
| #1 03/08/2016 | | | | | | | | | | | | | | |
| #2 03/10/2016 | | | | | | | | | | | | | | |
| #3 09/15/2016 | | ✓ | | ✓ | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| #4 09/15/2016 | | ✓ | ✓ | | | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ |
| #5 11/01/2016 | | | | | | | | | | | | | | |
| #6 04/07/2017 | | | | | | | | | | | | | | |
| #7 07/19/2017 | | | | ✓ | | | ✓ | | | | | | | |
| #8 11/01/2017 | | | | | | | | | | | | | | |
| #9 02/05/2019 | | | | | | | | | | | | ✓ | | |
| #10 11/12/2019 | | ✓ | | ✓ | | | ✓ | | ✓ | | | ✓ | ✓ | ✓ |
| #11 03/10/2020 | | ✓ | ✓ | | | | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ |
| #12 03/26/2020 | | | | | | | ✓ | | | | | | | |
| #13 08/19/2020 | | | | | | | | | | | | | | |
| #14 08/09/2021 | ✓ | | | ✓ | | | | | ✓ | | | ✓ | | |
| #15 10/04/2021 | | | | | | | | ✓ | | | | | | |
| #16 04/26/2023 | ✓ | | | | ✓ | | | | ✓ | | | ✓ | ✓ | |
| #17 09/08/2023 | | ✓ | ✓ | | | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ |
| #18 09/12/2023 | | | | | | | | | | | | | | |
| Total Reevaluations | 2 | 5 | 3 | 4 | 1 | 0 | 7 | 4 | 3 | 4 | 4 | 7 | 6 | 5 |

Segment 1 ☐ Segment 2 ☐ Included in Reevaluation ✓

***Permit and Approval Tracking***

Interviewed SMEs from GA EPD noted deficiencies in the management of permits and variances for the Transform project. Stream Buffer Variances (SBVs), granted by GA EPD, have a 5-year

validity period. If construction on a given project will exceed 5 years, therefore, an extension must be applied for not later than 90 days before expiry of the initial permit (SME #30). GA EPD SMEs reported that on the Transform I-285/SR-400 project an extension request was submitted after this deadline and was thereby declined. If the variance request was submitted due to an ongoing construction need within the buffer zone, or if design plans changed in the future to generate previously unaccounted for activity, the DBT would be left with imperfect options to avoid GA EPD fines and intervention: (1) submitting a new SBV application, opening a lengthy review process; (2) revising construction design or methods to avoid disturbing the sensitive area in perpetuity, or (3) a combination approach, revising construction phasing to avoid the area until the SPV application is approved.

## Opportunities

### *Proactive Reevaluation and Permitting Protocol*

One of the most critical managerial innovations to emerge from the Transform I-285/SR-400 project was the RSP protocol. Both the PMT interviewees (SME #13, SME #14, SME #33) and the senior GDOT project management interviewee (SME #15) recounted difficulty in compelling DBT partners to prepare environmental documentation with adequate detail for ultimate acceptance. Although GDOT itself does not perform the updated analyses to resource-specific impacts, it does assemble these inputs into a formal reevaluation document that it submits to the regulatory agencies. If the input materials for this document are insufficient, the reevaluation is destined for delay. Disagreements about documentary sufficiency are the source of the "ping-ponging" repetitive comment and revision cycles identified by private sector SMEs as a source of delay (SME #28).

The RSP protocol removes ambiguity for documentary requirements by delineating clearly "everything GDOT needs to submit changes" to the relevant regulatory agencies (SME #13). These items include: a narrative and rationale for updated plans, construction means and methods, plan sheets and design files demonstrating compliance with permit requirements, an updated ERIT, and documentation to demonstrate the completion of environmental commitments. By specifying the scope and standard of documentation, the RSP protocol can align public–private expectations for the reevaluation process. This can improve schedule performance through a reduction in PMT commentary cycles and also through an improved DBT understanding of the resources (personnel and time) required for documentary preparation. The PMT SME stressed that alignment on these expectations may be further solidified during post-award kickoff meetings (SME #13).

This proactive treatment of environmental submittals should be extended to the management of permit and variance applications. The expiration and maintenance requirements of all approvals should be clearly delineated in a platform (e.g., eBuilder) that can dynamically accommodate changes to permit details over the life of a project. The platform maintains version control, designates organizational responsibilities, and monitors the timing of documentary preparation against the preset durations specified in the contract.

## 4. ENVIRONMENTAL COMMITMENTS

### Challenges

#### *Persistent Ecology Violations*

Environmental commitments proved to be the largest environmental risk factor for the Transform I-285/SR-400 project; in the words of a GDOT PM: "Most of the issues are related to EPD" (SME #15). Following inspections, EPD assessed a failure to comply with erosion control

measures and initiated two consent orders with NPC. Under this arrangement, NPC paid a fine and committed to a corrective action plan (CAP) to bring its activity into compliance. NPC subsequently issued a voluntary shutdown of construction activity upon discovery of continued violations. Some of these events were triggered by complaints to GA EPD from citizens who witnessed violations such as a waterway sedimented with runoff after a precipitation event. A full timeline of commitments enforcement and corrective action is provided in Summary of Commitments Activity for the Transform I-285/SR-400 Project at the end of this appendix.

Findings of commitments noncompliance were a distinctive feature of the Transform I-285/SR-400 project, with multiple cycles of EPD inspection, fine, and re-inspection within areas of noncompliance. Consent orders and voluntary stoppages inserted schedule delays and extra expense. In this way, the Ecology section of the NEPA commitments, which includes erosion control, became a significant source of environmental risk on the project. This may reflect some deficiencies in the erosion control plans, which "need to be designed with the appropriate BMPs to control the sediment and control the runoff" (SME #15). A GA EPD staff member with experience spanning multiple large DB/public–private partnership (P3) projects offered reflections of the importance of prior experience with permit preparation and compliance:

> *"The permit is designed to be a self-implementing permit and to keep yourself in compliance. So, if you follow the guidelines that are laid out in the permit, you'll stay in compliance and you won't see us... somebody that's been doing business with the DOT—that's in-state or in the Southeast for the last 20 years, throughout the existence of this permit—they're well aware of the permit requirements. They're well aware of EPD, and they may have already been through this with us in the past"(SME #34).*

Multiple SMEs, both public and private, alluded to the importance of local expertise and linked poorer compliance outcomes to a lack thereof. DBT leadership (SME #28, SME #29) remarked that "the way you do business in Georgia is definitely different than how you do business in Texas, because their enforcement priorities are different." These SMEs noted how professionals drawing from experience in more arid states may lack familiarity with erosion from frequent rainwater events and the attending expectations from STA and regulatory agency partners with respect to BMP implementation. Continuity of environmental personnel can ensure commitments obligations receive consistent and commensurate attention. PMC staff pointed to frequent turnover within the DBT's ECM position as one potential shortcoming contributing to NPC's organizational learning curve.

**Opportunities**

Delivery Team SMEs described the administrative learning process that occurred over the life of the project. Collectively, several strategies emerged to address environmental commitments management.

***Preemptive Shutdown of Commitment Violation Sites***

On multiple occasions, after discovering areas of continued noncompliance after execution of the consent orders, NPC engaged in early, voluntary shutdown of problematic worksites to preempt more serious intervention from GA EPD. Shutdown allowed the DBT to demonstrate their commitment to achieving compliance and to avoid additional consent or stop work orders that might have extended into surrounding construction areas. The ECM for NPC noted that "as opposed to EPD coming in and just shutting down the whole entire segment of the project, that self-awareness allows us to act faster and act in a more focused way and not be waiting on anybody

else" (SME #29). The SME commended the collaborative attitude from GA EPD enforcement personnel who provided information on how to identify and prevent repeat violations. By incorporating these practices on the ground, NPC was able to contain noncompliance damages and continue construction operations on other project subsegments.

### *Environmental Commitments Training for Construction Employees*

After repeated findings of violation, NPC elected to overhaul its approach to environmental compliance training. Management enrolled large numbers of worksite staff into Georgia Soil and Water Conservation Commission (GSWCC) certification programs. GSWCC certifications come in four levels: 1A, 1B, 2-Plan Reviewer and 2-Design Professional (SME #34, SME #36). Though select construction staff for NPC were already contractually obligated to obtain Level 1A certifications and junior staff were briefed on compliance expectations, management found that broad enrollment into Level 1A certification facilitated a greater saturation of boots-on-the-ground knowledge and retention of BMP protocols. Especially in a worksite with high levels of subcontractor churn, NPC's ECM reflected on the efficacy of GSWCC training programs to establish a shared vocabulary:

> *"[Our intention] moving forward is to get as many people as possible through that basic training class so that when I say something in the field to a group at a mass safety and environmental meeting, it's going to ring a bell with a few people... and they know what I'm talking about... nobody stares at me blankly now when I mention certain things like silt fences or check dams" (SME #29).*

## SUMMARY OF COMMITMENTS ACTIVITY FOR THE TRANSFORM I-285/SR-400 PROJECT

In constructing the flow process (figure 13), the researchers first mapped out each stage within the consent orders, documenting the key commitment items and synthesizing enforcement activities into high-level categories. The researchers linked the item nodes using directional arrows that represent the progression of events and actions. In doing so, the researchers ensured that each arrow reflected the sequences in which each item node unfolded and how each influenced the next. While the majority of the item nodes are linked in consequential order with single directional arrows, nodes with potential for cyclical flow through the process (such as multiple rounds of inspections and noncompliance) are indicated by dotted lines.

