PROJECT AUDIT (PEER REVIEW) REPORT (EXECUTIVE SUMMARY MEMO)

TO: WSSC Water

FROM: WSP USA Inc.

SUBJECT: **Independent Evaluation and Audit (Peer Review) of the WSSC Water 48-Inch Patuxent Raw Water Main Project - BF1582E91**

RELEASED DATE: **November 19, 2025**

UPDATED DATE: **February 12, 2026 (Added Statement on Independence)**

EXECUTIVE SUMMARY

In response to concerns from residents and lawmakers brought to legislation in the proposed Senate Bill 0654 (SB654)- WSP USA Inc. (WSP) was commissioned by Washington Suburban Sanitary Commission (WSSC Water) as an independent reviewer to evaluate WSSC Water's 48-inch Patuxent Raw Water Pipeline Project (Contract No. BF1582E91) that extends from the Rocky Gorge Pumping Station on Brooklyn Bridge Rd to the Patuxent Water Filtration Plan on Sandy Springs Road. While this Senate Bill was only proposed and did not become law, this audit was conducted in accordance with the proposed SB654 and presents the key findings and recommendations, that were highlighted by the main provisions of the proposed SB654.

- The project started its initial planning in 2004, with design completion and all permitting secured in 2020. The Construction Contract started in December, 2020, with the contract end date in March, 2023, with a duration of 823 calendar days. The project was delayed by 641 days (as of December 2024 based on the most recent schedule update provided), with the final pavement restoration (performed under separate task) in Fall 2025.
- Project delays were driven by multiple factors, including severe rock conditions discovered in mid-2022 that slowed pipe installation for more than seven months, an 81-day crew demobilization for emergency work, and running sandy soil conditions and water main leaking in early 2024. Additional impacts included unforeseen utility conflicts requiring redesign and relocations, change orders adding scope to the critical path, and supply-chain challenges delaying owner-provided pipe fabrication and delivery. Emergency repairs, inefficient material handling, and a contractor calendar correction further extended the schedule, resulting in significant loss of float and cumulative delays through 2024.
- The original 48-inch Patuxent raw water main construction contract was $8,393,777.00. Seven approved change orders totaled $1,093,280.05, bringing the contract amount to $9,487,057.05. Potential Change Order #15 is under negotiation and not included in this total.
- Beyond the scope of proposed SB654, WSP conducted a holistic review of the Patuxent Raw Water Pipeline Project, examining the planning and design processes, procurement and contracting practices, construction execution and field oversight, as well as community engagement and stakeholder coordination**,** here are additional key gaps based on the audit:
    - Poor pavement issues throughout the project were largely driven by temporary patches that remained in place for years, beyond the temporary pavement 60-day requirement in the specifications, leading to pavement deterioration and community complaints.

- There were other gaps on project oversight due to non-compliance, incomplete documentation, and delayed reporting, with slow responses to RFIs and change management, and insufficient review of schedule updates. Oversight, agency coordination, and community engagement were mainly reactive rather than proactive, leading to resident dissatisfaction over poor scheduling around schools, prolonged temporary paving, ongoing disruptions, and infrequent project updates. Despite these issues, the community ultimately appreciated the completed infrastructure and WSSC Water's improved responsiveness during the final phase.

- **Key recommend improvements for future capital projects:**
  - **Proactive Risk Management:** For large, complex, and capital-intensive projects, WSSC Water should establish a formal risk register to centralize risk information and categorize risk's inevitability, mitigation approaches. This includes developing standardized templates, integrating the register with project management, applying a risk scoring system, and using technology for accessibility. Ongoing monitoring through scheduled reviews, leadership dashboards, and comprehensive staff training will help build a risk-aware culture and support continuous improvement. Practical risk management measures include phasing pipe installation and testing to enable timely pavement restoration and enforcing oversight of compaction, pavement installation and maintenance for public safety. Additionally, conduct thorough site investigations to mitigate risks from utility conflicts and soil conditions, ensuring proactive risk control throughout project execution.
  - **Integrated Change Management:** Adopt an agile and structured approach by scheduling regular change review meetings. Requests for information (RFI) should be reviewed and responded to in a timely manner, and each change proposal should include a detailed assessment of its impact on schedule and cost, with formal review and approval before implementation. Ensure baseline schedules are aligned with contract specifications and community needs, and require formal review for all schedule updates. Keep comprehensive documentation of all correspondence, decisions, and approvals to improve accountability and consistent risk management.
  - **Improved Process Management and QA/QC Process:** Implement formal Request for information (RFI) closure and submittal processes, ensure preconstruction documentation is complete, and require comprehensive daily inspection reports with material verification, safety photos, and traceability. Enhance quality assurance by mandating contractor Quality Control (QC) plans, reinforcing internal Quality Assurance (QA) inspections with corrective action follow-up, and holding regular QA/QC reviews. Empower contract managers and inspectors to enforce standards, including suspending work if necessary, and maintain a centralized registry (as WSSC Water currently uses Trimble/E-Builder) for submittals, RFIs, COs, DIRs, QA/QC Test Reports to drive transparency, accountability, and early issue identification and resolution.
  - **Strengthening Communication, Collaboration & Engagement:** Formalize communication protocols and use a centralized project management system for real-time updates. Hold regular progress meetings, and align schedules with utilities, partner agencies and community calendars to minimize disruptions. Expand outreach beyond civic associations through pop-ups and dedicated meetings, create task forces for major projects, and maintain consistent contact with elected officials. Document commitments in contracts, enforce them during execution, and track permits centrally to ensure transparency and efficient delivery.

STATEMENT ON INDEPENDENCE

WSP was retained under Master Agreement No. 67580 to conduct an independent evaluation and audit (peer review) of the Patuxent 48-inch Raw Water Main, Allentown Road Water Main Replacement, and South Osborne Road Water Main Replacement projects. Our mandate was to provide an objective and impartial review, grounded in verifiable evidence, with conclusions that are unbiased, evidence-based, and free from subjective interpretation. WSP developed and applied a process and methodology for the independent review founded on industry standards and best practices.

INDEPENDENT REVIEW STANDARD.

For WSP, an "independent" standard means that judgments are made objectively, without bias or predisposition, and that reported results are supported by sufficient, appropriate evidence. This is consistent with ISO 19011:2018, which frames independence as the basis for auditor impartiality and emphasizes an evidence-based, risk-based audit process.

METHODOLOGY AND EVIDENCE CONTROLS.

Uniform, transparent methodology. WSP developed a documented, repeatable approach across all three projects to minimize subjectivity and enhance comparability: comprehensive document and record reviews; compliance verification; construction-record audits; structured interviews with project personnel and stakeholders; root-cause analysis across planning /design /procurement /construction /outreach; and community /stakeholder feedback synthesis. The method and traceability of sources are reflected in the project peer review memos and public-facing materials. This methodology meant that all assessments and recommendations are based on the factual record of the review and can be readily traced to the information that was gathered and documented in each report.

Evidence sufficiency and appropriateness. We based findings on sufficient, appropriate evidence and maintained review logs that allow another qualified professional to understand the procedures performed and the basis for our conclusions. This included corroborating testimonial information against official records and independent sources to reduce over-reliance on any single perspective. This methodology meant that WSP based conclusions on the sufficiency of the comprehensive information that was available and did not rely on any one source.

Analytical neutrality (triangulation) to avoid bias. We triangulated inputs—documents, records, interviews, and data—before forming conclusions. Where viewpoints conflicted, we resolved them through traceable evidence and criteria, not opinion, to keep results unbiased and evidence-driven. (See project memos for the traceability of sources consulted.) This methodology limited any inherent bias in the assessment and recommendations.

Clear criteria and reporting. We stated scope, criteria, methods, and bases for conclusions in neutral language, enabling readers to see what was assessed, how it was assessed, and why the evidence supports the result. This methodology supports the transparency of our approach, allowing anyone who reads the reports to develop their own understanding of the projects and the report summaries.

CONCLUSION

WSP's evaluation and peer review were performed independently and presented objectively, in accordance with **ISO 19011** principles. By using a transparent, replicable methodology, corroborating multiple lines of evidence, and maintaining reviewer independence and quality management, our results are **objective and impartial, grounded in verifiable evidence, and free from subjective interpretation**. WSP believes our independent review approach meets industry standards and resulted in unbiased, defensible reports and focusing on process improvements for WSSC Water.

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

AHA: Activity Hazard Analysis

AC: Alternating Current

BCE: BOTA Consulting Engineers, Inc.

BGE: Baltimore Gas & Electric

BOA: Basic Order Agreement

CO: Change Order

CIRT: Report &Testing

CPM: Critical Path Method

DIR: Daily Inspection Reports

DNR: Department of Natural Resources

DPIE: Department of Permitting, Inspections, and Enforcement (Prince George's County)

DPW&T: Department of Public Works & Transportation (Prince George's County)

EBA: EBA Engineering Inc.

E&S: Erosion and Sediment Control

FCP: Forest Conservation Plan

FIO: For Information Only

IFB: Invitation for Bids

INCRP: Incident Report Compaction Testing

JPA: Joint State/Federal Application

MDE: Maryland Department of the Environment

MOT: Maintenance of Traffic

NTP: Notice to Proceed

N&W: Navarro & Wright Consulting Engineers, Inc.

OT: Overtime

PO: Purchase Order

PCO: Potential Change Order

QA/QC: Quality Assurance/Quality Control

RFI: Request for Information

RFQ: Request for Qualifications

ROW: Right of Way

RTA: Ready-to-Advertise

SHA: State Highway Administration

SHC: Sewer House Connection

SUE: Subsurface Utility Engineering

TCP: Traffic Control Plans

USACE: U.S. Army Corps of Engineers

WHC: Water House Connection

WLCA: West Laurel Civic Association

WRA: Whitman, Requardt and Associates

WSSC Water: Washington Suburban Sanitary Commission

WSP: WSP USA. Inc.

WTBC: Wilson T. Ballard Company

1. INTRODUCTION

1.1 PROJECT BACKGROUND AND PURPOSE

The 48-inch Patuxent Raw Water Main Project (Bond Mill Rd Project), WSSC Water Contract BF1582E91, is a major water infrastructure effort in West Laurel, Maryland. The purpose of the project is to install approximately 2.5 miles of large-diameter pipeline from the Rocky Gorge Pumping Station to the Patuxent Water Filtration Plant. This new pipeline was designed to significantly boost the region's water supply capacity – increasing the plant's output from roughly 72 million gallons per day (MGD) to 110 MGD – to improve water service reliability for nearly 1.9 million residents in Prince George's and Montgomery Counties. In simple terms, it provides a backup "raw water" supply to ensure local customers have consistent water pressure and supply even during peak demand or emergencies.

Originally scoped as a 2.5-year, $8.4 million effort (start December 2020, substantial completion finish in November 2022 with contract end date in March 2023), the project's substantial completion date has slipped to December 2024 amid numerous delays, with final pavement restoration completion (performed by a separate task and team) delayed into Fall 2025 .

Prolonged impacts on the community, particularly along Bond Mill Road, resulted in public dissatisfaction. Although the draft Maryland Senate Bill 654 proposed a legislative audit of the project, WSSC Water responded proactively by commissioning an independent evaluation to assess the project's planning, design, construction, and community engagement practices. The audit was conducted by WSP USA Inc. to assess the project's delivery performance, identify areas for improvement, and provide recommendations to enhance future infrastructure execution.

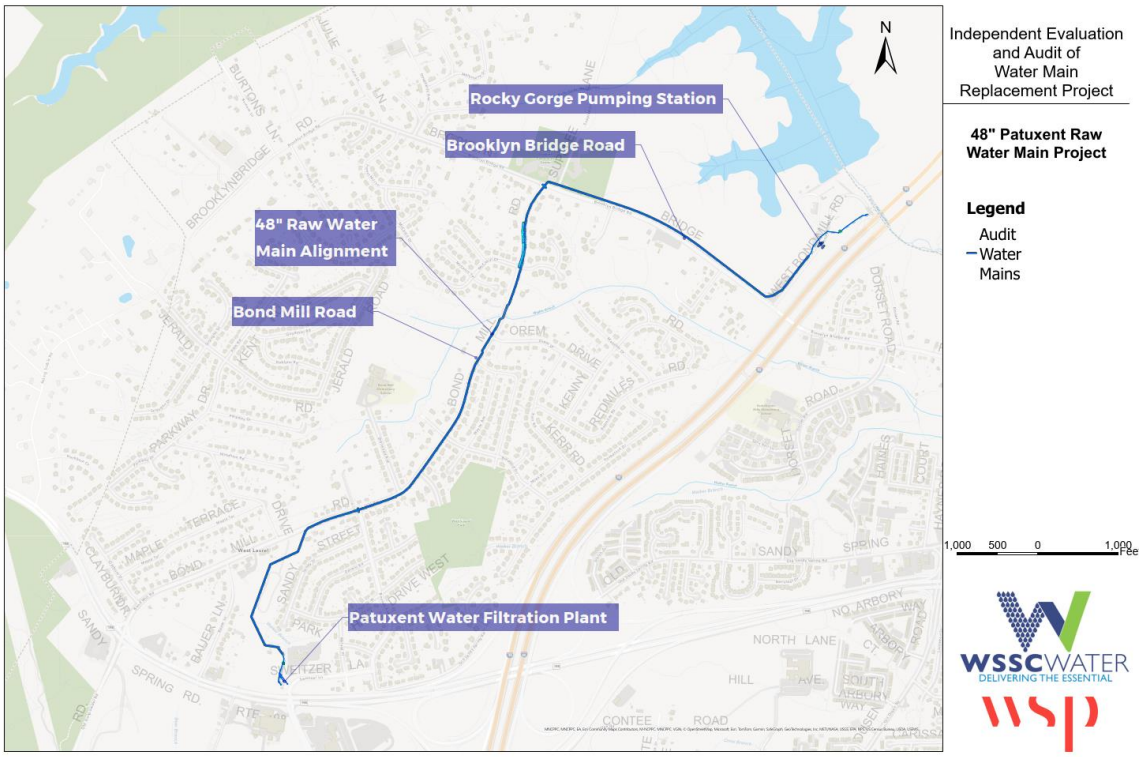

Figure 1-1 Project Overview Map

This Executive Summary Memo provides a high-level overview of the Patuxent Project audit, summarizing the review, findings, and lessons learned presented in the detailed Project Audit Report. While the audit report (separate document) offers an in-depth, technical evaluation of the entire project lifecycle, this executive summary memo maintains the same structural framework but focuses on key insights and overarching lessons rather than granular technical details. The intent is to deliver a concise, strategic perspective for leadership and stakeholders, ensuring clarity without sacrificing the core themes of the original audit.

