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A Framework for Building Efficient Environmental Permitting Processes

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Abstract: Despite its importance as a tool for protecting air and water quality, and for mitigating impacts to protected species and ecosystems, the environmental permitting process is widely recognized to be inefficient and marked by delays. This article draws on a literature review and interviews with permitting practitioners to identify factors that contribute to delayed permit decisions. The sociopolitical context, projects that are complex or use novel technology, a fragmented and bureaucratic regulatory regime, serial permit applications and reviews, and applicant and permitting agency knowledge and resources each contribute to permitting inefficiency when they foster uncertainty, increase transaction costs, and allow divergent interests to multiply, yet remain unresolved. We then use the interviews to consider the potential of a collaborative dialogue between permitting agencies and applicants to mitigate these challenges, and argue that collaboration is well positioned to lessen permitting inefficiency.

Keywords: environmental regulation; environmental permitting; water management; efficiency; collaborative governance

1. Introduction

> "It took 4 years, $1 M, and actions by our local congressperson to obtain a permit to build green infrastructure. The construction work took $2 M and 8 months. Developing a [way] to streamline permitting for projects . . . could lower costs by almost half."
>
> —Developer for a water treatment, flood control, and habitat restoration project

Around the world, governments are developing novel infrastructure and restoration projects to adapt to changing climate. As they do, they face a challenge described by the developer above. Any new construction proposal typically requires authorization by local, state, and national agencies in the form of environmental permits. These permits play a central role in regulating environmental impacts, as they prevent harmful projects from going forward and set limits on potential project damages to protected lands, endangered species, or people living nearby. While debates persist over whether permits are the most effective way to ensure this protection [1–3], they remain a critical and widely used regulatory tool for making project developers account for environmental impacts.

At the same time, it has long been recognized that permitting processes are inefficient [4,5]. Permits often take much longer to be issued than the on-the-books timelines [6,7]. Permitting delays

can drive up the staffing, resource, and transaction costs for both the applicant and the permitting agency [8] and postpone the realization of the project's social, economic, or environmental benefits [7,9]. Delays can also create opportunities for opposing political interests to alter or obstruct permitting outcomes [9] and can prevent project developers from making opportune use of construction windows [8]. Such problems have led to a widespread dissatisfaction with current permitting practices. Importantly, delay is particularly prevalent for more innovative projects, like renewable energy [10,11], and those we expect to see in response to environmental change—a concern emphasized in our opening quote.

Despite the central role that permitting plays in environmental regulation, there has been minimal research and little theorizing about the factors that influence how well permitting processes work. To that end, this article develops a framework to assist academics and regulators/practitioners in evaluating the factors that drive permitting processes. It draws on existing literature about the efficiency of permitting processes and interviews with practitioners for insights from their experience. The framework is then used to explore a possible strategy for improving environmental permitting: increasing collaboration within and across individual permitting processes.

This research considers efficiency to be a multidimensional concept, encompassing the time, resource, staff, information, and monetary costs necessary to obtain a given outcome [12]. Inefficiency entails unnecessary costs incurred because of delay or duplication of effort: extra process costs to achieve the same outcome. Inefficiencies have negative consequences for the permitting agency, the project developer, and the public [7–9]. Permitting efficiency is intricately intertwined with effectiveness, i.e., the extent to which issued permits adequately meet agency mandates and protect the resource under its jurisdiction. A faster process is not necessarily more efficient if that speed reduces a permit's environmental protection. Where relevant, potential interactions (positive or negative) between efficiency and effectiveness are raised. Nevertheless, based on their interviews and professional experience, the authors believe that there are process improvements that would reduce overall permit inefficiency without affecting effectiveness.

The following section elaborates the research approach. Sections 3 and 4 develop a conceptual framework about why permitting can become more expensive and time consuming. The framework lays out six general types of factors—the relevant regulatory regime, details of the application process, the political/environmental/social context, specific project characteristics, and characteristics of the various organizations involved—that can increase uncertainty, transaction costs, and divergent interests. These factors in turn can delay the permitting process, making it more costly and politically vulnerable. In Section 5, we then use the interviews to consider the potential for creating a collaborative dialogue between permitting agencies and applicants to mitigate these challenges, and argue that collaboration is well positioned to lessen permitting inefficiency.

2. Material and Methods

The analysis began with a review of extant literature on permitting processes, including both peer-reviewed articles and reports drafted by permitting agencies and consulting firms. Twenty three articles were identified through keyword searches (e.g., "permit streamlining", "permitting process", "environmental permitting") on Google Scholar and Scopus. The search was designed to be global in scope and includes reviews of permitting processes from the US to Sweden to Ghana, and was agnostic to the type of good being permitted and, therefore, includes not just environmental permits, but also drug approvals and vehicle manufacturing and a mix of more and less complex project types. These articles were coded to identify (1) factors empirically observed to positively or negatively affect permitting efficiency; (2) factors observed to affect permitting effectiveness; (3) how authors conceptualized efficiency and effectiveness (if available); and (4) any recommendations or factors otherwise hypothesized (but not empirically observed/tested) to affect efficiency and effectiveness. These factors were then categorized to identify what had been empirically shown to affect efficiency.

Since the literature review revealed that there were substantial areas where little was known about permitting, we interviewed participants involved in several recent permitting processes to identify additional potential factors. The interview data is exploratory and meant to generate research questions and hypotheses; it is, therefore, not meant to be comprehensive, but rather suggestive of particular experiences.

