Town of Damascus Sewer Improvements

Preliminary Engineering Report

Washington County Service Authority

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Mattern & Craig

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Town of Damascus Sewer Improvements
Preliminary Engineering Report

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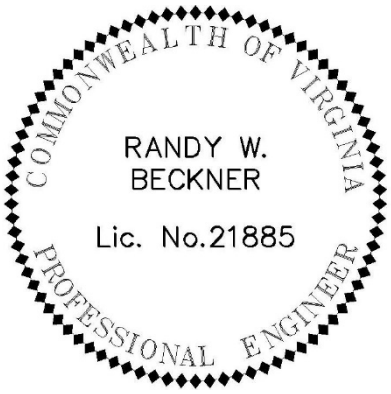

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EXECUTIVE SUMMARY

Mattern & Craig has prepared this Preliminary Engineering Report (PER) on behalf of the Washington County Service Authority (WCSA) to assess the technical and economic feasibility of extending public sewer infrastructure to a ±23-acre parcel owned by the Town of Damascus. This evaluation encompasses the identification of system enhancements necessary to support future service delivery to the site, with consideration given to regulatory compliance, operational efficiency, and long-term sustainability.

Field survey and preliminary design efforts were conducted to verify the constructability of the sewer alignment alternatives. These efforts included field survey, development of preliminary profiles, preparation of quantity and cost estimates, and completion of a 50-year present-worth analysis to evaluate both construction costs and long-term financial performance. The analysis concluded that Alternative 1B-3 - S.R. 91 Combination Gravity Sewer and Force Main provides the most favorable balance of topographic feasibility, construction cost, and long-term service potential.

Although this alternative includes a lift station and therefore carries ongoing operations and maintenance requirements, it can be constructed primarily within existing right-of-way, minimizing new disturbance and simplifying permitting. The alignment also provides the flexibility to accommodate the 30,000-GPD planning-level capacity scenario, ensuring the system can support a range of potential future uses at the Project Ground Zero site. Additionally, this corridor offers the greatest opportunity to extend service to currently unserved properties along S.R. 91, enhancing long-term system expansion and community benefit

It is recommended that the WCSA:

- Proceed with the development of Alternative 1B-3 - S.R. 91 Combination Gravity Sewer and Force Main.
- Authorize Mattern & Craig to assist with funding applications for the improvements.

I. PROJECT PLANNING

A. Location

The proposed sewer system improvements are planned to initiate at an existing sanitary sewer manhole situated near the intersection of State Route 91 and U.S. Route 58, just east of the Town of Damascus. From this starting point, the studied alignments extend eastward, extending service to the ±23-acre parcel owned by the Town, which serves as the primary target for future development and utility extension.

B. Environmental Resources Present

In Virginia, the construction of a new sanitary sewer system typically necessitates completion of a Categorical Exclusion (CE) or Environmental Report (ER) when utilizing federal or state funding sources such as USDA Rural Development, the Virginia Clean Water Revolving Loan Fund (VCWRLF), or Community Development Block Grants (CDBG).

The alternatives evaluated in this report involve varying levels of property acquisition, which may introduce new ground disturbance and thereby influence CE eligibility. While property acquisition alone does not inherently disqualify a project from receiving a CE, eligibility is contingent upon the extent of environmental impacts as a result of the new ground disturbance. The following section provides agency-specific guidance regarding CE eligibility.

USDA Rural Development

- Projects may qualify for a CE if they fall under §1970.54 – Small-scale development and do not trigger extraordinary circumstances listed in §1970.52.
- Applicants must submit an ER documenting:
  - No significant impact to historic properties, endangered species, wetlands, floodplains, or other sensitive resources.
  - That the project is consistent with CE criteria and does not require an Environmental Assessment (EA) or Environmental Impact Statement (EIS).
- New ground disturbance of previously undisturbed land may disqualify a CE if it introduces potential environmental impacts.
- RD Instructions 1970-B Exhibit C and D provides guidance and checklists to help applicants evaluate CE eligibility.

Virginia DEQ (VCWRLF)

- CE eligibility is determined using project-specific checklist that evaluates environmental impacts.

- Projects involving repair, rehabilitation, or replacement withing existing utility corridors are more likely to qualify
- New construction or expansion, especially involving undisturbed land, may require EA. Applicants must demonstrate:
    - No adverse effects to water quality, wetlands, endangered species, or cultural resources.
    - That the project complies with NEPA and state environmental review requirements.

Virginia DHCD (CDBG)

- CE eligibility is governed by HUD NEPA regulations and VDHCD's CDBG Program Design Manual.
- Projects may qualify for a CE if:
    - They involve minor rehabilitation, infrastructure upgrades, or incidental acquisition.
    - They do not affect historic properties, introduce new ground disturbance, or require new infrastructure.
- New property acquisition that leads to construction or expansion may trigger higher-level review (EA or EIS).
- Applicants must complete an environmental review record (ERR) dan demonstrate compliance with HUD's environmental checklist.

Threatened and Endangered Species (TES) reviews are mandated by the United States Army Corps of Engineers (USACE) under Clean Water Act permitting (if applicable), the U.S. Fish and Wildlife Service (USFWS), and the Virginia Department of Conservation and Recreation (DCR). As part of the regulatory compliance process, a query was submitted to USFWS through the Information for Planning and Consultation (IPaC) database to identify the presence of any known or potential occurrences of rare plant and animal species within the project area.

Based on the IPaC findings, several federally listed species with potential to inhabit or occur along the project alignment were identified. These include the following species:

Gray Bat (*Myotis grisescens*) - Endangered
Indiana Bat (*Myotis sodalist*) – Endangered
Nothern Long-eared Bat (*Myotis septentrionalis*) – Endagered
Virginia Big-eared Bat (*Corynorhinus townsendii virginianus*) – Endangered
Eastern Hellbender (*Cryptobranchus alleganiensis alleganiensis*) – Proposed Endangered
Monarch Butterfly (*Danaus plexippus*) – Proposed Threatened
Rock Gnome Lichen (*Gymnoderma lineare*) - Endangered

Additionally, Birds of Conservation Concern identified by the USFWS as potentially occurring within the project corridor include Black-capped Chickadee (*Poecile atricapillus practicus*), Cerulean Warbler (Setophaga cerulea), Chimney Swift (*Chaetura pelagica*), Eastern Whip-poor-will (*Antrostomus vociferus*), Northern Saw-whet Owl (*Aegolius acadicus*), and Wood Thrush (*Hylocichla mustelina*).

As part of the proposed sanitary sewer extension, the selected alignment is anticipated to intersect Laurel Creek at one or more locations, contingent upon the final alternative chosen. Such stream crossings will necessitate a Virginia Water Protection (VWP) Permit, administered by the Virginia Department of Environmental Quality (DEQ), and may also trigger additional regulatory oversight under Section 404 of the Clean Water Act, requiring coordination with the U.S. Army Corps of Engineers (ACOE).

Construction activities associated with sewer installation will likely involve selective clearing and tree removal to accommodate trenching and utility placement. Upon completion of construction, all disturbed areas will be subject to restoration efforts aimed at replicating pre-existing site conditions to the greatest extent practicable, thereby minimizing ecological disruption and preserving habitat continuity. Due to the confined nature of the construction corridor, adjacent undeveloped and forested lands will remain undisturbed, continuing to support local wildlife populations and maintain the ecological integrity of the surrounding area.

C. Population Trends

According to data published by the U.S. Census Bureau, both Washington County and the Town of Damascus experienced modest population declines over the decade spanning 2010 to 2020. Washington County saw a reduction of approximately 1.7%, while the Town of Damascus recorded a more pronounced decrease of roughly 3.2%. These demographic trends may have implications for long-term infrastructure planning, economic development strategies, and service delivery considerations. A summary of the referenced population data is provided in the table below:

Location	Year	Population
Washington County	2010	54,876
Town of Damascus	2010	814
Washington County	2020	53,876
Town of Damascus	2020	788

To support strategic planning across the Commonwealth, the Weldon Cooper Center for Public Service develops long-range population projections using established demographic modeling techniques. These projections inform urban planning, emergency response resource allocation, and the prioritization of public and private investments. According to

the Weldon Cooper Center, Washington County's population is expected to continue declining through 2040, with a slight rebound projected by 2050. The table below summarizes the Weldon Cooper Center projections:

Year	Population
2030	52,020
2040	50,753
2050	51,859

In contrast, the availability of long-term population projections for the Town of Damascus remains limited. While Virginia Demographics by CUBIT offers short-term projections through 2025, few resources provide reliable data beyond this timeframe. CUBIT's platform aggregates key demographic indicators including population, income, and housing statistics, derived from the latest U.S. Census Bureau datasets. It serves as a valuable tool for planners, analysts, and decision-makers by offering granular insights across counties, municipalities, and zip codes.

