

EAST BROOKWOOD STORMWATER
MANAGEMENT STUDY

**LOCATED IN BYRAM TOWNSHIP
SUSSEX COUNTY, NEW JERSEY**

Prepared For:

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1.0 Executive Summary

This report presents the findings of a stormwater management study for the East Brookwood residential community in Byram Township, New Jersey. The purpose of this study is to evaluate existing drainage conditions, identify deficiencies, and develop conceptual improvements in accordance with NJDEP Stormwater Management Rules (N.J.A.C. 7:8) and the Highlands Regional Master Plan (RMP).

The findings of this study indicate that several systems are undersized, discharge onto private property, and do not meet current stormwater management standards. In total, ten (10) drainage networks are analyzed as part of this study to review current deficiencies and make recommendations that will prioritize flood mitigation, water quality improvement, groundwater recharge, and regulatory compliance.

2.0 Introduction

2.1 Purpose of Study

The purpose of this study is to evaluate stormwater infrastructure, identify deficiencies, assess impacts, and develop improvement concepts that will serve to address the deficiencies that exist today within the East Brookwood residential community.

2.2 Study Area Description

The study area comprises the East Brookwood Community, a residential neighborhood located in Byram Township, Sussex County, New Jersey. The community is generally bound by and includes the following local roads: Stony Brook Road, Brookwood Road, Brookwood Drive, Joan Drive, Debbie Drive, Ross Road, Briar Lane and Woods Edge. The neighborhood consists of single-family homes situated on lots with a mix of maintained lawns, wooded areas, and mature vegetation.

Topography within the study area is characterized by steep slopes, with a high point/ridge located along the southern boundary of the community. Stormwater runoff generally flows northward and downslope from this ridge toward Lubber Run, a tributary of the Musconetcong River. The existing stormwater system has multiple outfall locations, and consists of roadside swales, curb inlets, and pipe networks, that ultimately discharge to Lubbers Run or adjacent overland flow paths.

Roadways are predominantly paved asphalt, with asphalt and granite block curbing. The area is typical of suburban development in the New Jersey Highlands Region, with residential impervious surfaces



(rooftops, driveways, and roads) contributing to runoff that is conveyed through the existing, aging drainage infrastructure.

2.3 Regulatory Framework

This report has been prepared in accordance with:

- NJDEP Stormwater Management Rules (N.J.A.C. 7:8)
- NJDEP Flood Hazard Area Control Act Rules (N.J.A.C. 7:13)
- NJDEP Freshwater Wetlands Protection Act Rules (N.J.A.C. 7:7A)

Stormwater management measures are designed to meet groundwater recharge, stormwater runoff quantity, and water quality standards pursuant to N.J.A.C. 7:8-5.4, 5.5, and 5.6.

3. Methodology

This study follows a multi-step approach to evaluate existing stormwater conditions and develop conceptual improvements for compliance with the New Jersey Department of Environmental Protection (NJDEP) Stormwater Management Rules (N.J.A.C. 7:8). The methodology emphasizes the use of green infrastructure (GI) practices to the maximum extent practicable, consistent with NJDEP priorities for nonstructural and low-impact development techniques. Key components include:

Data Collection and Site Assessment

Field observations, topographic data, existing drainage mapping, and review of as-built plans, aerial imagery, and municipal & county records were conducted to characterize site conditions, impervious coverage, soils, and existing stormwater infrastructure.

Drainage Area Delineation and Mapping

Contributing drainage areas were delineated using digital elevation models (AutoCAD), site surveys, and field-verified flow paths. Sub-basins were established to accurately represent runoff routing, inlet locations, and conveyance systems.

Hydrologic and Hydraulic Modeling

Stormwater modeling was performed using AutoCAD Civil 3D Storm Sewers extension to simulate existing and proposed conditions. The analysis incorporated the following:



- Sussex County FHA Intensity-Duration-Frequency (IDF) curves for design storms.
- NJDEP-defined water quality design storm (1.25 inches over 2 hours) for water quality treatment evaluation.
- Rational and NRCS methods for runoff computation, depending on drainage areas and BMP.
- Existing conditions were modeled to identify deficiencies (e.g., surcharge, excessive velocities, inadequate capacity), and proposed improvements were preliminary sized and routed to demonstrate compliance.
- The 10-year storm event was used as the primary design storm to evaluate conveyance capacity and compliance with peak flow requirements. This return period is consistent with NJDEP stormwater management standards (N.J.A.C. 7:8) for assessing hydraulic performance of storm sewer systems.
- The USDA Natural Resources Conservation Service (NRCS) National Engineering Handbook, Part 630, Chapters 7, 9, and 15 were used to establish ground-cover Curve Numbers (CN) and to calculate time of concentration (Tc) values. Specifically, Chapter 7 provided the hydrologic soil group classifications, Chapter 9 was used to develop composite CN values based on land cover, soil type, and hydrologic condition, and Chapter 15 supplied the methods for computing time of concentration.

Conceptual Design Development

Conceptual stormwater management measures were developed prioritizing green infrastructure BMPs (e.g., bioretention, infiltration basins, and grass swales) per N.J.A.C. 7:8-5.3 and aimed to address:

- Groundwater recharge standards (N.J.A.C. 7:8-5.4) using the NJ Groundwater Recharge Spreadsheet or equivalent long-term simulation.
- Stormwater runoff quality standards (N.J.A.C. 7:8-5.5), targeting 80–90% TSS removal and compliance with non-structural and structural pollutant load reductions.
- Stormwater runoff quantity control (N.J.A.C. 7:8-5.6), ensuring post-development peak flows do not exceed pre-development rates (or achieve allowable attenuation percentages) for the 2-, 10-, and 100-year storms, with no increase in downstream flood risk.

4. Existing Conditions Overview

The existing stormwater management infrastructure within the project area consists of fragmented, aging, and generally undersized conventional conveyance systems. These include circular and elliptical concrete storm pipes (predominantly 12-inch to 30-inch diameter), curb inlets, manholes, roadside swales, and direct overland flow paths to uncontrolled discharge points. No centralized stormwater management facilities (e.g., detention basins, infiltration systems, or water quality BMPs) are present, and many drainage segments, (nine outfall locations) discharge untreated runoff directly to adjacent streams, wetlands, or adjacent properties.

Key characteristics and deficiencies observed across the ten analyzed networks include:

- Fragmented and Undersized Conveyance
Most pipe networks are limited in extent and capacity, with many segments sized below current design standards. Downstream trunk lines frequently exhibit insufficient hydraulic capacity relative to upstream tributary areas, resulting in surcharge and pressurization during the 10-year design storm in several basins, notably Network 5 and 8.
- Excessive Pipe Velocities
High flow velocities occur in multiple networks. These velocities exceed the typical recommended maximum of 8–10 ft/s for concrete storm sewers, increasing the risk of long-term pipe abrasion, joint separation, scour at manholes and outfalls, and sediment transport issues.
- Localized Surcharging and Flooding Potential
In surcharge-prone storm sewers, the hydraulic grade line exceeds rim elevations in numerous segments during the 10-year event, indicating backwater effects and limited freeboard. This condition contributes to potential street flooding, grate surcharging, and surface ponding during moderate to heavy rainfall.
- Inadequate Self-Cleansing and Flat Slopes
Several upstream branches and connecting lines exhibit very flat or near-zero slopes, resulting in velocities below self-cleansing thresholds during lower flows and increasing the likelihood of sediment deposition over time.
- Uncontrolled Discharges and Erosion
Many systems terminate at undefined or poorly stabilized outfalls, leading to concentrated flows that cause localized erosion, and sediment deposition in receiving waters. Roadside swales and

overland flow paths often lack formal conveyance or energy dissipation, worsening erosion and sediment deposits.

- Lack of Water Quality and Recharge Controls

No structural or non-structural best management practices (BMPs) are present to provide groundwater recharge, pollutant removal, or peak flow attenuation. Runoff from impervious surfaces (driveways, and roadways) is conveyed untreated, contributing to increased pollutant loads and reduced recharge volumes in violation of current NJDEP standards (N.J.A.C. 7:8).

Overall, the existing stormwater infrastructure is inadequate to meet modern design standards for flood protection, water quality treatment, groundwater recharge, or erosion control. The combination of undersized pipes, high velocities, surcharge-prone segments, uncontrolled discharges, and absence of BMPs results in frequent localized flooding, erosion, and degraded water quality during design storm events.

5. Existing Conditions Hydraulic Summary

5.1 Drainage Network 1

Network 1 is a small, localized drainage system, consisting of two circular pipe segments with diameters of 12 inches. The network is infiltrating runoff from smaller storms and does not directly connect to existing stormwater networks.

5.2 Drainage Network 2

Network 2 consists of nine circular concrete pipe segments with diameters ranging from 12 inches to 18 inches. The network conveys stormwater runoff from Brookwood Road to Brookwood Drive and was analyzed for the 10-year design storm using FHA IDF curves. There is no known drainage easement in locations where existing drainage pipe runs between Brookwood Road and Brookwood Drive. The outfall discharges into an open area approximately 300 feet short of Lubber Run, located in the rear of existing houses.

Key Hydraulic Observations

- Velocities in the main trunk and several segments reach approximately 8–10 ft/s, which is within the typical recommended maximum range for concrete storm sewers.
- The hydraulic grade line remains below rim elevations in most segments, indicating the system operates without surcharge under the 10-year even
- Some upstream or branch lines have flat or negative slopes, which can limit self-cleansing capacity during lower flows and contribute to variable velocity distribution.



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- Moderate to steep slopes in portions of the trunk drive the higher velocities observed.

Assessment

The existing network conveys the 10-year design storm without surcharge or flooding. However, velocities in several segments are at the recommended limits, increasing the potential for long-term pipe abrasion and scour at junctions or the outfall. Energy dissipation features or velocity management measures are recommended to improve durability and align with standard stormwater design practices in New Jersey.