1.2 GOAL AND SCOPE OF THE AUDIT

The primary goal of the audit is to provide a comprehensive, objective assessment of the Project's performance across all phases—planning, design and permitting, procurement, construction, and community engagement. Specifically, the audit aims to:

- Evaluate compliance with design specifications, permitting requirements, and contractual obligations.
- Review project documentation for completeness, accuracy, and adherence to workflow protocols.
- Assess quality, schedule, and financial performance against baseline expectations.
- Conduct stakeholder interviews to gather qualitative insights.
- Analyze root causes of delays and deficiencies.
- Examine community feedback and WSSC Water's engagement practices.

2. AUDIT METHODOLOGY

The audit used a structured, multi-step approach designed to ensure transparency, accuracy, and actionable insights:

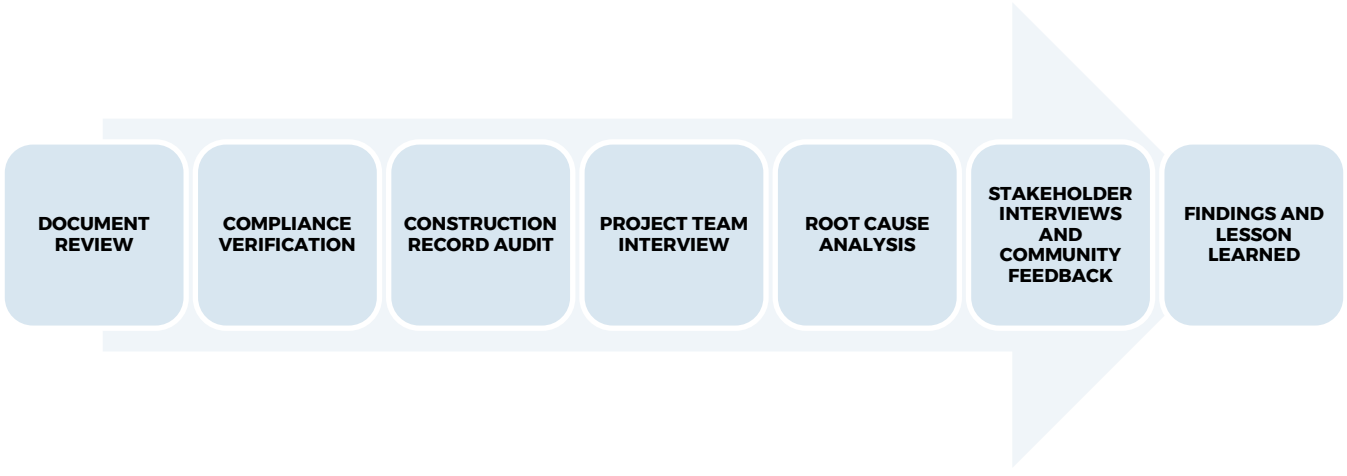

Figure 2-1 Audit Approach

2.1. DOCUMENT REVIEW

The audit team reviewed a wide range of project files, including design plans, permits, contracts, inspection reports, documented communication such as emails, and community outreach materials and logs. These

documents helped establish a clear picture of how the project was scoped, executed, communicated to the public, and adjusted over time. Materials were gathered from the WSSC Water staff, WSSC Water website, E-builder/Trimble system, and other key stakeholders.

Table 2-1 Document Review and Review Focus Area

Project Phase	Documents Reviewed	Focus Areas
Proposal Phase	Scope of work	Adequacy for Project Need
Planning & Design	Design packages, permitting submittals, bid documents, comment logs, meeting minutes	Design adequacy, constructability, permit alignment, responsiveness to input
Procurement & Contracts	Bid documents, construction contracts, contract addenda	Contract clarity, scope definition, bid competitiveness
Construction Execution	Requests for Information (RFIs), change orders, contractor submittals, as-builts, inspection & Quality Assurance/Quality Control (QA/QC) reports, schedules (baseline & updated)	Timeline, responsiveness to site conditions, QA/QC practices, change management
Community Engagement	Community communication and complaints, public meeting summaries, outreach logs	Communication effectiveness, response to public concerns
Cost Management	Project budgets, cost tracking reports, invoices	Budget adherence, cost drivers, correlation with delays
Agency Coordination and Permitting	Correspondence and documentation with regulatory/local/state agencies	Permit timelines, inter-agency collaboration

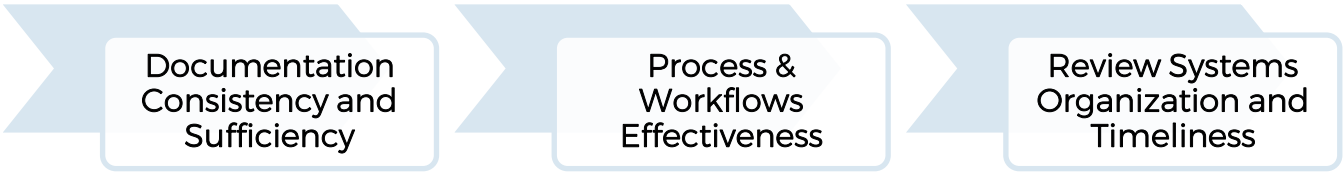

Figure 2-2 Document Review Process

2.2. COMPLIANCE VERIFICATION

The team checked whether the project met regulatory standards and internal WSSC Water protocols. This included reviewing constructability assessments and risk evaluations to ensure the work was done according to approved plans and codes.

2.3. CONSTRUCTION RECORD AUDIT (QUALITY, SCHEDULE & FINANCIAL)

Project records were analyzed across three dimensions:

- **Quality:** Inspection logs and compaction test reports were reviewed to assess workmanship and adherence to WSSC Water's standards.
- **Schedule:** The original timeline was compared to actual progress to identify delays and their causes.

- **Financial:** Budgets, invoices, and change orders were examined to understand cost increases and fiscal discipline.

2.4. PROJECT TEAM INTERVIEWS

The audit team interviewed WSSC Water staff involved in design, construction, contracts, and community outreach. They also spoke with elected officials and community representatives to gather firsthand perspectives. In addition to interviews, the project team deployed a comment form to garner additional feedback from impacted community members not interviewed. Field visits were conducted to discuss site-specific challenges directly with WSSC Water inspectors and managers.

2.5. ROOT CAUSE ANALYSIS

Using findings from documents, interviews, and compliance checks, the audit team traced key issues back to their origin—whether in planning, design, procurement, or execution. This helped identify systemic gaps and informed recommendations for future improvements.

2.6 STAKEHOLDER INTERVIEWS AND COMMUNITY FEEDBACK ANALYSIS

Community input was collected through meetings, emails, and a structured feedback form distributed along the project corridor. Comments were categorized by issue type and location and analyzed to assess public sentiment and the effectiveness of WSSC Water's engagement strategies.

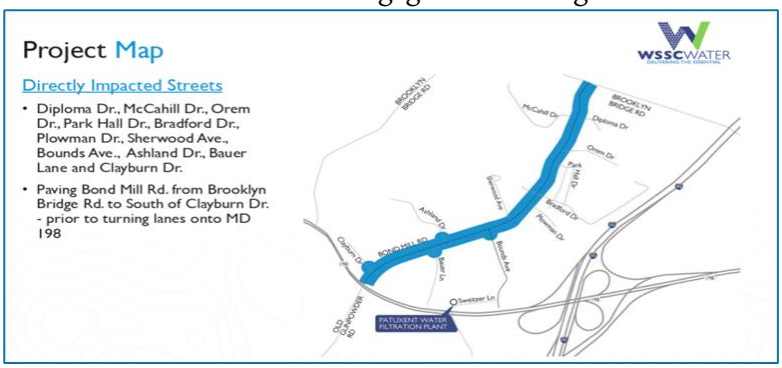

Figure 2-3 Document Review Process

3. THE PROJECT BASELINE

3.1 PROJECT GOAL AND SCOPE

The project was defined as installing approximately 2.5 miles of 48-inch raw water pipeline and relocating 0.11 miles of an existing 8-inch water main along Bond Mill Road.

Phase I included:

- 11,494 feet of 48-inch pipeline
- 648 feet of 8-inch water main relocation
- Water service connections and replacements
- Culvert rehabilitation
- Installation of supporting structures

Phase II included:

- 1,374 feet of 48-inch pipeline
- Additional segments: 42-inch (24 ft), 36-inch (364 ft), and 30-inch (88 ft) pipeline
- 129 feet of 8-inch water main relocation
- Supporting structures and pig launcher/receiver vaults

3.2 PROJECT TEAM

Table 3-1 summarizes the project design and construction team:

Table 3-1 List of Project Team

Project Team	Organization/Group	Key Team Members
WSSC Water Project Team	WSSC Water Pipeline Design Division	Design Project Manager
	WSSC Water Pipeline Construction Division	Construction Manager
		Contract Manager
		Construction Inspectors
	WSSC Water Communications & Community Engagement	Community Relations & Outreach Specialist
Planning & Design Phase Engineering	Whitman, Requardt and Associates (WRA)	Design Consultant (Design phase)
Construction Phase Engineer	Wilson T. Ballard Company (WTBC)	Design Consultant (During construction)
Construction Contractor	Allan Myers Construction Company	Contractor

Interviews were conducted by WSP to obtain input from the project team involved in the design and construction. A site visit was conducted with WSSC Water's contract manager and inspector. Additional Interviews were conducted virtually with the WSSC Water project team, the design engineer during construction - Wilson T Ballard Company (WTBC) and the construction contractor Allen Myers. The design engineering team, Whitman, Requardt and Associates (WRA), was not interviewed due to employee changed, and no commitment of resources to provide accurate details to response to the audit team.

3.3 PROJECT CONSTRUCTION BASELINE SCHEDULE AND COST

Schedule: The Construction Contract Notice to Proceed (NTP) Date started on December 7, 2020, with the contract end date on March 10, 2023, with a duration of 823 calendar days and was planned in two phases.

Cost: The original contract value awarded to Allen Myers was $8,393,777.00.

4. PLANNING AND DESIGN

4.1. TIMELINE OVERVIEW AND DOCUMENT REVIEW

The following graphic visualize the overall project timeline, including the key project milestones: blue representing planning and design phase, purple representing procurement phase, and green representing construction phase. The community engagement efforts are also shown on the timeline as orange icons.