CUBIT's projection model assumes a modest annual population decline of approximately -0.1%, based on observed trends between 2023 and 2024. Given this trajectory, it is unlikely that either Washington County or the Town of Damascus will experience significant population growth during the design period of the proposed infrastructure improvements.

D. Community Engagement

The WCSA does not publish a formal community engagement policy, but its practices reflect a commitment to transparency and public involvement. Project updates are routinely shared via the WCSA website, providing residents with insight into infrastructure planning and funding. While formal engagement mechanisms like advisory boards or public forums are not explicitly outlined, WCSA facilitates informal feedback through direct customer service channels and adheres to Virginia's Freedom of Information Act (FOIA), allowing public access to records related to water and sewer services. These practices support community awareness and provide avenues for stakeholder input.

II. EXISTING FACILITIES

A. Location Map

The sewer system identified for improvement is situated near the intersection of State Route 91 and U.S. Route 58, just east of the Town of Damascus. Figure 1 illustrates the current sewer collection network as well as the designated project area associated with the Town of Damascus Sewer Improvements project.

B. History

The Washington County Service Authority (WCSA) was formally established in 1976 through the strategic consolidation of three regional entities: the Goodson Kinderhook Water Authority, the Washington County Sanitation District, and the Manhaim Water Company. This unification marked a pivotal step in streamlining water and wastewater services across the county. However, the Authority's operational lineage extends much further, originating with the formation of the Abingdon Water Authority in 1910. Substantial infrastructure expansion occurred during the 1930s under the federal Works Progress Administration (WPA), which facilitated the installation of critical water distribution systems that remain foundational to current operations.

Today, WCSA stands as the third-largest water and sewer utility in Southwest Virginia, providing essential wastewater services to over 2,000 connections throughout Washington County and adjacent jurisdictions. The Authority's wastewater infrastructure comprises approximately 100 miles of gravity and force main collection lines, 29 lift stations, and two fully operational wastewater treatment facilities. This system reflects WCSA's continued commitment to reliable service delivery, regulatory compliance, and long-term infrastructure stewardship.

C. Condition of Existing Facilities

A formal condition assessment report for the WCSA sewer collection system is not publicly available at this time. However, WCSA employs standard industry methodologies to evaluate system performance and guide infrastructure management. These include routine flow monitoring and infiltration/inflow (I/I) analysis to quantify extraneous flow contributions, identify structural deficiencies, and prioritize rehabilitation efforts. Additionally, WCSA operates in compliance with the Virginia Sewage Collection and Treatment Regulations (9VAC25-790), which prescribe reliability classifications, construction documentation standards, and maintenance protocols for publicly owned sewer systems. These practices collectively support ongoing system evaluation and asset stewardship in the absence of a published condition assessment.

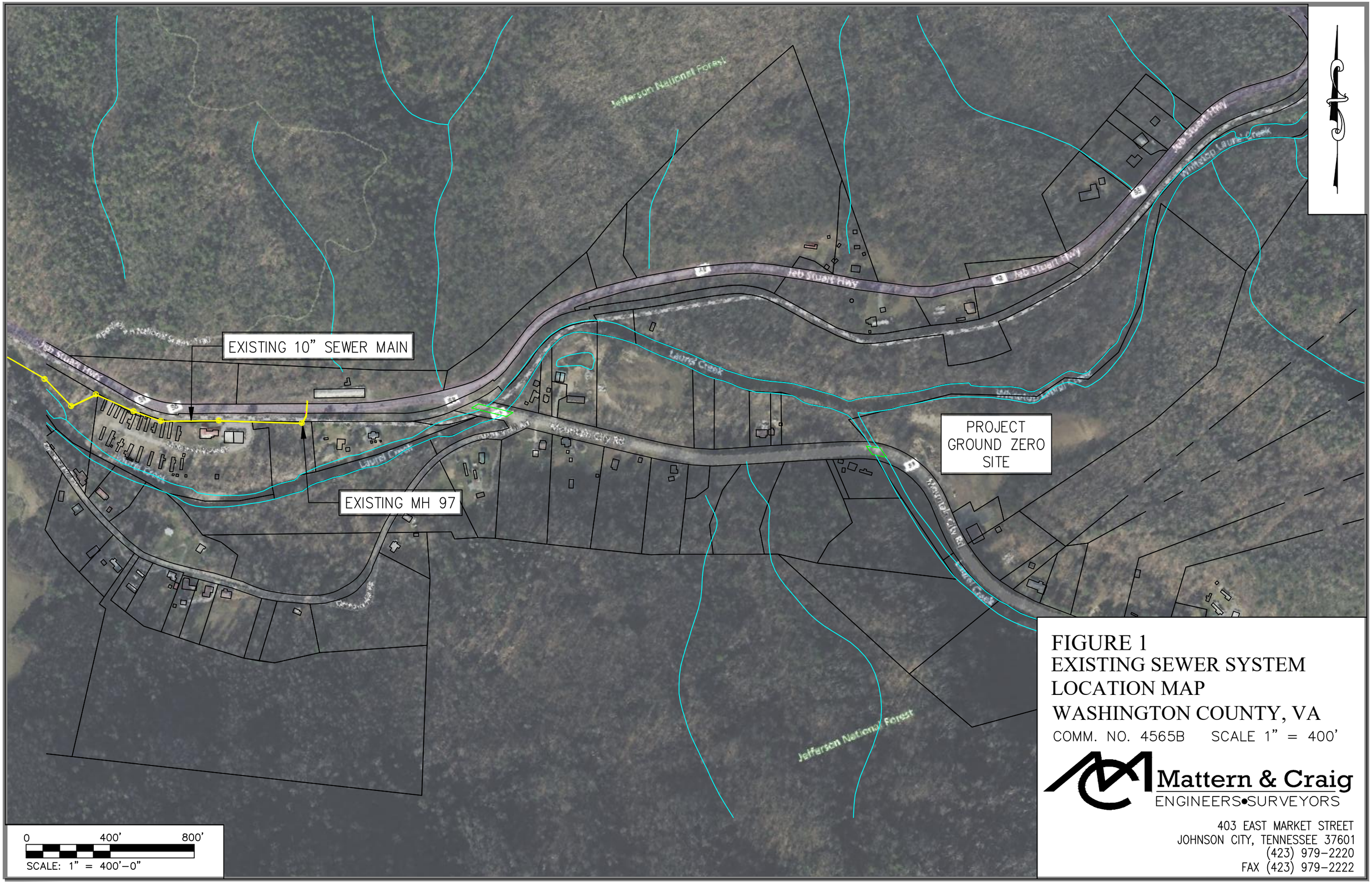

FIGURE 1
EXISTING SEWER SYSTEM
LOCATION MAP
WASHINGTON COUNTY, VA

COMM. NO. 4565B SCALE 1" = 400'

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D. Financial Status of the Existing Facilities

Not applicable to this report at this time.

E. Water/Energy/Waste Audits

Not applicable to this report at this time.

III. NEED FOR PROJECT

A. Health, Sanitation, & Security

Not applicable to this report at this time.

B. Aging Infrastructure

Not applicable to this report at this time.

C. Reasonable Growth

Washington County is preparing to submit an application to the GO Virginia Region 1 Helene Business Recovery Initiative (HBRI) program to fund a comprehensive market and feasibility study for Project Ground Zero, a 23-acre site located within Washington County and owned by the Town of Damascus. The study will evaluate the site's suitability for targeted development, with the objective of identifying economically viable land uses and implementation strategies that support long-term recovery and regional economic stabilization following Hurricane Helene.