Between January and April 2016, interviews were conducted with federal, state, and regional permitting agency staff (n = 4), local government staff (acting as both the permitting agency and the applicant, n = 3), project developers, and managers who recently applied for permits (n = 4), and consultants who oversee permitting for developers (n = 2). All interviewees were located in the US state of California. Interviewees were selected using purposive sampling [13] to represent a range of organizations and to target individuals with extensive careers in permitting and, therefore, high levels of professional expertise. The interviews covered each individual's experience with environmental permitting and reflections on barriers and facilitators they had observed. Interview transcripts were coded in NVivo qualitative analysis software (QSR International, Melbourne, Australia) using the categories developed from the initial article review, as well as emergent categories. Finally, relevant information was added to the framework.

The interviews focused on the permitting process for four multipurpose water projects in California (see Table 1). California is recognized to have particularly extreme levels of delay [9]. These delays represent an interesting tension between environmental activism, innovation, and regulatory inflexibility. California tends to be an innovator from which new policies and technologies are adopted by other states and/or at the national level [14]. California also has some of the strictest environmental regulations in the US, giving permitting agencies powerful tools to protect the environment [15]. At the same time, California has a particularly high level of fragmentation among environmental agencies, so tensions around interagency interactions are extreme.

Table 1. Permitting case studies.

Project	Project Type	Applicant Type	Permits Required
A	County-wide process overseeing construction and restoration near streams	Local landowners	Local land use, endangered species, clean water
B	Large-scale habitat restoration	State government	Endangered species, clean water, coastal management
C	Wastewater treatment and habitat restoration	Public water utility	Endangered species, clean water, coastal management
D	Flood control	Local government	Endangered species, clean water, coastal management

Additionally, the cases are environmentally beneficial projects proposed by public entities. A common trope was that interviewees were building marsh, habitat, or wetlands, "not a Wal-Mart parking lot". While many private developments pose stark choices between economic value and environmental consequences, public projects present difficult choices between different and competing environmental goods. Moreover, as public entities, the project developers are acting on behalf of the public interest, not to enhance the wealth or interests of a few. Thus, inefficiencies in public projects burden a larger populace than for private developers.

These cases are, thus, not representative of environmental permitting, but were selected as extreme cases [16]. By exploring permitting in particularly complex settings, we expect to uncover a more comprehensive suite of factors to help build a theory of permitting delay.

Unfortunately, data on the relative proportion of complex versus simple projects is not readily available. However, our findings should be generalizable for several reasons. First, the same laws and regulations apply for a wetland restoration and a Wal-Mart parking lot, and the same permitting agencies oversee those processes. Thus, challenges that relate to the regulatory setting, application

process, and organizational capacity (Sections 4.1, 4.2 and 4.5 below) exist to some degree for all projects and jurisdictions. Second, the literature review—which assessed a wide array of geographies, permits, and project types—suggested that permitting delay and inefficiency is widespread in both simple and complex settings and for local, regional, and national permits [17]. It also suggested that many of the same factors (as enumerated in Section 4) lead to delays in both simple and complex settings, but with more factors interacting the more complex a project or the more individual permits required. Finally, while the interviews focused on the four cases listed above, we asked the interviewees to reflect explicitly on how those processes were similar to or different from others they had undertaken, conversations that connected these water projects to transportation, renewable energy, and many other types of infrastructure. These conversations provided context for when and why particular factors affected permitting efficiency. Thus, even though the interviews focused on a particular subset of permit and project types, lessons learned can be applied more broadly to more traditional developments.

3. Background on the Permit Lifecycle

Every permit has a typical lifecycle (see Figure 1). The permitting process starts with development and submission of the application. In this stage, the permit is largely in the project developers' hands, as they are responsible for identifying needed permits, compiling the requisite information, and preparing and submitting the permit application. However, developers may choose to hire consultants to direct the process and/or have informal contact with the permitting agencies as they prepare the application.

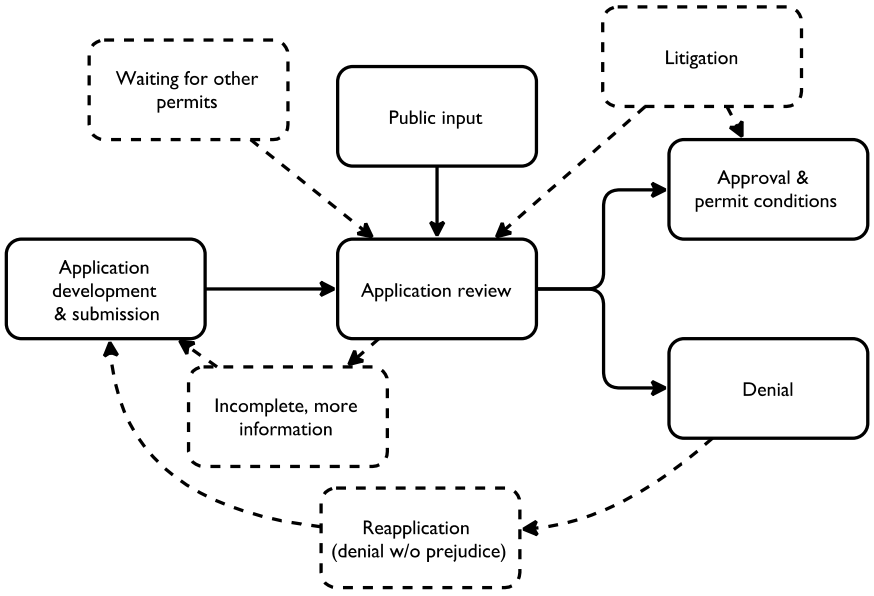

Figure 1. The permitting process. Solid lines indicate the "simple" model often presented on agency websites, while dotted lines indicate complicating interactions.