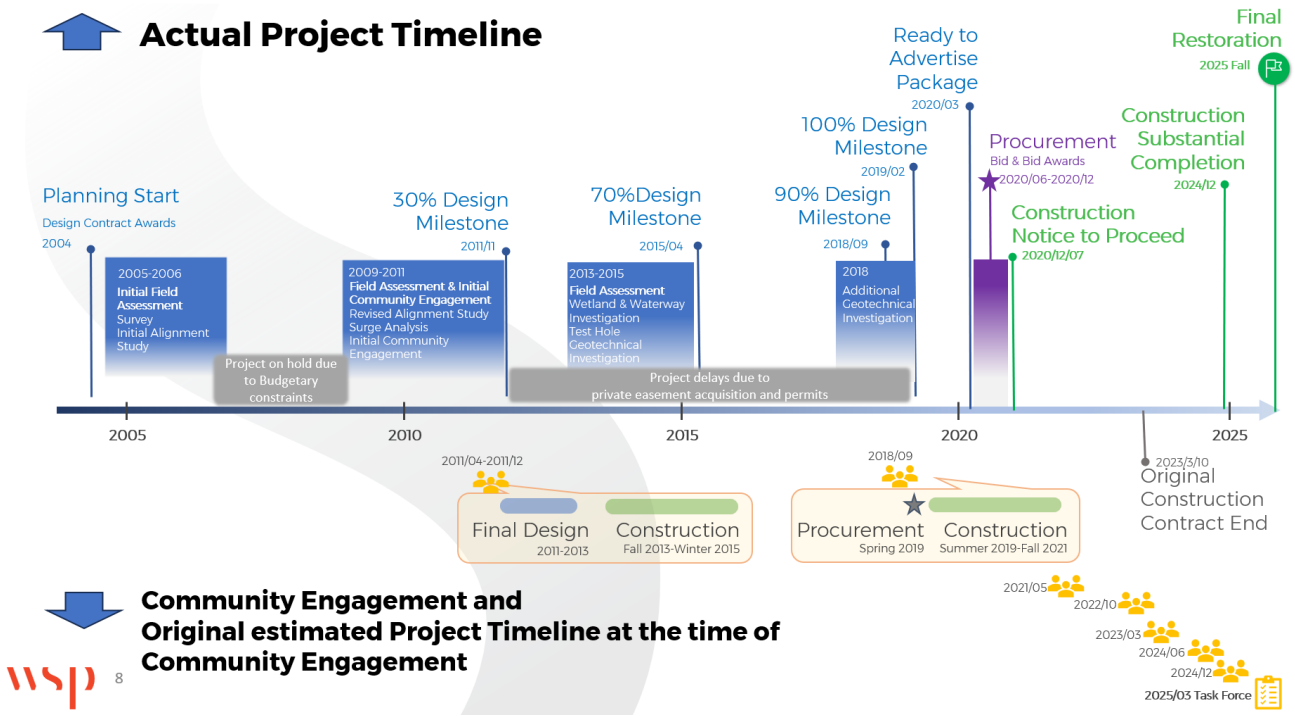

Figure 4-1 Overall Project Timeline

Planning and design for the Patuxent Raw Water Pipeline began in 2004, but due to various constraints (budgetary constraints, private easement acquisition and permitting), construction started in 2021. This long gap created several challenges.

Identified Gaps

Site data—elements such as surveys, utility maps, traffic studies, community impact evaluations, and soil studies—became outdated and didn't reflect current conditions when construction began.

Community engagement during planning was strong, but trust and momentum faded over time due to the delay.

Recommendations for future projects:

- Reduce pre-construction period to minimize the risk of changing condition.
- For prolonged planning projects, update site data regularly to reflect changing conditions.
- Recheck design assumptions before construction starts.
- Re-engage stakeholders to maintain transparency and trust.

4.2. PLANNING

During the planning phase, WSSC Water and its design consultant evaluated 11 possible pipeline routes using criteria such as engineering feasibility, environmental impact, construction complexity, cost, and community impact. Options that relied on third-party corridors—like BGE's transmission lines or I-95—were ruled out due to access restrictions.

Two final routes were considered, and the Modified Bond Mill Road alignment was selected for its shorter length, lower cost (about $1.4 million less), and reduced impact on residential streets.

Early community and stakeholder engagement in this phase worked well. In 2011, WSSC Water held several public meetings with the West Laurel Civic Association to address concerns about traffic, school safety, and road restoration. In response, WSSC Water committed to mitigation measures like full-width road resurfacing, avoiding school-hour construction, and exploring trenchless methods. The commitments were incorporated into the contract documents.

Identified Gaps

- Momentum and trust built during early outreach was not sustained through construction.
- Disconnect in executing commitments during the construction phase such as delayed full resurfacing, extensive use of temporary asphalt patches, and work during active school days/hours led to community grievances.
- Outdated site baseline conditions (surveys, SUE, geotechnical, traffic, and community studies) were no longer fully representative of the site.

Recommendation for future projects

- Planning commitments should be clearly written into construction contracts along with construction oversight to ensure they are followed during execution.

4.3. DESIGN

4.3.1. SUBSURFACE UTILITY ENGINEERING (SUE)

The pipeline route runs along a busy roadway with many underground utilities. Original utility surveys were done in 2005, with limited updates. During construction, crews encountered several unmarked or misaligned utilities—including sewer laterals and a recently installed gas main—not shown in the design plans. These conflicts led to field changes, RFIs, and delays.

Table 4-1 Utility Conflicts

Conflict Type	Underlying Cause	Impact on Project
Sewer Laterals (SHCs)	Unmapped or mislocated house sewer connections due to outdated records	Several rework and delays; ~$307k change orders; ~51 days delay
Gas Mains	Incorrect utility data or new installations post-design	Work with Design modifications; ~$93k; ~8 days delay
Water House Connections (WHC)	Not all identified or correctly marked by Miss Utility	Repairs/Clean up: ~22K, ~4 days
Storm Drain/Other	Conflicts with drainage structures or uncharted small mains	Cost Adjustment ~21K; no significant delay
Communication Cables	Unrecorded or unexpected telecom lines	Negligible impact; inactive lines; prompt restoration; no delay

Identified Gaps

- Outdated or missing utility records
- Elevation Discrepancies
- New utilities added after design
- Mismarked locations causing extra excavation

Recommendations for Future Projects

- Conduct high-quality SUE (Levels B and A) in critical areas. Update SUE if data is outdated.
- Improve record research and coordination with utility owners
- Early and continuous coordination with utility owners such as BGE during the entire project, planning through construction
- Overall System Improvement: Consider investing in improving asset management for sewer house connection and water house connection data.

4.3.2. GEOTECHNICAL INVESTIGATION

Two major underground conditions that were not anticipated by the initial field investigation or reflected in the design caused significant delays

- Rock elevations between stations 57+50 and 72+00 were shallower and harder at some locations than anticipated.
- Unstable and saturated sand near Bond Mill Elementary School. This type of sand can be difficult to construct on as it can lose strength abruptly.

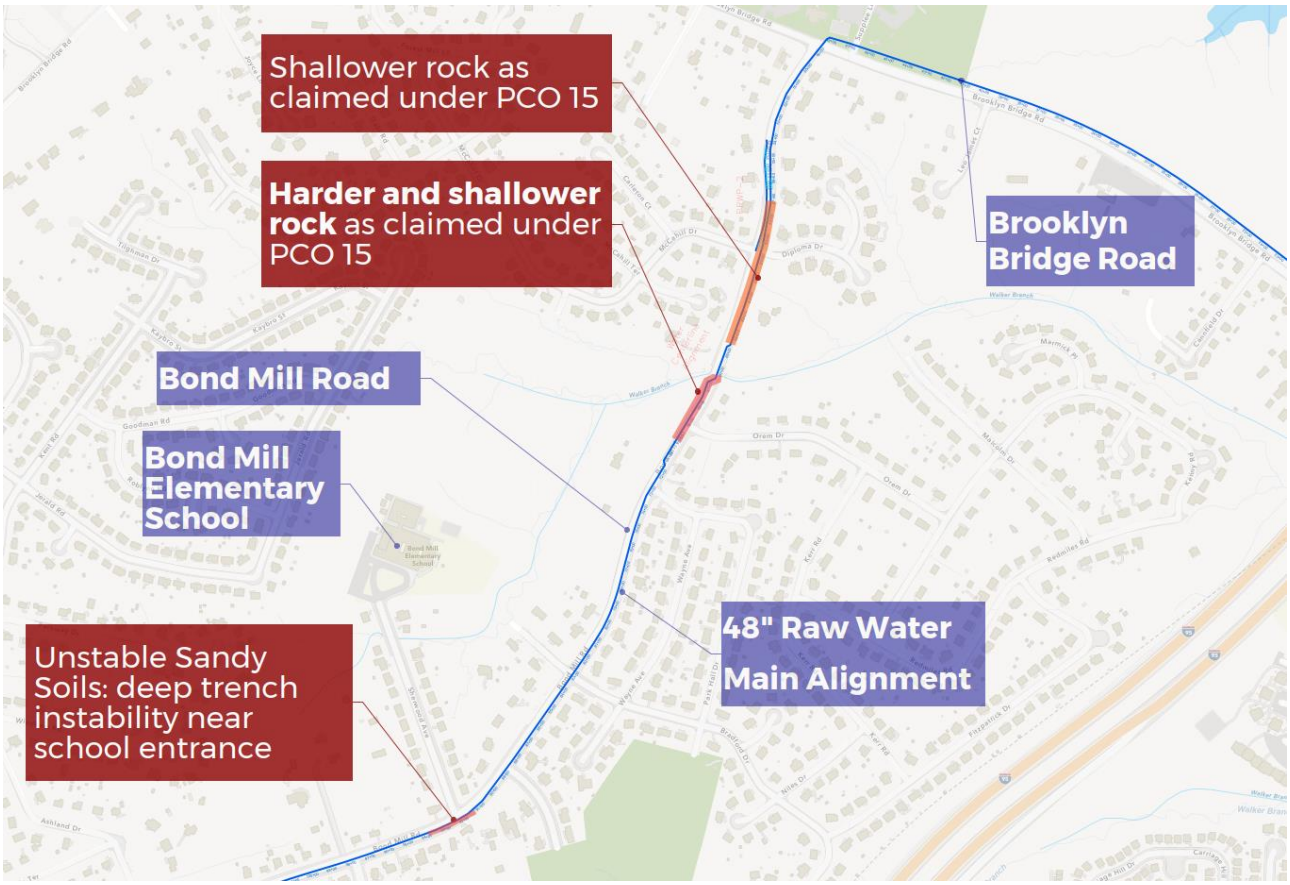

Figure 4-2 Geotechnical Challenges

While 45 borings were completed, one key location was spaced far apart or didn't reflect final alignment changes. Critical findings—like unstable soils with high groundwater—were not clearly communicated in bid documents or construction plans.

Identified Gaps

Soil borings Coverage and Depth

- Insufficient spacing at hard rock area, and insufficient depth in unstable saturated sand area.
- One boring in hard rock vicinity did not reflect final alignment after design changes.
- No intermediate borings or geophysical surveys were conducted in hard rock area.
- Challenges of water main low point, utility clearance and unstable sand condition.

Design and Documentation

- Design-phase borings missed local bedrock high points and unstable sand conditions.
- Key warnings about saturated sand and unstable soils were not communicated in construction documents or pre-bid or pre-construction meetings.
- Geotechnical reports and addenda were not included in the original bid package or provided to the contractor until after construction began.
- Information was not updated in accordance with the prolonged project timeline
- Contract left trench support methods to the contractor, resulting in reactive shoring and delays.

Recommendations for future projects:

- It's important to clearly share information about geotechnical risks from geotechnical reports in project designs and emphasized during pre-bid and pre-construction meetings..
- All geotechnical reports and updates should be included with bid packages, and all stakeholders before construction begins.
- Project plans need to include clear safety requirements for things like excavation support and emergency procedures (such as shoring or dewatering), instead of leaving these decisions solely up to contractors.
- Extra investigations should be done at key locations that might cause problems, when design changes, or if previous data isn't enough.

4.4. CONSTRUCTABILITY REVIEW & RISK ASSESSMENT

A comparison of the project's design phase review and construction execution revealed several constructability challenges rooted in early planning. WSSC Water confirmed that site walks were conducted with WRA during the 70% and 90% design stages, and a field review was held with WTBC in September 2020 prior to contractor selection. However, limited documentation was available for audit review regarding the outcomes of these constructability assessments. The following section highlights key challenges and risks that were not fully addressed during design, contributing to construction delays and community concerns.

Rigid Lay Schedule with owner furnished material (Limited Sequencing Flexibility)

The project used a non-traditional fixed "lay schedule" owner furnished material, meaning pipe materials were pre-ordered by the owner, and installed in a set sequence. This approach helped streamline procurement but reduced flexibility in the field. When crews encounter unexpected obstacles like hard rock or utility conflicts—they couldn't adjust the work sequence. This led to delays in pipeline installation, pressure testing, and permanent paving.
For example:

- No Intermediate Valves/Breaks in original lay schedule: Unforeseen obstructions (e.g., hard rock, utility conflicts) halted progress instead of allowing resequencing.
- Utility Conflicts and Design Changes: Utility conflicts requiring time-consuming solutions.
- Sequential Dependencies: Pressure testing and permanent paving deferred until full pipeline installation, resulting in prolonged temporary road patches and extended community disruption. Construction near Bond Mill Elementary continued during school days due to inability to isolate sections

Pavement Restoration Consideration

Community concerns about rough road conditions were linked to the project's approach to paving. Although WSSC Water's specifications required converting temporary pavement to permanent pavement within 60 days of trenching, the contractor's schedule deferred all temporary pavement to permanent pavement conversion until the end of the project. The design did not include intermediate valves/sleeves or phased testing, which could have allowed earlier restoration of road segments.

Other Gaps and Challenges

- Lack of detailed construction sequencing in contract documents
- Bulk material deliveries were not pre-planned because of concerns about covid-19 supply chain shortages, resulting in challenges related to on-site storage and logistics.
- Safety risks from deep trenching in narrow areas and working near traffic and utilities
- Limited work hours (9:00 AM to 3:30 PM) , which slowed progress
- No formal plan to minimize disruption near Bond Mill Elementary School, despite community requests

Recommendations for future projects

The audit recommends starting proactive risk management early—during planning and design—and continuing through construction. This includes integrating into the WSSC Water project team through project lifecycle, especially for large complex projects.