On September 27, 2024, Hurricane Helene traversed Southwest Virginia, causing widespread damage to commercial corridors, transportation infrastructure, and outdoor recreation assets. The Virginia Creeper Trail, a critical driver of seasonal tourism revenue for the Towns of Abingdon and Damascus and the Whitetop area of Grayson County, sustained substantial damage. The loss of trail access, coupled with the destruction of lodging infrastructure—including campgrounds and short-term rentals—has significantly disrupted the outdoor recreation economy and diminished tourism-based revenue streams.

Development of Project Ground Zero is anticipated to address these impacts by facilitating job creation, restoring tourism activity, and generating new revenue opportunities for the Town of Damascus and surrounding jurisdictions. The proposed improvements represent a strategic response to documented economic disruption and align with regional recovery objectives and long-term growth planning.

IV. ALTERNATIVES CONSIDERED

The primary objective of this PER is to identify and evaluate technically and economically feasible alternatives for extending public sewer infrastructure to the Project Ground Zero site. Due to the indeterminate nature of the site's future land use and final buildout configuration, the analysis incorporates a tiered design approach to projected wastewater flows. Three (3) planning-level capacity scenarios were assessed: 5,000 gallons per day (GPD), 10,000 GPD, and 30,000 GPD. This tiered evaluation framework supports adaptable infrastructure sizing and facilitates informed decision-making consistent with long-term serviceability, regulatory compliance, and regional growth planning objectives.

Based on the spatial relationship between existing sewer infrastructure and the Project Ground Zero site, three (3) primary sewer alignment corridors were identified for evaluation. A detailed review of topographic conditions along each corridor revealed that site gradients and elevation profiles present varying constraints and opportunities for conveyance design. Depending on the selected alignment, sanitary sewer service may be achieved through gravity flow, pressure conveyance via force main, or a hybrid configuration incorporating both. Accordingly, this PER evaluates the following four (4) sanitary sewer alternatives to support future development of the Project Ground Zero site:

1. S.R. 91
    A. Force Main
    B. Combination Gravity Sewer and Force Main
2. U.S. 58 Gravity Sewer
3. Creeper Trail Gravity Sewer

Each of the sewer alignment alternatives presented herein is designed to terminate at a newly constructed sanitary sewer manhole located at the existing 10-inch sewer crossing of U.S. Route 58, adjacent to Parcel Number 378. From this point, flow will be conveyed downstream to the existing sanitary sewer manhole designated as MH 97. Figure 2 illustrates the geographic layout of the sewer alignment alternatives analyzed herein, providing a visual reference for the comparative evaluation discussed throughout this report.

ALTERNATIVE 2
U.S. 58 GRAVITY SEWER

ALTERNATIVE 3
CREEPER TRAIL GRAVITY SEWER

EXISTING MH 97

ALTERNATIVE 1
1A. S.R. 91 FORCE MAIN
1B. S.R. 91 COMBINATION

PROJECT
GROUND ZERO
SITE

Jeb Stuart Hwy

Mountain City Rd

Laurel Creek

Whitetop Laurel Creek

Overbird Mill Rd

0 250' 500'
SCALE: 1" = 250'-0"

FIGURE 2
ALTERNATIVE LOCATION
LOCATION MAP
WASHINGTON COUNTY, VA

COMM. NO. 4565B SCALE 1" = 250'

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A. Description

Alternative 1A: S.R. 91 Force Main

The proposed sewer solution follows Alignment Alternative 1, extending from the planned Project Ground Zero site along State Route 91 to the existing sanitary sewer infrastructure located on U.S. Route 58.

This alternative includes the construction of a new sewer lift station at the Project Ground Zero site, designed to convey wastewater via ±2,950 linear feet of force main. The force main alignment has been preliminarily routed within the S.R. 91 and U.S. 58 right-of-way to minimize easement acquisition and construction impacts. Notably, this alignment will require two (2) subsurface crossings of Laurel Creek, which will necessitate additional permitting and construction considerations to mitigate environmental impacts and ensure hydraulic integrity. It should noted that, due to anticipated force main diameters, the pumps required under this alternative will need to be grinder type pumps.

As previously discussed, three (3) distinct capacity scenarios were evaluated to inform the design of the proposed force main. These scenarios reflect varying levels of service demand due to the unknown nature of the future construction. The table below summarizes the designed pump capacities and associated force main diameters required to accommodate each service tier:

Project Alternative	Projected Flow from Site (GPD)	Pump Rate (GPM)	Force Main Diameter (in)
1A-1	5,000	14	1.5
1A-2	10,000	28	2
1A-3	30,000	84	3

Alternative 1B: S.R. 91 Combination Gravity Sewer and Force Main

This alternative also utilizes Alignment Alternative 1, which is primarily routed within the existing rights-of-way of State Route 91 and U.S. Route 58. The alignment includes two (2) subsurface crossings of Laurel Creek, which will require appropriate permitting and construction methods to minimize environmental impacts and maintain hydraulic performance.

In contrast to the previously described alternative, this configuration proposes to collect sanitary flows at the Project Ground Zero site and convey them via approximately ±1,850 linear feet of 8-inch gravity sewer to a proposed lift station located on the upstream side of the bridge crossing at the intersection of S.R. 91 and U.S. 58. The use of gravity conveyance

along this segment not only reduces reliance on pumped infrastructure but also enables future sewer service to approximately 19 currently unserved parcels along the alignment corridor.

Based on contributing sewage flow estimates provided in 9VAC25-790-460 Table 3 and household/population data from the U.S. Census Bureau, each potential residential connection is projected to contribute an average of 300 gallons per day to the system. These additional flows have been incorporated into the design basis for the proposed lift station and downstream force main. It should noted that, due to anticipated force main diameters, the pumps required under this alternative will need to be grinder type pumps.

From the lift station, wastewater will be conveyed via approximately ±1,100 linear feet of force main to the existing sanitary sewer infrastructure along U.S. Route 58. As with the previous alternative, a tiered service analysis was conducted to evaluate varying capacities at the Project Ground Zero site, inclusive of the projected residential contributions. The table below summarizes the corresponding pump capacities and force main diameters required to accommodate each service tier.

Project Alternative	Projected Flow from Site (GPD)	Projected Residential Flow (GPD)	Pump Rate (GPM)	Force Main Diameter (in)
1B-1	5,000	5,700	30	2
1B-2	10,000	5,700	44	2
1B-3	30,000	5,700	100	3

Alternative 2: U.S. 58 Gravity Sewer

This sewer alternative follows Alignment Alternative 2, entering the Project Ground Zero site from U.S. Route 58. The alignment is primarily situated within the existing U.S. 58 right-of-way. However, the easternmost segment of the alignment traverses Parcel Numbers 3169 and 3170 prior to crossing Whitetop Laurel Creek, necessitating minor property acquisition to secure the required easements.

A single subsurface crossing of Whitetop Laurel Creek is proposed along this alignment. This crossing will require additional environmental permitting and specialized construction methods to mitigate ecological impacts and ensure long-term structural integrity.

The proposed alignment will convey sanitary flow from the Project Ground Zero site via ±4,000 linear feet of 8-inch gravity sewer. As discussed in the previous design alternative, the use of gravity conveyance along this corridor presents an opportunity to extend sewer service to approximately 11 currently unserved parcels. These potential connections have been incorporated into the projected flow scenarios used to evaluate system capacity.

In accordance with the Virginia Sewage Collection and Treatment Regulations (9VAC25-790-320), public gravity sewer mains must be a minimum of 8 inches in diameter. Based on the three (3) service tiers evaluated for the Project Ground Zero site, each reflecting varying levels of development, an 8-inch gravity sewer is sufficient to accommodate all anticipated flows, including contributions from the additional service connections.

Alternative 3: Creeper Trail Gravity Sewer

This sewer alternative follows Alignment Alternative 3 and mirrors the general approach of the previously evaluated option. Situated within the U.S. Route 58 right-of-way on its western extents, the alignment proceeds eastward, traversing Parcel Number 1261 and the Virginia Creeper Trail. Beyond this point, the alignment continues along the northern boundary of Parcel Number 3170 before reaching and crossing Whitetop Laurel Creek.