5.3 Drainage Network 3

Network 3 consists of twenty-seven circular concrete pipe segments with diameters ranging from 18 inches to 30 inches. The network conveys stormwater runoff from Briar Lane through Brookwood Road and Brookwood Drive and was analyzed for the 10-year design storm using Sussex County FHA IDF curves. This is one of the larger networks in the study area. The outfall discharges directly into Lubber Run.

Key Hydraulic Observations

- The system experiences surcharge in multiple segments, with the hydraulic grade line above rim elevations in several locations.
- Velocities in the trunk and several upstream lines reach velocities far exceeding the typical recommended maximum of 8–10 ft/s for concrete storm sewers.
- Downstream capacity appears insufficient relative to upstream inflows, resulting in pressurized flow and backwater effects.
- Slopes vary from very flat in some branches to steep in the main trunk, contributing to the velocity distribution.

Assessment

The existing network does not provide adequate capacity for the 10-year design storm. High velocities and surcharge conditions indicate potential for flooding, pipe wear, and maintenance concerns. Capacity improvements, such as upsizing pipes or adding parallel lines, are recommended to meet standard stormwater performance objectives.

5.4 Drainage Network 4

Network 4 consists of thirteen circular concrete pipe segments, predominantly 15-inch diameter. The network conveys stormwater runoff from Brookwood Drive and Shady Brook Lane and was analyzed for the 10-year design storm using FHA IDF curves. This is one of the larger networks in the study area with an outfall that discharges directly into Lubber Run.

Key Hydraulic Observations

- The system experiences surcharge in multiple segments, with the hydraulic grade line above rim elevations in several locations.
- Velocities in the trunk lines reach approximately 18 ft/s, exceeding the typical recommended maximum of 8–10 ft/s for concrete storm sewers.
- Downstream capacity appears insufficient relative to upstream inflows, resulting in pressurized flow and backwater effects.
- Flat slopes in portions of the trunk contribute to limited conveyance under peak conditions.

Assessment

The existing network does not provide adequate capacity for the 10-year design storm. High velocities and surcharge conditions indicate potential for flooding, pipe wear, and maintenance concerns. Capacity improvements, such as upsizing pipes or adding parallel lines, are recommended to meet standard stormwater performance objectives in New Jersey.

5.5 Drainage Network 5

This network now consists of two (2) separate networks, and it is the largest network in the study area, with the most deficiencies, all of which contribute to the same outfall.

5.5.1 Drainage Network 5A

Network BD-9A consists of twenty-three circular concrete pipe segments, primarily 30-inch and 24-inch trunk lines transitioning to 18-inch and 15-inch laterals. As part of the overall Network 5, this is one of the largest networks in the study area, conveying stormwater runoff from Ross Road, Joan Drive, Brookwood Road, and Brookwood Drive. The network was analyzed for the 10-year design storm and exhibits major drainage deficiencies under existing conditions. The outfall discharges into a rock filled void midway between Brookwood Road and Brookwood Drive.

Key Hydraulic Observations

- Velocities are excessively high in multiple segments, reaching 13–17 fps in several trunk and branch lines, notably Lines 1, 3, 4, 5, 6, 7, 12, 13, and 15.
- The hydraulic grade line exceeds rim elevations in numerous segments, indicating widespread surcharge and pressurized flow under the 10-year event.
- Slopes are steep in the upper reaches (many 11–14%), which is the primary driver of the high velocities.

Assessment

The existing network BD-9A experiences significant hydraulic deficiencies under the 10-year storm. High velocities and surcharge create risks of abrasion, joint damage, and localized flooding. The steep slopes and undersized pipes in the upper branches are the main causes of these issues. Substantial conveyance upgrades (pipe upsizing and/or energy dissipation) will be required to bring velocities below 10 fps and eliminate surcharge.

5.5.2 Drainage Network 5B

Network 5B consists of seven circular concrete pipe segments, primarily 30-inch and 24-inch trunk lines. As part of the overall Network 5, this is part of the largest network in the study area, conveying stormwater runoff from Ross Road, Joan Drive, Brookwood Road, and Brookwood Drive. The network was analyzed for the 10-year design storm and exhibits major drainage deficiencies under existing conditions. The outfall discharges into a swale along Shady Brook Road.

Key Hydraulic Observations

- Velocities are extremely high throughout the network, reaching 15–23 fps in the main trunk segments.
- The hydraulic grade line exceeds rim elevations in multiple segments, indicating surcharge and pressurized flow under the 10-year event.
- Slopes range from very flat (0.2%) to steep (12%), contributing to both capacity limitations and excessive velocities.

Assessment

The existing network 5B exhibits severe hydraulic deficiencies under the 10-year storm. Extremely high velocities and widespread surcharge create serious risks of pipe abrasion, structural damage, and flooding at inlets. The combination of undersized pipes and poor slope distribution is the root cause. Major conveyance upgrades, including pipe upsizing and energy dissipation measures, will be required to restore acceptable performance.

5.6 Drainage Network 6

Network 6 consists of fourteen circular concrete pipe segments, predominantly 18-inch diameter. This localized network conveys stormwater runoff along Joan Drive and was analyzed for the 10-year design storm using Sussex County IDF curves. The system performs decently overall, largely due to recent updates completed in 2019.

Key Hydraulic Observations

- Velocities are below the typical recommended maximum range of 8–10 ft/s for concrete storm sewers.
- The hydraulic grade line remains below rim elevations in most segments, indicating the system operates without surcharge under the 10-year event.
- Some trunk and connecting lines have relatively flat slopes (e.g., below 1% in portions), which can limit self-cleansing capacity during lower flows.

Assessment

The existing network conveys the 10-year design storm without surcharge or flooding. However, velocities in certain segments are above recommended limits, increasing the potential for long-term pipe abrasion and scour at junctions or the outfall.

5.7 Drainage Network 7

Network BD 4-6 consists of three circular concrete pipe segments with 18-inch and 15-inch diameters. This small, localized network conveys stormwater runoff from Brookwood Drive and was analyzed for the 10-year design storm using FHA IDF curves. The outfall discharges in the rear of existing houses, with no drainage easements present.

Key Hydraulic Observations

- Velocities in the main trunk reach approximately 6.0–6.9 ft/s, which is within typical acceptable ranges for concrete storm sewers.
- Upstream and branch segments show velocities of 1.2–4.7 ft/s, with the flatter branch line remaining near or slightly above self-cleansing thresholds.
- The hydraulic grade line remains below rim elevations in all segments, indicating the system operates without surcharge under the 10-year event.
- Slopes vary from moderate $\pm 9\%$ in the trunk to a flatter $\pm 1\%$ in one branch line, influencing the observed velocity distribution.

Assessment

The existing network conveys the 10-year design storm without surcharge or flooding. Velocities are generally appropriate across the system, though the flatter branch slope may limit self-cleansing during lower flows. No major capacity or excessive velocity concerns are indicated for this return period. Routine inspection and potential minor energy or maintenance measures are recommended to support long-term performance in accordance with standard stormwater design practices in New Jersey.

5.8 Drainage Network 8

Network 8 consists of twelve circular concrete pipe segments with diameters ranging from 15 inches upstream to 30 inches. This large network conveys stormwater runoff from Ross Road through Brookwood Road and Brookwood Drive and was analyzed for the 10-year design storm using Sussex County FHA IDF curves. The outfall discharges between houses in an area where a drainage easement exists; however, no easements are present from Ross Road to Brookwood Road.

Key Hydraulic Observations

- Velocities in the main trunk significantly exceed the typical recommended maximum of 8–10 ft/s for concrete storm sewers (e.g., downstream trunk reaches approximately 14–15 ft/s).
- The hydraulic grade line remains below rim elevations in most segments, indicating the system operates without surcharge under the 10-year event.
- Steep to moderate slopes in portions of the trunk contribute to the elevated velocities observed.
- Flat slopes appear in some upstream or connecting lines, which may limit self-cleansing during lower flows.

Assessment

The existing network conveys the 10-year design storm without surcharge or flooding. However, velocities in the trunk are well above recommended limits, increasing the potential for pipe abrasion, scour at junctions or the outfall, and long-term structural wear. Energy dissipation measures, velocity reduction features, or minor pipe adjustments are recommended to improve durability and align with standard stormwater design practices in New Jersey.

5.9 Drainage Network 9

Network 9 consists of five circular concrete pipe segments, all 24-inch diameter. This small network, despite its limited number of pipes, collects runoff from relatively large drainage areas along Ross Road and Brookwood Road. It was analyzed for the 10-year design storm using Sussex County IDF curves. The outfall discharges between houses with no drainage easement present. Constant surface flow is observed down Ross Road due to the significant contributing drainage areas.

Key Hydraulic Observations

- Velocities in the main trunk reach 7.4–7.9 ft/s, which are below the typical recommended maximum of 8-10 ft/s for concrete storm sewers.
- Velocities in upstream branches range from 4.1–5.6 ft/s, generally within acceptable limits.
- The hydraulic grade line remains below rim elevations in all segments, indicating no surcharge under the 10-year event.
- Slopes vary from moderate to steep in portions of the system, contributing to the higher velocities observed.

Assessment

The existing network conveys the 10-year design storm without surcharge. However, velocities in the trunk are near recommended limits, which may increase long-term pipe wear and scour potential. Energy dissipation measures or minor adjustments are recommended to improve durability and align with standard stormwater design practices in New Jersey.

5.10 Drainage Network 10

Network 10 consists of two circular concrete pipe segments, both 15-inch diameter. This small network conveys stormwater runoff from Brookwood Drive and was analyzed for the 10-year design storm using Sussex County IDF curves. The outfall discharges between houses with no drainage easement present.