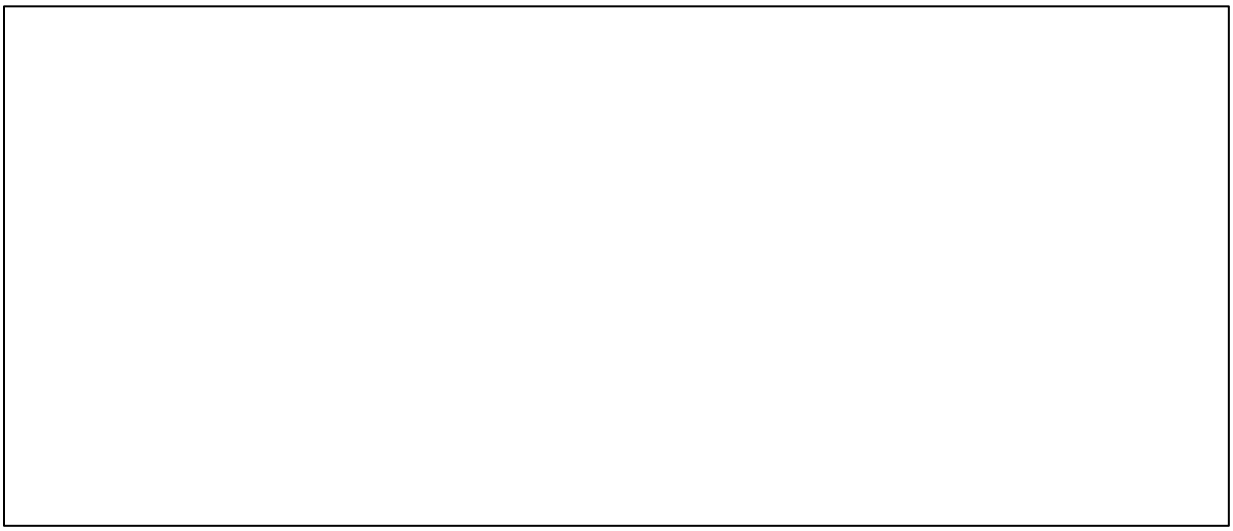

**Figure 13. Flowchart. Process flow for the enforcement of environmental commitments.**

For the visual timeline construction (figure 14), the researchers analyzed the chain of events from the history section of the consent orders. Because the events are written in a nonlinear manner, the researchers analyzed the sequences and connections between key incidents to create a coherent narrative. By doing so, the researchers were able to highlight the patterns, recurring noncompliance issues, and the outcomes of the accumulated events. Reflecting that different items

on the timeline hold various orders of significance, the researchers visualized them in ascending order of importance, with voluntary shutdown being the most prominent followed by two consent orders. Items that affect both segments with lines that cross both segment bars, and items specific to individual segments are shown only within their respective segment bars.

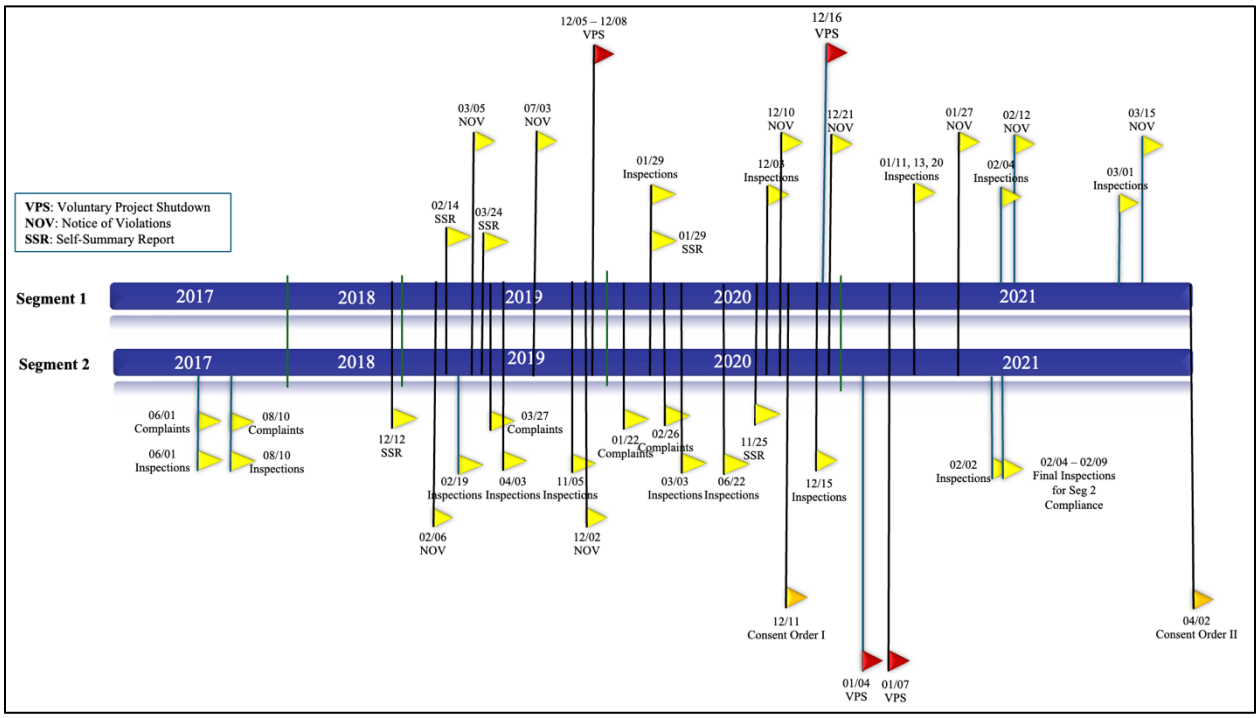


**Figure 14. Timeline. Timeline of commitments for the Transform I-285/SR-400 project.**

The process flow of Segments 1 and 2 demonstrates the potential environmental risks posed by large-scale construction projects. Small lapses in compliance by the contractor can accumulate over time, leading to rounds of ad hoc inspections and continued noncompliance. This chain of events may result in the issuance of consent orders to the contractor to address the noncompliance, ultimately causing significant project delays and incurring additional financial costs. This narrative demonstrates an alternative pathway of environmental risk exposure—accumulating from a "bottom-up" finding of commitments noncompliance at the project site, in contrast to "top-down" interactions between post-let design choices and the need for NEPA reevaluation.

# APPENDIX D. CASE STUDY VA1: TRANSFORM I-66 OUTSIDE THE BELTWAY

## KEY TAKEAWAYS

- Using a tiered NEPA process for complex projects can facilitate dependable pre-let approval timelines and establish parameters for post-award reevaluations.
- Early coordination between the GEC, DBT, and stakeholders can establish a working dialog to communicate commitments and avoid lengthy reevaluations.
- Requiring environmental training courses for subcontractors can reduce knowledge gaps and mitigate commitments violations.

## 1. PROJECT BACKGROUND

The Transform I-66 Outside the Beltway project (figure 15) is a P3 initiative undertaken by the Virginia DOT (VDOT), the Virginia Department of Rail and Public Transportation (VDRPT), and the private firm I-66 Mobility Partners. The Transform I-66 project sought to improve multimodal mobility along Virginia's I-66 from US 15 in Prince William County to I-495 in Fairfax County. I-66 is the main east–west highway in Northern Virginia and primarily serves the Washington metropolitan area. The initial study area along the I-66 corridor was approximately 25 miles. VDOT identified several persistent issues along the I-66 corridor that necessitated improvements to the highway:

- Insufficient travel capacity
- Localized congestion points
- Limited travel mode choices
- High crash rates

- Unreliable travel times during peak traffic periods

Collectively, the Transform I-66 Outside the Beltway project is consistent with other case studies in that post-let environmental risk did not impose significant delay or excess costs. SMEs interviewed for this case study indicated that the observed delays may be attributed to developer-initiated design changes and, in some cases, an inconsistent protocol of design package submission. Although the installation of tolling infrastructure was completed and opened to the public for travel in 2022, the developer had still not reached 100 percent completion for the project as of June 2024.

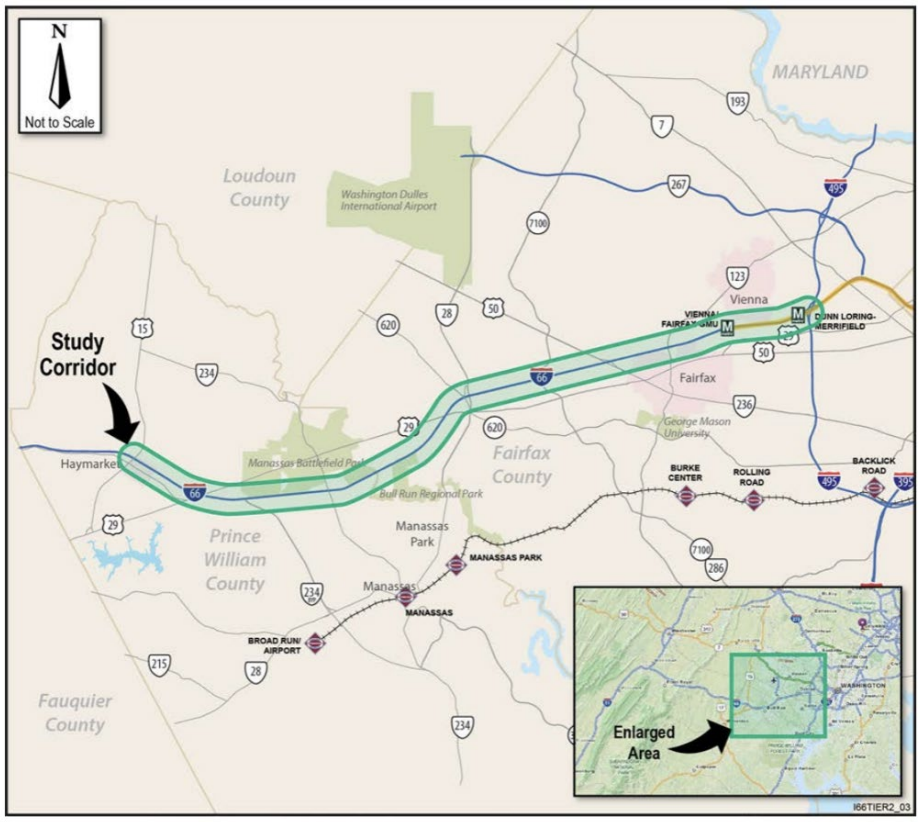


**Figure 15. Map. Project location for Transform I-66 Outside the Beltway project. Source: FHWA, VDOT, and VDRPT (2013, ES-2)**

## 2. DATA SOURCES

A variety of sources were drawn from to evaluate environmental performance on the Transform I-66 Outside the Beltway project. Data sources may be broadly categorized into letting documents, NEPA reevaluation, environmental commitments, and SME interviews. A total of 2154 pages of documents and three interviews with four SMEs who worked on the Transform I-66 project serve as the main body of evidence for this case study (table 11).