As with the prior alternative, this alignment includes a single subsurface crossing of Whitetop Laurel Creek. This crossing will necessitate additional environmental permitting and the implementation of specialized construction techniques to minimize ecological disturbance and ensure the long-term durability of the infrastructure.

The proposed alignment is designed to convey sanitary flow from the Project Ground Zero site through ±3,850 linear feet of 8-inch gravity sewer. While the corridor offers potential for future sewer service expansion, this particular alignment intersects only two (2) currently unserved parcels, limiting immediate service extension opportunities.

B. Design Criteria

Design standards for public sanitary sewer and force main infrastructure in Virginia are established by the Sewage Collection and Treatment Regulations (9VAC25-790) and further defined by local jurisdictional requirements. For this project, the applicable local standards are those of the Washington County Service Authority (WCSA). Key design criteria include:

General Requirements

- **System Containment:** All facilities must be designed to fully accommodate projected sewage flows within the defined service area
- **Separate Conveyance:** Combined sewer systems are prohibited; sanitary and stormwater flows must be conveyed independently

Gravity Sewer Design

- **Minimum Velocity:** 2.0 feet per second (fps) under full-flow conditions.

- **Minimum Pipe Diameter:** 8 inches for public mains; 6 inches may be permitted for short laterals serving six or fewer connections.
- **Minimum Slope:** Determined by pipe diameter (e.g., 0.40% for 8-inch pipe), in accordance with 9VAC25-790-460.
- **Manhole Spacing:** Maximum spacing of 400 feet; manholes are required at all changes in alignment, grade, or diameter.
- **Drop Connections:** Drop structures are required where invert differences exceed 24 inches.
- **Testing Protocols:** Air testing shall be conducted in accordance with ASTM standards.

Force Main Design

- **Velocity Criteria:**
  - **Minimum:** 2.0 fps to prevent solids deposition.
  - **Maximum:** 8.0 fps to mitigate surge effects.
- **Minimum Diameter:** 4 inches, except where serving grinder pump systems or low-flow applications.
- **Air/Vacuum Relief:** Valves must be installed at high points to prevent air locking.
- **Discharge Configuration:** Force mains must discharge into a manhole or approved structure equipped with energy dissipation features.
- **Material Specifications:** Acceptable materials include Ductile Iron Pipe (DIP) and High-Density Polyethylene (HDPE), with restrained joints and corrosion-resistant coatings as required.
- **Testing Protocols:** Hydrostatic testing shall be performed at 150% of design pressure for a minimum duration of two hours.

Additional Considerations

- **Utility Easements:** Typically range from 20 to 30 feet in width, subject to depth and local requirements.
- **Water Line Separation:** A minimum horizontal separation of 10 feet and vertical clearance of 18 inches must be maintained between sanitary sewers and potable water lines.
- **Pump Station Design:** Facilities must incorporate redundancy, alarm systems, and provisions for emergency storage or backup power.

C. Map

Figure 3 illustrates the existing sanitary sewer infrastructure along with the proposed improvements associated with proposed Alternative Alignments.

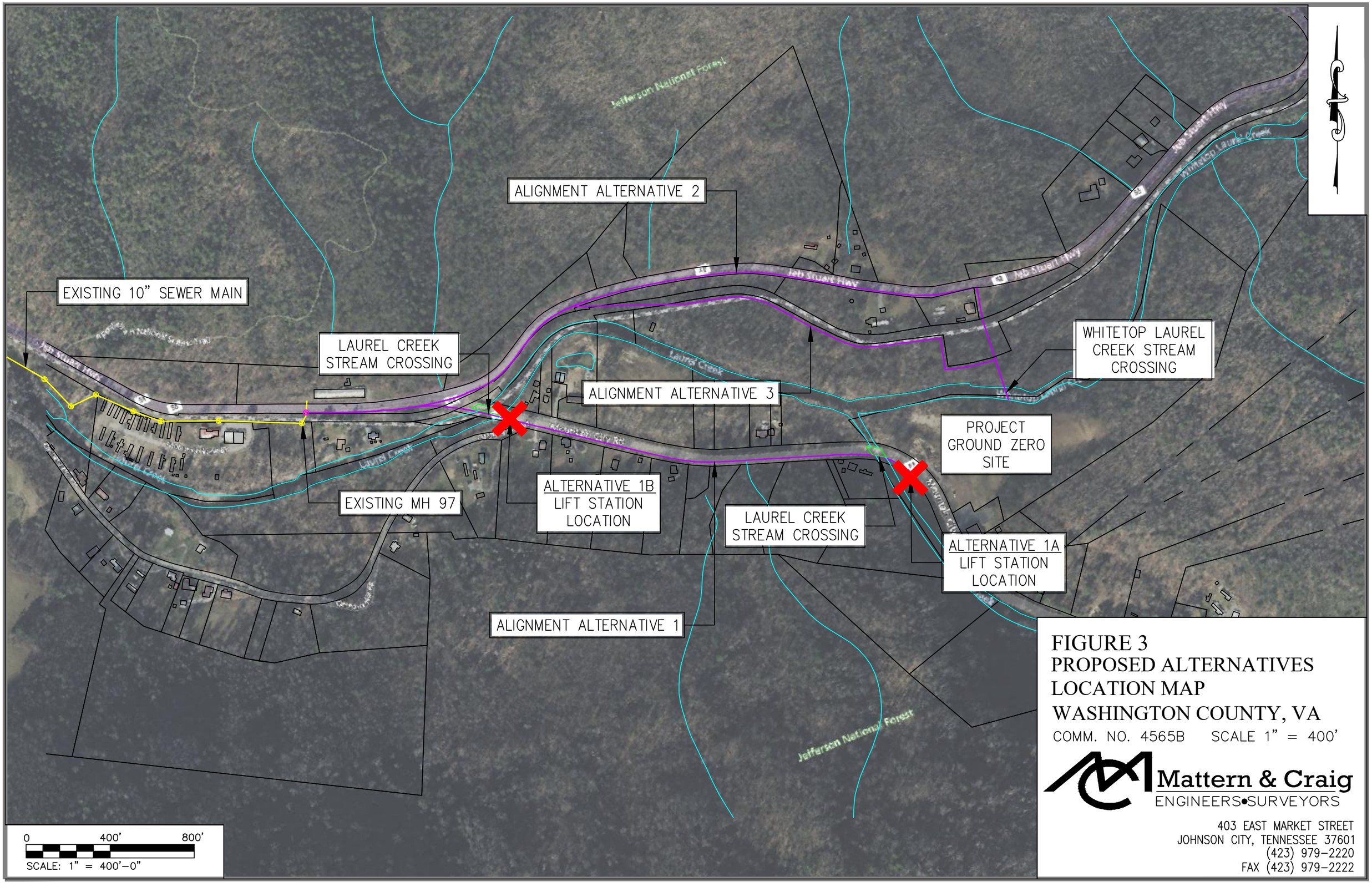

FIGURE 3
PROPOSED ALTERNATIVES
LOCATION MAP
WASHINGTON COUNTY, VA

COMM. NO. 4565B SCALE 1" = 400'

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D. Environmental Impacts

No long-term adverse environmental impacts to floodplains, wetlands, significant land resources, endangered species, historical properties, or archaeological sites are anticipated for this project. All impacts will be temporary and will be mitigated by implementing Best Management Practices (BMPs) in accordance with the latest edition of the Virginia Erosion and Sediment Control Handbook and Virginia Erosion and Sediment Control Regulations.

E. Land Requirements

Alignment Alternative 1 is located primarily within the S.R. 91 and U.S. 58 rights-of-way, allowing the majority of improvements to be constructed within existing transportation corridors. Construction of the proposed sewer lift station may require minor property acquisition to accommodate the wet well, valve vault, and associated appurtenances.

Alignment Alternative 2 traverses private property identified as Parcel Numbers 3169 and 3170 along the easternmost portion of the proposed corridor, immediately preceding the crossing of Whitetop Laurel Creek. To facilitate construction within this segment, a 40-foot-wide temporary easement and a 20-foot-wide permanent easement are anticipated, resulting in the permanent acquisition of approximately 0.2 acres of private property.