Once the application is submitted, the permitting agency reviews the application to determine whether the project is consistent with its regulatory mandate and, if not, what changes to the project or additional mitigation might be required. The permit review often starts with a cursory review to ensure that the application is complete, followed by the full review. For most permitting processes that have legally-mandated timelines, the clock starts ticking either when the application is received or when the agency deems the application complete. Some permits may provide opportunity for public input during the application review stage, through written comments or an open meeting.

Once the review process is complete, the permitting agency approves or denies the permit.

The process presented by the solid lines in Figure 1 is linear and for a single permit (similar to how the process is presented on the books). However, many of the interviewees did not characterize it that

way, but instead described many back and forth, iterative steps. For example, Project D's application was returned to the applicant with a request for more information and later rejected without prejudice (a rejection wherein the developer can apply again). In other instances, a developer or permitting staff was managing multiple permit applications at once, meaning there were essentially multiple interacting versions of the process happening simultaneously. As discussed below, several permits required prior issuance of other permits, forcing permitting agencies to wait before conducting their review. Additionally, several of the projects had concurrent lawsuits, with both applicants and community groups filing complaints against the permitting agency. The dotted lines represent this complexity.

4. Findings: Factors Affecting Permit Efficiency

For each stage of the permitting process, we identified several categories of factors that affect efficiency. These categories are:

- Regulatory regime: characteristics of the regulatory setting in which permitting takes place,
- Application process: the actual requirements of the application development, submission, and review, including application contents, information requirements, and use of technology,
- Political, social, and environmental context: the setting in which a particular project is being developed and permitted,
- Project characteristics: what type of project is being permitted and what resources it affects, and
- Organizational characteristics: culture, practices, knowledge, and resources held by both the permitting agencies and the applicant.

The following subsections draw on the literature review and interviews to enumerate how these factors operate, separately and in conjunction with one another, to affect permitting efficiency, and demonstrates that the permitting process slows down when uncertainty increases, transaction costs rise, and/or preferences diverge.

4.1. Regulatory Regime

The regulatory regime consists of the multitude of statutes, implementing regulations, agency policies, and court decisions that affect what permits are required, what agencies look for during a permitting process, and what activities or discharges they can allow. Across the many jurisdictions covered in the literature review, the regulatory regime was consistently portrayed as highly complex and bureaucratic. As codified on paper, obtaining even a single permit requires careful adherence to what interviewees characterized as a byzantine set of laws and regulations. Moreover, because larger projects typically require multiple permits, the applicant must engage with multiple agencies, each with a different set of authorizing regulations [4,5,18]. This means each agency has specific application procedures, forms, and timelines, which sometimes even vary across multiple regions of the same agency [11,19]. Additionally, the permits are sometimes interdependent, so the agency must wait for another permit before they can issue a decision. For instance, Clean Water Act [CWA] Section 404 certification requires a completed biological assessment under the Endangered Species Act and issuance of the CWA Section 401 certification—each of which come from separate agencies. In three of the four cases analyzed, a delay in one approval led to cascading delays throughout the process.

As written state and federal statutes are not always clear about designating an agency with ultimate authority over a permitting decision [18], which is particularly problematic when the various permitting approvals are interdependent [19]. The US's strong federalist system complicates permitting processes. Some have argued that federal oversight lengthens the permitting process in the US as compared to Germany without necessarily leading to better outcomes [20].

Regardless of whether any federal or state agency has ultimate authority over permitting a project, each agency typically has an effective veto power due to its ability to delay the permitting process to the point where it becomes uneconomical for the applicant to proceed with the project [9,21]. Beyond the specific statutory language, however, each agency is responsible for interpreting their guiding

regulations and setting agendas in the form of plans and definitions. This leads to complications when multiple agencies have competing interpretations (and, therefore, competing requirements) of what best practice is for a particular type of project or mitigation approach. For instance, Project B's manager, when developing a new type of environmentally-friendly levee, discovered that the absolute minimum slope that one agency would permit was the maximum that another agency would allow, leaving no leeway to adapt the slope of their levee to fit material availability or the particular characteristics of their site. Additionally, a single agency may sometimes interpret its own rules inconsistently [11], making it highly uncertain for the applicants to know exactly what will be required. Clearer definitions and criteria in general promote a more uniform interpretation of rules across jurisdictions [22].

Across the individual permit types, applicant interviewees felt that some permitting processes were easier and more certain to deal with than others, and would deliberately try to find a nexus to desirable permits while avoiding others. For instance, multiple applicants revealed the strategy of incorporating some action in a wetland into their project so that they could invoke Clean Water Act Section 404 (authorized by the US Army Corps of Engineers). This meant that any endangered species consultations would go under Section 7 of the Endangered Species Act (federal consultation) and not Section 10 (incidental take), which they felt gave them a better sense of how long the process would take and what the outcome would be.