Key Hydraulic Observations

- Velocities reached, at the downstream end of the main line, and in the upstream segment, far exceeding the typical recommended maximum of 8–10 ft/s for concrete storm sewers.
- The hydraulic grade line is below rim elevations in both segments, indicating no significant surcharge.
- Steep slopes, approximately 15% in the main line and 6% in the upstream segment contribute to the elevated velocities.

Assessment

The existing network conveys the 10-year design storm without surcharge. However, the observed velocities are above recommended limits, increasing the potential for pipe abrasion and scour at junctions or the outfall. Energy dissipation features or other velocity control measures are recommended to reduce long-term maintenance concerns.

6. Recommended Improvement Strategy

The recommended improvements are designed to address the documented deficiencies in the existing stormwater networks, including surcharge, excessive velocities, inadequate self-cleansing, and the lack of water quality treatment and groundwater recharge.

The strategy prioritizes green infrastructure (GI) practices to the maximum extent practicable, in accordance with NJDEP Stormwater Management Rules (N.J.A.C. 7:8), while incorporating targeted conventional upgrades where necessary. All measures will be developed to achieve compliance with groundwater recharge, runoff quantity control, runoff quality control, and safety standards, while minimizing environmental impacts through low-impact placement, native vegetation, and erosion control during construction.

Proposed Conveyance System Upgrades:

- Upgrades include upsize undersized trunk lines in surcharge-prone storm sewers to eliminate pressurization and restore adequate capacity for the 10-year storm.
- Replace high-velocity pipe segments with larger diameters to reduce velocities to ≤ 10 ft/s.
- Regrade or realign flat-slope branches where terrain allows to achieve minimum self-cleansing velocities (≥ 3 ft/s).
- Install energy dissipators (rip-rap aprons and scour holes) at outfalls to prevent scour and stabilize discharge points.

Installation of Green Infrastructure and Water Quality BMPs:

- Implement distributed GI practices such as bioretention basins, subsurface infiltration systems, and vegetated swales along roadways, and open spaces to capture, treat, and infiltrate runoff at the source.
- Provide an 80–90% total suspended solids (TSS) removal target through a multi-stage treatment train approach, consistent with N.J.A.C. 7:8-5.5.

Redirection of Flows and System Integration

- Redirect roadway runoff from direct pipe conveyance to upstream GI practices to reduce peak flows and volumes entering the existing network.
- Connect fragmented drainage segments into a cohesive system with defined, stabilized outfalls.

- Eliminate uncontrolled overland discharges by routing flows through properly sized BMPs prior to final discharge.

Future Implementation Considerations

Improvements will be phased to address the most critical deficiencies first (surcharge and extreme-velocity basins), followed by velocity control and GI retrofits. All designs will incorporate climate resilience factors, safety features (trash racks, overflow protection), and coordination with NJDEP, county, and municipal permitting requirements. Detailed hydrologic and hydraulic modeling will verify that post-improvement conditions meet or exceed pre-development peak flow rates for the 2-, 10-, and 100-year storms, achieve required recharge volumes, and provide water quality treatment.

This integrated approach will eliminate existing flooding and erosion risks, improve long-term system durability, enhance water quality, and restore groundwater recharge while minimizing construction-related environmental impacts.

7. Proposed Conditions Hydraulic Summary

7.1 Drainage Network 1

Under proposed conditions, the drainage structures that are part of Network 1 will be connected to Network 2 by constructing additional drainage pipe along Stony Brook Road and Brookwood Drive. These upgrades will illuminate the drainage network that only infiltrates today and has no defined discharge location.

7.2 Drainage Network 2

Network 2 consists of five circular concrete pipe segments with diameters predominantly 15 inches and 18 inches. The network was analyzed for the 10-year design storm. Under the proposed conditions, the portion of the network along Brookwood Road has been piped and redirected to Network 3. The existing pipe connection between Brookwood Road and Brookwood Drive will be eliminated. This change was necessary because of the lack of a drainage easement in between the properties. The outfall location remains unchanged, with only a new energy dissipator (scour hole) added for erosion protection. Proposed upgrades include new catch basins to improve inlet capacity and overall system performance.

NJDEP Permit Considerations

Because the proposed work includes construction or stabilization at an existing stormwater outfall, the improvements will be evaluated under the Freshwater Wetlands Protection Act Rules and the Flood Hazard Area Control Act Rules. Anticipated approvals include a Highlands Applicability Determination and, if applicable, a Highlands Preservation Area Approval; a Freshwater Wetlands Letter of Interpretation to confirm regulated-resource boundaries; and a Freshwater Wetlands General Permit 11 for the outfall, associated pipe or headwall, and energy-dissipation measures such as riprap or a scour hole. An Individual Freshwater Wetlands Permit would be required if the work does not satisfy the General Permit 11 criteria.

Where the work is located within a regulated water, flood hazard area, floodway, or riparian zone, the project may also require a Flood Hazard Area Verification and an Individual Flood Hazard Area Permit, unless the proposed activity qualifies for an exemption under N.J.A.C. 7:13. If the combined project disturbance is one acre or more, authorization under the NJPDES Construction Activity Stormwater General Permit, Permit No. 5G3, will also be required. Final permit applicability will be confirmed during final design based on surveyed resource limits, drainage areas, disturbance limits, and the final outfall details.

7.3 Drainage Network 3

Proposed Network 3 consists of twelve concrete pipe segments, including an extension of the 30-inch elliptical trunk, transitioning from 24-inch and 15-inch circular pipes, and includes the newly added 15-inch portion from Network 2. The network was analyzed for the 10-year design storm. Proposed upgrades include new catch basins and increased pipe sizes to improve inlet capacity and overall hydraulic performance. The outfall location remains unchanged, with the addition of a scour hole for energy dissipation and erosion protection.

NJDEP Permit Considerations

Because the proposed work includes construction or stabilization at an existing stormwater outfall, the improvements will be evaluated under the Freshwater Wetlands Protection Act Rules and the Flood Hazard Area Control Act Rules. Anticipated approvals include a Highlands Applicability Determination and, if applicable, a Highlands Preservation Area Approval; a Freshwater Wetlands Letter of Interpretation to confirm regulated-resource boundaries; and a Freshwater Wetlands General Permit 11 for the outfall, associated pipe or headwall, and energy-dissipation measures such as riprap or a scour hole. An Individual Freshwater Wetlands Permit would be required if the work does not satisfy the General Permit 11 criteria.

Where the work is located within a regulated water, flood hazard area, floodway, or riparian zone, the project may also require a Flood Hazard Area Verification and an Individual Flood Hazard Area Permit, unless the proposed activity qualifies for an exemption under N.J.A.C. 7:13. If the combined project disturbance is one acre or more, authorization under the NJPDES Construction Activity Stormwater General Permit, Permit No. 5G3, will also be required. Final permit applicability will be confirmed during final design based on surveyed resource limits, drainage areas, disturbance limits, and the final outfall details.

7.4 Drainage Network 4

Network 4 consists of thirteen circular concrete pipe segments, predominantly 30-inch and 24-inch trunk lines transitioning to 18-inch and 15-inch laterals upstream. The network was analyzed for the 10-year design storm. Proposed upgrades include new catch basins and increased pipe sizes for most of the pipe runs to improve inlet capacity and overall hydraulic performance. The outfall location remains unchanged, with the addition of a scour hole for energy dissipation and erosion protection.

NJDEP Permit Considerations

Because the proposed work includes construction or stabilization at an existing stormwater outfall, the improvements will be evaluated under the Freshwater Wetlands Protection Act Rules and the Flood Hazard Area Control Act Rules. Anticipated approvals include a Highlands Applicability Determination and, if applicable, a Highlands Preservation Area Approval; a Freshwater Wetlands Letter of Interpretation to confirm regulated-resource boundaries; and a Freshwater Wetlands General Permit 11 for the outfall, associated pipe or headwall, and energy-dissipation measures such as riprap or a scour hole. An Individual Freshwater Wetlands Permit would be required if the work does not satisfy the General Permit 11 criteria.

Where the work is located within a regulated water, flood hazard area, floodway, or riparian zone, the project may also require a Flood Hazard Area Verification and an Individual Flood Hazard Area Permit, unless the proposed activity qualifies for an exemption under N.J.A.C. 7:13. If the combined project disturbance is one acre or more, authorization under the NJPDES Construction Activity Stormwater General Permit, Permit No. 5G3, will also be required. Final permit applicability will be confirmed during final design based on surveyed resource limits, drainage areas, disturbance limits, and the final outfall details.

7.5 Drainage Network 5

This network now consists of three (3) separate networks, and it is still the largest network in the study area, with the most proposed modifications, all of which contribute to the same outfall.

7.5.1 Drainage Network 5A

Network 5A (Ross Road to Joan Drive), consists of 1 existing 18-inch circular concrete pipe segment and the installation of a new 18-inch HDPE trunk line now discharging to the existing Joan Drive Basin.

7.5.2 Drainage Network 5B

Network 5B (Joan Drive to just below Brookwood Road) consists of seventeen circular concrete pipe segments, primarily 36-inch, 30-inch and 24-inch trunk lines transitioning to 18-inch and 15-inch laterals. As part of the overall Network 5, this is one of the largest networks in the study area, conveying stormwater runoff from Ross Road, Joan Drive, Brookwood Road down to Brookwood Drive. The network was analyzed for the 10-year design storm and exhibited major improved capacities and pipe velocities. Proposed upgrades include increased pipe sizes throughout much of the network.

7.5.3 Drainage Network 5C

Network 5C (Upstream of Brookwood Drive to the Outfall) will consist of seven circular concrete pipe segments, primarily 36-inch and 30-inch trunk lines. As part of the overall Network 5, this network is conveying stormwater runoff from upstream Ross Road, Joan Drive, and Brookwood Road. The network was analyzed for the 10-year design storm. Proposed upgrades include significantly increased pipe sizes. The outfall location remains unchanged and discharges into a swale along Shady Brook Road, with the addition of a scour hole for energy dissipation and erosion protection.