- Evaluating construction flexibility during design and incorporate to contract document
- Planning for phased water main installation work and pavement restoration
- Including detailed sequencing and safety measures in contract documents
- Coordinating closely with community stakeholders to reduce disruption

4.5. PERMITS

The project required multiple permits from state and county agencies, as well as internal WSSC Water approvals, prior to and during construction. The project team proactively managed this complex permitting landscape, securing all necessary approvals and renewals, and adapting to evolving requirements through collaboration with agencies, elected officials, and the community. The following table summary the key permits involved in this project.

Table 4-2 Key Permits Summary

Permit/Approval	Key Dates	Summary
Utility Permit (Prince George's)	Approved Aug 2021; seven extensions through 2025	Required for roadwork; included traffic/pavement plans, bike lane, and community improvements.
Wetlands/Waterways (MDE & USACE)	Assessment 2013; expired May 19, 2024	Covered minor impacts near culvert; all work associated with culvert completed by 2021.
Water Construction (MDE)	Issued June 20, 2019	Authorized water main installation; valid for five years.
Forest Conservation (MD-DNR)	Submitted 2014; approved Aug 18, 2016	Mitigation credits purchased for 11.7 acres.
Tree Care Maintenance (MD-DNR)	Issued Nov 17, 2014; revised nine times	Authorized tree removal, pruning, and replacement; latest update allowed 21 removals/replants.
Erosion & Sediment Control (E&S)	Approved Dec 7, 2020	WSSC Water approved and overseeing the E&S, and performed inspections.
Stormwater Management Waiver	Waiver submitted June 2014;	Design team submitted stormwater management waiver to MDE. MDE deferred the Memorandum of Understanding (MOU) between MDE and WSSC Water for pipeline projects. According to Subtitle 32-126 (Water Resources Protection and Grading Code) of the County Code of Prince George's County, no grading permit required.

5. PROCUREMENT AND CONTRACTING

5.1 PROCUREMENT PACKAGE REVIEW

WSSC Water's bid package included contract documents, four addenda addressing updates and bidder questions, design plans, as-built information, and special conditions. However, key supporting materials—such as all reports, including two geotechnical studies—were omitted, despite being uploaded to Trimble/E-builder during design.

Recommendations for future projects

- Ensure all essential technical documents, especially geotechnical reports, are included in future procurement packages.
- Add contract language allowing contractors to request plumbing card information, helping prevent field conflicts.

5.2 VENDOR SELECTION

For the Project, WSSC Water held a two-step bidding process in mid-2020. Nine contractors submitted bids; seven met all requirements. The winning bid, from Allan Myers MD, Inc., was $8,393,77 significantly below the engineer's estimate of $10.4 million and approximately $1-3+ million below most competitors. Allan Myers met all criteria and past performance standards. The contract was awarded in October 2020, with notice to proceed in December 7, 2020.

5.3 MATERIAL PROCUREMENT

This project had to follow a Lay Schedule that was approved on December 24, 2020, and Material were procured through WSSC Water from Core & Main/ US Pipe, therefore the following challenges were encountered during construction:

- 2022 supply chain disruptions led to bulk delivery of all remaining pipeline materials, causing:
    - Need to lease/rent BGE ROW for storage.
    - Inefficient retrieval and loss of productivity (PCO #16).
- Storage and inspection challenges:
    - long-term stockpiling required ongoing checks.
    - some items misplaced or damaged but repairs managed proactively.

5.4 DESIGN ENGINEERING SUPPORT

WSSC Water engaged WTBC for design support after the original engineer's contract ended. Gaps in project background information could potentially lead to extra effort required for the different design team to address field changes.

6. CONSTRUCTION EXECUTION

6.1. DOCUMENTATION REVIEW

As mentioned in our methodology, the audit team has reviewed and examined the following Construction Phase documents in table below and summarized them with the documentation performance indicators.

Table 6-1 Overall Project Documentation Key Performance Indicators

Document Type	Quality	Risk Identification	Approval Process	Timeliness	Field Inspector Accessibility
Plan/Specs	✓	✓	✓	✓	Unknown
Pre-construction Meeting Minutes	✓	✓	✓	✓	N/A
Pre-construction Submittals	No	No	No	No	No
RFIs	✓	✓	✓	No	Unknown
Submittals	-	-	✓	-	Unknown
Monthly Progress Meetings	✓	✓	N/A	No	Unknown
Daily Inspection Reports	Not Always	No	✓	✓	✓
QC Reports (Compaction Test)	No	No	✓	No	✓
QA Reports (Compaction)	No	✓	✓	Not Aways	No
Schedule Updates	✓	✓	Occasionally	✓	N/A

6.2. REQUEST FOR INFORMATION AND THEIR IMPACT

The audit reviewed key construction documents and identified mixed performance across categories. Plans and specifications were complete and accessible, while pre-construction submittals were largely missing. RFIs (27 total) were critical for resolving field coordination issues, design clarifications, and utility conflicts. However, response times varied widely—from 8 to 1,042 days—and 13 RFIs remained unclosed in eBuilder.

RFI Overview:

- **Design Changes**: 17 RFIs led to design modifications.
- **Cost Impacts**: 14 RFIs incurred additional costs.
- **Schedule Impacts**: 12 RFIs affected timelines.
- **Not Closed in eBuilder:** 13
- **Longest Outstanding**: RFI #14 (Vault H) was over 1,000 days overdue (not closed in system)
- **Most Critical Utility Conflict:** RFI #17 addressed an unmapped BGE gas main

WSP Key Observations:

- Plumbing cards SHC info limited
- Vault H redlines led to lay schedule changes
- Test pitting paid under contingency
- Trench detail provided by email
- No official response to hydrostatic pressure test limits
- Multiple RFIs not officially closed in eBuilder

Recommendations for future projects

- Digitize and verify plumbing cards and sewer house connections data before construction.
- Enforce test pit stakeout protocols as indicated in specifications.
- Implement formal RFI closure checklists in system.
- Assign RFI oversight to WSSC Water's Construction Manager, not the contractor.

6.3. SUBMITTALS LOG AND THEIR TIMELINESS REVIEW

WSP was not provided with a formal Submittal Log or granted access to the original submittals throughout this review. Utilizing the available review responses provided, the audit team developed a submittal log and performed a comprehensive evaluation of the timeliness, completeness, and quality of the reviews.

Submittal Log Summary

- Total Submittals Logged: 72
- Approved: 17
- Approved as Noted: 7
- For Information Only (FIO): 20
- Rejected: 1
- Revise & Resubmit: 13
- Missing Submittals (not available to WSP): 7

WSP Key Observations

- Submittal Log: Not Available

- Review Timeliness: 16 submittals reviewed late (3–228 days delay), all related to schedule updates—potentially contributing to project schedule slippage.
- Review Completeness & Quality: Observed submittals required multiple revisions, remains unresolved, or indicated week progress monitoring
- Preconstruction Submittals: No evidence of preconstruction submittals being submitted or reviewed.

Recommendations for future projects

- Require and review preconstruction documents (e.g., baseline schedule, safety plan, QA/QC plan) before mobilization.
- Include preconstruction items in the official submittal log and workflow.
- Treat schedule updates as actionable documents requiring formal review.
- Avoid marking schedules as "For Information Only (FIO" without review, especially when delays are present.
- Use schedule reviews to identify risks and adjust field execution proactively.

6.4. PROCESS & MANAGEMENT AUDIT

This section outlines the core process and management workflow adopted for the Project, emphasizing the importance of clear decision-making structures and robust communication channels.

Table 6-2 Established Decision-Making Framework

Decision Type	Process	Key Decision-Makers	Documentation
Design Clarification (RFI)	Contractor submits RFI via e-Builder Form Process. WSSC Water design team proposes an answer a response. Contract Manager reviews and approves response. Contractor closes RFIs.	Design Engineer (WTBC or consultant) responds to technical questions; WSSC Water Contract Manager (or Construction Manager) signs off on solution.	RFI Log with official response text and date;
Field Directive (quality/ safety)	Inspector or WSSC Water representative gives on-site instructions to contractor (often verbal, then noted in DIR).	WSSC Water Field Inspector or Contract Manager if higher approval is needed.	Daily Inspection Report (WSSC Water) noting instruction and contractor action;
Progress/ Schedule Adjustment	Discussion in progress meeting. If minor (within contract scope), contractor and WSSC Water agree on field modification. If major (affecting milestones), formal notice given.	WSSC Water Construction Manager and Contractor PM in meetings; Chief Engineer if extending contract time formally.	Meeting minutes capturing agreement or action item; Official letters if schedule slippage;
Change Order (Scope/Cost)	PCO proposal prepared (by contractor for differing work, or by WSSC Water request). WSSC Water evaluates, negotiates. Internal approval memo up chain. Formal CO executed.	WSSC Water Contracts Manager & Section Manager negotiate and recommend; Pipeline Division Manager/Chief Engineer approve; Procurement issues CO;	PCO letter or e-Builder form with cost/time breakdown; Change Order memo (Construction manager through Chief Engineer) summarizing decision; Signed Change Order document adjusting contract.

Decision Type	Process	Key Decision-Makers	Documentation
		Contractor Project Manager signs concurrence.	
Submittal Approval	Contractor submits product/work plan submittal in e-Builder. WSSC Water engineer/inspector reviews for compliance and marks approved/approved as noted/revise.	WSSC Water Design Engineer or subject-matter reviewer (e.g., cathodic protection. expert for test station submittal).	Submittal register entry with status.
Payment Approval	Contractor submits monthly pay request. Inspector/Manager verify quantities % complete. WSSC Water Section Manager approves payment.	WSSC Water Inspector validates field progress; WSSC Water Contracts Manager approves invoice; WSSC Water Section Manager signs off to accounting.	Pay Estimate form with signatures;

Observations:

While clear decision-making structures were implemented, the project team fell short in most effectively following that structure which resulted in a mismanaged process, several gaps in communication, and an overall disjointed project. Some gaps noticing:

- The audit team could not confirm if QA incident reports were properly corrected and closed per procedure.
- Meeting minutes were not properly documented.

Recommendations for future projects

Ensure consistency in process management, decision records, corrective actions, and issue closure.

6.5. SITE INSPECTIONS REVIEW

WSP had access to total of 973 Daily Inspection Reports (DIR) dated from March 1, 2021, through July 3, 2025 and reviewed them with regards to the following aspects:

Table 6-3 Site Inspections Review

Aspect	Observations
Timeliness	DIRs were created consistently when crews were onsite; reviews/approvals were generally timely. There are instances that DIRs were created a month after the actual work was completed.
Completeness and Quality	Frequent missing info: backfill details, compaction equipment, pressure test of pipes, CMA (Cold Asphalt Mix) storage, excavation depth, labor/equipment hours, pipe inspection records. Reliance on third-party testing BOTA for compaction testing without inspector verification.
Safety	Notable incident: Nuclear density gauge struck (Jul, 2022)—no harm due to proper protocols. Trench shoring sometimes missing (not noted in DIRs). MOT plan references generic; no traffic control inspector visits recorded.
Incidents	Approximate 30+ incidents: Utility strikes, property damage, improper repairs, use of unsuitable materials, and incomplete documentation of corrective actions. Examples include water main and SHC strikes, mailbox damage, and sewage backup.

Recommendations for future projects

- **Improve Documentation**
    - Standardize required DIR fields (e.g., materials, equipment, testing, labor).
    - Ensure inspectors verify and record test results.
    - Track all materials and their in situ performance.
- **Enhance Safety Oversight**
    - Document trench safety conditions and include photos.
    - Record all safety incidents with follow-up actions and agency notifications.
- **Strengthen Incident Management**
    - Ensure formal reports for all incidents.
    - Track repair quality, testing, and resident resolutions.

6.6. QUALITY ASSURANCE PROCEDURE ASSESSMENT

WSP performed the review of the quality assurance procedure and the following summary the findings.

Table 6-4 Quality Assurance Process Review

Area	Observations
QA Plan	No QA plan was developed or approved for the project.
Specifications	Specification did not require a comprehensive QA/QC plan or procedure. However, on September 5, 2024 there an internal operation procedure has been approved for compaction QA testing. Dedicated QA team performed compacting inspections for projects, the team creates incident report when finding violation.
Required QC	Specs called for Engineer inspections (materials, hydrostatic tests, visual inspections, compaction test), except for random compaction testing nothing else has been documented.
Compaction Testing	Report & Testing, as well as Incident Report Compaction Testing lacked precise locations, updated proctor data, and details on corrective actions. Reports often referenced the same proctor data despite varying soil conditions/proctor with Geotech rep report.
Documentation	Reports did not include backfill material, lift thickness, test depths, or photos. Activity locations, test results and corrective actions often missing or unclear. No evidence that QA reports were sent to the contractor for rectification.
Testing Issues	On Feb 7, 2024, violations included: no testing for backfilling lifts, continued backfilling after failed tests, and use of unapproved backfill material.