Several interviewees felt that regulatory rigidity hindered agencies from being able to adapt to new types of projects. They complained that the laws were often applied in a rigid one-size-fits-all manner, failing to distinguish between different types of uses or between projects with net habitat gains—despite some damage to existing low-quality habitat—from projects that were simply destructive of habitat. As one applicant opined, "They couldn't say yes even though they wanted to". Going back and forth on these issues was an expensive and time-consuming endeavor.

While the regulatory regime appeared mostly to counteract an efficient review process, one regulatory tool—strict timelines—has been shown to shorten the overall duration of permitting processes [23,24]. In California, the Permit Streamlining Act (CA Government Code § 65920 et seq) imposes time limits within which state agencies must either approve or deny a permit. In theory, this should help speed up the process. However, interviewees hinted at many ways agencies can work around strict timelines, including being able to start and stop the clock. Additionally, the timelines only apply until there is a single decision. If the agency's decision is that an application is incomplete or denied without prejudice, the applicant will need to resubmit it, which starts a new countdown. Added together, these many sequential clocks can create a long process. Finally, some applicants felt that deadlines can serve as a negative reinforcement, arguing that some agency staff sit on an application until their allotted time is almost up before looking at it regardless of how minor and routine the decision might be. It also means that if there are minor errors to be fixed, the delay in considering the permit is added on to the delay of resubmission. In short, trying to achieve efficiency through strict deadlines can sometime backfire.

Finally, the regulatory regime determines whether the permit is open to public comment, when in the process that occurs, and who has standing to comment. While the exact requirements vary across jurisdictions and permit types, they often depend on the level of expected impacts and the type of permit action being taken. For instance, Clean Water Act Section 404 permits require public notices triggering a 30-day comment period for standard permits (generally issued for larger projects) but not for letters of permission (issued for projects with smaller impacts), nor for permits that are modified or rejected [25].

4.2. Application Process

The application process, which is dictated by the legal and regulatory regime, entails the specific requirements for permitting/evaluating the project, including what information is needed by the agencies and how that information is collected (including the contents of the application and any technology used to facilitate the process).

As mentioned previously, the permit application process generally entails serial review by multiple agencies. Even though each agency has slightly different forms and different information requirements [19], some of the information (like project descriptions) is duplicated across applications. This means that there can be multiple forms requesting the same information in different ways. Reform attempts in integrated permitting [5,22] have created a single form that collects all information needed for major permits. That way, applicants only have to provide information once (and to fill out one long form and file it once). A similar idea suggested by some interviewees was building an online database of technical information (e.g., on distributions of endangered species, critical habitat, or previous permit requirements) so that new information does not have to be gathered anew for every project operating in a similar watershed or geographic area.

However, such tools are only useful if they are actually used. While there is a joint application form available for aquatic permits in California, interviewees from permitting agencies had not seen it in recent use. Other researchers have found that applicants do not use such expedited permitting processes because they still require multiple studies to prove that a project meets the requirements for expediting [26].

Another tension raised both in prior literature and by interviewees is the mismatch between the amount of information desired by permitting agencies and what applicants can reasonably be expected to provide. Davies et al. [17] argue that processes "require more information" than is actually needed to issue a permit. Agencies who face scrutiny from elected officials and stakeholder groups want to minimize risk by gathering information, at the least to demonstrate due diligence to critics. However, the burden of providing this political protection means asking for marginally useful information that applicants may not be able to obtain, may be unwilling to share (in the case of proprietary information), or may only collect with considerable expense.

Another challenge relates to the use of web-based technology during the application process. A common recommendation in the literature is to provide guidance on how to fill out the application, share studies and maps (as recommended above), or to have an online tracker to monitor one's permit status post-application—all on an easy-to-find and navigate website [17,27,28]. While interviewees agreed that these changes would be useful, they presented many examples of failed attempts at reform. Many current agency websites, they claimed, are highly convoluted, out of date, or even non-existent, making it difficult to find permit requirements. Of the relevant agencies operating in California, only the US Army Corps of Engineers has an online web tracker (other states appear to have better functioning online presences [29,30]). While there was a statewide attempt to create an online database of Clean Water Act permits and information, interviewees reported that it was halted by bureaucratic challenges.

Public participation (opportunities for public comments and/or public hearings) is an important efficiency consideration in many application processes. Existing research argues that any public participation lengthens the process [20], but this is not necessarily inefficient because providing opportunities for public comment increases the likelihood of identifying overlooked resource concerns or unintended side effects [31,32]. Public participation raises efficiency concerns when individuals who are not directly affected by the project but become involved because the permit presents an opportunity to voice tangentially related concerns [33]. This forces the permitting agencies to spend time and resources processing these concerns that ultimately do not have bearing on their permit decision.

4.3. Political, Social, and Environmental Context

While the regulatory regime and application requirements directly affect permit efficiency, our analysis suggests that these proximal factors depend on the broader context, project characteristics, and organizational capacities. First, every project is developed within a particular social, political, and environmental context. This includes socioeconomic and cultural characteristics, political leadership, prevailing social values, and the project's site-specific environment. In various ways, context both directly and indirectly affects uncertainty, transaction costs and preference divergence. For instance,

previous research on permitting has found that agencies in higher population density areas and more liberal states tend to process permits more slowly [6]. One likely explanation is that more highly populated areas have more economic activity with potential environmental consequences, and liberal areas will have a greater number of environmental stakeholders that need to be consulted. In general, conscientious consultation with diverse interests both increases transaction costs and requires more time to negotiate with various concerned parties [6,7].