NJDEP Permit Considerations

Because the proposed work includes construction or stabilization at an existing stormwater outfall, the improvements will be evaluated under the Freshwater Wetlands Protection Act Rules and the Flood Hazard Area Control Act Rules. Anticipated approvals include a Highlands Applicability Determination and, if applicable, a Highlands Preservation Area Approval; a Freshwater Wetlands Letter of Interpretation to confirm regulated-resource boundaries; and a Freshwater Wetlands General Permit 11 for the outfall, associated pipe or headwall, and energy-dissipation measures such as riprap or a scour hole. An Individual Freshwater Wetlands Permit would be required if the work does not satisfy the General Permit 11 criteria.

Where the work is located within a regulated water, flood hazard area, floodway, or riparian zone, the project may also require a Flood Hazard Area Verification and an Individual Flood Hazard Area Permit, unless the proposed activity qualifies for an exemption under N.J.A.C. 7:13. If the combined project disturbance is one acre or more, authorization under the NJPDES Construction Activity Stormwater General Permit, Permit No. 5G3, will also be required. Final permit applicability will be confirmed during final design based on surveyed resource limits, drainage areas, disturbance limits, and the final outfall details.

7.6 Drainage Network 6

The proposed network 6 conveys the 10-year design storm without surcharge or flooding. Trunk capacities and flow velocities are adequate; therefore, no improvements to the main trunk are required.

Modifications are proposed to the existing basin pipe configuration to enhance both hydraulic performance and water-quality treatment. The direction of flow in the two inlets at the low point of Joan Drive has been reversed. Previously, these inlets conveyed runoff away from the basin; they now direct flows into the basin, thereby capturing and treating additional stormwater runoff from Joan Drive.

A new outlet structure and discharge pipe, sized for the 100-year storm, is proposed to connect to the first downstream structure. The basin footprint is also being enlarged to provide greater storage volume and improved treatment.

Additionally, a portion of the upstream inlets along Joan Drive (toward Ross Road) that previously bypassed the basin are now redirected into the basin. This change further increases the volume of runoff treated within the Joan Drive basin and enhances overall water-quality benefits.

7.7 Drainage Network 7

Network 7 will consist of three circular concrete pipe segments with 18-inch and 15-inch diameters. This small, localized network conveys stormwater runoff from Brookwood Drive and was analyzed for the 10-year design storm using FHA IDF curves. The existing system performs adequately under the design storm event. Therefore, no major improvements are being proposed. A scour hole will be added at the outfall for energy dissipation and erosion protection.

NJDEP Permit Considerations

Because the proposed work includes construction or stabilization at an existing stormwater outfall, the improvements will be evaluated under the Freshwater Wetlands Protection Act Rules, and the Flood Hazard Area Control Act Rules. Anticipated approvals may include a Highlands Applicability Determination and, if applicable, a Highlands Preservation Area Approval; a Freshwater Wetlands Letter of Interpretation to confirm regulated-resource boundaries; and a Freshwater Wetlands General Permit 11 for the outfall, associated pipe or headwall, and energy-dissipation measures such as riprap or a scour hole. An Individual Freshwater Wetlands Permit would be required if the work does not satisfy the General Permit 11 criteria.

Where the work is located within a regulated water, flood hazard area, floodway, or riparian zone, the project may also require a Flood Hazard Area Verification and an Individual Flood Hazard Area Permit, unless the proposed activity qualifies for an exemption under N.J.A.C. 7:13. If the combined project disturbance is one acre or more, authorization under the NJPDES Construction Activity Stormwater General Permit, Permit No. 5G3, will also be required. Final permit applicability will be confirmed during final design based on surveyed resource limits, drainage areas, disturbance limits, and the final outfall details.

7.8 Drainage Network 8

The Network 8 proposed improvements corrected the hydraulic deficiencies of the existing network. Undersized pipe diameters have been increased to provide adequate conveyance capacity and improve flow velocities to below 10 ft/sec. Catch basins and modified catch basins have been incorporated to

accommodate the larger pipe sizes. Sediment and erosion control measures, including a scour hole at the outfall, have been added to prevent scour. The redesigned system conveys the 10-year design storm without surcharge or flooding and is intended to satisfy the applicable hydraulic performance criteria, subject to final design and regulatory review.

NJDEP Permit Considerations

Because the proposed work includes construction or stabilization at an existing stormwater outfall, the improvements will be evaluated under the Freshwater Wetlands Protection Act Rules and the Flood Hazard Area Control Act Rules. Anticipated approvals include a Highlands Applicability Determination and, if applicable, a Highlands Preservation Area Approval; a Freshwater Wetlands Letter of Interpretation to confirm regulated-resource boundaries; and a Freshwater Wetlands General Permit 11 for the outfall, associated pipe or headwall, and energy-dissipation measures such as riprap or a scour hole. An Individual Freshwater Wetlands Permit would be required if the work does not satisfy the General Permit 11 criteria.

Where the work is located within a regulated water, flood hazard area, floodway, or riparian zone, the project may also require a Flood Hazard Area Verification and an Individual Flood Hazard Area Permit, unless the proposed activity qualifies for an exemption under N.J.A.C. 7:13. If the combined project disturbance is one acre or more, authorization under the NJPDES Construction Activity Stormwater General Permit, Permit No. 5G3, will also be required. Final permit applicability will be confirmed during final design based on surveyed resource limits, drainage areas, disturbance limits, and the final outfall details.

7.9 Drainage Network 9

Network 9 consists of five circular concrete pipe segments, primarily 24-inch diameter. The network was analyzed for the 10-year design storm. Proposed upgrades include increasing the last pipe run from 15 inches to 30 inches to provide adequate capacity. A drop manhole has been added to reduce flow velocity, and a scour hole is included at the outfall for energy dissipation and erosion protection.

NJDEP Permit Considerations

Because the proposed work includes construction or stabilization at an existing stormwater outfall, the improvements will be evaluated under the Freshwater Wetlands Protection Act Rules and the Flood Hazard Area Control Act Rules. Anticipated approvals may include a Highlands Applicability Determination and, if applicable, a Highlands Preservation Area Approval; a Freshwater Wetlands Letter of Interpretation to confirm regulated-resource boundaries; and a Freshwater Wetlands General Permit 11 for the outfall, associated pipe or headwall, and energy-dissipation measures such as riprap or a scour hole. An Individual Freshwater Wetlands Permit would be required if the work does not satisfy the General Permit 11 criteria.

Where the work is located within a regulated water, flood hazard area, floodway, or riparian zone, the project may also require a Flood Hazard Area Verification and an Individual Flood Hazard Area Permit, unless the proposed activity qualifies for an exemption under N.J.A.C. 7:13. If the combined project disturbance is one acre or more, authorization under the NJPDES Construction Activity Stormwater General Permit, Permit No. 5G3, will also be required. Final permit applicability will be confirmed during final design based on surveyed resource limits, drainage areas, disturbance limits, and the final outfall details.

7.10 Drainage Network 10

Network 10 consists of two circular concrete pipe segments, both 18-inch diameter. The network was analyzed for the 10-year design storm. No improvements are proposed to the existing pipes. A scour hole will be added at the outfall for energy dissipation and erosion protection.

NJDEP Permit Considerations

Because the proposed work includes construction or stabilization at an existing stormwater outfall, the improvements will be evaluated under the Freshwater Wetlands Protection Act Rules and the Flood Hazard Area Control Act Rules. Anticipated approvals may include a Highlands Applicability Determination and, if applicable, a Highlands Preservation Area Approval; a Freshwater Wetlands Letter of Interpretation to confirm regulated-resource boundaries; and a Freshwater Wetlands General Permit 11 for the outfall, associated pipe or headwall, and energy-dissipation measures such as riprap or a scour hole. An Individual Freshwater Wetlands Permit would be required if the work does not satisfy the General Permit 11 criteria.

Where the work is located within a regulated water, flood hazard area, floodway, or riparian zone, the project may also require a Flood Hazard Area Verification and an Individual Flood Hazard Area Permit, unless the proposed activity qualifies for an exemption under N.J.A.C. 7:13. If the combined project disturbance is one acre or more, authorization under the NJPDES Construction Activity Stormwater General Permit, Permit No. 5G3, will also be required. Final permit applicability will be confirmed during final design based on surveyed resource limits, drainage areas, disturbance limits, and the final outfall details.

8. Cost Summary

The Engineer's Construction Cost Estimate for the proposed drainage improvements has been developed based on the conceptual designs for all ten networks. The estimates include mobilization, erosion control, pipe installation, inlets, manholes, trench restoration, stormwater management basins, and energy dissipation measures (scour holes).

The Total Estimated Cost of Construction for the entire project to construct drainage improvements within the East Brookwood community will be \$3,760,000. This figure is broken down by individual networks as follows:

Network 1:	\$ 280,000
Network 3:	\$ 350,000
Network 4:	\$ 480,000
Network 5A:	\$ 175,000
Network 5B:	\$ 615,000
Network 5C:	\$ 280,000
Network 8:	\$ 1,350,000
Network 9:	\$ 200,000
Network 10:	\$ 30,000

These costs are based on current unit pricing for HDPE pipe, structures, excavation, and restoration. The estimates assume standard construction conditions and include estimates for engineering design and construction management.

Detailed cost estimates for each network are provided in the Appendix B. Final costs will be refined during the final design phase as additional survey, geotechnical data, and material pricing become available.



9. Highlands RMP Consistency

The project area is located within the New Jersey Highlands Region and includes lands identified within the Highlands Preservation Area. Accordingly, the proposed improvements will be advanced with consideration of the Highlands Water Protection and Planning Act, the NJDEP Highlands Water Protection and Planning Act Rules at N.J.A.C. 7:38, and the Highlands Regional Master Plan. The specific regulatory reviews and approvals applicable to each improvement will be determined during final design based on the final scope of work, limits of disturbance, and the presence of regulated environmental resources.