Similarly, Alignment Alternative 3 intersects privately owned parcels, specifically Parcel Numbers 1261 and 3170, along the eastern extent of the proposed sewer corridor, just prior to the planned crossing of Whitetop Laurel Creek. To accommodate construction activities within this segment, a 40-foot-wide temporary easement and a 20-foot-wide permanent easement are anticipated. These easements will require the permanent acquisition of approximately 1.0 acre of privately owned land.

Additionally, both alignment Alternative 1 and 2 intersect the Virginia Creeper Trail right-of-way. This crossing will necessitate coordination with multiple agencies and may require formal approvals, including easement agreements, environmental review, and construction-related permits.

F. Potential Construction Problems

Each alignment alternative introduces a distinct set of construction challenges requiring careful evaluation during design development. These include stream crossings, intersection with the Virginia Creeper Trail right-of-way, and private property acquisition for utility easements.

Initial alternatives analysis indicated relatively shallow stream crossings along the analyzed corridors. However, due to the utilization of minimum allowable slopes each crossing

introduces hydraulic constraints that force downstream gravity sewer segments to progressively greater depths in order to maintain positive flow. Preliminary profiles developed for Alternative 2 – U.S. 58 Gravity Sewer indicate excavation depths ranging from approximately 10 to 40 feet. Depths of this magnitude directly affect trench safety, dewatering requirements, and long-term maintenance access, and would require detailed geotechnical evaluation during final design.

For these reasons, the U.S. 58 Gravity Sewer alternative was removed from further consideration. The alignment requires a stream crossing at Whitetop Laurel Creek followed by a significant grade transition between the creek and the U.S. 58 right-of-way. Maintaining minimum gravity slope through this reach would necessitate roughly 2,000 linear feet of sewer installed at depths between 20 and 40 feet, presenting substantial constructability challenges and disproportionately high construction costs.

Additional field survey was subsequently conducted to verify the publicly available LiDAR data used during the initial alternatives analysis. These measurements identified several locations along Alternative 3 – Creeper Trail Gravity Sewer where ground elevations differed from the LiDAR surface. The surveyed stream cross section at the Laurel Creek crossing also differed significantly from the LiDAR model, indicating a deeper channel than originally assumed. Likewise, this alternative relies on minimal slopes to achieve a gravity connection to the existing sanitary sewer along U.S. Route 58. The deeper-than-expected channel further depressed the proposed profile and increased required installation depths along the downstream reaches.

Comparison of the proposed sanitary sewer profile with the field-verified ground shots indicated approximately 2,250 linear feet of the alignment would require installation depths greater than 12 feet, including roughly 550 linear feet exceeding 18 feet. Excavation at these depths would require large, engineered trench boxes and extensive sloping, shoring, and stabilization measures. The combination of deep cuts, limited access, and elevated safety and constructability risks would significantly increase project cost.

Based on these findings, Alternative 3 was also removed from further evaluation due to constructability concerns.

G. Sustainability Considerations

- **Water and Energy Efficiency:** The construction of a centralized sewer network to serve the subject project will reduce the risk of groundwater contamination and enable future opportunities for water reuse and conservation. Additionally, incorporation gravity conveyance where feasible, minimizing reliance on energy-intensive pumping. Where pump stations are required, modern controls and high-efficiency equipment will be specified to reduce operational energy demand. These

measures contribute to long-term resource stewardship while supporting the economic vitality of the project area.

- **Green Infrastructure:** This project primarily involves upgrades to the sanitary sewer collection systems and the installation of sub-surface utilities. Given the nature and scope of the proposed improvements, no significant impacts to stormwater runoff are anticipated. Construction activities will be limited to defined work zones, minimizing the extent of surface disturbance throughout the project area. Upon completion, all impacted areas will be either permanently stabilized or restored to their original, pre-construction conditions. These measures ensure minimal disruption to existing drainage patterns and uphold the integrity of surrounding infrastructure and landscapes.

H. Cost Estimates

A detailed cost estimate has been developed for each sewer alignment alternative under consideration. Total construction and associated costs are summarized in the table below for comparative reference. Comprehensive itemized estimates for each alternative are included in Appendix A.

Projected Flow from Site (GPD)	Alternative 1A	Alternative 1B	Alternative 2	Alternative 3
5,000	$ 1,889,700	$ 2,570,700	Removed from Consideration	Removed from Consideration
10,000	$ 1,911,600	$ 2,570,700		
30,000	$ 1,999,000	$ 2,603,200		

V. SELECTION OF AN ALTERNATIVE

A. Life Cycle Cost Analysis

A present-worth analysis was conducted to assess the long-term economic feasibility of each sewer alignment alternative. The evaluation considered a 50-year planning period and applied an annual inflation rate of 2.5%. Estimated operation and maintenance (O&M) costs were based on anticipated personnel requirements for routine facility upkeep. Capital replacement costs reflect the projected expense of pump replacement within the proposed lift station, assuming a 10-year service life for this equipment.

A detailed summary of present-worth calculations for each alternative is included in Appendix B.

It should be noted that this financial assessment excludes potential revenue from future sewer service connections, focusing solely on cost-based metrics. A comparative summary of net present worth values for each alternative under the 30,000 GPD flow scenario is presented in the following table.

	Alternative 1A	Alternative 1B	Alternative 2	Alternative 3
Capital Costs	$ 1,999,000	$ 2,603,200	Removed from Consideration	Removed from Consideration
Total O&M Expenses	$ 2,682,402	$ 3,303,130		
Total Capital Replacement	$ 1,288,916	$ 1,288,916		
Present Worth	$ 5,970,318	$ 7,195,246		

B. Non-Monetary Factors

No non-monetary factors, such as environmental impacts, operability concerns, performance reliability issues, institutional challenges, or system flexibility considerations, were identified as having any influence on the determination of the selected alternative.

VI. PROPOSED PROJECT (RECOMMENDED ALTERNATIVE)

A. Preliminary Project Design

Alternative 1B-3 – S.R. 91 Combination Gravity Sewer and Force Main has been identified as the preferred alignment for advancement into final design and construction. Given the uncertainty surrounding the future development's ultimate use, it is recommended to proceed with the configuration that supports the 30,000-GPD capacity scenario to provide the greatest operational flexibility.

This alternative includes the installation of approximately 1,850 linear feet of 8-inch gravity sewer to convey sanitary flows from the Project Ground Zero site to a downstream lift station. From that point, wastewater will be pumped via approximately 1,100 linear feet of force main to the existing sanitary sewer system along U.S. Route 58. The alignment originates within the U.S. Route 58 right-of-way and extends eastward toward the Project Ground Zero site. By remaining within the existing S.R. 91 and U.S. 58 transportation corridors, the proposed route minimizes new disturbance and avoids impacts to undeveloped areas. The alignment will require two subsurface crossings of Laurel Creek, which will necessitate careful design coordination to maintain stream stability, protect existing bank conditions, and ensure compliance with applicable state and federal permitting requirements.

While this alternative exhibits a higher capital cost and 50-year present worth, its utilization of gravity conveyance provides meaningful opportunities to serve currently unserved properties along the corridor. This enhances the potential for future service connections and supports long-term system expansion.

B. Project Schedule

The recommended alternative is projected to require approximately 18 months for full implementation, encompassing both design and construction phases. Upon project award, an estimated 12-month period will be allocated for detailed design development and regulatory permitting, followed by approximately 6 months for construction activities.

It should be noted that the recommended alternative is not anticipated to require the acquisition or disturbance of previously undeveloped land. Should such actions become necessary, the project may be subject to elevated levels of environmental review and permitting. The extent and duration of these requirements would depend on the nature of the anticipated impacts and the findings of any required environmental assessments, which could influence the overall project schedule.

C. Permit Requirements

The following permits are expected to be required for implementation of the proposed sanitary sewer extension:

- **VDH Construction Permit**: Required for the construction, expansion, or modification of sewage disposal infrastructure.
- **VDOT Land Use Permit (LUP)**: Authorizes utility installation, maintenance, and repair activities within state-maintained rights-of-way.
- **Virginia Water Protection (VWP) Permit**: Administered by DEQ, this permit is necessary for any excavation, fill, or disturbance within jurisdictional waterbodies or adjacent banks.
- **Section 404 Clean Water Act Permit**: Issued by ACOE, this permit is required when dredge or fill material is placed in waters of the U.S.