The interviewees mentioned several other ways that context can affect permitting. First, the match between regulatory agencies and the resources they oversee will vary by location. In Project A, a single resource (watersheds) was highly fragmented within a single county jurisdiction. This led to a higher demand and permitting workload for each agency as compared to areas with less resource fragmentation. The upside of this situation was that it spurred the adoption of a more streamlined permitting approach, in this case developing regional permits for routine projects as defined by some predetermined thresholds. This freed up agency time and resources for larger, more complex projects.

When a project involves multiple resources, coordination problems can multiply because several agencies have to separately permit a project. Applicants in all four projects noted that because the projects impacted endangered species, protected wetlands, and water quality, the permitting process required more steps, more resources, and more complexity. This increases the chances of applicant error, agency disagreement, and prolonged negotiations [5].

Socioeconomic and cultural characteristics also influence what citizens care about, including whether they are likely to be supportive of a project and/or benefit from it. Depending on the political and social makeup of a specific area, the stakeholder mix can vary enormously, affecting the volume and nature of the public input that agencies receive when they solicit community feedback (as discussed above). Each of the case studies had fairly engaged organizations and dedicated individuals who participated actively in the permitting process. However, in other settings where interviewees had worked (e.g., in poorer counties), they found little or no organized public input. The stakeholder mix may also differentially affect overall duration of the process, as different types of interest groups may affect the process differently: environmental groups and business groups dependent on a healthy environment lengthen the overall permitting process, while other industry groups can speed it up [6,7].

Political leadership at the time a project is being considered can also affect the length and timing of permitting processes. Interviewees spoke of US Senators exercising informal political influence to move individual permitting processes along more expeditiously. Agency heads sometimes lead efforts at coordinating permit processes more efficiently [34]. Since most administrative agencies have political appointees in their ranks [35], partisanship affects the way that a particular administration implements existing environmental laws. This also means, in federalist systems, the political orientations of state and federal agencies may diverge.

4.4. Project Characteristics

Project characteristics, such as size, social and economic benefits, technology, and resource impacts, can affect the length, cost, and difficulty of a permitting process. Empirical research has shown that permitting processes for larger and more ambitious projects tend to take longer [6,7,36] because they require a more extensive and nuanced review. If the natural resource environment is diverse to begin with and the project in question has diverse potential environmental impacts, the transaction and coordination costs will go up. This will cause delays, particularly if permits build off one another.

An additional challenge, raised in both interviews and the literature, is the uncertainty associated with novel technology that had not been permitted previously. The permitting requirements for newer technologies—e.g., renewable energy, water reuse, and state-of-the-art restoration methods—may be unclear or nonexistent [11]. Interviewees noted that this can pose a challenge in developing the application, as applicants lack guidance about what agencies will expect from them. It is also problematic during application reviews if agencies have no standards against which to compare the project or have a more difficult time anticipating side-effects. Even when rules exist for a

particular technology, permitting can be slowed if the individual agency staff is simply unfamiliar with the technology. Finally, the public is likely to be more skeptical and risk averse about unfamiliar technologies [37], which can increase public opposition and critical input during the permitting process, thus lengthening the process [4,20].

High-profile projects can also create either momentum or opposition depending on the circumstances. Project B, a largescale habitat restoration project spanning three counties, benefitted from having easily visible and widespread environmental benefits in otherwise degraded land, leading to support from local and state elected officials. Likewise, emergencies can motivate political leaders to pressure agencies to move permit applications quickly. Project D began with substantial momentum following a large flood. However, visibility can also create a tremendous amount of negative media coverage, stoking public uncertainty and distrust. Following the initial energy behind Project D, nearby landowners became anxious about the potential for increased flooding (even though it was a project designed to control floods) and voiced their concerns in local media. Several interviewees felt that the permitting agencies were therefore reluctant to take what they perceived to be a political stance, delaying the permit process for the project. Additionally, since public attitudes can vary at different scales (local vs. regional vs. national), highly salient projects can create various political problems at different levels for all of the agencies that must grant approval [38].

4.5. Organizational Characteristics

The permitting process involves three primary organizational types: the applicant (who may be an individual, a business or other private entity, or a public agency); the permitting agencies (who may operate at the local, regional, state, or federal jurisdiction); and consulting firms hired to prepare permitting applications and interface with the agencies. Each actor participating in the permitting process has unique knowledge, resources, and practices that play a role in determining the overall efficiency of the permitting process.

For applicants, knowledge of the process can play a large role in affecting permitting efficiency. Applications are often returned because they are incomplete or contain errors, both of which slow down the process and create more work for all parties [11]. The probability of making these sorts of mistakes tends to vary with applicant experience. According to interviewees, some applicants (and/or their consultants) are so familiar with a particular permit that they can tailor their proposed mitigation measures to the particular desires of the agency staff member they are most likely to encounter. This lessens requests for more information or changes to proposed mitigation measures, allowing applicants to get their permits faster. Research has also shown that applicants who initially propose measures that surpass minimum compliance are more likely to be successful [10] and that applicants with good compliance records get permits faster [6]. Conversely, less-knowledgeable or less experienced applicants can get overwhelmed by the complexity of the process and less likely to check all of the required boxes on the first try, leading to a higher incompletion rate [19].