Consistency with the Highlands Regional Master Plan

The proposed improvements are generally intended to support the water-resource protection objectives of the Highlands Regional Master Plan by improving stormwater conveyance, reducing localized flooding and erosion, stabilizing existing discharge locations, and incorporating appropriate stormwater management measures where practicable.

Final consistency with the applicable goals, policies, and objectives of the Regional Master Plan will be evaluated as the design is advanced and site-specific environmental constraints, resource impacts, and regulatory requirements are confirmed.

Highlands Approval

The proposed improvements will be evaluated under the Highlands Water Protection and Planning Act Rules, N.J.A.C. 7:38. The Township will obtain a Highlands Applicability Determination and, if NJDEP determines that the work constitutes regulated major Highlands development, a Highlands Preservation Area Approval. The final design will also be reviewed to identify any related freshwater wetlands and flood hazard area authorizations. Coordination with NJDEP and the Highlands Council is recommended before submission of the required applications.

10. Drainage Easements

Some of the recommended improvements are located on private property, so the Township will need to obtain drainage easements before that work can be built and maintained. A drainage easement is a recorded agreement that gives the Township the right to enter a property to install, inspect, and maintain a stormwater facility.

Most of the proposed piping follows the existing road right-of-way along Brookwood Drive, Brookwood Road, Ross Road, Joan Drive, and Briar Lane, so much of the work should not require new easements;



this should be confirmed against the Township tax map. Easements will mainly be needed where the facilities leave the roadway: at the outfalls that cross private property to reach the wetlands and low-lying areas north of Brookwood (Networks 2, 3, 4, 5B, 5C, 7, 8, 9, and 10), at the two new basins and the enlarged Joan Drive basin, and at the few locations where pipes cross between private lots. The exact properties, easement widths, and areas will be determined from the tax map and the final design drawings.

11. Conclusion

The proposed improvements provide a comprehensive solution to the stormwater deficiencies identified across the ten drainage networks in the East Brookwood area. By increasing pipe sizes, improving inlets, adding new and enlarged detention basins, and providing energy dissipation at the outfalls, the redesigned networks convey the 10-year design storm without surcharge or flooding, keep flow velocities within acceptable limits, and meet the New Jersey stormwater management standards (N.J.A.C. 7:8). The new basins and treatment measures also improve water quality and help restore more natural drainage conditions, consistent with the goals of the Highlands Regional Master Plan.

Carrying the project forward will involve two efforts in addition to completing the design. Because the work lies within the Highlands Preservation Area, it will require a Highlands Preservation Area Approval from the NJDEP, which also covers the related freshwater wetlands and flood hazard area reviews. At the same time, the Township will need to acquire drainage easements for the facilities located on private property, starting with the basin sites and outfall corridors, which are likely to take the longest to secure.

The recommended next steps are to refine the designs using final survey data, prepare detailed construction cost estimates, and complete the supporting engineering, including final grading plans, soil erosion and sediment control details, and the stormwater management calculations required for permitting. Coordination with the NJDEP and the Highlands Council should begin early, ideally with a pre-application meeting, so that permitting and easement acquisition can move forward together with final design and keep the project on schedule toward construction.

APPENDICES

Appendix A

Preliminary Hydrology & Hydraulic Calculations

Preliminary Hydrology Calculations

10-YEAR STORM RUNOFF SUMMARY

Structure Label	Drainage Area (sf)	Draiang Area (ac)	Weighted Coeficiant "c"	Rational Method Equation: $Q = c i A$ (CFS)
Network 1				
EW-1	55321	1.27		
Network 2				
BD-24	42955	0.99	0.49	3.27
BD- 25	25637	0.59	0.88	3.51
BD- 26	5959	0.14	0.99	0.92
BD-27	39396	0.90	0.52	3.23
Network 3				
TB- 1	15751	0.36	0.71	1.74
BR- 23	301940	6.93	0.54	25.67
BR- 23A	25700	0.59	0.72	2.89
BR- 24	23958	0.55	0.66	2.45
BR- 25	10613	0.24	0.96	1.59
BR- 26	23644	0.54	0.64	2.34
BR-27	31406	1.86	0.47	5.94
BR- 28	41859	0.96	0.50	3.27
BR - 29	2000	0.05	0.99	0.31
BD- 20	35116	0.81	0.51	2.77
BD-21	2607	0.06	0.98	0.40
BD-22	18448	0.42	0.69	1.97
BD- 23	32977	0.76	0.66	3.39
Briar 1	9743	0.22	0.95	1.44
Briar 2	83488	1.92	0.61	7.91
Network 4				
SB- 1	6485	0.15	0.99	1.00
SB- 2	10384	0.24	0.78	1.26
SB-3	625	0.01	0.98	0.10
SB- 4	625	0.01	0.99	0.10
BD- 10	78307	1.80	0.48	5.89
BD- 11	34811	1.80	0.50	6.11

10-YEAR STORM RUNOFF SUMMARY

Structure Label	Drainage Area (sf)	Draiang Area (ac)	Weighted Coeficiant "c"	Rational Method Equation: $Q = c i A$ (CFS)
BD- 12	43251	3.21	0.47	10.30
BD- 13	4971	0.11	0.99	0.74
BD- 14	140011	1.03	0.69	4.82
BD- 15	44964	0.64	0.59	2.57
BD- 16	28059	1.73	0.52	6.06
BD- 17	75335	0.74	0.62	3.12
BD- 18	52510	0.71	0.64	3.11
BD- 19	21922	0.50	0.63	2.14
Network 5A				
RO-2A	134523	3.09	0.52	10.92
JD-18	3695	0.08	0.99	0.57
Network 5B				
JD-19 MH	3695	Known Flow		
BR- 12	43039	0.99	0.58	3.90
BR- 13	72779	1.67	0.65	7.38
BR- 14	44639	1.02	0.68	4.74
BR- 15	136273	3.13	0.52	11.06
BR- 16	174019	3.99	0.51	13.94
BR-17A	54038	1.24	0.54	4.56
BR-17	77297	1.77	0.59	7.14
BR- 18	103612	2.38	0.53	8.57
BR-19	61678	1.42	0.71	6.84
BR- 20	72616	1.67	0.57	6.47
BR- 21	98131	2.25	0.53	8.09
BR- 22	68518	1.57	0.50	5.34
BR- 22A	42700	0.98	0.70	4.67
Network 5C				
BD- 7	125157	2.87	0.52	10.15
BD- 8	29867	0.69	0.72	3.36
BD- 8A	5121	0.12	0.99	0.79

10-YEAR STORM RUNOFF SUMMARY

Structure Label	Drainage Area (sf)	Draiage Area (ac)	Weighted Coeficiant "c"	Rational Method Equation: $Q = c i A$ (CFS)
BD- 8B	42458	0.97	0.48	3.18
BD- 9	113565	2.61	0.52	9.19
Network 6				
JD- 1	109445	2.51	0.48	8.20
JD- 2	22666	0.52	0.99	3.50
JD-3	76613	1.76	0.49	5.81
JD-4	25011	0.07	0.99	0.47
JD-5	36006	0.06	0.99	0.40
JD-6	53753	4.39	0.49	14.54
JD-7	6426	0.08	0.99	0.54
JD-8	3651	0.08	0.99	0.56
JD-9	181560	4.17	0.49	13.77
JD-11	15621	0.36	0.99	2.41
JD-12	6568	0.15	0.99	1.02
JD-15 HW	155456	Known Flow		
JD-16	1605	0.04	0.99	0.25
JD-17	6820	0.16	0.99	1.05
Network 7				
BD-4	15755	0.36	0.80	1.97
BD-5	50388	1.16	0.56	4.39
BD-6	48253	1.11	0.56	4.22
Network 8				
RO- 1	382305	8.78	0.48	28.65
RO-1A	2319	0.05	0.99	0.36
RO-1B	131463	3.02	0.94	19.29
RO- 2	37953	0.87	0.95	5.63
RO- 3	3429	0.08	0.99	0.53
RO-4	30705	0.70	0.70	3.36
RO-5	258494	5.93	0.50	20.18
RO- 7	117604	2.70	0.50	9.18
RO- 8	140760	3.23	0.52	11.43

10-YEAR STORM RUNOFF SUMMARY

Structure Label	Drainage Area (sf)	Draiage Area (ac)	Weighted Coeficiant"c"	Rational Method Equation: $Q = c \ i \ A$ (CFS)
RO- 9	179018	4.11	0.58	16.21
BR- 8	109907	2.52	0.67	11.50
BR- 9	58393	1.34	0.71	6.50
BR-9A	40075	0.92	0.66	4.13
BR-9B	40947	0.94	0.63	4.03
BR-10	33220	0.76	0.58	3.01
BR- 11	121560	2.79	0.58	10.94
BD-1	81833	1.88	0.53	6.77
BD- 2	101599	2.33	0.53	8.42
BD- 3	83798	1.92	0.51	6.65
Network 9				
BR-3	257524	5.91	0.48	19.30
BR- 4	16256	0.37	0.75	1.90
BR- 5	363779	8.35	0.48	27.26
BR- 6	6222	0.14	0.99	0.96
BR- 7	86208	1.98	0.71	9.57
Network 10				
BR- 1	198068	4.55	0.50	15.46
BR- 2	18120	0.42	0.87	2.46