**Table 11. Summary of documentation gathered for the Transform I-66 Outside the Beltway case study.**

| Category | Source | Page/Hour |
|---|---|---|
| Letting Documents | Comprehensive Agreement | 226 |
| | First Amendment to Comprehensive Agreement | 22 |
| | Second Amendment to Comprehensive Agreement | 9 |
| | Technical Requirements for Developer | 422 |
| NEPA Reevaluation | Tier 1 Environmental Impact Statement and Record of Decision | 421 |
| | Tier 2 Environmental Assessment | 214 |
| | Tier 2 Environmental Assessment Appendices | 452 |
| | Tier 2 FONSI | 28 |
| | Final PS&E Reevaluation | 3 |
| | Final Right of Way Reevaluation | 8 |
| | Tier 2 Reevaluation Package | 310 |
| Environmental Commitments Documentation | Final Environmental Certification/Commitments Checklist Reevaluation | 12 |
| | Construction Runoff Control Inspection Form C-107 Contractor Inspection Sheet – 10 October 2022 | 16 |
| | Construction Runoff Control Inspection Form C-107 Contractor Inspection Sheet – 9 February 2024 | 11 |
| Interview Note | SME #42 (DBT ECM) | — |
| Interview Note and Transcript | SME #39 (GEC), SME #40 (GEC) | 00:53:24 |
| | SME #41 (GEC) | 01:02:06 |

## 3. PRE-LET NEPA DOCUMENTATION

### Two-Tiered NEPA Process

The NEPA authorization for the Transform I-66 project proceeded in a two-tiered process, as outlined in American Association of State Highway and Transportation Officials (AASHTO)-sponsored guidance for especially complex projects (Hess 2007). The use of a tiered NEPA process facilitated a dependable approval timeline during pre-award project development and established the parameters for post-award reevaluations. This approach was chosen for the Transform I-66 project due to the complexity and scale of the proposed improvements. The Tier 1 Final EIS (FEIS), completed in 2013, documented the existing transportation needs along the I-66 corridor at the time of the study and the potential improvement concepts to address those needs, and it quantified the human and environmental impacts caused by the stated improvement concepts. The second tier of the NEPA documentation process for the Transform I-66 project was performed at an EA class of action and was completed in 2016. VDOT determined that an EA was preferable to an EIS for the Tier 2 documentation because the environmental impacts for the chosen Preferred Alternative design were determined to be minimal.

### Tier 1 Final Environmental Impact Statement (2013)

A Tier 1 FEIS is a document that analyzes broad issues such as general location, mode choice, and areawide air quality and land use implications of major alternatives. The lead agencies responsible for the Tier 1 FEIS were VDOT, VDRPT, and FHWA. The Tier 1 FEIS identified 10 Build Improvement Concepts (BICs) that could alleviate issues along the I-66 corridor, including tolled managed lanes, expansions to public transit options, and improvements to congestion choke points.

The Tier 1 FEIS provided a preliminary analysis of potential environmental impacts that could be caused by each BIC, but detailed analyses that quantify specific footprints and operational

details were left to be completed in the Tier 2 EA. Several key potential impacts were identified within the FEIS:

- Transit improvement concepts (metrorail, light rail, bus rapid transit) and capacity improvement concepts (general purpose/managed lanes) would add urban elements and potentially obstruct farmland and parkland viewsheds.
- As the corridor is located within the Coastal Zone, any BIC would need to be designed to not impair protected resources such as wetlands, dunes, and aquatic animals.
- Three federally listed species and two state-listed species may have habitats within the corridor.

Notably, the corridor also runs through Manassas National Battlefield Park, a Civil War battle site that became a significant point of interest throughout the Transform I-66 project. The GEC responsible for preparing the initial environmental documentation for Transform I-66 took the stance that final designs should remain within the designated footprint at all costs so as not to trigger a Section 4(f) and Section 106 process (SME #41). The GEC conducted initial meetings with Manassas National Battlefield Park stakeholders early in the procurement process to discuss their concerns with the project and noted that the stakeholders were primarily concerned with impacts on the visual quality of the park (SME #41). Ultimately, the 10 BICs were advanced from the Tier 1 FEIS to the Tier 2 EA for further analysis and selection of a Preferred Alternative.

**Tier 2 Environmental Assessment (2016)**

A Preferred Alternative design was developed as a combination of five BICs that aimed to improve the I-66 corridor through various multimodal solutions. The Preferred Alternative included the following design elements:

- Two express lanes and three general purpose lanes in each direction of I-66, for future separate guideway transit.
- Dedicated access point serving the express lanes.
- High-frequency, fast, and reliable bus service along the corridor during extended peak periods.
- Four new and expanded park-and-ride lots, all having direct access to the express lanes.
- Corridor-wide bikeway, trail, and sidewalk improvements.
- Safety and operational improvements at key interchanges throughout the I-66 corridor.

The environmental analysis for the Tier 2 EA demonstrated that the Preferred Alternative design would not create significant environmental impacts. Notably, it was determined that the Preferred Alternative would not have an adverse effect on historic properties along the corridor and, with the exception of *de minimis* impacts to Random Hills Park, would not utilize any Section 4(f) properties. FHWA concurred with the findings of the Tier 2 EA and issued a FONSI in June 2016.

## 4. NEPA REEVALUATIONS AND PERMITTING

According to SMEs who worked on the Transform I-66 project, an estimated 100 reevaluations took place over the course of the project (SME #41). Of these reevaluations, eight "formal" NEPA reevaluations were conducted and packaged together as a single document, which was approved by FHWA in June 2019 (figure 16). Nonformal reevaluations that occurred during the Transform I-66 project were mainly of a "checklist" variety. VDOT utilizes an "abbreviated" reevaluation process for ROW Authorization and Plan Specifications and Estimates (PS&E) Authorization to determine consistency with what is written in the original NEPA documentation (SME #41).

VDOT's checklist reevaluations may be understood as akin to a No Change reevaluation in Georgia. If ROW and PS&E are determined to fit within the original documentation, then the checklist form is filled out and the reevaluation is complete. SME #41 recounted a typical checklist reevaluation process: "[We] ask the question: Is the right of way that they're anticipating consistent with the right of way limits that were originally evaluated in the NEPA document? And if the answer is yes, then that sort of simplified form serves as the reevaluation for that." Checklist reevaluations were prominent throughout the project due to the developer's "piecemealed" submittal of design packages (SME #41).

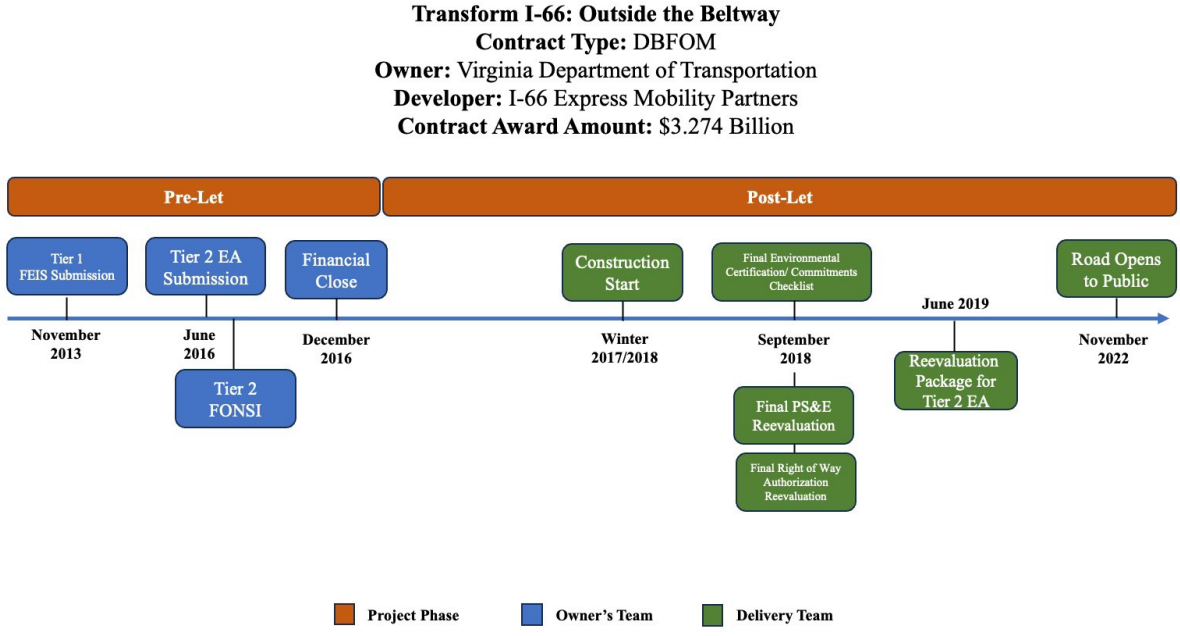


**Figure 16. Timeline. Pre- and post-let reevaluations for the Transform I-66 project.**

## Challenges

### *Design Choices Leading to Lengthy Reevaluations*

The largest reevaluation that occurred for Transform I-66 addressed changes to environmental impacts resulting from a design package known as "ATC 30," which was submitted by the developer. The ATC 30 reevaluation took approximately 1.5 years to resolve, adding a significant amount of time to the project schedule (SME #42). The developer added two elevated access ramps (EARs), also known as flyovers, that were intended to ease traffic flow between the general-purpose lanes and the express lanes. While the EARs did not overstep the footprint of the original design, the Virginia Department of Historic Resources (VDHR), National Park Service, and additional consulting parties believed that ATC 30 would create significant visual alterations to Manassas Battlefield National Park. Specifically, the park maintained that the addition of the EARs would diminish the quality of the viewshed for visitors. Although GA DNR originally found that there would not be significant impacts to the viewshed, the State Historic Preservation Office disagreed and concurred with the park's assessment. The discrepancy among the parties triggered a Section 106 MOA developed by VDOT to address the adverse visual effects of the EARs. According to an Owner's Representative SME, Section 106 documentation was a significant hurdle during the project, "That process took quite a while to get through. We did end up with a... 106 concurrence document where they all had to sign off. There was mitigation. There were many meetings to get that," (SME #39).

## Opportunities

### *Early Coordination Between GEC, DBT, and Stakeholders*

A member of the Transform I-66 GEC team reiterated that a reevaluation of this nature was identified as a potential risk during the project's procurement phase (SME #41). Early meetings between the GEC and stakeholders revealed that visual impacts to Manassas National Battlefield Park were the chief concern among stakeholders. The GEC counseled the developer early on to avoid visual alterations to the park to avoid complications to the Section 4(f) and Section 106 documentation process: "[I]t can be a very convoluted process of getting that documentation done. So, we try to make it clear to [the developer] early on that one of the things we wanted to try to avoid is further encroachment on this Section 4(f) and Section 106 properties" (SME #41). Notwithstanding this risk, multiple SMEs indicated a firm commitment from the developer to insert the EARs, thereby improving traffic flow and subsequent tolling revenue potential.