In addition to these regulatory approvals, the project must comply with all applicable local sewer construction standards and ordinances as enforced by Washington County and relevant municipal authorities.

D. Sustainability Considerations

- **Water and Energy Efficiency:** A centralized sewer system will reduce groundwater contamination risks and support future water-reuse initiatives. The recommended alternative maximizes gravity conveyance, reducing reliance on energy-intensive pumping and limiting power use to the lift station. These measures support long-term resource stewardship and strengthen community resilience.

- **Green Infrastructure:** The proposed improvements primarily involve subsurface utility and are anticipated to have no impact on stormwater runoff. All areas disturbed during construction will be restored to their original pre-construction conditions, ensuring minimal environmental impact.

E. Total Project Cost Estimate (Engineer's Opinion of Probable Cost)

An itemized cost estimate for the proposed improvements is provided in Appendix A. The estimate includes both construction costs and related expenses associated with the proposed project. The total cost for the proposed project is estimated at $2,603,200.

F. Annual Operating Budget

The present-worth analysis provided in Appendix B outlines the estimated annual O&M

costs associated with each sewer alignment alternative evaluated in this report. For the recommended alternative, projected O&M expenditures are limited primarily to the operation and maintenance of the proposed lift station.

Following identification of a funding source, a comprehensive set of Project Planning Factors including anticipated revenue, annual O&M obligations, and debt service schedules can be developed to evaluate the financial impact of proposed capital investment on the utility's long-term operating budget.

VII. CONCLUSIONS AND RECOMMENDATIONS

Based on the findings presented in this report, Alternative 1B-3 – S.R. 91 Combination Gravity Sewer and Force Main represents the most effective and sustainable solution for meeting the project's objectives. This alternative offers a well-balanced approach by maximizing the use of gravity conveyance while avoiding the deep excavation, hydraulic limitations, and constructability challenges identified in the other alignments. Although the inclusion of a lift station introduces ongoing operations and maintenance responsibilities, the ability to utilize gravity sewer along much of the corridor provides meaningful opportunities to extend service to currently unserved properties, supporting long-term system expansion and enhancing community benefit.

It is recommended that the WCSA:

- Proceed with the development of Alternative 1B-3 - S.R. 91 Combination Gravity Sewer and Force Main.
- Authorize Mattern & Craig to assist with funding applications for the improvements.

APPENDIX A
Quantity and Cost Estimates

M&C Form #107c

QUANTITY AND COST ESTIMATE

PROJECT: Damascus Sewer PER — COMM NO. 4565B
Alternative 1A-1: S.R. 91 Force Main (5k GPD) — SHEET NO. 1
LOCATION: Washington County, VA — DATE: 5-Mar-26
SUMMARY BY: DAS PRICES BY: DAS CHECKED BY: RWB

ITEM NO.	DESCRIPTION	UNIT	QUAN.	UNIT COST	TOTAL
1	Mobilization (8%)	LS	1	$ 93,400	$ 93,400
2	1.5" Force Main	LF	2950	$ 45	$ 132,750
3	Sub Surface Stream Crossing	LF	270	$ 800	$ 216,000
4	Air Release Valve	EA	2	$ 4,000	$ 8,000
5	Sewer Manhole (4'-6')	EA	1	$ 10,000	$ 10,000
6	Sewer Manhole (8'-10')	EA	0	$ 16,500	$ -
7	Sewer Manhole (10'-12')	EA	0	$ 18,000	$ -
8	Sewer Manhole (12'-14')	EA	0	$ 20,000	$ -
9	Sewer Manhole (14'-16')	EA	0	$ 24,000	$ -
10	Sewer Lift Station	EA	1	$ 800,000	$ 800,000
11	Inflation (5%/Yr)	Year	2	$ 63,100	$ 126,200
		Sub-Total			$ 1,386,400
	Contingency			15%	$ 208,000
	Legal			1%	$ 13,900
	Land & Rights				
	Temporary	SF	0	$ 0.25	$ -
	Permanent (Pump Station Site)	EA	1	$ 15,000	$ 15,000.00
	Permit Fees				$ 5,000
	Environmental Clearance				$ 15,000
	Basic Engineering			8%	$ 111,000
	Bidding				$ 6,000
	Construction Administration	Month	6	$ 3,000	$ 18,000
	Additional Engineering				
	Permits			1%	$ 13,900
	Easements	EA	0	$ 1,000	$ -
	Construction Inspection	Month	6	$ 16,250	$ 97,500
				TOTAL	**$ 1,889,700**

M&C Form #107c

QUANTITY AND COST ESTIMATE

PROJECT: Damascus Sewer PER — COMM NO. 4565B
Alternative 1A-2: S.R. 91 Force Main (10k GPD) — SHEET NO. 2
LOCATION: Washington County, VA — DATE: 5-Mar-26
SUMMARY BY: DAS PRICES BY: DAS CHECKED BY: RWB

ITEM NO.	DESCRIPTION	UNIT	QUAN.	UNIT COST	TOTAL
1	Mobilization (8%)	LS	1	$ 94,600	$ 94,600
2	2" Force Main	LF	2950	$ 50	$ 147,500
3	Sub Surface Stream Crossing	LF	270	$ 800	$ 216,000
4	Air Release Valve	EA	2	$ 4,000	$ 8,000
5	Sewer Manhole (4'-6')	EA	1	$ 10,000	$ 10,000
6	Sewer Manhole (8'-10')	EA	0	$ 16,500	$ -
7	Sewer Manhole (10'-12')	EA	0	$ 18,000	$ -
8	Sewer Manhole (12'-14')	EA	0	$ 20,000	$ -
9	Sewer Manhole (14'-16')	EA	0	$ 24,000	$ -
10	Sewer Lift Station	EA	1	$ 800,000	$ 800,000
11	Inflation (5%/Yr)	Year	2	$ 63,900	$ 127,800
		Sub-Total			$ 1,403,900
	Contingency			15%	$ 210,600
	Legal			1%	$ 14,100
	Land & Rights				
	Temporary	SF	0	$ 0.25	$ -
	Permanent (Pump Station Site)	EA	1	$ 15,000	$ 15,000.00
	Permit Fees				$ 5,000
	Environmental Clearance				$ 15,000
	Basic Engineering			8%	$ 112,400
	Bidding				$ 6,000
	Construction Administration	Month	6	$ 3,000	$ 18,000
	Additional Engineering				
	Permits			1%	$ 14,100
	Easements	EA	0	$ 1,000	$ -
	Construction Inspection	Month	6	$ 16,250	$ 97,500
				TOTAL	**$ 1,911,600**

M&C Form #107c

QUANTITY AND COST ESTIMATE

PROJECT: Damascus Sewer PER — COMM NO. 4565B
Alternative 1A-3: S.R. 91 Force Main (30k GPD) — SHEET NO. 3
LOCATION: Washington County, VA — DATE: 5-Mar-26
SUMMARY BY: DAS PRICES BY: DAS CHECKED BY: RWB

ITEM NO.	DESCRIPTION	UNIT	QUAN.	UNIT COST	TOTAL
1	Mobilization (8%)	LS	1	$ 99,300	$ 99,300
2	3" Force Main	LF	2950	$ 70	$ 206,500
3	Sub Surface Stream Crossing	LF	270	$ 800	$ 216,000
4	Air Release Valve	EA	2	$ 4,000	$ 8,000
5	Sewer Manhole (4'-6')	EA	1	$ 10,000	$ 10,000
6	Sewer Manhole (8'-10')	EA	0	$ 16,500	$ -
7	Sewer Manhole (10'-12')	EA	0	$ 18,000	$ -
8	Sewer Manhole (12'-14')	EA	0	$ 20,000	$ -
9	Sewer Manhole (14'-16')	EA	0	$ 24,000	$ -
10	Sewer Lift Station	EA	1	$ 800,000	$ 800,000
11	Inflation (5%/Yr)	Year	2	$ 67,000	$ 134,000
		Sub-Total			$ 1,473,800
	Contingency			15%	$ 221,100
	Legal			1%	$ 14,800
	Land & Rights				
	Temporary	SF	0	$ 0.25	$ -
	Permanent (Pump Station Site)	EA	1	$ 15,000	$ 15,000.00
	Permit Fees				$ 5,000
	Environmental Clearance				$ 15,000
	Basic Engineering			8%	$ 118,000
	Bidding				$ 6,000
	Construction Administration	Month	6	$ 3,000	$ 18,000
	Additional Engineering				
	Permits			1%	$ 14,800
	Easements	EA	0	$ 1,000	$ -
	Construction Inspection	Month	6	$ 16,250	$ 97,500
				TOTAL	**$ 1,999,000**