However, knowledge of the process was less of a concern for applicants interviewed than one might expect thanks to consultants whose job is familiarity with the process. At the same time, agency interviewees noted that a consultant-heavy process works well for wealthier individuals, firms, and communities, but not for affluent applicants who struggle to afford high priced consultants.

At the agency level, the quality of in-house expertise affects the permitting staff's capacity to deal with the particular project type or technology they must oversee [19]. For technologically novel projects, the staff may be less able to act decisively because the projects pose a higher level of uncertainty and may be more unfamiliar to the staff.

Another major resource challenge associated with slow permits is staffing at the permitting agency. Like most government agencies, budget cuts at resource agencies have led to overall reductions in staff numbers. Permitting groups within agencies tend to have high staff turnover. Permits are often given to newer staff who are also frequently overloaded [11,17]. Within an organization, there can be inconsistent

workflow between individual staff members and poor communication among them [18]. Additionally, smaller agencies (such as regional or local agencies) may have fewer resources and less expertise [10].

One applicant spoke of waiting for months to hear about a permit decision and finding, upon inquiry, that the staff member had been reassigned several months earlier and that his application had been relegated to a forgotten pile. A concern raised by agency staff was that permitting agencies are no longer hiring technical experts (e.g., biologists, engineers) to work in permitting offices as a cost-cutting measure, relying instead on external experts (e.g., consultants) to assess technical considerations. This can save money but also means that any decision that hinges on a technical explanation can become a battle of competing consultants hired by all parties. All staffing problems are magnified in the cases of large, complex projects [7] and interrelated permit approvals. Additionally, interviews suggested that an understaffed agency will likely wait for other agencies to act before beginning its review of a proposed project, aware this application is likely to change as it undergoes review by other agencies.

In addition to knowledge and resources, each agency (and even within the office of an agency) has its own unique practices. This is reflected in the variance of approval time (holding other factors constant) across regional offices [7]. One factor playing a role in these different orientations is that the relationships between the permitting staff and directors/managers and their commissioners/board (who are either nominated or appointed) can vary. According to interviewees, when the permitting staff is disconnected from leadership, slow permitting processes are easily overlooked, whereas when a project is higher profile and comes to the directors' attention, they will work to move it through more quickly. Finally, because the boards have of a political stake in any outcomes, if problems surrounding a project come to public attention, officials are more likely to intervene so processing proceeds quickly as well. Moreover, interviewees felt that when the directorship of an office changed, the overall efficiency of permitting from that office could also shift. Indeed, prior research has argued that permits are more likely to be political—not objective—if elected officials oversee review as opposed to agency civil servants [10].

4.6. Summary: Inefficiency Arises through Divergent Interests, Transaction Costs, and Uncertainty

The interviews and literature review indicate myriad factors that interplay to affect overall permitting efficiency, which interviewees characterized as duration of the permitting process, as well as staff and resource costs for the permitting agency and applicant. Figure 2 summarizes the key variables and their interactions. The factors are grouped by the timing of their influence (per Figure 1): external drivers (existing before the process begins), factors affecting application development, factors affecting application review, and factors arising during public comment.

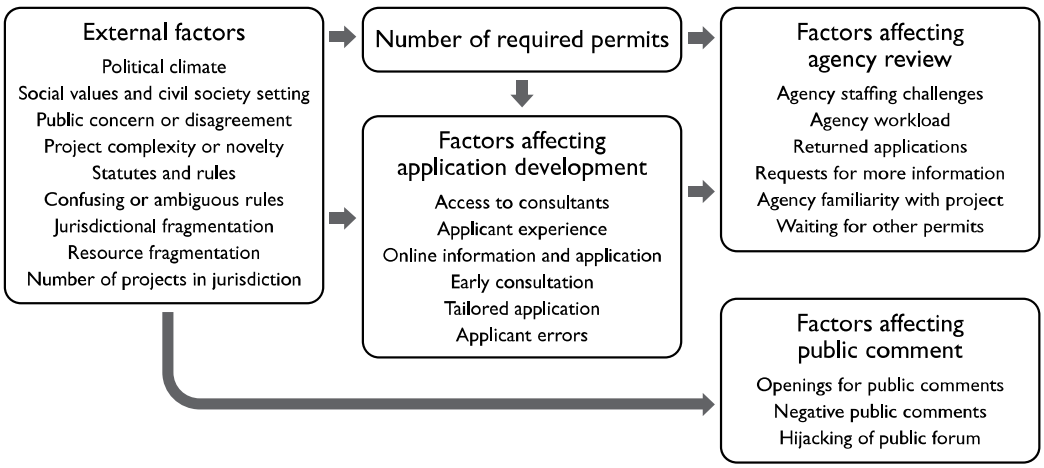

Figure 2. Factors affecting permitting delay and inefficiency. While only the connections between groups of factors are indicated, additional arrows among factors in each box also exist.

Many of the connections highlighted in Figure 2 are connections proposed by our interviews or suggested by at most one or two existing studies. The authors encourage researchers to use this framework as guidance for future research to test causal mechanisms and/or identify the contexts under which different pathways occur.