Ultimately, in coordination with park administration and affiliated interest groups, the developer modified the EAR design so that the ramps were shielded by and incorporated into the topography of the park. This resulted in additional environmental commitments to lessen visual impacts, including choosing a neutral concrete stain color, avoidance of elevated lighting and signage structures, and a payment of $100,000 to Manassas National Battlefield Park to complete a Cultural Landscape Report.

## 5. ENVIRONMENTAL COMMITMENTS

### Challenges

#### *Environmental Knowledge Gaps Leading to Noncompliance*

An environmental compliance SME (#42) for the developer acknowledged shortcomings and pointed to the immense numbers of subcontractors hired for the project—at its peak, more than 4000 laborers were on the worksite. The SME described how some subcontractors tended to take "shortcuts" with respect to environmental compliance, exposing the developer to risk of violation. As one example, SME #42 discovered a hole was cut in a silt fence to facilitate easier dewatering during a utility relocation. This type of noncompliance was representative of a labor force unaccustomed to the oversight required on large, complex projects in the Commonwealth of Virginia.

### Opportunities

#### *Proactive Inspections and Collaborative Strategies*

A GEC SME emphasized that VDOT utilized partnering strategies to ensure environmental compliance rather than an authoritative, command-and-control approach: "I will say that environmentally... the whole project team—the GEC, VDOT, everybody—we took really a collaborative approach with...ensuring environmental compliance; we didn't act really as policemen to...hold their feet to the fire and so forth," (SME #41).

To ensure commitments compliance was achieved, a variety of interorganizational inspection report protocols were instituted. Weekly site inspections were completed by the developer using a checklist developed by VDOT. If deficiencies were identified during the inspections, the reports included required corrective actions and timelines in which corrections

would be made. Monthly site inspections were also completed by VDOT's ECM. The ECM documented the findings of each inspection in a comprehensive report, which included photographs, descriptions of observed conditions, and any recommended corrective actions. These reports were distributed to the project team, contractors, and relevant regulatory agencies. If the ECM identified noncompliance issues during an inspection, they worked closely with the construction team to develop and implement CAPs. The ECM conducted follow-up inspections to verify that the corrective actions had been completed satisfactorily and that the project was back in compliance with environmental requirements. Noncompliance notices were issued by the Virginia Department of Environmental Quality (DEQ) as a last resort when corrective measures had not been taken after repeated intervention.

***Environmental Training for Subcontractors***

As a preventative managerial measure, SME #42 described instituting an intensive environmental training process for subcontracted labor. The preemptive training included a mandatory environmental orientation class and workshops, as well as "Toolbox Talks" to discuss basics like pump installation. Thus, while unexpected environmental reevaluations have not proven a major risk exposure for the project, environmental commitments and permits have generated substantial challenges requiring nimble oversight of the larger delivery network.

# APPENDIX E. ENVIRONMENTAL DATA MANAGEMENT AND PERFORMANCE

## PROJECT MANAGEMENT PLATFORMS

GDOT utilizes digital performance management platforms to track and manage their project delivery portfolio at different phases. These digital platforms serve as "one-stop shops" for official correspondence, document signature, and data repository on a project. Typically, administrators use these cloud-based platforms to manage an entire STA portfolio, granting relevant personnel compartmentalized access on a project-level basis. This approach facilitates the smooth integration of broad project delivery networks without compromising the security of the broader system.

GDOT practice with respect to project management software has evolved alongside the growth of its portfolio and, in particular, its alternative delivery portfolio. The bulk of project management actions are memorialized in at least one of two popular software applications: ProjectWise and eBuilder. Documentation on GDOT's website ("Why ProjectWise?") details the history of the agency's implementation and the relative advantages of cloud-based project management over the prior practice:

> *"Prior to ProjectWise, project files were stored in a variety of locations (i.e. file servers, Pccommon, local hard drives, etc.), many times duplicated in several of those locations. ProjectWise provides a centralized storage system of all project data but also uses its intelligent server architecture to replicate data across District offices to get the information as close to the user as possible. This allows for a single folder structure for each project accessed from anywhere in the state which is routinely backed up to assure business continuity."*

In practice, however, both ProjectWise and eBuilder are used for each GDOT alternative delivery project, resulting in some duplication of file storage. The two platforms are utilized at different times and by different segments of the project delivery network. Their characteristics and usage patterns are summarized below.

**ProjectWise**

ProjectWise is GDOT's primary project management software, which is in use for both the traditional and alternative delivery portfolios. File storage for each project is structured according to project phase and subject area. For example, a typical alternative delivery ProjectWise site contains Preconstruction and Construction folders, with subfolders (e.g., Materials) inside each. Despite this distinction, according to SME interviews (SME #23, SME #43), ProjectWise is primarily utilized by GDOT staff members, with less frequent utilization by the partner DBT. Thus, whereas pre-award activities initiated by the Owner's Team are memorialized in ProjectWise, the post-award activities initiated by the DBT are more often memorialized in eBuilder. A protocol to transfer post-let project data to ProjectWise after project closeout is still in the early stages; at time of writing, only 11 of 61 alternative delivery projects have pre- and post-let data in ProjectWise. For this reason, the Construction folder and its subfolders typically remain unpopulated.

For the purposes of this report, the researchers note that while the Construction folder does not include an Environmental subfolder, post-let information is sometimes captured in the Environmental subfolder of the Preconstruction folder. Figure 17 captures this phenomenon: a NEPA reevaluation from October 2023 is stored in the Preconstruction folder of a highway project let in 2021. Post-let data related to resource-based investigations (e.g., an ecology addendum) may

similarly be found in the Preconstruction Environmental subfolder. This inclusion is not consistent across the project portfolio.

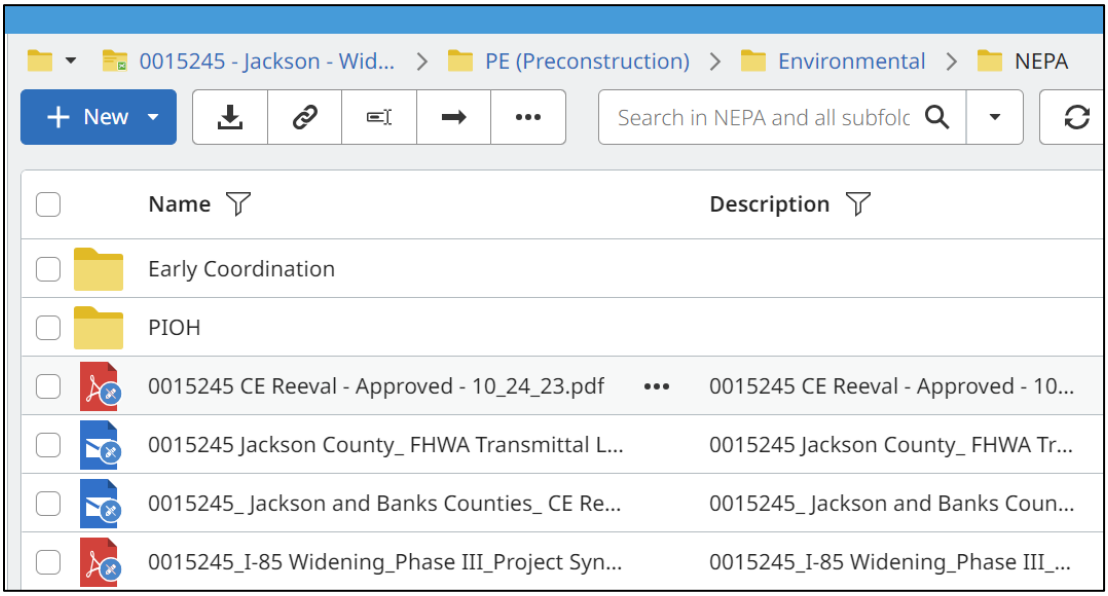


**Figure 17. Screenshot. A typical file storage structure in ProjectWise Web Connections.**

### eBuilder

eBuilder serves as a platform to host correspondence, file transfer, and project management activities in the post-let phase. These activities may be initiated by staff from GDOT, GDOT's PMC, or the DBT. The activities are sorted into high-level Modules (e.g., Planning and Schedule) and granted different access permissions according to user profile.

eBuilder facilitates environmental processes like NEPA reevaluation by memorializing the pathways and timing of document transfer between public and private partners. PMC interviewees (SME #25, SME #26) described how when DBT submits an assessment for approval, eBuilder initiates a digital "stopwatch" to track the passage of time down to the minute. In this manner, both the DBT and GDOT may be held accountable to the timely responses outlined in the contractual

technical provisions. A single reevaluation "bundle" may have multiple rounds of comment and revision from each party recorded in eBuilder.

eBuilder similarly facilitates the execution of environmental commitments. One DB contractor (SME #29) noted that a DBT staff person uploads regular inspection reports and commitment communications to a designated folder in eBuilder. A PMC SME (#26) added that self-reported noncompliance (for example, a stream sedimentation event) would appear in eBuilder, along with any attending documentation from relevant resource agencies.

## PERFORMANCE DATA COLLECTION AND ANALYSIS

Although GDOT captured components of environmental risk management at the project level in the software platforms detailed above, no portfolio-level aggregation of data had been performed at the time of research. To initiate a performance analysis, therefore, researchers engaged with staff at GDOT OAD and its PMC to (1) itemize a list of potential performance measures and (2) assemble a comprehensive database of the same.

At the project level of analysis, primary categories for measurement include a count and schedule of post-let NEPA reevaluations, a count and schedule of engagements for the acceptance process of NEPA- and permit-related environmental analyses, and a count of violations or stoppages related to environmental commitments. Collectively, these measures capture the manifestation of risk exposures discussed by SMEs in Georgia and elsewhere, and correspond with the categories isolated in the environmental risk matrix (see appendix G).

Given that these post-let activities are initiated by the DBT, and the division of software management already discussed, it may be expected that the resulting data would be preserved in eBuilder software. For example, with respect to the acceptance process for environmental analyses, DBT SMEs described a sequential submission process in which documentation ascends a chain of

approval from DBT to PMC to GDOT and ultimately to the lead NEPA agency affiliated with the project (figure 18). Each of these submissions generates a timestamp and begins the contractual "stopwatch" inside of eBuilder for the subsequent authority to provide comments and/or approval. Any rejection of documentation would likewise generate a digital timestamp. Organizationally diverse SMEs (SME #3, SME #16, SME #17, SME #25, SME #26, SME #27) described a game of "ping-pong" between parties sending and returning documents up this delivery chain. Even as all parties may abide by contractual obligations for a timely response to submitted documentation, an unanticipated increase to the number of "volleys" between parties may result in the accrual of unanticipated delay. Auditing eBuilder records at a programmatic level for the number and timing of environmental documentary submissions and revisions may therefore reveal patterns of bottlenecking between different entities. Likewise, a retrospective assessment of portfolio-level violation notices, consent orders, and stop-work orders inside of eBuilder may reveal patterns to "commitments" risk damages during the construction phase. An audit and assessment of eBuilder records was not performed for this research project, but researchers communicated the performance metrics findings to GDOT for future efforts.