Preliminary Hydraulic Calculations

Network 2 Proposed Conditions – Pipe Summary (10-Year Storm)											
Line	Line ID	Size (in)	Inv Dn (ft)	Inv Up (ft)	Slope (%)	HGL Dn (ft)	HGL Up (ft)	Vel Dn (fps)	Vel Up (fps)	Rim Dn (ft)	Rim Up (ft)
1	BD-25 to Outfall	24	712.69	713.42	0.5	714.07	714.88	6.37	6.03	714	716.17
2	BD-24 to BD-25	24	713.42	714.56	5.1	715.63	715.82	3.94	5.91	716.17	717.31
3	BR-25 to BD-24	15	714.56	727.08	5.8	715.82	728.17	6.15	6.64	729.93	729.93
4	BR-29 to BR-25	15	727.08	727.31	0.5	728.33	728.72	5.25	5.25	730.06	730.06
5	BR-28 to BR-29	15	727.31	727.96	2.05	729.33	729.58	5.07	5.07	730.71	730.71
6	BR-27 to BR-28	15	727.96	728.48	0.53	730.18	730.5	3.3	3.3	730.71	731.23
7	BR-26 to BR-27	15	728.48	729.88	1.17	730.59	730.68	1.69	2.49	731.23	732.63
8	BD-26 to BD-24	15	714.56	717.49	1.65	715.82	718.23	2.69	4.42	717.31	721.6
9	BD-27 to BD-26	15	717.49	718.06	0.5	718.23	718.73	3.76	4.17	721.6	720.81

Network 3 Proposed Conditions – Pipe Summary (10-Year Storm)											
Line	Line ID	Size (in)	Inv Dn (ft)	Inv Up (ft)	Slope (%)	HGL Dn (ft)	HGL Up (ft)	Vel Dn (fps)	Vel Up (fps)	Rim Dn (ft)	Rim Up (ft)
1	TB-1 to Outfall	30	702.00	705.83	2.41	703.47	707.39	7.07	6.57	705.00	710.29
2	BD-20 to TB-1	30	706.72	712.60	2.41	707.66	714.14	12.27	6.50	710.29	717.10
3	BD-22 to BD-20	30	712.60	713.83	2.84	714.14	715.30	5.90	6.26	717.10	717.61
4	BR-24A to BR-22	30	714.86	722.16	3.61	715.61	723.53	13.33	5.98	717.61	731.81
5	BR-24 to BR-24A	24	729.06	733.29	3.07	729.92	734.75	12.78	6.71	731.81	741.18
6	BR-23A to BR-24	15	737.16	738.48	3.08	737.83	739.54	10.33	6.32	741.18	741.23
7	Briar 2 to BR-23A	15	738.48	744.95	3.08	739.54	745.92	5.15	5.61	741.23	765.81
8	Briar 1 to Briar 2	15	762.20	763.16	3.08	762.43	763.53	5.77	2.91	765.81	765.91
9	BR-23 to BR-24	15	738.43	740.40	3.08	739.30	741.59	11.18	8.44	741.18	746.34
10	BD-23 to BD-22	15	714.08	715.13	3.08	715.30	715.88	2.84	4.50	717.61	718.28
11	BD-21 to BD-22	15	715.13	715.78	3.08	715.88	716.01	0.46	2.27	718.28	718.53
12	BD-19 to BD-20	15	714.35	717.25	3.08	714.68	717.80	7.24	3.66	717.10	720.73

Network 4 Proposed Conditions – Pipe Summary (10-Year Storm)											
Line	Line ID	Size (in)	Inv Dn (ft)	Inv Up (ft)	Slope (%)	HGL Dn (ft)	HGL Up (ft)	Vel Dn (fps)	Vel Up (fps)	Rim Dn (ft)	Rim Up (ft)
1	SB-3 to Outfall	36	702.94	704.3	1.24	705.25	705.78	3.65	6.12	705.94	709.11
2	SB-1 to SB-3	30	705.11	705.61	0.92	706.35	707.17	8.65	6.55	709.11	709.61
3	BD-13 to SB-1	30	705.61	706.6	0.63	707.17	708.16	6.55	6.55	709.61	710.6
4	BD-11 to BD-13	30	706.6	707.08	0.89	708.16	708.63	6.5	6.53	710.6	711.08
5	BD-12 to BD-11	30	707.08	707.75	1.09	708.63	709.12	5.16	5.99	711.08	711.75
6	BD-14 to BD-12	30	707.75	716.34	2.45	709.12	717.67	5.59	5.85	711.75	721.03
7	BD-15 to BD-14	24	716.84	717.15	0.5	718.06	718.39	5.94	5.82	721.03	720.82
8	BD-16 to BD-15	18	717.65	717.97	0.5	719.15	719.58	5.31	5.31	720.82	720.97
9	BD-17 to BD-16	18	717.97	719.01	0.69	719.8	720.43	4.36	4.44	720.97	722.01
10	BD-18 to BD-17	15	719.26	720.11	2.34	720.59	720.93	3.31	4.8	722.01	722.86
11	BD-10 to BD-11	15	708.33	709.34	1.5	708.92	710.1	6.29	4.57	711.08	712.09
12	SB-4 to SB-3	15	706.05	706.17	0.5	706.33	706.46	2.68	2.58	709.11	709.24
13	SB-2 to SB-4	15	706.17	706.42	0.5	706.46	706.52	0.21	1.06	709.24	709.17

Network 5B Proposed Conditions – Pipe Summary (10-Year Storm)

Line	Line ID	Size (in)	Inv Dn (ft)	Inv Up (ft)	Slope (%)	HGL Dn (ft)	HGL Up (ft)	Vel Dn (fps)	Vel Up (fps)	Rim Dn (ft)	Rim Up (ft)
1	BR-19 to BR-19A	30"	735.58	762.80	14.00	738.00	764.86	7.65	8.59	738.08	770.18
2	BR-17 to BR-19	30"	765.73	766.14	0.50	767.48	767.89	7.16	7.14	770.18	770.14
3	BR-17A to BR-17	24"	766.64	770.37	11.42	769.08	771.83	5.21	6.67	770.14	773.87
4	JD-20 to BR-17A	24"	770.37	797.57	11.41	771.83	798.97	6.14	6.42	773.87	801.07
5	JD-19 to JD-20	24"	797.57	817.04	9.35	798.97	818.44	6.42	6.42	801.07	820.54
6	JD-15 to JD-16	18"	822.50	823.00	2.88	823.50	824.41	12.07	8.74	830.50	828.00
7	BR-18 to BR-19	30"	767.10	767.25	0.50	768.33	768.57	6.34	5.82	770.18	770.00
8	BR-20 to BR-18	24"	767.25	768.00	0.42	768.62	769.38	5.61	5.60	770.00	771.30
9	BR-21 to BR-20	18"	768.00	769.76	0.92	769.62	770.95	5.35	6.30	771.30	772.51
10	BR-22 to BR-21	15"	769.76	775.31	2.66	770.95	776.39	6.10	6.52	772.51	778.06
11	BR-22A to BR-22	15"	775.31	783.57	4.61	776.39	784.26	2.61	4.24	778.06	786.32
12	BR-15 to BR-17	24"	767.39	772.85	2.14	769.08	774.22	5.14	6.32	770.14	775.60
13	BR-13 to BR-15	15"	772.85	774.02	3.22	774.22	775.20	8.05	8.23	775.60	776.77
14	BR-12 to BR-13	15"	774.02	778.84	14.00	775.20	779.59	2.87	4.49	776.77	783.50
15	BR-14 to BR-15	15"	772.85	775.91	4.94	774.22	776.66	2.78	4.48	775.60	778.66

Network 5C Proposed Conditions – Pipe Summary (10-Year Storm)											
Line	Line ID	Size	Inv Dn	Inv Up	Slope (%)	HGL Dn	HGL Up	Vel Dn (fps)	Vel Up (fps)	Rim Dn	Rim Up
1	BD-9 to Outfall	36"	705.50	708.75	9.60	707.88	711.48	12.66	11.27	710.00	713.76
2	BD-8 to BD-9	36"	708.75	708.88	0.50	711.75	712.01	10.26	10.26	713.76	713.38
3	BD-8A to BD-8	30"	709.38	712.84	5.28	714.45	715.93	13.62	13.61	713.38	716.84
4	BD-8B to BD-8A	30"	712.84	715.62	10.00	717.37	718.04	13.55	13.67	716.84	720.37
5	BR19-B to BD-8B	30"	716.37	720.40	10.00	718.04	722.81	18.39	13.23	720.37	725.22
6	BR-19A to BR-19B	30"	721.22	728.56	10.00	722.81	730.98	19.45	13.23	725.22	738.08
7	BD-7 to BD-8	18"	710.63	717.17	4.41	714.45	718.05	2.94	4.84	713.38	719.92

Network 6 Proposed Conditions – Pipe Summary (10-Year Storm)											
Line	Line ID	Size (in)	Inv Dn (ft)	Inv Up (ft)	Slope (%)	HGL Dn (ft)	HGL Up (ft)	Vel Dn (fps)	Vel Up (fps)	Rim Dn (ft)	Rim Up (ft)
1	JD-13 to JD-14 (HW)	18	818.94	820.66	6.0	820.43	822.02	7.52	7.88	825.00	829.41
2	JD-11 to JD-13	18	820.56	823.01	3.8	822.02	824.37	7.58	7.90	829.41	828.51
3	JD-10 to JD-11	18	823.21	830.42	4.2	824.37	831.75	8.50	7.51	828.51	834.22
4	JD-8 to JD-10	18	830.72	837.09	4.6	831.75	838.42	9.65	7.53	834.22	841.29
5	JD7 to JD-8	18	837.19	848.34	5.0	838.42	849.49	5.70	6.09	841.29	853.64
6	JD-5 to JD-7	18	848.39	853.87	3.1	849.49	855.02	6.30	6.06	853.64	857.47
7	JD-4 to JD-5	18	853.97	855.39	0.8	855.02	856.23	3.67	4.71	857.47	861.74
8	JD-3 to JD-4	18	855.49	861.55	5.4	856.23	862.38	5.40	4.67	861.74	870.30
9	JD2 to JD-3	18	861.55	869.95	8.1	862.38	870.63	3.13	4.09	870.30	882.05
10	JD-1 to JD-2	18	876.50	878.05	5.2	876.80	878.61	8.96	3.66	882.05	882.70
11	JD1A	18	878.05	878.74	7.7	878.61	880.24	0.00	0.00	882.70	883.88
12	JD-6 to JD-5	18	854.87	855.90	3.4	855.55	857.06	11.38	6.12	857.47	859.11
13	JD-9 to JD-8	18	837.19	839.46	7.8	838.42	840.77	7.73	7.32	841.29	842.67
14	JD-12 to JD-11	18	822.90	823.19	1.0	824.37	823.54	0.51	2.83	828.51	828.21