Despite the complexity of these factors and their interactions, our findings suggest that three drivers underlie many of these factors: divergent interests, transaction costs, and uncertainty. Divergent interests refers to the number of competing requirements and interests the applicant and permitting agencies need to manage, including competing views of how resources should be managed and competing priorities of environment versus development. These divergent interests stem from conflicting regulatory requirements, from the concerns of community groups, and from the complexity of the project. Transaction costs relate to the number of repeated interactions between and across permit applications. They arise from applicant errors (leading to returned applications), redundant information reported for multiple permits, and wasted effort in reviewing small-impact projects that could be fast-tracked. Finally, uncertainty arises both when project impacts are hard to predict and when the requirements, timing, and outcomes of the permitting process are unknown; uncertainty is the result of project, regulatory, and organizational characteristics. Together, these three features can cause the permitting process to slow down and require more resource expenditures—in other words, to be less efficient.

5. Can Collaboration Help Overcome These Challenges?

We have argued that the primary challenges underlying inefficient permitting are divergent interests, transaction costs, and uncertainty. In this section, we explore one potential solution to these challenges: creating early and ongoing dialogue between applicants and permitting agencies. Such a collaborative approach [39–41] was utilized by two of the cases studied and suggested as a potential efficiency reform by many interviewees (see also [42]), but as a new reform its impact is unknown. We focus on collaboration because it is a more immediately accessible change than large-scale reform of permitting's regulatory mandates. By analyzing the approach to collaboration used in each case (Table 2) and the literature on collaborative governance, we assess whether collaboration is well positioned to address each of the permitting challenges identified above.

Table 2. Case study approaches to collaboration.

Project	Project Type	Approach to Collaboration
A	County-wide process overseeing construction and restoration near streams	Highly collaborative. Agencies work together to prioritize problem areas across multiple watersheds, work with developers and landowners to develop projects, then fast-track permits for all but the most complex projects.
B	Large-scale habitat restoration	Moderately collaborative. Regular regulatory workgroup to review upcoming permit needs and assess project implementation.
C	Wastewater treatment and habitat restoration	Held pre-application meetings but with minimal attendance or agency feedback.
D	Flood control	Held pre-application meetings but with minimal attendance or agency feedback.

Collaborative governance is a "governing arrangement where one or more public agencies directly engage non-state stakeholders in a collective decision-making process that is formal, consensus-oriented, and deliberative and that aims to make or implement public policy or manage public programs or assets" [39]. While collaborative governance in the context of permitting could entail collaboration with the broader public (including local residents and any stakeholders who would

normally engage through the public comment process), we focus specifically on collaboration between the applicant and the permitting agencies for each required permit.

Through the process of face-to-face deliberation, collaboration allows participants to learn about one another's interests and develop a unified goal for a project or policy area [41,43,44]. By using principled negotiation and deliberation to develop and evaluate projects, agencies and applicants can better ensure that their interests—and the interests of other participants—are met in the final permit [45,46]. For those interviewees who had been engaged in more collaborative permitting processes, this ability to check in and make sure the project was meeting everyone's mandates was an obvious benefit. As the director of Project B stated:

> Since the start of the project, we've held regulatory workshops. They started out twice a year, but now are once a year. We bring together people from all the main regulatory agencies, update them on what we've done, what's working, and what challenges there are. We also introduce what's next to identify potential red flags. It's very important for navigating the regulatory process.

In this case, agencies liked the meetings because it gave them an opportunity to ensure that prior permits were mitigating impacts as they expected, and the applicant liked having the opportunity to receive feedback from the agencies before initiating the more bureaucratic permitting process.

Additionally, while interviewees did not provide direct evidence for this, collaboration should help ameliorate the problem of competing definitions by bringing agencies and applicants into the room together to discuss their priorities [41]. This would allow agencies to understand and identify where there are mismatches and help create a more comprehensive vision for how to prioritize across resources and agency mandates.

Transaction costs and uncertainty should both be decreased by creating opportunities for early (pre-application) collaboration. The quote from Project B (above) suggests that by discussing the project in early stages of development, the applicants could learn more about agencies' expectations before preparing the application. Other interviewees noted that (in theory) agencies could, likewise, identify all information they might need to evaluate a project's impacts. Together, these steps should reduce incomplete application submittals and additional information requests, reducing time lost to secondary preparation and review. Likewise, the early conversations with the applicant (who is generally more knowledgeable) should give agencies time to learn about unfamiliar projects or technologies before the application is submitted. In Project A, the agencies actually visited potential project sites well before engineering designs were completed. This way, they could "raise questions and concerns during the design phase; by the time the permit applications came in, agencies had their questions answered". Finally, if agencies provide applicants with feedback on potential concerns when a project is in a more conceptual phase, the applicants should be better able to address those concerns without having to substantially redesign their project. This was an important lesson for Project C's manager, who learned through dialogue with agencies that permitting staff were more willing to consider a scaled-down pilot project since they were using a new technology. Had the project gone through the full permitting process first, the developer would have wasted time and resources on a full design they were unable to use.

Collaboration should also help agencies to prioritize activities at the landscape or ecosystem scale rather than project by project [47]. Before the process behind Project A was created, agencies felt that they were overloaded because the county had eleven small watersheds, and each watershed was competing for similar permits and for the small pot of grant funding available. Since they wanted to find a way to reduce their workload and identify higher-priority projects, the agencies developed a collaborative process to identify key problem areas across watersheds and find projects that addressed those areas. In this example, collaboration was also able to increase the agencies' flexibility and ability to address broad problems despite individually having narrow mandates (see also [48]).