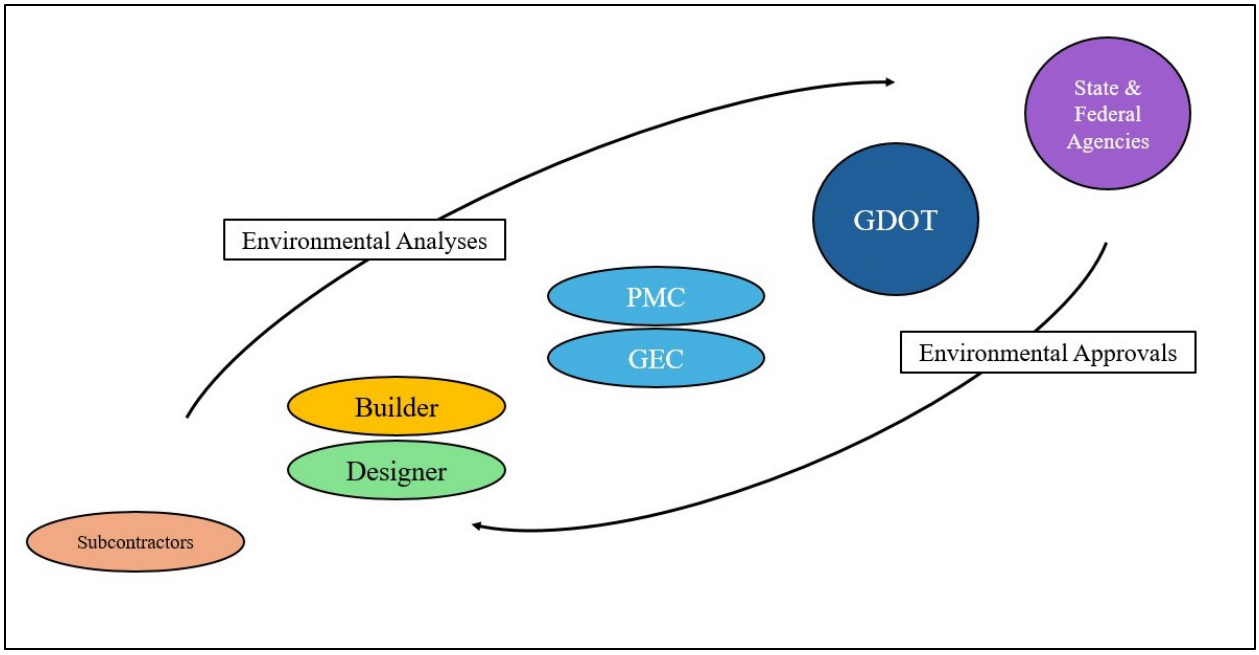


**Figure 18. Flowchart. Chain of approval for environmental documentation.**

A portion of ProjectWise sites housed post-let NEPA reevaluation documentation in their respective Preconstruction folders. Therefore, the researchers coordinated with SMEs within GDOT's Office of Design Policy and Support to aggregate the available reevaluation metadata housed inside ProjectWise Web Connections. Web Connections access had been arranged for 59 of 61 known alternative delivery projects since 2008. Of these, RFPs or design-build agreements (DBAs) were available for 19 projects. Of the 11 projects with data importation from eBuilder, 9 were let between 2017 and 2019, and the remaining 2 were let in 2022. These 11 projects were small to medium in size, with a largest contract award of $47 million. The projects with eBuilder data did not exhibit greater completeness with respect to the documentation of NEPA reevaluation, and the timestamped records of the approval process were not repatriated to ProjectWise.

At least one NEPA reevaluation was indicated in 30 of the 59 alternative delivery projects with ProjectWise records. Researchers either counted the unique reevaluations documented within the folder, or intuited the number of reevaluations through careful reading of an assessment known

as a "post-evaluation report." Of projects with a reevaluation, 16 had a single reevaluation and 14 had multiple reevaluations. Of projects with multiple records, the two GDOT case studies in this report, the I-20 at Savannah River Bridge Replacements project and the Transform I-285/SR-400 project, had the greatest number of reevaluations, with 5 and 18, respectively.

An evaluation of programmatic performance using ProjectWise count data requires incorporation of several considerations:

1. An unpopulated NEPA folder in ProjectWise does not guarantee that no reevaluation was performed, only that none was uploaded. Likewise, the presence of documented reevaluations is not a guarantee that subsequent, undocumented reevaluations were not performed.
2. Some project folders featured multiple documented versions of an individual reevaluation event. The presence of multiple copies implies a lack of programmatic version control and introduces uncertainty about the finality of any given reevaluation encountered.
3. The presence alone of a NEPA reevaluation does not imply positive or negative project performance. A project may have one or many NEPA reevaluations and be a successful project, provided its schedule was planned and managed effectively. In fact, multiple SMEs recommended phasing reevaluation on large and complex projects in order to expedite the construction of early works packages. Project performance might therefore be measured more appropriately by counting the number of reevaluations against an *expected* or *forecasted* number in the post-let master schedule. The presence of unanticipated reevaluations or evaluations extending longer than planned would indicate poorer performance in this framework.

## ENVIRONMENTAL DATA MANAGEMENT CHALLENGES

In aggregating environmental performance data for GDOT's alternative delivery portfolio, researchers encountered challenges stemming from current data management practices. These challenges may be broadly associated into two categories of (1) data assimilation and (2) environmental schedule estimation, each detailed below.

### Data Access and Assimilation

Although either ProjectWise or eBuilder could function as the "single folder structure" advocated by GDOT's documentation, their concurrent usage does not achieve this goal. Rather, the division of data between the two platforms according to project phase and organizational affiliation generates a degree of difficulty for any one individual to access a holistic picture of project performance.

The central fulcrum of this inefficiency, as stated, is the digital separation of public (namely, GDOT and coordinating agency) employees and private (i.e., PMC, DBT, subcontractor) employees. In practice, this has resulted in a divergence of documentary storage techniques for both legacy and current projects, splitting data between eBuilder, ProjectWise, physical file storage, and other means. One SME described how post-let documents requiring GDOT signature may be pulled out of the eBuilder software by the PMC, converted into formats that GDOT employees are more familiar with, and then converted back into eBuilder format for submission. Because the majority of GDOT's portfolio is traditional delivery and utilizes ProjectWise, this eBuilder knowledge gap is particularly significant for employees not directly tethered to alternative delivery project management (SME #1). The public–private divide in eBuilder comfortability extends to partner agencies like FHWA, as well, sometimes generating friction in the environmental approval of alternative delivery projects (SME #27).

A related and significant ramification of this bifurcation pertains to the custody of environmental data. A senior GDOT SME recounted frequently searching for a document or folder inside eBuilder and, upon not finding it, knowing that an appeal for expanded access was required. The SME emphasized the intense threshold to gaining full credentials. Whereas this security may be an asset for sensitive file storage, it may also impede project flow in cases like environmental management. Given that the fundamental resource-based analyses (e.g., ecology, noise, etc.) should assume the same form regardless of organizational origin, whether performed by the DOT's consultants in traditional delivery or the DBT's consultants in alternative delivery, this level of access restriction may not be warranted.

**Environmental Schedule Estimation**

The second main challenge stems not from software but from the uncertainty inherent to delivering a project through alternative delivery. Because design is necessarily incomplete at the time of procurement, the NEPA document—though formally approved—can in practical terms only be considered a preliminary document. As the post-let phase proceeds, design changes will implicate changes to the magnitudes of environmental impact, and **reevaluations will emerge as a normal and expected course of action**. With this said, the necessity and severity of a NEPA reevaluation (or permit modification) resulting from a given bundle of design changes will depend upon a variety of factors, including the flexibility of agency partners, and is difficult to forecast. In the words of one GDOT SME (#27), "You don't know what the future reevaluations are going to be. You don't know for sure how many re-evals, or what the levels will be."

This uncertainty manifests in the management protocol for environmental scheduling and the associated data. In typical practice, a NEPA reevaluation will not visually appear in the eBuilder system until the design changes precipitating it have been finalized and approved by all

parties. At that point, any resource-based studies implicated by the design must be updated, beginning the "stopwatch" and the register of itemized due dates. Mechanically speaking, therefore, the NEPA reevaluation process is a reactive response to NEPA requirements as they emerge, rather than a proactive plan with a forecasted sequence. Although DBTs may incorporate timing for environmental review and comment into master schedules, PMC and GEC SMEs (SME #13, SME #14, SME #33) maintained that these allotments are often unrealistically short, not accounting for iterative Owner commentary, and insufficiently strategic with respect to sequencing. To address this shortcoming, SMEs supported the recent revision to GDOT's scheduling protocol of requiring submission of "reevaluation support packages" (RSPs), which outline the DBT's proactive plan for NEPA sequencing. By jumpstarting the logistical process, the RSP requirement facilitates collaboration and feedback between public and private sector environmental staff. The development and implementation of RSPs is treated in more detail in chapter 3.

## PERFORMANCE DATA OPPORTUNITIES

In light of the foregoing analysis and synthesizing the input from SMEs, the following opportunities for environmental performance data practice are presented.

### Assimilation of Documentation into a Single Digital Platform

The researchers do not offer a judgement on the efficacy of ProjectWise versus eBuilder as a project management platform. Transitioning the entire project delivery network to a single platform would require administrative transaction costs for some portion of actors, but such a move may enjoy long-term administrative efficiencies as a result of relative simplicity. Alternatively, if ProjectWise and eBuilder are to continue to be used independently according to project phase and organizational affiliation, a more thorough data repatriation protocol to GDOT servers is

recommended. GDOT's stated protocol is to repatriate data to ProjectWise upon project closeout; however, in the period since the earliest record of eBuilder data (2016) in ProjectWise, there are 15 completed DB projects with no such data transfer. This absence of aggregated post-let data impedes performance analysis. Expansion of eBuilder access among GDOT personnel may assist in this process.