Recommendations for future projects:

- Establish a QA Plan: Develop and approve a comprehensive QA plan with defined roles, inspection/testing protocols, and corrective action procedures.
- Improve Inspection Practices: Use standardized checklists, require photo documentation, and ensure traceability of materials and inspections.
- Formalize Testing Oversight: Implement clear procedures for hydrostatic and compaction testing, including acceptance criteria and documentation standards.
- Enforce Backfill QA Testing: Schedule and document compaction tests using independent agencies. Track test locations, frequencies, and outcomes.
- Enhance Accountability: Assign QA responsibilities, hold regular review meetings, and share QA findings with stakeholders to ensure transparency.

6.7. QUALITY CONTROL PROCEDURE ASSESSMENT

WSP performed the review of the quality control procedure and the following summary the findings.

Table 6-5 Quality Control Process Review

Area	Observations
QC Plan	No requirement for a comprehensive, project-specific QC plan with definable feature of work.
Soil Testing	- Sub-hired for compaction testing, but technician qualifications are not confirmed by WSSC Water. - Technician sometimes absent during backfilling. - Reports are often submitted late. - Only one proctor test report was submitted; native soils varied. - Backfill lifts often exceed specified 8-inch (up to 16-inch). - Testing not always across full trench depth. - Reports lacked detail and were not logged into E-Builder.
Concrete Testing	No compressive strength tests were conducted for thrust collars.
Hydrostatic Testing	Pressure tests for pipes/valves are not consistently documented or submitted for review.
Temporary Asphalt	Cold mix asphalt used without documented approval; storage of CMA unverifiable, temporary pavement often exceeded 60-day limit.
Permanent Pavement	Temporary pavement exceeds allowed duration; cutbacks and tack coats are often missing.

Recommendations for future projects

Similar to the QA procedure, for a better-Quality Control process WSSC Water should consider the followings:

- Require contractors to submit a detailed QC plan with defined work features and assigned QC personnel.
- Conduct regular QA/QC meetings to track deficiencies.
- Maintain a submittal registry from preconstruction to ensure traceability.
- Enforce timely submission of test reports.
- Empower inspectors to halt work when testing personnel are absent.

6.8. EFFECTIVENESS OF RISK MANAGEMENT DURING CONSTRUCTION AUDIT

After reading through DIRs and emails, WSSC Water had a reactive approach to all risks (utility conflicts, delayed compaction reports, pressure testing, settlement in pavements, etc.).

Recommendations for future projects

WSP recommends a proactive approach to risk mitigation for the project. Table 6-6 details the risk management methods, actions, tools, and responsible parties, and Table 6-7 provide sample risks and mitigation strategies based on design and construction observations for the project.

Table 6-6 Suggested Risk Management

Stage	Action	Tools/Methods	Responsible Party	Output
Risk Identification	Spot potential risks during planning, design, or construction phases	- Site investigations - Utility records - Geotechnical reports - Lessons learned from past projects	Design Engineer, WSSC Water Project Manager, Contractor	Risk Register Entry (initial)
Risk Logging	Document the risk formally in the project risk register	- Risk Register Template - RFI/Field Report logs - Meeting minutes	WSSC Water Project Controls, Project Manager	Risk ID, Description, Phase, Owner, Status
Risk Assessment	Evaluate likelihood and impact of each risk	- Qualitative scoring (Low/Med/High) - Historical data - Expert judgment	WSSC Water Risk Manager, Project Manager, Technical Leads	Risk Matrix (Heat Map), Prioritized Risk List
Mitigation Planning	Define proactive and reactive strategies to reduce or respond to the risk	- Mitigation Plan Template - Design revisions - Contingency planning	Design Team, Contractor, WSSC Water Project Manager	Mitigation Measures added to Risk Register
Risk Monitoring	Track risk status and effectiveness of mitigation	- Weekly Progress Meetings - QA/QC Reports - Change Order Logs	WSSC Water Construction/Contract Manager, Inspectors, Contractor	Updated Risk Register, Action Items
Risk Closure	Close risk once resolved or no longer applicable	- Final inspection - Audit confirmation - Lessons learned documentation	WSSC Water Project Manager, QA/QC Lead	Risk marked “Closed” in Register, Lessons Logged

Table 6-7 Major Encountered Risks and Mitigations

Risk	Cause	Impact	Potential Mitigation Strategy
Lay Schedule	Lay Schedule limited construction flexibility	Schedule delay	Coordinate layout schedule to allow flexibility at critical construction location
Unmapped sewer/gas/telecom lines	Incomplete utility records; outdated surveys	Work stoppage, redesign, service disruption	Test pitting, Enforce Specification to get utility stakeout from the Contractor, coordination with utility owners (BGE, Verizon, etc.)
Hard rock excavation	Inadequate geotechnical data	Slow progress, change orders	Pre-bid boring logs, contingency excavation plans (this was discussed during a meeting with the Engineer of Record (EOR)). Value Engineering (VE) for Alternative Options, WSP does not have documentation to show that VE has taken place.
Unstable sandy condition	Inadequate Geotech data and design planning	Slow progress, safety concerns	Communicate geotechnical risks in contract documents and pre-construction meeting
Construction during school time	Construction schedule delay	Safety concerns at sole school entrance Community dissatisfaction	Pre-planning break points of pipe segments to allow the construction near school to be executed during the planning time.
Pavement cannot be restored timely	Construction schedule delay	Roadway condition Community dissatisfaction	Pre-plan pavement timeline in sequence of construction and schedule Discuss at pre-conference meeting for expectation
Culvert crossing restrictions	County DPW&T concerns over clearance	Alignment redesign, multi-year delay	Early agency engagement, alternate routing scenarios
Power line ROW denial (BGE)	BGE refusal to allow parallel alignment	Forced reroute into congested corridor	Early negotiation with BGE, perpendicular crossings only
Inconsistent QC reports	Delayed or missing compaction/concrete test results	Pavement settlement, rework, community complaints	Enforce QA/QC protocols, require timely reporting, independent inspections
Use of unapproved materials	Contractor deviations from approved submittals	Potential non-compliance, performance risks	Strict submittal review process, field verification, corrective action enforcement

6.9. SAFETY COMPLIANCE

A safety plan was discussed during pre-construction and is assumed to have been implemented by Allen Myers, though it was not available for WSP to review.

WSP has record of one safety incident that occurred on the project which per OSHA 29 CFR 1904.7 is major recordable injury, an untrained laborer attempted to use a Roller CS34 – Carter CAT #052059, during the maneuver, the roller overturned, and its roof impacted Laborer's left ankle, resulting in a fracture and significant bleeding.
Prompt action has been taken by the Contractor and WSSC Water's field inspector:

- Called 911, the laborer was transported to a health care facility
- Allan Myers recorded the incident, enhanced safety briefing to avoid recurrence.
- WSSC Water requested formal incident report from AM.
- Required AM to conduct a review of internal equipment safety protocols

Recommendations for future projects:

WSSC Water should require formal safety plans and daily toolbox or Activity Hazard Analysis (AHA) meetings.

6.10. CHANGE MANAGEMENT- UNFORESEEN CONDITIONS

The project had 40 Potential Change Orders (PCOs), consolidated into 7 formal Change Orders (CO). While standard procedures were followed, many PCOs were submitted after work was completed, and RFI responses were delayed. All PCOs were reviewed by WSSC Water, except PCO #15 which remains under negotiation. Only one PCO was confirmed to have third-party review; documentation for others is unavailable.

Recommendations for future projects:

WSSC Water should adopt a structured yet agile change management approach by conducting regular change review meetings.

6.11. FIELD OVERSIGHT STRUCTURE AND ROLES

Contract Manager: Oversaw project correspondence, approved submittals, PCOs, pay estimates, and led decision-making.

Field Inspectors: Prepared daily reports, tracked pay items, and reported incidents to the Contract Manager.

Contractor PM and his subordinates reported to the contract manager and field inspectors.

Figure 6-1 outlines the field oversite structure.

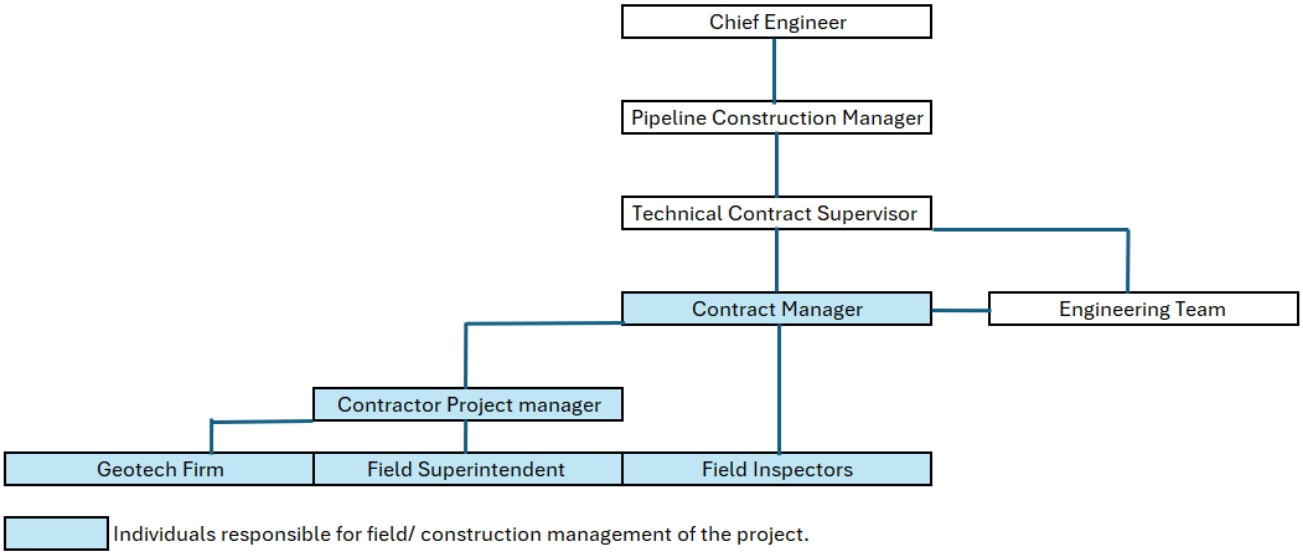

Figure 6-1 Field Oversite Structure

6.12. COMMUNITY IMPACT AND CUSTOMER NOTIFICATION

Identified Gaps: The project lacked a formal log of community communications and complaints, making it difficult to track outreach efforts. WSP reconstructed a communications log from reports and emails on project folder (Appendix B.7).

Impacts included service interruptions, property damage, and unclear or missing notifications—especially during emergency water shutdowns. One resident reported no warning before a water outage, and incorrect contact info on signage caused confusion during staff changes.

A shutdown log was also reconstructed (Appendix B.5), but no record was found related to water main shutdown event without proper notice, indicating a gap in emergency communication.

Recommendations for future projects

- Maintain communication log tracking notices and complaints, as well as follow-up actions.
- Implement an emergency alert protocol for unplanned outages.
- Provide clear, timely, and accurate notifications with correct contact info.
- Use multiple outreach channels (e.g., flyers, mail, SMS, email).

7. TIMELINE AND SCHEDULE EVALUATION

7.1. BASELINE VS ACTUAL TIMELINE

Table 7-1 Summary of Baseline schedule vs Actual Timeline

Milestone	Baseline	Actual (End of 2024)
Notice to Proceed (NTP)	Dec 7, 2020	Dec 7, 2020
Substantial Completion	Oct 4, 2022	Dec 10, 2024
Contract Required Completion	March 10, 2023	-
Duration (Calendar Days)	823	1464
Total Delay	-	641

Key Observations

- Baseline schedule projected completion 157 days ahead of contract requirement.
- Actual completion was 641 days delayed vs. baseline.
- Delays linked to material procurement, installation, school/work constraints, and schedule review gaps.
- Baseline schedule did not fully align with contract sequence requirements related to permanent pavements, final permanent paving had been planned for the last phase of the project in the baseline; schedule reviews by owner/engineer were not performed as specified.

7.2. ROOT CAUSE ANALYSIS OF DELAYS

The project experienced a total delay of 641 calendar days, with mobilization starting on February 25, 2021. Delays began early, consuming float by March 31, 2021, due to utility conflicts, unresolved RFIs, and permit-related constraints. Figure on the next Gantt Chart indicates impacted milestones and their respective impact on the project schedule, vs. original project duration.

The following summary of the key causes of delay in details:

- **Float Consuming**
    - Issues with marking utilities on WSSC Water property, utility conflict, culvert rehabilitation submittal approval had consumed available float (the amount of extra time a task can be delayed without affecting the overall project completion date) in original baseline schedule.
- **Pipe installation delays**
    - **Rock impacts:** The presence of rock slowed installation of several pipe segments. In mid-2022, rock was discovered at shallow depths, including some areas of hard, non-rippable rock, affecting production rates and causing construction delays. Limited geotechnical investigation and omission of the report from bid documents made planning more difficult. Fixed pipe schedules and absence of sleeves restricted options for work acceleration or alternative sequencing.
    - **Temporary crew demobilization:** The primary pipe crew was demobilized from August 18 to November 7, 2022, in order to respond to an emergency on a separate project. This resulted in

an 81-day interval without pipeline progress, which contributed directly to the schedule delay. Consequently, the project lost all positive float and experienced further schedule setbacks. Contractor was non-compliant with Articles 15 and 19 of the General Conditions.