While these vignettes suggest that early collaboration can help make permitting processes more efficient, the cases also demonstrate it is most effective if all agencies engage in the process at the same time. By having agencies learn about the project together and hear one another's concerns, they will be able to more comprehensively identify knowledge gaps or knowledge mismatch [48], allowing the applicant to respond a single time. More importantly, giving everyone the time to learn with, and from, one another also helps create the trust necessary to make collaboration effective [49,50].

In summary, it appears that collaboration is one potential option to overcome the primary barriers to efficient permitting. By creating opportunities for agencies and applicants to learn about each another's interests, to identify potential synergies and conflicts, and to provide early feedback and adapt the project before the official permitting process starts, a more collaborative approach to permitting could lead to a more efficient process with fewer delays.

Considerations for Creating a More Collaborative Permitting Process

The interviews also highlighted several existing considerations that would need to be addressed to build a more collaborative permitting process: willingness to engage collaboratively, the need to ensure that the process meets everyone's mandates, the importance of leadership, and the importance of sustaining collaboration for larger-scale projects. While these considerations have all been raised extensively in the collaborative governance literature, they are important enough to revisit in the context of environmental permitting.

The first, and most critical, consideration was that many interviewees had examples of permitting processes where either the agencies or applicants had tried to create early dialogue but found other parties unwilling to engage collaboratively. In some instances, the parties simply did not show up:

> We knew that pre-application consultation was important, so we tried twice to get all five agencies in the room together . . . We got two out of five in one and then a different two out of five in the other.
>
> —Project C

This suggests that the agencies did not feel strongly that attending these meetings was the best use of their time. In contrast, one permitting staff member in Project A drove over three hours to attend the group's meetings—a signal that he felt the meetings were worthwhile.

These examples suggest that creating a collaborative permitting process requires structuring incentives so that all parties feel that it is in their best interest to attend and to discuss the permit openly. This could be done by demonstrating that participation will help meet their mandates. In Project A, all of the agencies were falling short on meeting their internal goals (improved species populations, improved water quality) through unilateral action. This meant that they felt that they had nothing to lose by trying to work together—an example of collaboration being spurred by a collective action dilemma [51]. As the agencies worked together, they saw visible evidence of cleaner water and healthier habitats, spurring the projects' continuation.

In other instances, agencies attended meetings but did not provide the dialogue and feedback necessary to be effective:

> Agencies like to talk about early involvement. We did that four years ago—hosted a meeting with lots of agency representatives to present our ideas . . . That process was not useful to the permitting, as the agencies didn't raise concerns that came up later in the process. (Project D).

Here, the agencies attended but were unwilling or unable to give meaningful feedback in a way that would make the process more efficient later. This suggests that building trust between partners, such that agencies feel that applicants are being forthcoming with information and that applicants trust that the agencies will follow through on their word, is an important consideration [39,52].

A final consideration is the importance of leadership [41,53–55] and attention to sustaining the collaboration. In Project A, a staff member from the county Resource Conservation District acted as a neutral broker who initially brought the agencies together. However, when she moved jobs, the process dissipated due to a lack of leadership. In Project B, motivation to participate was high, but burnout has been an increasing concern:

> At the beginning it was easy to get everyone together; everyone wanted to give their two cents. It was a very high profile project. Now, thirteen years later, people are fatigued. It's a 50-year project.

While agency staff and other stakeholders still attend the regulatory workgroup meetings, the director finds it increasingly difficult to get the feedback he needs as new permits and projects arise.

These considerations suggest that a centralized, mandated approach to collaboration might be beneficial to ensure that everyone engages early in the permitting process and that collaboration is applied consistently (rather than depending on an applicant or agency's prior experience or resources). An example of a permitting process that creates opportunities for early collaboration is the Federal Energy Regulatory Commission's (FERC) process for licensing hydropower dams [45,56]. In this process, electrical utilities are encouraged to collaborate with permitting agencies and other stakeholders in the development of their license application. The process begins with scoping to identify all resources that might be affected by the project, followed by a series of studies to quantify those impacts. Since the permitting agencies are involved in these early stages, they are less likely to raise additional concerns or request new information after the application is submitted and they are preparing their authorization.

Creating a mandated process like FERC relicensing, however, requires attention to going beyond simple attendance to ensure that participants engage actively in dialogue and deliberation [45]. This returns to the need of providing leadership, creating incentives such that all participants feel that they are meeting their mandates by participating, and building the trust needed to share information across organizational boundaries [44,52].

6. Conclusions

Permitting is an understudied area of research, yet it is a critical part of environmental regulation, especially as environmental goals have multiplied and the challenge of addressing environmental change has become more urgent. This review has raised numerous factors that affect permitting efficiency, to guide future research and reform attempts. Permitting becomes harder when the environmental context is more varied and when the projects are novel and complex. When permitting is undertaken in a serial manner across many agencies and without user-friendly guidance, it dis-incentivizes ambitious efforts to meet important infrastructure goals, raises costs, marginalizes some communities, and contributes to public frustration with the political process. The effort to make permitting processes more efficient without sacrificing their effectiveness should focus on reducing uncertainty, lowering transaction costs, and improving the negotiation and compromise necessary to reconcile the divergent interests that arise with particular projects. We have argued that a collaborative approach to permitting is one potential approach to overcome these challenges, as a way to improve efficiency without sacrificing environmental protection. Better permitting may, in the end, be as important as better technology when it comes to meeting global environmental challenges.

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