**Amendment of the Post-Evaluation Report**

As described above, the number of NEPA reevaluations performed is not, in isolation, a predictive measure of environmental risk management performance. It is to be expected that reevaluations will occur for alternative delivery projects and with increasing frequency as project size and frequency increase. Therefore, it is recommended that DBT schedules include a number and sequencing of forecasted NEPA reevaluations, against which performance might be measured. Interviewed PMC and GEC SMEs (SME #13, SME #14) supported the efficacy of such an approach, "forcing the question" of proactive NEPA management to DBTs early into the post-award phase. To capture these initiatives and standardize conceptions of performance for portfolio-level assessment, the Post-Evaluation Report could be amended to include such measures as (1) an affirmative number of NEPA reevaluations completed and (2) a compilation of environmental commitments-based violation notices, consent orders, and stop-work orders.

**Systematic Evaluation of eBuilder Environmental Performance Data**

Given the limitations of evaluating NEPA performance in absence of a schedule, an evaluation of historical performance would examine the two remaining measures of (1) environmental analysis acceptance timing and (2) and environmental commitments violations. These measures capture risk management during the design and construction phases, respectively. Compilation of the

documentary transfer and acceptance timestamps in eBuilder could generate valuable insights for programmatic schedule risk management. Specifically, knowledge of repeat bottlenecks in the documentary approval process—whether organizational or procedural—offers opportunity for proactive management of DBT engagement in future projects. Likewise, understanding DBT construction-phase environmental performance and its relationship to interventions, such as requirements for GSWCC certification for laborers, would allow for more effective and analytical management.

## APPENDIX F. INTERVIEW PROTOCOL

Much of the information on post-let environmental processes for alternative delivery projects was obtained from interviews with various STAs, federal and state agencies, PMCs, GECs, and design-builders. Based on the purpose of the interview, respondents were categorized into general SMEs and case study SMEs. General SMEs were either in senior management positions or with substantial experience (20+ years) in alternative delivery who could provide overarching insights into managerial challenges and opportunities on post-let environmental processes based on their cumulative professional experience, including prior positions in different parts of the alternative delivery network. Case study SMEs were key personnel who were recruited for being directly involved in the implementation of the I-20 at Savannah River Bridge Replacements, Transform I-285/SR-400, and Transform I-66 (Virginia) Outside the Beltway projects. Many case study SMEs had the breadth of experience similar to that of general SMEs and were able to provide higher level insight on managing post-let environmental risk in alternative delivery settings.

The following exhibits include a sample introductory statement and questionnaires shared by the research team as part of the interview protocol. The interview protocol was tailored to each interviewee and shared in advance. Each interview lasted on average for 1 hour.

*Exhibit 1*
**Sample Introductory Statement**

The primary objective of this research is to assist the Georgia Department of Transportation (GDOT) in its efforts to streamline post-let environmental analysis and permitting processes for its alternative delivery projects. This research aims to better understand a) the triggers of environmental reevaluation in design-build projects and b) the relationship between reevaluation and project outcomes across the portfolio of alternative delivery projects.

We'd like to discuss these issues with you and hear your perspective and experience. The interview process will be conversational and informational in nature. For research purposes,

we'd like to record the interview. However, if you feel uncomfortable, we'd be glad to proceed with the interview without recording.

*Exhibit 2*
**Sample Questionnaire for General SMEs**

1. Interviewee Background
    a. What is your (work) title?

    b. How many years have you worked on alternative delivery projects?

    c. What states have you worked in?

    d. Describe your position within a typical project delivery network of public and private actors.

    e. What is your involvement with the NEPA/environmental reevaluation process?

2. Environmental Risks
    a. What are the primary environmental responsibilities and risks in the post-let phase of a DB project?
        i. For the owner team?
        ii. For the design-build team?
        iii. Which risks are shared between the parties, and how?
            1. How much responsibility (NEPA documentation/permitting, mitigation, monitoring, and etc.) is transferred to the design-builder?

    b. How do these differ from DBB delivery?

    c. Which of the following processes poses the greatest risk: permitting, NEPA re-evaluations, or site-level environmental compliance problems/infractions?

    d. How would you compare the risk of environmental to other major risk exposures on large alternative delivery projects such as utilities risk, geotechnical risk, and ROW risk?

3. Permitting
    a. Please describe the timeline of environmental analysis/permitting and procurement for a design-build project.
        i. Which permits typically require new acquisition versus modification?
            1. Who is the signatory on the application?
        ii. Are some permits more problematic than others?

1. If yes, why?

b. Are some state/federal partners more difficult to engage with?
    i. Who, and why?

c. How do you track performance?

4. NEPA Reevaluation
    a. When would a design-builder decide to 'phase' design and construction such that multiple (conditional) NTP3s might be granted?

    b. In the process of evaluating a particular design change element, how do you evaluate whether a formal re-evaluation will be required?
        i. At the project level, do you forecast the number of re-evaluations that will be required?
            1. If yes, how and when?
        ii. Do you evaluate prospective ATCs for their impacts/conflicts with existing environmental approvals?
            1. If yes, how do you evaluate an ATC for the tradeoffs between the potential for financial/schedule savings and the potential for re-evaluation delays?

    c. In the design finalization process, to what extent does the design team communicate/consult with:
        i. internal environmental experts?
            1. Do the environmental staff attend design meetings? How often? Are they consulted on an as-needed basis?
        ii. external (e.g., public agencies like FHWA/owner) environmental experts?
            1. Do the environmental staff attend design meetings? How often? Are they consulted on an as-needed basis?

    d. How does the design team's environmental staff understand "thresholds" of design change and align its expectations with the state/federal agencies who will evaluate those changes?
        i. What party determines this threshold?
        ii. What party makes the determination it has been crossed (owner's rep, state DOT, federal agency)?
        iii. How are these thresholds communicated to the broader industry?

    e. In the course of a project, there may be multiple reevaluations. How would you know if a particular reevaluation is at risk of becoming problematic?
        i. Can you provide an example of a reevaluation that experienced delay? How, and at what point, was it clear that the reevaluation was not proceeding as scheduled?
        ii. How do you keep track?

5. Environmental Commitments
    a. Can you describe the process of assembling the "greensheet" for a project?
        i. How is the greensheet amended?
        ii. If the greensheet is amended, is that considered a reevaluation? Does it trigger a reevaluation?

    b. Can you describe the process of executing and enforcing greensheet commitments for a project?
        i. What does "environmental compliance" mean for:
            1. GDOT?
            2. the design-builder?
        ii. If a design-builder satisfies the requirements of the greensheet, would that constitute compliance?

    c. How are the responsibilities allocated in the event of an environmental discovery/problem that delays the project?
        i. For example, if an endangered species or archaeological site is found after construction begins,
            1. What is the timeline of this problem management?
            2. How would associated schedule delays be adjudicated? Design changes?

6. Communication and Coordination
    a. Please describe the communication networks between environmental personnel within GDOT (and subs, and HNTB) and those within the design-build team.
        i. Who coordinates with whom?
        ii. Are there GDOT-designated coordination procedures between these parties and/or responsibility handoff points?
        iii. What occurs at the Avoidance and Mitigation Measures Meeting (from Pre-Let Workflow diagram)?

    b. As a Design-Builder, what is your interaction with GDOT's Program Management Consultant?
        i. In the ordinary timeline of procurement, how much do you interact with HNTB staff versus GDOT staff?
        ii. Under what circumstances would you approach GDOT versus HNTB?

    c. What is the role of the federal/state government agencies in the alternative delivery process?
        i. How much influence do they exert over the need to re-evaluate, and/or the need to implement additional mitigative measures?
        ii. Are there notable communication choke points?
        iii. Are there STA-funded positions in federal/state agencies?

7. Performance Data
    a. How is environmental performance measured in alternative delivery contexts?

    b. What would be appropriate performance metrics to assess the effectiveness of post-let environmental risk management?

    c. How do reevaluations affect on-time and on-budget delivery?

8. Projected Challenges
    a. What challenges do you anticipate will emerge in the coming decade, particularly as GDOT scales up the size and complexity of its portfolio?
        i. What will be the largest constraints to successful delivery?
        ii. What administrative processes and procedures will need to be amended to accommodate this scaling up?

*Exhibit 3*
**Sample Questionnaire for Case Study SMEs**

A. Interviewee Background
1. What was your title for the [PROJECT NAME]?

2. Describe your role for the [PROJECT NAME].

3. How many years have you worked on alternative delivery projects?

4. What states have you worked in?

B. Environmental Risks
1. What does "environmental risk" mean to you?
2. How would you rank order the following environmental risks: NEPA reevaluation, permit acquisition/modification, environmental resource commitments?
3. How would you rank order the following project risks: environmental, utilities, geotechnical?
4. What environmental risks were identified during pre-let phases?

C. Permitting
1. Please describe the timeline of environmental analysis/permitting and procurement for a design-build project.
    a. Which permits typically require new acquisition versus modification?
        i. Who is the signatory on the application?
    b. Are some permits more problematic than others?
        i. If yes, why?

2. Are some state/federal partners more difficult to engage with?
    a. Who, and why?

3. How do you track performance?

D. NEPA Reevaluation

1. When would a design-builder decide to 'phase' design and construction such that multiple (conditional) NTP3s might be granted?

2. In the process of evaluating a particular design change element, how do you evaluate whether a formal reevaluation will be required?
    a. At the project level, do you forecast the number of reevaluations that will be required?
        i. If yes, how and when?
    b. Do you evaluate prospective ATCs for their impacts/conflicts with existing environmental approvals?
        i. If yes, how do you evaluate an ATC for the tradeoffs between the potential for financial/schedule savings and the potential for re-evaluation delays?

3. In the design finalization process, to what extent does the design team communicate/consult with:
    a. internal environmental experts?
        i. Do the environmental staff attend design meetings? How often? Are they consulted on an as-needed basis?
    b. external (e.g., public agencies like FHWA/owner) environmental experts?
        i. Do the environmental staff attend design meetings? How often? Are they consulted on an as-needed basis?

4. How does the design team's environmental staff understand "thresholds" of design change, and align its expectations with the state/federal agencies who will evaluate those changes?
    a. What party determines this threshold?
    b. What party makes the determination it has been crossed (owner's rep, state DOT, federal agency)?
    c. How are these thresholds communicated to the broader industry?

5. In the course of a project, there may be multiple reevaluations. How would you know if a particular reevaluation is at risk of becoming problematic?
    a. Can you provide an example of a reevaluation that experienced delay? How, and at what point, was it clear that the reevaluation was not proceeding as scheduled?
    b. How do you keep track?