Network 8 Proposed Conditions – Pipe Summary (10-Year Storm)

Line	Line ID	Size	Inv Dn	Inv Up	Slope (%)	HGL Dn	HGL Up	Vel Dn (fps)	Vel Up (fps)	Rim Dn	Rim Up
1	BD-2 to Outfall	36"	704.15	714.46	6.1	707.38	717.55	11.04	11.38	707.15	718.96
2	BD-1 to BD-2	36"	714.96	715.89	2.8	717.55	718.77	14.73	13.73	718.96	719.89
3	MH-2 to BD-1	36"	715.89	724.86	5.3	718.77	727.67	12.23	12.38	719.89	728.86
4	MH-1 to MH-2	36"	724.86	745.02	9.3	727.67	747.84	12.47	12.46	728.86	749.02
5	BR-9 to MH-1	36"	745.02	766.88	11.8	747.84	769.70	12.54	12.53	749.02	771.40
6	BR-11 to BR-9	36"	767.90	769.74	1.4	770.01	772.42	13.51	10.76	771.40	773.24
7	BR-10 to BR-11	30"	769.74	770.01	0.9	772.42	773.10	12.69	12.69	773.24	773.51
8	RO-9 to BR-10	30"	770.51	823.60	14.0	774.50	826.00	12.32	12.50	773.51	844.73
9	RO-7 to RO-9	30"	840.20	840.50	0.4	842.70	843.51	9.45	9.45	844.73	843.25
10	RO-8 to RO-7	18"	840.50	841.59	3.7	845.60	846.20	8.21	8.21	843.25	844.34
11	BR-8 to BR-9	15"	768.13	768.24	0.4	769.70	770.28	8.25	8.25	771.40	770.99
12	BD-3 to BD-2	15"	717.14	724.60	2.1	718.77	725.58	4.79	5.69	719.89	727.35

Network 9 Proposed Conditions – Pipe Summary (10-Year Storm)

Line	Line ID	Size (in)	Inv Dn (ft)	Inv Up (ft)	Slope (%)	HGL Dn (ft)	HGL Up (ft)	Vel Dn (fps)	Vel Up (fps)	Rim Dn (ft)	Rim Up (ft)
1	BR-7 to Outfall	24	745.58	770.67	11.9	747.19	772.61	11.20	8.60	748.33	778.34
2	BR-6 to BR-7	24	770.77	773.58	3.7	772.61	775.43	9.70	9.60	778.34	777.43
3	BR-4 to BR-6	24	773.68	778.47	9.2	775.43	780.01	6.30	7.10	777.43	783.30
4	BR-3 to BR-4	24	778.57	780.00	4.2	780.01	781.49	7.00	6.80	783.30	783.75
5	BR-5 to BR-6	24	773.68	776.18	2.5	775.43	777.34	3.60	5.60	777.43	779.00

Appendix B

Engineers Cost Estimate

Proposed Drainage Improvements - East Brookwood

Byram Township, Sussex County, NJ

HPA Project #25-527

Engineer's Cost Estimate for Pipe Network #1

STD. ITEM NO.	TO BE CONSTRUCTED	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	MOBILIZATION	100%	LUMP SUM	\$22,000.00	\$22,000.00
2	TRAFFIC CONTROL	100%	LUMP SUM	\$10,000.00	\$10,000.00
3	SOIL EROSION & SEDIMENT CONTROL	100%	LUMP SUM	\$11,250.00	\$11,250.00
4	INLET, TYPE "A"	2	UNIT	\$4,000.00	\$8,000.00
5	15" HDPE PIPE, SMOOTH LINED	800	LIN. FT.	\$60.00	\$48,000.00
6	TRENCH EXCAVATION & BACKFILL	800	LIN. FT.	\$100.00	\$80,000.00
7	TRENCH REPAIR	800	LIN. FT.	\$60.00	\$48,000.00
8	DENSE GRADED AGGREGATE, IF & WHERE	80	TONS	\$40.00	\$3,200.00
9	3/4" STONE PIPE BEDDING & BACKFILL	230	TONS	\$50.00	\$11,500.00
10	ENGINEERING DESIGN	100%	LUMP SUM	\$22,000.00	\$20,000.00
11	CONSTRUCTION MANAGEMENT & INSPECTION	100%	LUMP SUM	\$10,000.00	\$15,000.00
	TOTAL ESTIMATED PROJECT COST:				\$276,950.00

Proposed Drainage Improvements - East Brookwood

Byram Township, Sussex County, NJ

HPA Project #25-527

Engineer's Cost Estimate for Pipe Network #3

STD. ITEM NO.	TO BE CONSTRUCTED	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	MOBILIZATION	100%	LUMP SUM	\$26,000.00	\$26,000.00
2	TRAFFIC CONTROL	100%	LUMP SUM	\$5,000.00	\$5,000.00
3	SOIL EROSION & SEDIMENT CONTROL	100%	LUMP SUM	\$10,000.00	\$10,000.00
4	INLET, TYPE "E"	4	UNIT	\$5,000.00	\$20,000.00
5	MANHOLE, 4' DIAMETER	1	UNIT	\$5,000.00	\$5,000.00
6	15" HDPE PIPE, SMOOTH LINED	585	LIN. FT.	\$55.00	\$32,175.00
7	30" HDPE PIPE, SMOOTH LINED	270	LIN. FT.	\$125.00	\$33,750.00
8	TRENCH EXCAVATION & BACKFILL	855	LIN. FT.	\$100.00	\$85,500.00
9	TRENCH REPAIR	855	LIN. FT.	\$60.00	\$51,300.00
10	DENSE GRADED AGGREGATE, IF & WHERE	90	TONS	\$40.00	\$3,600.00
11	3/4" STONE PIPE BEDDING & BACKFILL	500	TONS	\$50.00	\$25,000.00
12	SCOUR HOLE	100%	LUMP SUM	\$5,000.00	\$5,000.00
13	ENGINEERING DESIGN	100%	LUMP SUM	\$30,000.00	\$30,000.00
14	CONSTRUCTION MANAGEMENT & INSPECTION	100%	LUMP SUM	\$15,000.00	\$15,000.00
	TOTAL ESTIMATED PROJECT COST:				\$347,325.00

Proposed Drainage Improvements - East Brookwood

Byram Township, Sussex County, NJ

HPA Project #25-527

Engineer's Cost Estimate for Pipe Network #4

STD. ITEM NO.	TO BE CONSTRUCTED	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	MOBILIZATION	100%	LUMP SUM	\$30,000.00	\$30,000.00
2	TRAFFIC CONTROL	100%	LUMP SUM	\$8,000.00	\$8,000.00
3	SOIL EROSION & SEDIMENT CONTROL	100%	LUMP SUM	\$13,500.00	\$13,500.00
4	INLET, TYPE "A"	2	UNIT	\$4,000.00	\$8,000.00
5	INLET, TYPE "E"	5	UNIT	\$5,000.00	\$25,000.00
6	MODIFIED INLET, TYPE "E"	1	UNIT	\$6,500.00	\$6,500.00
7	15" HDPE PIPE, SMOOTH LINED	55	LIN. FT.	\$55.00	\$3,025.00
8	18" HDPE PIPE, SMOOTH LINED	65	LIN. FT.	\$75.00	\$4,875.00
9	24" HDPE PIPE, SMOOTH LINED	65	LIN. FT.	\$100.00	\$6,500.00
10	30" HDPE PIPE, SMOOTH LINED	750	LIN. FT.	\$125.00	\$93,750.00
11	36" HDPE PIPE, SMOOTH LINED	110	LIN. FT.	\$150.00	\$16,500.00
12	TRENCH EXCAVATION & BACKFILL	925	LIN. FT.	\$100.00	\$92,500.00
13	TRENCH REPAIR	925	LIN. FT.	\$60.00	\$55,500.00
14	OUTLET STRUCTURES	1	UNIT	\$5,000.00	\$5,000.00
15	DENSE GRADED AGGREGATE, IF & WHERE	100	TONS	\$40.00	\$4,000.00
16	3/4" STONE PIPE BEDDING & BACKFILL	800	TONS	\$50.00	\$40,000.00
17	SCOUR HOLE	100%	LUMP SUM	\$5,000.00	\$5,000.00
18	ENGINEERING DESIGN	100%	LUMP SUM	\$40,000.00	\$40,000.00
19	CONSTRUCTION MANAGEMENT & INSPECTION	100%	LUMP SUM	\$20,000.00	\$20,000.00
	TOTAL ESTIMATED PROJECT COST:				\$477,650.00

Proposed Drainage Improvements - East Brookwood

Byram Township, Sussex County, NJ

HPA Project #25-527

Engineer's Cost Estimate for Pipe Network #5A

STD. ITEM NO.	TO BE CONSTRUCTED	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	MOBILIZATION	100%	LUMP SUM	\$25,000.00	\$25,000.00
2	TRAFFIC CONTROL	100%	LUMP SUM	\$2,500.00	\$2,500.00
3	SOIL EROSION & SEDIMENT CONTROL	100%	LUMP SUM	\$12,500.00	\$12,500.00
4	FLARED END	1	UNIT	\$1,500.00	\$1,500.00
5	18" HDPE PIPE, SMOOTH LINED	165	LIN. FT.	\$75.00	\$12,375.00
6	TRENCH EXCAVATION & BACKFILL	165	LIN. FT.	\$100.00	\$16,500.00
7	TRENCH REPAIR	165	LIN. FT.	\$60.00	\$9,900.00
8	STORMWATER MANAGEMENT BASINS	1	L.S.	\$40,000.00	\$40,000.00
9	RETAINING WALL	1	LUMP SUM	\$25,000.00	\$25,000.00
10	DENSE GRADED AGGREGATE, IF & WHERE	50	TONS	\$40.00	\$2,000.00
11	3/4" STONE PIPE BEDDING & BACKFILL	110	TONS	\$50.00	\$5,500.00
12	SCOUR HOLE	100%	LUMP SUM	\$5,000.00	\$5,000.00
13	ENGINEERING DESIGN	100%	LUMP SUM	\$15,000.00	\$15,000.00
14	CONSTRUCTION MANAGEMENT & INSPECTION	100%	LUMP SUM	\$10,000.00	\$10,000.00
	TOTAL ESTIMATED PROJECT COST:				\$172,775.00