- **Running sand & wet conditions:** In early 2024, wet weather and "running sand" soils slowed shoring and excavation, making the work hazardous. A leaking WSSC Water 8-inch main flooded the trench, stopping progress for three days.
- **Weather shutdowns:** From January to March 2024, frequent rain, snow, and ice led to major work stoppages, with Bond Mill Road often unworkable due to Prince George's County restrictions.

Task	Actual Start	Duration Days	Actual Finish
Project Original Duration	12/7/2020	823	3/10/2023
Actual Project Duration	12/7/2020	1464	12/10/2024
Owner Provided Materila Procurment	12/3/2020	1214	3/31/2024
Pipe installation effort	5/20/2021	1300	12/10/2024
Vaults H and G Installation	5/24/2021	963	1/12/2024
Test Pit - WWTP Tie In Area/ Marking	8/9/2021	1121	9/3/2024
Change Orders Work	11/1/2021	1037	9/3/2024

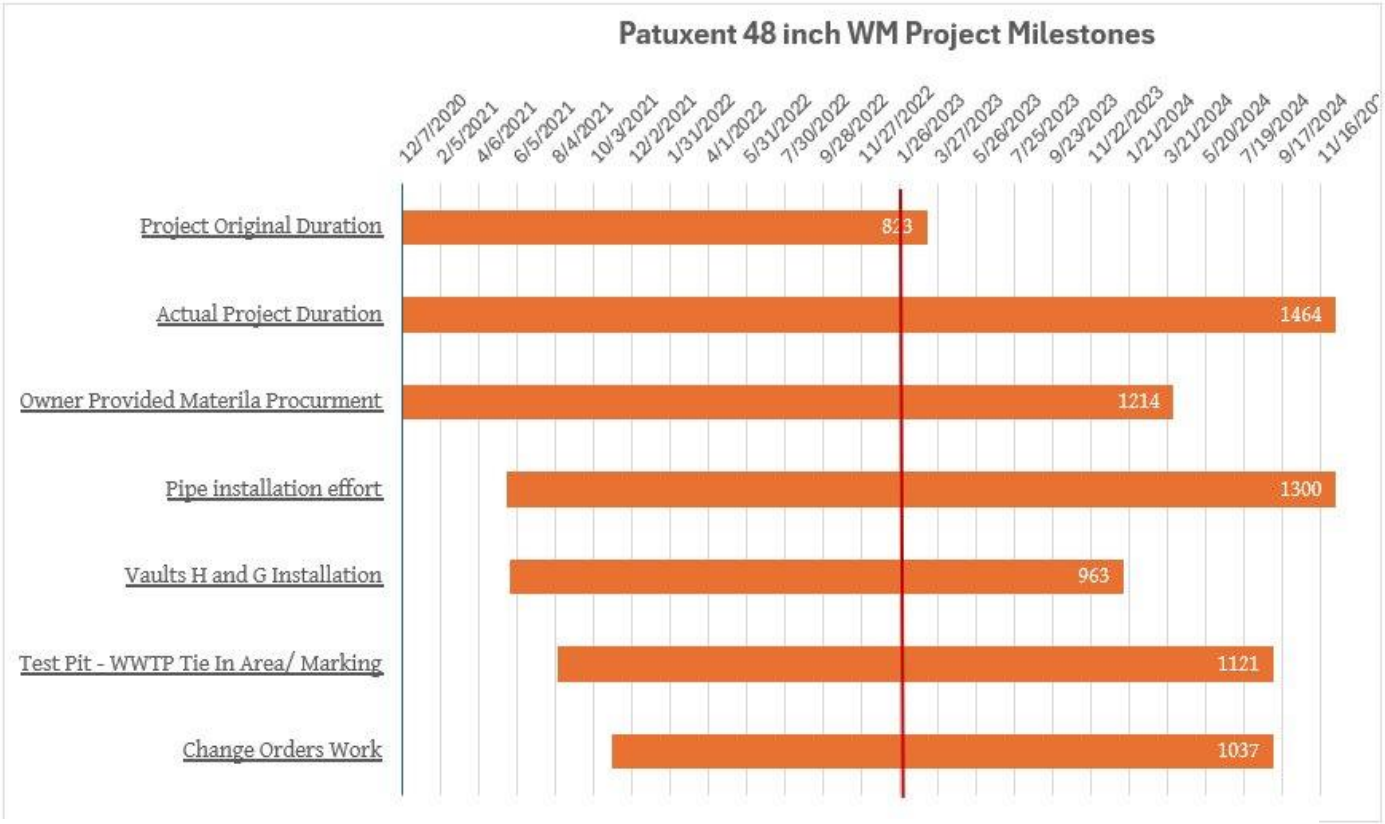

Figure 7-1 Activity Level Delays from Contractor's CPM Schedule

- **Utility conflicts**

- The presence of unidentified or misplaced utilities (majorly related to sewer house connections, water house connections and gas mains) necessitated test pits, design adjustments, and additional relocations, resulting in project schedule float consumption, or schedule delays until these issues were resolved. Contributing factors included incomplete subsurface utility mapping based on outdated baseline data, missing records, as well as rigid pipe construction lay schedules that limited sequencing flexibility.

- **Change orders:** Change orders for chemical lines, vault revisions, and other scope items added time to the critical path.
- **Supply-chain challenges impacting on pipe fabrication and material handling**
  - **Owner-Provided pipe fabrication and delivery:** Delays in fabrication and delivery of owner-provided pipe and fittings caused critical path activities to become delayed, especially in 2023 and2024.
  - **Materials handling:** Release and stage pipe in the ROW required double/triple handling according to the contractor, which was not in the original plan and consumed critical path time.
- **Repairs:** Emergency repairs of leaking water main and repair of a damaged water house connection.
- **Logic changes on contractor's calendar:** Contractor's 2024 calendar corrected to include non-workdays, holidays, and weather days, adding 68 days to the schedule completion deadline.

The figure below visualizes the delay drivers on the project map, and color coded based on driver categories. The table on the next page summarizes the delays by time and activities.

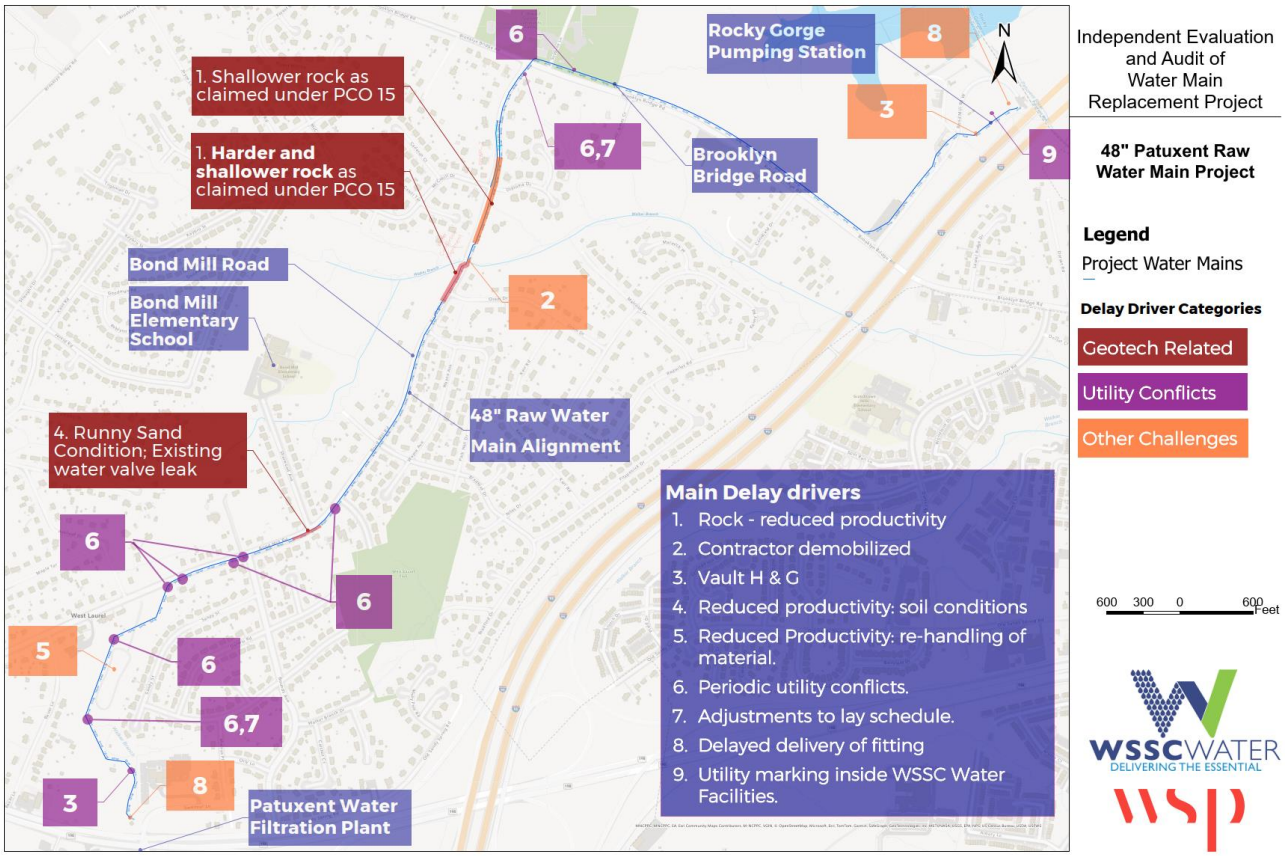

Figure 7-2 Map of Delay Drivers

Table 7-2 Root Cause of Delays Summary

Category	Description	Timeframe	Impact on Schedule
Early Float Consumption	Utility locating conflict on WSSC WATER property delayed test pitting	Feb–Mar 2021	Consumed ~20 days of float
Early Float Consumption	3-inch gas main at Sta. 49+20 may require relocation	Mar 2021	Awaiting response; float erosion
Early Float Consumption	Culvert rehab submittal pending; MDE permit restrictions	Q1 2021	Delayed procurement and trenching
Baseline Float Consumption	Pipe installation Sta. 65+46 to 105+00	Mid-2022 onward	Became critical due to rock delays
Baseline Float Consumption	Tie-in pipe segments Sta. 126+00 to 128+95 and 0+00 to 1+64	2023	Late fittings caused float loss
Baseline Float Consumption	Vault H installation and backfill	2024	Became critical due to pipeline delays
Baseline Float Consumption	Fabrication/delivery of owner-supplied pipe	2023–2024	Late delivery pushed tie-in work
Baseline Float Consumption	Change orders added scope and consumed float	2021–2023	Became zero-float activities
Actual Delay	Pipe installation Sta. 57+00 to 92+87	Mid-2022 to Mar 2024	Rock, weather, crew demobilization caused 7+ month delay
Actual Delay	Owner-provided pipe delays	2023–2024	Critical path delay due to missing materials
Change Orders & Utility Conflicts	8-inch WM relocation reinstated due to field discovery	2022–2023	Reintroduced delay to critical path
Change Orders & Utility Conflicts	Test pit for unknown SHC on Bond Mill Rd.	2022	Required redesign and halted progress
Change Orders & Utility Conflicts	Chemical lines, vault revisions, BGE gas conflict	2021–2023	Added time to critical path
Change Orders & Utility Conflicts	Emergency repairs: WHC and leaking water main	Feb–Mar 2024	Direct work stoppages
Material Handling Delay	Double/triple handling of pipe in BGE ROW	2021–2022	Inefficient logistics consumed critical path time
Logic Change	Calendar correction added non-workdays and holidays	Dec 2023	Added 68 days to schedule completion deadline

7.3. SCHEDULE MANAGEMENT AND RESPONSIVENESS

Key Observations

Baseline Schedule was approved with no comments, and schedule updates 2 through 16, which predominantly were reviewed as “For Information Only”. It is not clear whether WSSC Water authorized the contractor to

demobilize from the site or not, but there are email correspondences available showing WSSC Water's concern about the Contractor not being on site, and directing them to mobilize back as soon as possible.

Overall, the project schedule updates/ review process was not detailed and WSSC Water has not tracked potential delays rigorously throughout the project; however, since the audit review is based on the contractor's schedule updates and it appears that the contractor provided schedule updates mostly in a monthly basis, and in the CPM schedule update the Contractor did track down delays and kept WSSC Water Informed of potential complications.

It is the audit team understanding that there was not a meaningful collaboration between the contractor and WSSC Water in addressing potential conflicts/ delays proactively.