E. Environmental Commitments

1. Can you describe the process of assembling the "greensheet" for a project?

a. How is the greensheet amended?
b. If the greensheet is amended, is that considered a reevaluation? Does it trigger a reevaluation?

2. Can you describe the process of executing and enforcing greensheet commitments for a project?
    a. What does "environmental compliance" mean for:
        i. GDOT?
        ii. the design-builder?
    b. If a design-builder satisfies the requirements of the greensheet, would that constitute compliance?

3. How are the responsibilities allocated in the event of an environmental discovery/problem that delays the project?
    a. For example, if an endangered species or archaeological site is found after construction begins,
        i. What is the timeline of this problem management?
        ii. How would associated schedule delays be adjudicated? Design changes?

F. Communication and Coordination

1. Please describe the communication networks between environmental personnel within GDOT (and subs, and HNTB) and those within the design-build team.
    a. Who coordinates with whom?
    b. Are there GDOT-designated coordination procedures between these parties, and/or responsibility handoff points?
    c. What occurs at the Avoidance and Mitigation Measures Meeting (from Pre-Let Workflow diagram)?

2. As a Design-Builder, what is your interaction with GDOT's Program Management Consultant?
    a. In the ordinary timeline of procurement, how much do you interact with HNTB staff versus GDOT staff?
    b. Under what circumstances would you approach GDOT versus HNTB?

3. What is the role of the federal government agencies in the alternative delivery process?
    a. How much influence do they exert over the need to reevaluate, and/or the need to implement additional mitigative measures?
    b. Are there notable communication choke points in the federal network? Do these emerge at predictable junctures in the project schedule?

G. Performance Data

1. How is environmental performance measured in alternative delivery contexts?

2. What would be appropriate performance metrics to assess the effectiveness of post-let environmental risk management?

3. How do reevaluations affect on-time and on-budget delivery?

H. Projected Challenges

1. What challenges do you anticipate will emerge in the coming decade, particularly as GDOT scales up the size and complexity of its portfolio?
    a. What will be the largest constraints to successful delivery?
    b. What administrative processes and procedures will need to be amended to accommodate this scaling up?

# APPENDIX G. RISK MATRIX SURVEY

## POST-LET ENVIRONMENTAL RISK MATRIX FOR ALTERNATIVE DELIVERY PROJECTS

The Georgia Department of Transportation's Offices of Alternative Delivery and Environmental Services have commissioned researchers at Georgia Tech to evaluate post-let environmental risk across GDOT's alternative delivery program.

This survey invites experts **to complete an Environmental Risk Matrix** developed on the basis of this research. The matrix is divided into three categorical risk components: NEPA Reevaluation, Permitting & Approval, and Environmental Commitments.

The purpose of this survey is to understand environmental risk at the programmatic level rather than for a single project. Therefore, please answer the following questions according to **your cumulative experience** with alternative delivery projects, rather than any one individual project.

Please answer individually and without collaboration from others. As an expert in alternative delivery projects, your participation is crucial to GDOT's efforts to streamline post-let environmental risk management in alternative delivery projects.

Thank you.

### Demographic Information

1. What is your job title?
2. What is your organizational affiliation?
3. What is your professional email address?
4. What is your primary state of operation?
5. Have you worked in other states?
    a. If yes, what other states have you worked in?
6. How many years have you worked in infrastructure delivery (including DBB)?
7. How many years have you worked in alternative delivery (DB, P3, etc.)?

8. On what size alternative delivery projects have you worked? Select all the responses that apply.

| | |
|---|---|
| $0–99 million | YES/NO |
| $100–499 million | YES/NO |
| $500+ million | YES/NO |

**Risk Matrix**

You will now begin the risk matrix portion of the survey.

The risk matrix is divided into three components: NEPA Reevaluation, Permitting & Approval, and Environmental Commitments.

Please fill in the risk matrices according to **your cumulative experience** working on alternative delivery projects.

**NEPA Reevaluation**

Please see the NEPA Reevaluation Risk Matrix below. Provide a value between 1 (lowest) and 3 (highest) for the likelihood and impact that each risk poses, according to **your cumulative experience** on alternative delivery projects.

Glossary of Terms:

| | |
|---|---|
| Unanticipated Reevaluation: | The initiation of a NEPA reevaluation not accounted for in the project schedule. |
| Sequencing Disruption: | Risks pertaining to the interplay of sequencing reevaluations for environmental analyses and construction activities. |
| Environmental Analyses Approval Process: | Risks pertaining to the environmental analyses and documentation performed in service of reevaluation. |
| NEPA Reclassification: | Reclassification of a project's NEPA class of action; e.g., from EA to EIS. |

9. NEPA Reevaluation Risk Matrix

| NEPA Reevaluation Risk Matrix | | | |
|---|---|---|---|
| | **Likelihood** | **Impact (Budget)** | **Impact (Schedule)** |
| Unanticipated Reevaluation | | | |
| Reevaluation Sequencing | | | |
| Environmental Impact Analyses Submission | | | |
| NEPA Level Reclassification | | | |

a. Please explain your rationale for the values you have provided for each risk factor.

**Permitting & Approval**
Please see the Permitting and Approval Risk Matrix below. Provide a value between 1 (lowest) and 3 (highest) for the likelihood and impact that each risk poses, according to **your cumulative experience** on alternative delivery projects.

Glossary of Terms

| | |
|---|---|
| Section 7 Approval: | Risks pertaining to acquisition and modification of approval under Section 7 of the Endangered Species Act. |
| 404 Permit: | Risks pertaining to acquisition and modification of permits under Section 404 of the Clean Water Act. |
| Stream Buffer Variance: | Risks pertaining to acquisition and modification of approval and variances for construction activities by stream resources. |
| Section 106 Approval: | Risks pertaining to acquisition and modification of approval under Section 106 of the National Historic Preservation Act. |
| 4(f) Approval: | Risks pertaining to acquisition and modification of approval under Section 4(f) of the Department of Transportation Act. |

10. Permitting & Approval Risk Matrix

| Permitting & Approval Risk Matrix | | | |
|---|---|---|---|
| | **Likelihood** | **Impact (Budget)** | **Impact (Schedule)** |
| Section 7 Approval | | | |
| 404 Permit | | | |
| Stream Buffer Variance | | | |
| Section 106 Approval | | | |
| 4(f) Approval | | | |

a. Please explain your rationale for the values you have provided for each risk factor.

**Environmental Commitments**

Please see the Environmental Commitments Risk Matrix below. Provide a value between 1 (lowest) and 3 (highest) for the likelihood and impact that each risk poses, according to **your cumulative experience** on alternative delivery projects.

11. Environmental Commitments Risk Matrix

| Environmental Commitments Risk Matrix | | | |
|---|---|---|---|
| | **Likelihood** | **Impact (Budget)** | **Impact (Schedule)** |
| Endangered Species | | | |
| Noise | | | |
| Erosion/Sedimentation | | | |
| Historical/Archaeological | | | |
| Environmental Justice | | | |
| Hazardous Materials | | | |

a. Please explain your rationale for the values you have provided for each risk factor.

**Risk Matrix Improvements**

12. Are there additional items we should include in the risk matrix?

13. Are there items we should remove from the risk matrix? Check all that apply.

| | |
|---|---|
| Unanticipated Reevaluation | Keep/Remove |
| Reevaluation Sequencing | Keep/Remove |
| Environmental Analyses Approval Process | Keep/Remove |
| NEPA Level Reclassification (e.g., EA to EIS) | Keep/Remove |
| Section 7 Approval | Keep/Remove |
| 404 Permit | Keep/Remove |
| Stream Buffer Variance | Keep/Remove |
| Section 106 Approval | Keep/Remove |
| 4(f) Approval | Keep/Remove |
| Endangered Species | Keep/Remove |
| Noise | Keep/Remove |
| Erosion/Sedimentation | Keep/Remove |
| Historical/Archaeological | Keep/Remove |
| Environmental Justice | Keep/Remove |
| Hazardous Materials | Keep/Remove |

14. Across your cumulative experience, how would you **compare the magnitude of environmental risks** for **traditional delivery versus alternative delivery?** Select all the responses that apply.

| | |
|---|---|
| About the same | YES/NO |
| Greater for traditional delivery | YES/NO |
| Greater for alternative delivery | YES/NO |
| Other: | |

15. Rank the magnitude of the following risks from greatest to least (1 to 4), based on your cumulative experience with **traditional delivery projects**.

| | |
|---|---|
| Environmental | |
| Geotechnical | |
| Right of Way | |
| Utilities | |

16. Rank the magnitude of the following risks from greatest to least (1 to 4), based on your cumulative experience with **alternative delivery projects**.

| | |
|---|---|
| Environmental | |
| Geotechnical | |
| Right of Way | |
| Utilities | |

**Alternative/Additional Risk Exposures**

17. If you have experience with alternative delivery projects in multiple states, have you perceived differences in the frequency and magnitude of environmental risks across state lines? Please elaborate and provide examples.

18. Are you willing to participate in a secondary round of risk matrix construction?
    - YES
    - NO

Thank you for completing the Risk Matrix Survey.
Your input is crucial to GDOT's research efforts.
We will be in touch with additional information
regarding the next round of surveys.

| NEPA Reevaluation Risk Matrix | | | |
|---|---|---|---|
| | **Likelihood** | **Impact (Budget)** | **Impact (Schedule)** |
| Unanticipated Reevaluation | | | |
| Sequencing Disruption | | | |
| Environmental Impact Analyses Submission | | | |
| NEPA Reclassification | | | |
| **Permitting & Approval Risk Matrix** | | | |
| | **Likelihood** | **Impact (Budget)** | **Impact (Schedule)** |
| Section 7 Approval | | | |
| 404 Permit | | | |
| Stream Buffer Variance | | | |
| Section 106 Approval | | | |
| 4(f) Approval | | | |
| | **Likelihood** | **Impact (Budget)** | **Impact (Schedule)** |
| Endangered Species | | | |
| Noise | | | |
| Erosion/Sedimentation | | | |
| Historical/Archaeological | | | |
| Environmental Justice | | | |
| Hazardous Materials | | | |

## REFERENCES


American Association of State Highway Transportation Officials (AASHTO). (2005). "Design-Build Environmental Compliance Process and Level of Detail: Eight Case Studies." Washington, DC. Available online: https://onlinepubs.trb.org/onlinepubs/archive/NotesDocs/25-25(12)_FR.pdf.

Ameyaw, E.E., Hu, Y., Shan, M., Chan, A.P.C., and Le, Y. (2016). "Application of Delphi Method in Construction Engineering and Management Research: A Quantitative Perspective." *Journal of Civil Engineering and Management*, *22*(8), pp. 991–1000. Available online: https://doi.org/10.3846/13923730.2014.945953.