M&C Form #107c

QUANTITY AND COST ESTIMATE

PROJECT: Damascus Sewer PER — COMM NO. 4565B
Alternative 1B-1: S.R. 91 Combination (5k GPD) — SHEET NO. 4
LOCATION: Washington County, VA — DATE: 5-Mar-26
SUMMARY BY: DAS PRICES BY: DAS CHECKED BY: RWB

ITEM NO.	DESCRIPTION	UNIT	QUAN.	UNIT COST	TOTAL
1	Mobilization (8%)	LS	1	$ 130,100	$ 130,100
2	2" Force Main	LF	1100	$ 50	$ 55,000
3	8" Gravity Sewer	LF	1250	$ 120	$ 150,000
4	8" Gravity Sewer (12'-18' Depth)	LF	600	$ 300	$ 180,000
5	Sub Surface Stream Crossing	LF	270	$ 800	$ 216,000
6	Air Release Valve	EA	1	$ 4,000	$ 4,000
7	Sewer Manhole (4'-6')	EA	2	$ 10,000	$ 20,000
8	Sewer Manhole (8'-10')	EA	1	$ 16,500	$ 16,500
9	Sewer Manhole (10'-12')	EA	4	$ 18,000	$ 72,000
10	Sewer Manhole (12'-14')	EA	2	$ 20,000	$ 40,000.00
11	Sewer Manhole (14'-16')	EA	3	$ 24,000	$ 72,000
12	Sewer Lift Station	EA	1	$ 800,000	$ 800,000
13	Inflation (5%/Yr)	Year	2	$ 87,800	$ 175,600
		Sub-Total			$ 1,931,200
	Contingency			15%	$ 289,700
	Legal			1%	$ 19,400
	Land & Rights				
	Temporary	SF	0	$ 0.25	$ -
	Permanent (Pump Station Site)	EA	1	$ 15,000	$ 15,000.00
	Permit Fees				$ 5,000
	Environmental Clearance				$ 15,000
	Basic Engineering			8%	$ 154,500
	Bidding				$ 6,000
	Construction Administration	Month	6	$ 3,000	$ 18,000
	Additional Engineering				
	Permits			1%	$ 19,400
	Easements	EA	0	$ 1,000	$ -
	Construction Inspection	Month	6	$ 16,250	$ 97,500
				TOTAL	**$ 2,570,700**

M&C Form #107c

QUANTITY AND COST ESTIMATE

PROJECT: Damascus Sewer PER — COMM NO. 4565B
Alternative 1B-2: S.R. 91 Combination (10k GPD — SHEET NO. 5
LOCATION: Washington County, VA — DATE: 5-Mar-26
SUMMARY BY: DAS PRICES BY: DAS CHECKED BY: RWB

ITEM NO.	DESCRIPTION	UNIT	QUAN.	UNIT COST	TOTAL
1	Mobilization (8%)	LS	1	$ 130,100	$ 130,100
2	2" Force Main	LF	1100	$ 50	$ 55,000
3	8" Gravity Sewer	LF	1250	$ 120	$ 150,000
4	8" Gravity Sewer (12'-18' Depth)	LF	600	$ 300	$ 180,000
5	Sub Surface Stream Crossing	LF	270	$ 800	$ 216,000
6	Air Release Valve	EA	1	$ 4,000	$ 4,000
7	Sewer Manhole (4'-6')	EA	2	$ 10,000	$ 20,000
8	Sewer Manhole (8'-10')	EA	1	$ 16,500	$ 16,500
9	Sewer Manhole (10'-12')	EA	4	$ 18,000	$ 72,000.00
10	Sewer Manhole (12'-14')	EA	2	$ 20,000	$ 40,000
11	Sewer Manhole (14'-16')	EA	3	$ 24,000	$ 72,000
12	Sewer Lift Station	EA	1	$ 800,000	$ 800,000
13	Inflation (5%/Yr)	Year	2	$ 87,800	$ 175,600
		Sub-Total			$ 1,931,200
	Contingency			15%	$ 289,700
	Legal			1%	$ 19,400
	Land & Rights				
	Temporary	SF	0	$ 0.25	$ -
	Permanent (Pump Station Site)	EA	1	$ 15,000	$ 15,000.00
	Permit Fees				$ 5,000
	Environmental Clearance				$ 15,000
	Basic Engineering			8%	$ 154,500
	Bidding				$ 6,000
	Construction Administration	Month	6	$ 3,000	$ 18,000
	Additional Engineering				
	Permits			1%	$ 19,400
	Easements	EA	0	$ 1,000	$ -
	Construction Inspection	Month	6	$ 16,250	$ 97,500
				TOTAL	**$ 2,570,700**

M&C Form #107c

QUANTITY AND COST ESTIMATE

PROJECT: Damascus Sewer PER — COMM NO. 4565B
Alternative 1B-3: S.R. 91 Combination (30k GPD — SHEET NO. 6
LOCATION: Washington County, VA — DATE: 5-Mar-26
SUMMARY BY: DAS PRICES BY: DAS CHECKED BY: RWB

ITEM NO.	DESCRIPTION	UNIT	QUAN.	UNIT COST	TOTAL
1	Mobilization (8%)	LS	1	$ 131,800	$ 131,800
2	3" Force Main	LF	1100	$ 70	$ 77,000
3	8" Gravity Sewer	LF	1250	$ 120	$ 150,000
4	8" Gravity Sewer (12'-18' Depth)	LF	600	$ 300	$ 180,000
5	Sub Surface Stream Crossing	LF	270	$ 800	$ 216,000
6	Air Release Valve	EA	1	$ 4,000	$ 4,000
7	Sewer Manhole (4'-6')	EA	2	$ 10,000	$ 20,000
8	Sewer Manhole (8'-10')	EA	1	$ 16,500	$ 16,500
9	Sewer Manhole (10'-12')	EA	4	$ 18,000	$ 72,000.00
10	Sewer Manhole (12'-14')	EA	2	$ 20,000	$ 40,000
11	Sewer Manhole (14'-16')	EA	3	$ 24,000	$ 72,000
12	Sewer Lift Station	EA	1	$ 800,000	$ 800,000
13	Inflation (5%/Yr)	Year	2	$ 89,000	$ 178,000
		Sub-Total			$ 1,957,300
	Contingency			15%	$ 293,600
	Legal			1%	$ 19,600
	Land & Rights				
	Temporary	SF	0	$ 0.25	$ -
	Permanent (Pump Station Site)	EA	1	$ 15,000	$ 15,000.00
	Permit Fees				$ 5,000
	Environmental Clearance				$ 15,000
	Basic Engineering			8%	$ 156,600
	Bidding				$ 6,000
	Construction Administration	Month	6	$ 3,000	$ 18,000
	Additional Engineering				
	Permits			1%	$ 19,600
	Easements	EA	0	$ 1,000	$ -
	Construction Inspection	Month	6	$ 16,250	$ 97,500
				TOTAL	**$ 2,603,200**

APPENDIX B
Present-Worth Analysis

Project Planning Factors
Damascus Sewer PER
Washington County Service Authority
Commission Number 4565B
3/5/2026

Planning Period: 50 Years

Present Worth Analysis
Alternative 1A-1 - SR 91 FM (5K)

Capital Cost		$ 1,889,700	
Long Term O&M Cost			
	Capital Replacement Reserve	$ 17,186	
	Life cycle	50	years
	inflation	2.50%	
	Total O&M	$ 2,639,115	
	Total Capital Replacement	$ 859,277	
	Present Worth	**$ 5,388,092**	