Recommendations for future projects

WSP suggest the following in Table 7-3 for better CPM Schedule Control:

Table 7-3 Suggestions for Higher CPM Schedule Control

Step	Action
1. Initial Review	Review (project controls team); check for compliance and completeness.
2. Logic Check	Validate activity sequencing, durations, and critical path.
3. Risk Identification	Flag delays and ask corrective actions from the Contractor.
4. Documentation	Request for time impact analysis and revised schedule for changes.
5. Approval	Contractor shall obtain written approval before implementing schedule changes.
6. Continuous Monitoring	Treat updates as actionable; document responses and adjust proactively. Be mindful of Float Usage, while reviewing PCOs

8. COST AUDIT AND FINANCIAL ANALYSIS

WSP reviewed all documented change orders and the following provided the summary of findings.

- **Original Contract**: $8,393,777
- **Approved Change Orders (CO #1–7)**: $1,093,280
- **Latest Contract Value**: $9,564,939 (as of Pay Request No. 49, May 2025)
- **Pending Negotiation**: PCO #15 (rock excavation costs) not yet included

PCO #15 related to the rock excavation is under negotiation, both the Contractor and WSSC Water cannot discuss this in detail, hence the cost is not included in this report.

Table 8-1 Summary of Change Order Log

Change Order	PCOs Included	Settlement Type	Time Impact (days)	Cost Adjustment
CO #1	#01, #04	Lump Sum	6	$156,705.00
CO #2	#05, #08, #09, #11, #12, #13	Lump Sum	65	$534,475.00
CO #3	Budget transfer only	Administrative	-	-
CO #4	#06, #16, #20, #21 + 4 contingency items	Lump Sum	33	$206,725.33
CO #5	#18, #22, #23, #24, #26, #27, #28, #29, #30	Lump Sum	45	$239,084.00
CO #6	#31, #34, #35, #36 + emergency replacement	Lump Sum	6	$16,288.46
CO #7	#38, #39-R1, #40	Lump Sum	7	$17,884.00

Observations: Markups and cost adjustments varied across PCOs, with some discrepancies noted between PCOs, COs, and pay requests.

9. INTERNAL AND EXTERNAL COORDINATION

Effective coordination—both within WSSC Water and with external stakeholders—was critical to the delivery of this complex infrastructure project. The audit reviewed how internal roles, communication channels, and collaborative efforts influenced project outcomes.

9.1. INTERNAL COORINATION

The project involved multiple WSSC Water departments:

- **Engineering & Design**: Managed planning, design, and permitting with input from internal stakeholders.
- **Procurement & Contract Administration**: Prepared bid documents and contracts.
- **Construction Management**: Oversaw field execution, inspections, and QA/QC, including compaction oversight and third-party testing.
- **Shutdown & Repairs**: Utility Services staff handled water main leaks, valve repairs and coordinated shutdowns.
- **Customer & Community Affairs**: Initially limited to periodic updates, later expanded to include a Public Outreach Manager, Outreach Specialist, and Customer Advocate.
- **Leadership**: Senior management became more engaged following leadership changes, improving coordination and forming a Cross-Functional Task Force.

Internal communication challenges and gaps

- **Personnel Turnover & Continuity Gaps**
    - Changes in key roles (design manager, contract manager, inspectors) led to loss of critical knowledge and inconsistent documentation.
    - 6-month lag in updating public contact info for contract manager changed.
- **Design–Construction Handoff Issues:** Incomplete transfer of geotechnical findings and other critical info from Design to Construction.
- **Delayed Response to Unforeseen Conditions:** Slow internal communication and unclear escalation processes led to longer project timelines.
- **Siloed Departments & Reactive Communication:** Lack of seamless interdepartmental communication; field reports did not trigger prompt action until issues escalated publicly.
- **Fragmented Community Communication:** Internal disconnects resulted in inconsistent and outdated public messaging.
- **Delayed Internal Escalation:** Significant issues (e.g., rock excavation, change orders, road degradation) were known internally but were not escalated early enough.
- **Difficulty Enforcing Corrective Actions:** Communication issues between the QA team and construction team related to the implementation of corrective actions from QA inspections, resulted in delays or incomplete follow-through.

Recommendations for future projects

- Create cross-functional project teams from the start.

- Improve handoff of documents and information between departments.
- Structured risk management and joint problem solving.
- Use shared systems to track updates and risks.
- Hold regular coordination meetings and escalate issues early.
- Improved communication on enforcing corrective actions.
- Ensure public-facing teams have accurate, timely info from internal sources.

9.2. INTER-AGENCY COLLABORATION

Key external agencies and entities

The project required coordination with multiple external agencies and utility companies across county, state, and federal levels. Key agencies included Prince George's County DPIE and DPW&T, Maryland Department of the Environment (MDE), U.S. Army Corps of Engineers (USACE), and Maryland DNR. Utility coordination involved BGE, Verizon, and Comcast.

Observations and lesson learned in interagency coordination

- **Multi-Agency Sequencing:** Early permit applications and alignment with county, state, and federal review cycles were essential for timely approvals.
- **Work Hour Restrictions:** Initial limits (9:00 AM–3:30 PM) on Bond Mill Road reduced productivity. Project later negotiation with Prince George's County extended hours to 8:30 AM–5:00 PM in August 2021. Lesson: Engage permitting authorities early to address restrictions and seek broader allowances upfront.
- **Traffic Control & Restoration:** Required submission and approval of traffic/pavement plans. WSSC Water Actively Collaboration with Prince George's County DPW&T and DPIE expedited updates and led to shared costs for enhancements.
- **Utility Company Coordination:** Challenges included BGE's refusal for right-of-way and lack of records from private utilities, resulting in redesigns due to unidentified infrastructure.

Recommendations for future projects

- **Early Engagement:** Initiate permit applications early and align with county, state, and federal review cycles to avoid delays.
- **Dedicated Coordination Plan:** For complex project that required multiple agencies involvements, develop a formal interagency coordination plan that includes timelines, responsibilities, and escalation paths.
- **Regular Joint Meetings:** Schedule recurring meetings with agencies and utility owners to discuss upcoming projects and navigate potential conflicts.

10. COMMUNITY ENGAGEMENT

Community engagement is essential to successful design and construction. It connects directly with those affected, ensuring projects meet the needs of the community. WSP reviewed outreach materials, meetings with stakeholders, gathering public feedback, and identifying areas for improvement to strengthen future engagement.

10.1. REVIEW OF EXISTING OUTREACH DOCUMENTATION

WSP reviewed outreach materials, meeting notes, and community feedback to assess how well WSSC Water engaged with the public on the 48-inch Patuxent Raw Water Main project. Since 2011, WSSC Water held multiple meetings with residents and stakeholders, shared updates, and responded to questions and concerns. The table below documents all outreach related project meetings. The main challenges of the project were 1) temporary paving and damage caused to the community, 2) trash being left on the project site, 3) minor damage to residents' property through ongoing construction, 4) delays in project completion without satisfactory explanation and 5) lack of frequent and consistent communication to the wider community. The documentation revealed that while not all, most issues were resolved in a timely manner, and most residents were overall satisfied with the resolution. There were a few examples where community members' complaints were not resolved but per most documentation notes, those issues were outside the control of WSSC Water, the inspector, or the Contractor.

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Table 10-1 Summary of Community Outreach Meetings/Updates

Project Phase	Outreach Date	Location	Host	Representatives	Communication Summary	WSP Remarks on Project Status	Challenges/Delays encountered after the community meeting
Planning	2011/04	West Laurel Community Building	WLCA/ WSSC Water	WLCA Boards, Elected Officials, WSSC Water, Design Engineer Team	Discussed the purpose of the Patuxent raw water pipeline project, alternative alignments, and community impact.	Project at 30% Planning phase.	WSSC Water encountered budgeting issues and delayed the project design schedule.
	2011/05	West Laurel Community Building	WLCA/ WSSC Water	WSSC Water, Design Engineer Team, WLCA, Community	WSSC Water gave presentation and held community discussion on Patuxent raw water pipeline project to receive community input on the alignment.		
	2011/06	WSSC Water Headquarters	WSSC Water	WSSC Water, Design Engineer Team, WLCA, Community	The community and elected officials pushed for BGE and SHA to allow for longitudinal occupancy of their ROWs for the water main.		
	2011/07	WSSC Water Headquarters	WSSC Water	WSSC Water, Design Engineer Team, BG&E, SHA, WLCA	BGE and SHA stated they cannot allow longitudinal occupation of their ROWs for the water line. The WLCA expressed concerns regarding public safety near the school, repaving, sidewalks assess, and communications from WSSC Water regarding community impacts and schedule.		
	2011/12	WSSC Water Headquarters	WSSC Water	WSSC Water, Design Engineer Team, Elected Officials, WLCA	The pipeline's preliminary alignment was discussed.		
Design	2018/09	West Laurel Community Building	WLCA	Community, WSSC Water, WLCA	WSSC Water presented the project, stating design anticipating completed in 2018, construction to start in 2019 and to complete in Fall 2021.	Outreach meeting at 100% Design	WSSC Water coordination with Prince George's County on the Culvert rehabilitation work and MOU delayed the project started date.
Construction	2021/05	Virtual at WLCA Spring General Meeting	WLCA	Community, WSSC Water, WLCA	WSSC Water gave a presentation on community impacts to expect during construction. Anticipated start of construction was Summer/Fall 2021 and completion was Fall 2023.	NTP received, contractor started mobilized. Based on CPM schedule, project was 6 months in construction, schedule on track	Utility conflicts, Rock impact slow down progress during later stage
	2022/10	West Laurel Community Building	WLCA	Community, WSSC Water, WLCA	WLCA held a community meeting that WSSC Water personnel attended to provide project updates.	Rock encountered during construction. Contractor demobilized from 8/18/2022.	Contractor demobilized schedule impact as 81 days. Rock started significantly after the Contractor resumed work in 11/2022.
	2023/02	WLCA Spring General Meeting	WLCA	Community, WSSC Water, WLCA	WLCA held a community meeting that WSSC Water personnel attended to provide project updates.	Rock delayed construction progress	Rock issues significantly impacted installation progress. Unstable sandy condition slow pipeline installation process.

Project Phase	Outreach Date	Location	Host	Representatives	Communication Summary	WSP Remarks on Project Status	Challenges/Delays encountered after the community meeting
	2024/06	WSSC Water Headquarters; Hybrid with virtual option	WSSC Water	Community, WSSC Water	WSSC Water gave a presentation on an updated timeline for the project which discusses the rock encountered in August of 2023.	Rock and unstable sandy condition delayed construction progress Global supply chain impact on material handling	Sewer House Connection conflicts, Final tie-in fitment issues
	2024/11	Location not stated	WSSC Water	Elected Officials, WSSC Water	WSSC Water held a meeting for the elected officials to get their feedback before the upcoming community meeting.	-	-
	2024/12	West Laurel Community Building; Hybrid with virtual option	WLCA	Community, WSSC Water, WLCA	WLCA held a community meeting that WSSC Water personnel attended to provide project updates.	Permanent Patching installed in Nov 2024.	NA
	2025/03	Online, via Teams	WSSC Water	Elected officials, WLCA President, WSC Water	The Task Force discussed action plans	Task Force to prioritize and refine community requests, to conduct final paving and striping.	NA
	2025/04	Online, via Teams	WSSC Water	Community, WSSC Water, WLCA, DPIE, DPW&T, Elected Officials	The Task Force was introduced to incorporate community requests		
	2025/06	Online, via Teams	WSSC Water	Elected officials, WLCA President, WSC Water	WSSC Water provided updates on the items pertinent to the Task Force		

10.2. SUMMARY OF STAKEHOLDER ENGAGEMENT AND SURVEY

WSP interviewed four elected officials: Delegate Mary Lehman, Senator Jim Rosapepe, Council Member Tom Dernoga, and Delegate Ben Barnes. Each 45-minute session gathered their views on the 48-inch Patuxent Raw Water Main project, including feedback from constituents and suggestions for improving future planning and communication. In addition to the elected officials, WSP interviewed three community members and deployed a public comment form which was completed by 17 residents affected by the project.

Based upon feedback provided, WSP noted the project was disruptive and frustrating during construction, but many agreed the final outcome improved the area. Concerns focused on three areas:

- Community experience
- Project planning, management, and execution
- Community outreach and communication

Both officials and residents questioned the delay caused by unexpected rock, suggesting better pre-construction surveys could have helped. Notifications about delays were often late, and documentation confirmed the public wasn't informed until well after issues were known.

Additional frustration came when the contractor left the site without notice, leaving behind equipment and debris. WSSC Water said the site was left in good condition, but residents disagreed. No photos were available to confirm either claim.

Final paving was appreciated, but temporary road conditions caused vehicle damage. Some residents felt their feedback was valued, especially those involved in the Civic Association and task force. Others felt compensation was lacking, with requests for amenities like a dog park or walking path going unmet. WSP noted these requests fall outside WSSC Water's scope and recommended forming an interagency task force to explore them.

Oversight and planning didn't fully account for the nearby elementary school. Public timelines weren't met, affecting trust. Communication improved after leadership changes, with more effective meetings and outreach. However, some residents felt outreach relied too heavily on the Civic Association, leaving others out. Issues like incorrect contact information on signage and lack of notice about water shutoffs persisted.

Some residents believed the project mainly benefited future development rather than current community needs, highlighting the importance of early and inclusive engagement.