An, Y., Rogers, J. Kingsley, G., Matisoff, D.C., Mistur, E., and Ashuri, B. (2018). "Influence of Task Complexity in Shaping Environmental Review and Engineering Design Durations." *Journal of Management in Engineering*, *34*(6), 04018043. Available online: https://doi.org/10.1061/(ASCE)ME.1943-5479.0000649.

Ashuri, B., Mostaan, K., and Hannon, D. (2013). *How Can Innovative Project Delivery Systems Improve the Overall Efficiency of GDOT in Transportation Project Delivery?*" GDOT Research Project No. RP 11-21. Georgia Department of Transportation, Atlanta, GA. Available online: https://www.dot.ga.gov/BuildSmart/research/Documents/11-21.pdf.

Aven, T. (2017). "Improving Risk Characterisations in Practical Situations by Highlighting Knowledge Aspects, with Applications to Risk Matrices." *Reliability Engineering & System Safety*, Special Section: Applications of Probabilistic Graphical Models in Dependability, Diagnosis and Prognosis, *167*(November), pp. 42–48. Available online: https://doi.org/10.1016/j.ress.2017.05.006.

Bhandari, S. and Hallowell, M.R. (2021). "Identifying and Controlling Biases in Expert-Opinion Research: Guidelines for Variations of Delphi, Nominal Group Technique, and Focus Groups." *Journal of Management in Engineering*, *37*(3), 04021015. Available online: https://doi.org/10.1061/(ASCE)ME.1943-5479.0000909.

Design-Build Institute of America (DBIA). (2024). *2024 Design-Build State Statute Report*. DBIA, Washington, DC. Available online: https://store.dbia.org/product/state-statute-report.

Design-Build Institute of America and FMI Consulting (DBIA). (2023). "Mid-Cycle Update Report." DBIA, Washington, DC. Available online: https://dbia.org/wp-content/uploads/2024/04/DBIA-2023-Mid-Cycle-Survey-Report-FMI.pdf.

Federal Highway Administration (FHWA). (2009). *State Transportation Liaison Funded Positions Study*. FHWA, Washington, DC. Available online: https://www.environment.fhwa.dot.gov/Pubs_resources_tools/publications/fundedPositionsReport/report.pdf.

Federal Highway Administration (FHWA) and Georgia Department of Transportation (GDOT). (2016). "Memorandum of Agreement (MOA) Between the Federal Highway Administration Georgia Division (FHWA) and the Georgia Department of Transportation (GDOT) for the Implementation of National Environmental Policy Act (NEPA) Reevaluations Pursuant to 23 CFR 771.129." FHWA, Washington, DC.

Federal Highway Administration (FHWA), Virginia Department of Transportation (VDOT), and Virginia Department of Rail and Public Transportation (VDRPT). (2013). "Interstate 66 Corridor- From U.S. Route 15 to Interstate 495 (Capital Beltway) Fairfax and Prince William Counties, Virginia: Tier 1 Final Environmental Impact Statement and Tier 1 Record of Decision" FHWA, Washington, DC.

Georgia Department of Transportation (GDOT). (2002). "Transform 285/400 I-285 & SR 400 Improvements." GDOT, Atlanta, GA. Available online: https://transform285400-gdot.hub.arcgis.com/.

Georgia Department of Transportation (GDOT). (2012). *Environmental Procedures Manual*. GDOT, Atlanta, GA.

Georgia Department of Transportation (GDOT). (2018). "Categorical Exclusion: I-20 at Savannah River Bridge Replacements and Roadway Widening Project." GDOT, Atlanta, GA.

Georgia Department of Transportation (GDOT). (2019). "Environmental Survey Boundary (ESB) Guidance." GDOT, Atlanta, GA.

Georgia Department of Transportation (GDOT). (2021). "Meeting Minutes on Robust Redhorse Mitigation: I-20 at Savannah River Bridge Replacements and Roadway Widening Project (October 28, 2021)." GDOT, Atlanta, GA.

Georgia Department of Transportation (GDOT). (2022). "Design-Build Manual: Accelerating Solutions From Idea to Reality Using Design-Build." GDOT, Atlanta, GA.

Georgia Department of Transportation (GDOT). (2024). *Plan Development Process*. Revision 3.10, GDOT, Atlanta, GA. https://www.dot.ga.gov/PartnerSmart/DesignManuals/PlanDevelopmentProcess/PDP.pdf

Georgia Department of Transportation (GDOT) Office of Environmental Services. (2021). "Environmental Procedures Guidebook: Design-Build." GDOT, Atlanta, GA.

Georgia Department of Transportation (GDOT) Office of Environmental Services. (2024). "Environmental Procedures Guidebook: Roles & Responsibilities." GDOT, Atlanta, GA.

Georgia Department of Transportation (GDOT) and Superior Construction Company Southeast LLC. (2018). "GDOT Design-Build Contract: I-20 at Savannah River Bridge Replacements and Roadway Widening Project." GDOT, Atlanta, GA.

Hannon, D., Mostaan, K., and Ashuri, B. (2014). Challenges and Opportunities for Expediting Environmental Analysis in Transportation Design-Build Projects," *Construction Research Congress 2014*, May, pp. 1319–28. Available online: https://doi.org/10.1061/9780784413517.135.

Hess, K. (2007). *Modification and Amendment of Environmental Permits on Design-Build Projects*. National Cooperative Research Program (NCHRP) Project 25-25, Task 25. Transportation Research Board of the National Academies, Washington, DC. Available online: https://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=1297.

Hu, Y., Chan, A.P.C., Le, Y, Xu, Y., and Shan, M. (2016). "Developing a Program Organization Performance Index for Delivering Construction Megaprojects in China: Fuzzy Synthetic Evaluation Analysis." *Journal of Management in Engineering*, *32*(4), 05016007. Available online: https://doi.org/10.1061/(ASCE)ME.1943-5479.0000432.

Keetley, A. and Goldstein, G. (2021). "Innovative Contracting Risk Management Best Practices." Michigan Department of Transportation, Lansing, MI. Available online: https://www.michigan.gov/mdot/-/media/Project/Websites/MDOT/Programs/Research-Administration/Final-Reports/SPR-1711-Report.pdf.

Korman, R. (2022). "Granite Execs See Light at End of Turnaround Tunnel." *Engineering News-Record*, July 28. https://www.enr.com/articles/54523-granite-execs-see-light-at-end-of-turnaround-tunnel.

Kucharski, M. and Spellecacy, R. (2014). "Environmental Reviews and Case Studies: Environmental Reevaluations for Design-Build Highway Projects: Implementing the SR 520 Bridge Replacement and HOV Program." *Environmental Practice*, *16*(3), pp. 239–45. Available online: https://doi.org/10.1017/S1466046614000180.

LBJ Development Partners. (n.d.) "IH 635 Managed Lanes Project Technical Proposal Chapter C: Project Development Plan."

Lin, S.L. (2021). "Environmental Risk and Delay Analysis: Lessons Learned from the California High Speed Rail Project." Ph.D. dissertation, University of California, Los Angeles. Available online: https://www.proquest.com/docview/2544873282/abstract/9031E96F26424A64PQ/1.

Linstone, H.A. and Turoff, M. (2011). "Delphi: A Brief Look Backward and Forward." *Technological Forecasting and Social Change*, The Delphi technique: Past, present, and future prospects (special issue). *78*(9), pp. 1712–19. https://doi.org/10.1016/j.techfore.2010.09.011.

Mistur, E.M., Kingsley, G., Matisoff, D.C., and An, Y. (2021). "Green Rules and Green Tape: Streamlining the Environmental Review for Transportation Projects." *Transportation Research Part D: Transport and Environment*, *97*(August), 102937. Available online: https://doi.org/10.1016/j.trd.2021.102937.

Perez, B., Giordano, R., and Thompson, J. (2013). "Federal Environmental Compliance for Projects Utilizing Alternative Funding Models." National Cooperative Highway Research Program (NCHRP) Project 25-25, Task 81, Transportation Research Board of the National Academies, Washington, DC. Available online: http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP25-25(81)_FR.pdf.

Pesesky, L., Snyder, K., Heller, A., and Hoffman, S. (2019). "Successful Practices for Environmental Commitments In Public Private Partnerships (P3) and Design-Build (D-B) Contracts." The Louis Berger Group, Inc., New York, NY. Available online: https://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP25-25_Task109_FinalReport.pdf.

Qazi, A. and Dikmen, I. (2021). "From Risk Matrices to Risk Networks in Construction Projects." *IEEE Transactions on Engineering Management*, *68*(5), pp. 1449–60. Available online: https://doi.org/10.1109/TEM.2019.2907787.

Rubin, D.K. and Powers, M.B. (n.d.). "After Bottom-Line Hits, More Firms Exit Fixed-Price Work." *ENR Engineering News-Record*. Available online: https://www.enr.com/articles/47299-after-bottom-line-hits-more-firms-exit-fixed-price-work, last accessed August 13, 2024.

Superior Construction Company Southeast, LLC, and WSP USA, Inc. (2018). "Technical Proposal: I-20 at Savannah River Bridge Replacements and Roadway Widening Project."

The Louis Berger Group, Inc., McVoy Associates, LLC, and Wayne W. Kober, Inc. (2019). *Environmental Management System Perspectives for State Departments of Transportation*. Final Report, NCHRP Project 25-25, Task 111. Available online: https://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP25-25(111)_FinalReport.pdf.

Turoff, M. (1970). "The Design of a Policy Delphi." *Technological Forecasting and Social Change*, *2*(2), pp. 149–71. Available online: https://doi.org/10.1016/0040-1625(70)90161-7.

U.S. Department of Transportation. (2019). NEPA Re-Evaluation Joint Guidance for Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), & Federal Transit Administration (FTA). USDOT, Washington, DC. Available online: https://www.environment.fhwa.dot.gov/legislation/nepa/Reevaluation_guidance_08142019.aspx.

Whittington, J. (2012). "When to Partner for Public Infrastructure?" *Journal of the American Planning Association*, *78*(3), pp. 269–85. Available online: https://doi.org/10.1080/01944363.2012.715510.

Yang, X., Liu, S., Jia, C., Liu, Y., and Yu, C. (2021). "Vulnerability Assessment and Management Planning for the Ecological Environment in Urban Wetlands." *Journal of Environmental Management*, *298*(November), 113540. Available online: https://doi.org/10.1016/j.jenvman.2021.113540.