Capital Replacement Reserve

Inflation 2.5%

Item	maintenance time (yrs)	Current capital cost	future cost	annual reserve
[Item]	5	$ -	$ -	$ -
Pumps	10	$ 10,000	$ 171,855	$ 17,186
[Item]	15	$ -	$ -	$ -
[Item]	20	$ -	$ -	$ -
[Item]	25	$ -	$ -	$ -
		Accumulated annual reserve required		**$ 17,186**

Annual O&M Expenses	Annual Amount
Salaries & Wages	$ 13,650
Legal Fees	$ -
Vehicle maintenance	$ -
Advertising	$ -
Permits	$ -
Electricity	$ 232
Postage	$ -
Insurance	$ -
Office Supplies	$ -
Cleaning Supplies	$ -
Maintenance Supplies	$ -
Fuel	$ -
Miscellaneous	$ -
Utility Bill	$ -
Force Main ($0.50 per LF)	$ 1,475
Total O&M Expenses	**$ 15,357**

Present Worth Analysis

Alternative 1A-2 - SR 91 FM (10K)

Capital Cost		$ 1,911,600	
Long Term O&M Cost			
	Capital Replacement Reserve	$ 20,623	
	Life cycle	50	years
	inflation	2.50%	
	Total O&M	$ 2,644,498	
	Total Capital Replacement	$ 1,031,133	
	Present Worth	**$ 5,587,231**	

Capital Replacement Reserve

Inflation 2.5%

Item	maintenance time (yrs)	Current capital cost	future cost	annual reserve
[Item]	5	$ -	$ -	$ -
Pumps	10	$ 12,000	$ 206,227	$ 20,623
[Item]	15	$ -	$ -	$ -
[Item]	20	$ -	$ -	$ -
[Item]	25	$ -	$ -	$ -
		Accumulated annual reserve required		**$ 20,623**

Annual O&M Expenses	Annual Amount
Salaries & Wages	$ 13,650
Legal Fees	$ -
Vehicle maintenance	$ -
Advertising	$ -
Permits	$ -
Electricity	$ 263
Postage	$ -
Insurance	$ -
Office Supplies	$ -
Cleaning Supplies	$ -
Maintenance Supplies	$ -
Fuel	$ -
Miscellaneous	$ -
Water/Sewer Bill	$ -
Force Main ($0.50 per LF)	$ 1,475
Total O&M Expenses	**$ 15,388**

Present Worth Analysis
Alternative 1A-3 - SR 91 FM (30K)

Capital Cost		$ 1,999,000	
Long Term O&M Cost			
	Capital Replacement Reserve	$ 25,778	
	Life cycle	50	years
	inflation	2.50%	
	Total O&M	$ 2,682,402	
	Total Capital Replacement	$ 1,288,916	
	Present Worth	**$ 5,970,318**	

Capital Replacement Reserve

Inflation 2.5%

Item	maintenance time (yrs)	Current capital cost	future cost	annual reserve
[Item]	5	$ -	$ -	$ -
Pumps	10	$ 15,000	$ 257,783	$ 25,778
[Item]	15	$ -	$ -	$ -
[Item]	20	$ -	$ -	$ -
[Item]	25	$ -	$ -	$ -
		Accumulated annual reserve required		**$ 25,778**

Annual O&M Expenses	Annual Amount
Salaries & Wages	$ 13,650
Legal Fees	$ -
Vehicle maintenance	$ -
Advertising	$ -
Permits	$ -
Electricity	$ 483
Postage	$ -
Insurance	$ -
Office Supplies	$ -
Cleaning Supplies	$ -
Maintenance Supplies	$ -
Fuel	$ -
Miscellaneous	$ -
Water/Sewer Bill	$ -
Force Main ($0.50 per LF)	$ 1,475
Total O&M Expenses	**$ 15,608**

Project Planning Factors
Damascus Sewer PER
Washington County Service Authority
Commission Number 4565B
3/5/2026

Planning Period: 50 Years

Present Worth Analysis
Alternative 1B-1 - SR 91 Combination (5K)

Capital Cost		$ 2,570,700	
Long Term O&M Cost			
	Capital Replacement Reserve	$ 17,186	
	Life cycle	50	years
	inflation	2.50%	
	Total O&M	$ 3,271,846	
	Total Capital Replacement	$ 859,277.0	
	Present Worth	**$ 6,701,823**	

Capital Replacement Reserve

Inflation 2.5%

Item	maintenance time (yrs)	Current capital cost	future cost	annual reserve
[Item]	5	$ -	$ -	$ -
Pumps	10	$ 10,000	$ 171,855	$ 17,186
[Item]	15	$ -	$ -	$ -
[Item]	20	$ -	$ -	$ -
[Item]	25	$ -	$ -	$ -
		Accumulated annual reserve required		**$ 17,186**

Annual O&M Expenses	Annual Amount
Salaries & Wages	$ 13,650
Legal Fees	$ -
Vehicle maintenance	$ -
Advertising	$ -
Permits	$ -
Electricity	$ 213
Postage	$ -
Insurance	$ -
Office Supplies	$ -
Cleaning Supplies	$ -
Maintenance Supplies	$ -
Fuel	$ -
Miscellaneous	$ -
Utility Bill	$ -
Force Main ($0.50 per LF)	$ 550
Gravity Sewer ($2.50 per LF)	$ 4,625
Total O&M Expenses	**$ 19,038**

Present Worth Analysis

Alternative 1B-2 - SR 91 Combination (10K)

Capital Cost		$ 2,570,700	
Long Term O&M Cost			
	Capital Replacement Reserve	$ 20,623	
	Life cycle	50	years
	inflation	2.50%	
	Total O&M	$ 3,293,169	
	Total Capital Replacement	$ 1,031,133.0	
	Present Worth	**$ 6,895,002**	

Capital Replacement Reserve

Inflation 2.5%

Item	maintenance time (yrs)	Current capital cost	future cost	annual reserve
[Item]	5	$ -	$ -	$ -
Pumps	10	$ 12,000	$ 206,227	$ 20,623
[Item]	15	$ -	$ -	$ -
[Item]	20	$ -	$ -	$ -
[Item]	25	$ -	$ -	$ -
		Accumulated annual reserve required		**$ 20,623**

Annual O&M Expenses	Annual Amount
Salaries & Wages	$ 13,650
Legal Fees	$ -
Vehicle maintenance	$ -
Advertising	$ -
Permits	$ -
Electricity	$ 337
Postage	$ -
Insurance	$ -
Office Supplies	$ -
Cleaning Supplies	$ -
Maintenance Supplies	$ -
Fuel	$ -
Miscellaneous	$ -
Water/Sewer Bill	$ -
Force Main ($0.50 per LF)	$ 550
Gravity Sewer ($2.50 per LF)	$ 4,625
Total O&M Expenses	**$ 19,162**

Present Worth Analysis

Alternative 1B-3 - SR 91 Combination (30K)

Capital Cost		$ 2,603,200	
Long Term O&M Cost			
	Capital Replacement Reserve	$ 25,778	
	Life cycle	50	years
	inflation	2.50%	
	Total O&M	$ 3,303,130	
	Total Capital Replacement	$ 1,288,916.0	
	Present Worth	**$ 7,195,246**	

Capital Replacement Reserve

Inflation 2.5%

Item	maintenance time (yrs)	Current capital cost	future cost	annual reserve
[Item]	5	$ -	$ -	$ -
Pumps	10	$ 15,000	$ 257,783	$ 25,778
[Item]	15	$ -	$ -	$ -
[Item]	20	$ -	$ -	$ -
[Item]	25	$ -	$ -	$ -
		Accumulated annual reserve required		**$ 25,778**

Annual O&M Expenses	Annual Amount
Salaries & Wages	$ 13,650
Legal Fees	$ -
Vehicle maintenance	$ -
Advertising	$ -
Permits	$ -
Electricity	$ 395
Postage	$ -
Insurance	$ -
Office Supplies	$ -
Cleaning Supplies	$ -
Maintenance Supplies	$ -
Fuel	$ -
Miscellaneous	$ -
Water/Sewer Bill	$ -
Force Main ($0.50 per LF)	$ 550
Gravity Sewer ($2.50 per LF)	$ 4,625
Total O&M Expenses	**$ 19,220**