10.3. KEY FINDINGS

The project revealed several challenges and opportunities to improve how WSSC Water engages with the community.

- **Outreach lacked frequency, consistency and inclusiveness:** WSSC Water shared updates through mailers and flyers, but most outreach focused on the West Laurel Civic Association. Residents along Bond Mill Road and the nearby elementary school received limited direct communication. Meetings were often held in response to complaints rather than proactively, and delays were not shared with the public until nearly 10 months later. WSSC Water has since improved outreach through efforts like the Customer Advocates program.
- **Oversight and Contractor Issues:** While WSSC Water assigned a Contract Manager and Inspector, residents and officials noted that problems like poor road patching and leftover debris were only addressed after complaints. More consistent oversight could have prevented these issues.

- **Limited Agency Coordination:** Other agencies worked near the project site, but coordination was lacking. This caused confusion and disruption. Toward the end of the project, collaboration improved, resulting in new sidewalks, crosswalks, and signage. Early coordination like this can reduce disruptions and build community trust.

11. LESSON LEARNED

The audit of the 48-inch Patuxent Raw Water Main project identified various lessons that may be applicable to future infrastructure projects. This section provides a summary of the main challenges, gaps, areas for improvement, and recommendations for process enhancement based on prior findings.

11.1. SUMMARY OF CHALLENGS AND GAPS

PRECONSTRUCTION CHALLENGES AND GAPS

1. Long Planning and Design Phase: A prolonged design phase led to outdated baseline data and reduced continuity in stakeholder engagement.
2. Utility Coordination: Incomplete records and outdated assessments contributed to field conflicts and adjustments.
3. Geotechnical Investigations: Subsurface variability was underestimated, highlighting the need for more robust and adaptive site analysis.
4. Rigid Lay Schedule with owner furnished materials: Limited flexibility in lay schedules and material procurement impacted responsiveness to field conditions.
5. Community Considerations: Design did not fully accommodate school-hour work restrictions or phased paving, which were raised during planning.
6. Permitting: Multi-agency coordination required extensive effort; integrating permitting timelines and traffic control requirements earlier could improve efficiency.

CONSTRUCTION CHALLENGES AND GAPS

1. Preconstruction Communication: Some key requirements (e.g., temporary pavement duration, QA/QC plans) were not emphasized early on.
2. Utility Conflicts: Unmarked or inaccurately mapped utilities led to service disruptions and reactive field verification.
3. Material Handling: Bulk deliveries posed logistical challenges; improved staging plans could enhance productivity.
4. Documentation & QA/QC: Inspection reports and compaction testing lacked consistency and completeness. Strengthening QA/QC protocols and documentation practices is recommended.
5. Health & Safety: Activity hazard analyses and traffic control oversight can be improved to better support site safety.
6. Change Management: Delayed RFI responses and unresolved change orders affected timelines and cost control. Establishing a Change Control Board and clearer escalation paths may help.
7. Schedule Management: Delays due to rock conditions, weather, and coordination gaps highlight the need for more collaborative scheduling and contingency planning. Contractor left site without formal approval, and schedules were not thoroughly reviewed.

8. Delayed RFI Responses & Change Management: Slow RFI turnaround and unresolved changes were observed, and most lacked independent cost estimates, specification requirements were not enforced.
9. Quality Control & Assurance Gaps:
    - Compaction Testing Issues: Missing technician approvals, late reports, incomplete depth testing, and non-compliant lift thicknesses.
    - QA Documentation Failures: Reports lacked location accuracy, test depth, corrective actions, and photographic evidence.
    - Pavement Compliance Gaps: Unapproved cold mix use, delayed temporary patch replacement, missing tack coat data, and absent asphalt delivery records.
10. Customer Notification Issues: Inconsistent Outreach was identified. Complaints and notifications were not systematically tracked, and some residents were not informed during emergency shutdown.
11. Risk Management: No documents indicating proactive risk management in the project. Everything was managed reactively.

COMMUNITY ENGAGEMENT CHALLENGES, GAPS AND IMPROVEMENT

1. Outreach lacked frequency, consistency and inclusiveness.
2. Reactive rather than proactive engagement.
3. Positive outcomes from late-stage coordination: At the project's conclusion, enhanced collaboration with the community and local agencies resulted in improvements such as new sidewalks, pavement markings, signage, and raised pedestrian crosswalks, which helped restore community trust and support.

11.2. RECOMMENDATIONS FOR PROCESS IMPROVEMENT

Comprehensive Risk Identification & Management: A more proactive risk management approach should be standard, especially for large and complex projects, which capital-intensive, multi-disciplinary infrastructure initiatives that involve significant planning, design, permitting, and construction efforts. On the Project, many risks (utility conflicts, extended patch duration, rock excavation difficulty, deep trenching with unsaturated sand conditions, rigid lay schedule) were handled reactively. Going forward, it is recommended WSSC Water to implement a formal risk register for large and complex projects because it centralizes risk information, categorize risk's inevitability, and mitigation approaches, and enables proactive mitigation to prevent cost overruns and delays. To implement effectively, WSSC Water should establish clear governance and ownership, develop a standardized template with key fields (risk ID, category, likelihood, impact, mitigation plan, owner, status, as shared in Table 6-6 and 6-7 in this report), integrate the register into project management processes, apply a risk scoring framework, and leverage technology for accessibility and visualization. Regular monitoring through scheduled reviews, leadership dashboards, and staff training will foster a risk-aware culture and ensure continuous improvement.

Comprehensive Pre-Construction Investigations: The project emphasized the necessity of conducting thorough site investigations prior to finalizing design decisions. SUE activities should be elevated to at least Quality Level B or A in critical zones to minimize unexpected utility discoveries during construction.

Additionally, detailed geotechnical investigations should be performed and any associated risks must be clearly communicated within the contract documents. Note that it may be necessary to perform subsequent investigations if the alignment changes as the design progresses as was the case for this project.

Enhancing Stakeholder Coordination for Construction Efficiency: WSSC Water should strengthen stakeholder coordination by engaging roadway authorities and key stakeholders early, aligning construction schedules with community calendars such as school activities, and requesting flexible work-hour provisions during initial permit applications. Additionally, commitments and requirements agreed upon with stakeholders should be documented in the construction contract and enforced during execution to ensure compliance. Formalizing stakeholder notification protocols and implementing centralized tracking for permits and renewals will further prevent delays, improve communication, and support smoother project delivery.

Enhance Change Management with Schedule and Cost Integration: The Project highlighted the importance of maintaining both flexibility and oversight in change management processes. WSSC Water should improve how changes are documented, approved and communicated. Change Management should be agile to be quickly responded to the field changes, also change review meetings with the project team so that potential changes (i.e., RFIs, differing site conditions) are addressed in a timely, transparent way.

Integrating Change Management with Schedule and Cost: The project emphasized
Integrate Schedule and Contract Requirements for Better Control: Project controls and design teams at WSSC Water should align baseline schedules with specifications and community needs. Schedule updates must be formally reviewed and approved, enabling proactive risk identification and adjustment of field activities. Document all correspondence to ensure consistent risk management across similar projects.

Improve Documentation and Process Management: WSSC Water's project team should improve the documentation, reporting and process management in the following areas:

- **Implement a formal RFI closure checklist** to verify all RFIs are marked as resolved when complete.
- **Standardize the submittal and review process:** Confirm that all preconstruction documents are submitted and reviewed prior to mobilization, and recorded within the official submittal log and workflow.
- **Standardize Daily Inspection Reports** for consistent documentation of repairs, materials, and testing.
- **Verify material deliveries and QC tests** are clearly documented by inspectors.
- **Material Traceability & Traffic Control:** Record materials used with daily documentation and maintain records of traffic control practices, including oversight visits.
- **Safety Oversight:** Update safety incident records and daily trench shoring reports with photographs and detailed notes.
- **Incident Management:** Document both temporary and permanent repairs, post-repair bacterial testing, and confirm all incidents have formal reports with tracked resolution timelines.
- **Neighbor Impact Tracking**: Log communications and resolutions with residents, confirm satisfaction, and verify completed repairs.

Strengthening QA/QC: The Project experience showed some QA/QC process gaps that can be improved.

- **Contractor Quality Control Plans:** Require contractors to submit a comprehensive QC plan at project outset, detailing how they will meet specs for each major work item.
- **Strengthen correction process:** Enforce follow-up corrective procedures in response to inspection findings regarding non-compliance issues on compacting, pavement, testing or erosion and sediment control.
- **Regular QA/QC Meetings:** Instituting weekly or biweekly QA/QC meetings between WSSC Water inspectors and the Contractor can facilitate early identification of quality issues.
- **Enforcement of Standards:** WSSC Water's contract managers and field inspectors should be empowered – and expected – to halt work when critical standards aren't met.
- **Submittal and Testing Tracking:** Another improvement is maintaining a registry of required submittals and test reports with status and deadlines.

Inter-Departmental Coordination: Internally, it is recommended to implement formal communication protocols and regular milestone meetings between design, construction, and utility divisions. A centralized project management system should enable real-time sharing of updates and site conditions. Rapid-response teams from each department should address unforeseen issues promptly.

External Agency Coordination: Externally, WSSC Water should implement consistent communication and coordination practices with partner agencies such as DPWT and DPIE to ensure projects are aligned and minimize disruption to the community. Coordination should include discussions on scheduling, timelines and joint community engagement efforts. This approach promotes transparency, maximizes community benefit and helps prevent resident fatigue from overlapping meetings or competing priorities.

Establish Regular Communication Protocols with Elected Officials: WSSC Water should implement protocols for regular communication with elected officials for major projects, including kickoff meetings to present project overviews, followed by major milestone meetings to keep officials informed and prepared to update constituents. Additionally, special meetings should be held before presenting to community meetings to allow for feedback, ensuring alignment with community priorities. For minor projects, teams should share summary overviews and provide milestones updates to elected officials' office.

Increase the Frequency of Community Engagement: WSSC Water should prioritize early and consistent communication with the community and key stakeholders throughout the project lifecycle. Proactive outreach and regular updates will improve transparency, elevate the community experience and ensure meaningful input is incorporated. Community meetings should be held at all major milestones included but not limited to alternative analysis and selection of the final alternative during the planning phase, 30, 60, and 100% design milestones, as well as the beginning of construction. During construction, the Project Team should engage with residents through corridor pop-ups and informal check-ins to proactively address concerns. If significant changes occur, such as delays, a dedicated meeting should be scheduled to keep the community informed.

Enhance Proactive and Broad Community Engagement Practices: WSSC Water should maintain a proactive approach to community engagement by consistently initiating dialogue with residents and stakeholders throughout the project lifecycle. This includes timely communication of major project changes, such as delays. This will provide transparency for the community as well as build trust. Engagement efforts should consistently extend beyond civic associations to include the broader community, ensuring all voices are invited

to provide feedback and input. The broader engagement efforts should be combined with ongoing active engagement with the Civic Association.

Continue the Use of Project Task Force: For major initiatives like the 48-inch Patuxent Raw Water Main Project, WSSC Water should form and actively engage a dedicated project task force. This group would provide a structured platform for interested community members to offer feedback and stay informed throughout the project. The task force can also serve as a forum to review and refine engagement materials, ensuring they reflect the community's priorities and concerns. Additionally, it can help facilitate inclusive outreach by ensuring participation from all impacted groups—including community centers, hospitals and care facilities, schools, neighborhoods, and local businesses.

12. CONCLUSION

The independent evaluation and audit of the WSSC Water 48-inch Patuxent Raw Water Main Project revealed that while the initiative is essential for long-term water supply resiliency, its delivery was challenged by a combination of outdated baseline data, unforeseen subsurface conditions, utility conflicts, rigid lay schedule sequencing, and gaps in quality assurance and community engagement. The project's extended timeline and cost overruns were primarily driven by hard rock excavation, utility strikes, and reactive rather than proactive management of risks and schedule, also impacted by the Contractor being allowed to leave the site for an extended period. These issues, resulting in extended disruptions and stakeholder dissatisfaction during key phases of the project.

Despite these challenges, the project's completion reflects WSSC Water's commitment to addressing community concerns and delivering essential water infrastructure, such as taking corrective measures to restore public trust, such as building a task force to engage the community during the final project close-out and strengthening the oversight to the Contractor on pavement and compaction. However, the audit findings underscore the need for systemic improvements in risk management, pre-construction investigations, stakeholder coordination, and quality assurance processes to prevent similar issues in future capital projects.

Moving forward, WSSC Water should strengthen project delivery through four integrated strategies:

- Formal Risk Management with centralized registers, scoring, and continuous monitoring;
- Structured Change Control with timely RFI responses, impact assessments, and full documentation;
- Standardized QA/QC Processes with centralized tracking, detailed inspections, and empowered enforcement;
- Enhanced Communication & Engagement through formal protocols, real-time project management, milestone meetings, and proactive outreach.

By implementing these recommendations, WSSC Water can transform lessons learned from this project into actionable improvements that drive efficiency, accountability, and stakeholder confidence. These measures will not only mitigate risks and enhance quality but also position WSSC Water as a proactive leader in delivering complex infrastructure projects that meet community expectations and regulatory standards.

APPENDICES