Proposed Drainage Improvements - East Brookwood

Byram Township, Sussex County, NJ

HPA Project #25-527

Engineer's Cost Estimate for Pipe Network #5B

STD. ITEM NO.	TO BE CONSTRUCTED	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	MOBILIZATION	100%	LUMP SUM	\$40,000.00	\$40,000.00
2	TRAFFIC CONTROL	100%	LUMP SUM	\$8,000.00	\$8,000.00
3	SOIL EROSION & SEDIMENT CONTROL	100%	LUMP SUM	\$22,500.00	\$22,500.00
4	INLET, TYPE "B"	2	UNIT	\$5,000.00	\$10,000.00
5	18" HDPE PIPE, SMOOTH LINED	305	LIN. FT.	\$55.00	\$16,775.00
6	24" HDPE PIPE, SMOOTH LINED	900	LIN. FT.	\$100.00	\$90,000.00
7	30" HDPE PIPE, SMOOTH LINED	120	LIN. FT.	\$125.00	\$15,000.00
8	36" HDPE PIPE, SMOOTH LINED	180	LIN. FT.	\$150.00	\$27,000.00
9	TRENCH EXCAVATION & BACKFILL	1,505	LIN. FT.	\$100.00	\$150,500.00
10	TRENCH REPAIR	1,505	LIN. FT.	\$60.00	\$90,300.00
11	OUTLET STRUCTURES	1	UNIT	\$5,000.00	\$5,000.00
12	DENSE GRADED AGGREGATE, IF & WHERE	150	TONS	\$40.00	\$6,000.00
13	3/4" STONE PIPE BEDDING & BACKFILL	1,000	TONS	\$50.00	\$50,000.00
14	SCOUR HOLE	100%	LUMP SUM	\$5,000.00	\$5,000.00
15	ENGINEERING DESIGN (10%)	100%	LUMP SUM	\$50,000.00	\$50,000.00
16	CONSTRUCTION MANAGEMENT & INSPECTION (6%)	100%	LUMP SUM	\$25,000.00	\$25,000.00
	TOTAL ESTIMATED PROJECT COST:				\$611,075.00

Proposed Drainage Improvements - East Brookwood

Byram Township, Sussex County, NJ

HPA Project #25-527

Engineer's Cost Estimate for Pipe Network #5C

STD. ITEM NO.	TO BE CONSTRUCTED	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	MOBILIZATION	100%	LUMP SUM	\$20,000.00	\$20,000.00
2	TRAFFIC CONTROL	100%	LUMP SUM	\$5,000.00	\$5,000.00
3	SOIL EROSION & SEDIMENT CONTROL	100%	LUMP SUM	\$10,000.00	\$10,000.00
4	INLET, TYPE "B"	1	UNIT	\$5,000.00	\$5,000.00
5	INLET, TYPE "E"	3	UNIT	\$5,000.00	\$15,000.00
6	MODIFIED INLET, TYPE "E"	2	UNIT	\$6,500.00	\$13,000.00
7	18" HDPE PIPE, SMOOTH LINED	205	LIN. FT.	\$55.00	\$11,275.00
8	30" HDPE PIPE, SMOOTH LINED	255	LIN. FT.	\$125.00	\$31,875.00
9	36" HDPE PIPE, SMOOTH LINED	70	LIN. FT.	\$150.00	\$10,500.00
10	TRENCH EXCAVATION & BACKFILL	530	LIN. FT.	\$100.00	\$53,000.00
11	TRENCH REPAIR	530	LIN. FT.	\$60.00	\$31,800.00
12	OUTLET STRUCTURES	1	UNIT	\$5,000.00	\$5,000.00
13	DENSE GRADED AGGREGATE, IF & WHERE	50	TONS	\$40.00	\$2,000.00
14	3/4" STONE PIPE BEDDING & BACKFILL	350	TONS	\$50.00	\$17,500.00
15	SCOUR HOLE	100%	LUMP SUM	\$5,000.00	\$5,000.00
16	ENGINEERING DESIGN	100%	LUMP SUM	\$20,000.00	\$25,000.00
17	CONSTRUCTION MANAGEMENT & INSPECTION	100%	LUMP SUM	\$5,000.00	\$20,000.00
	TOTAL ESTIMATED PROJECT COST:				\$280,950.00

Proposed Drainage Improvements - East Brookwood

Byram Township, Sussex County, NJ

HPA Project #25-527

Engineer's Cost Estimate for Pipe Network #8

STD. ITEM NO.	TO BE CONSTRUCTED	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	MOBILIZATION	100%	LUMP SUM	\$100,000.00	\$100,000.00
2	TRAFFIC CONTROL	100%	LUMP SUM	\$25,000.00	\$25,000.00
3	SOIL EROSION & SEDIMENT CONTROL	100%	LUMP SUM	\$52,000.00	\$52,000.00
4	MANHOLE, 4' DIAMETER	3	UNIT	\$5,000.00	\$15,000.00
5	FLARED END	1	UNIT	\$1,500.00	\$1,500.00
6	INLET, TYPE "B"	6	UNIT	\$5,000.00	\$30,000.00
7	MODIFIED INLET, TYPE "B"	3	UNIT	\$6,500.00	\$19,500.00
8	MODIFIED INLET, TYPE "E"	2	UNIT	\$6,500.00	\$13,000.00
9	24" HDPE PIPE, SMOOTH LINED	175	LIN. FT.	\$100.00	\$17,500.00
10	30" HDPE PIPE, SMOOTH LINED	1,200	LIN. FT.	\$125.00	\$150,000.00
11	36" HDPE PIPE, SMOOTH LINED	1,315	LIN. FT.	\$150.00	\$197,250.00
12	TRENCH EXCAVATION & BACKFILL	2,690	LIN. FT.	\$100.00	\$269,000.00
13	TRENCH REPAIR	2,690	LIN. FT.	\$60.00	\$161,400.00
14	STORMWATER MANAGEMENT BASINS	1	L.S.	\$40,000.00	\$40,000.00
15	OUTLET STRUCTURES	1	UNIT	\$5,000.00	\$5,000.00
16	DENSE GRADED AGGREGATE, IF & WHERE	300	TONS	\$40.00	\$12,000.00
17	3/4" STONE PIPE BEDDING & BACKFILL	2,250	TONS	\$50.00	\$112,500.00
18	SCOUR HOLE	100%	LUMP SUM	\$5,000.00	\$5,000.00
19	ENGINEERING DESIGN	100%	LUMP SUM	\$90,000.00	\$90,000.00
20	CONSTRUCTION MANAGEMENT & INSPECTION	100%	LUMP SUM	\$30,000.00	\$30,000.00
	TOTAL ESTIMATED PROJECT COST:				\$1,345,650.00

Proposed Drainage Improvements - East Brookwood

Byram Township, Sussex County, NJ

HPA Project #25-527

Engineer's Cost Estimate for Pipe Network #9

STD. ITEM NO.	TO BE CONSTRUCTED	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	MOBILIZATION	100%	LUMP SUM	\$10,000.00	\$10,000.00
2	TRAFFIC CONTROL	100%	LUMP SUM	\$30,000.00	\$30,000.00
3	SOIL EROSION & SEDIMENT CONTROL	100%	LUMP SUM	\$50,000.00	\$50,000.00
4	MANHOLE, 4' DIAMETER	1	UNIT	\$5,000.00	\$5,000.00
5	30" HDPE PIPE, SMOOTH LINED	215	LIN. FT.	\$125.00	\$26,875.00
6	TRENCH EXCAVATION & BACKFILL	215	LIN. FT.	\$100.00	\$21,500.00
7	TRENCH REPAIR	215	LIN. FT.	\$60.00	\$12,900.00
8	DENSE GRADED AGGREGATE, IF & WHERE	50	TONS	\$40.00	\$2,000.00
9	3/4" STONE PIPE BEDDING & BACKFILL	150	TONS	\$50.00	\$7,500.00
10	SCOUR HOLE	100%	LUMP SUM	\$5,000.00	\$5,000.00
11	ENGINEERING DESIGN (10%)	100%	LUMP SUM	\$20,000.00	\$20,000.00
12	CONSTRUCTION MANAGEMENT & INSPECTION (6%)	100%	LUMP SUM	\$10,000.00	\$10,000.00
	TOTAL ESTIMATED PROJECT COST:				\$200,775.00

Proposed Drainage Improvements - East Brookwood

Byram Township, Sussex County, NJ

HPA Project #25-527

Engineer's Cost Estimate for Pipe Network #10

STD. ITEM NO.	TO BE CONSTRUCTED	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	MOBILIZATION	100%	LUMP SUM	\$1,000.00	\$1,000.00
2	TRAFFIC CONTROL	100%	LUMP SUM	\$500.00	\$500.00
3	SOIL EROSION & SEDIMENT CONTROL	100%	LUMP SUM	\$250.00	\$250.00
4	FLARED END	1	UNIT	\$1,500.00	\$1,500.00
5	SCOUR HOLE	100%	LUMP SUM	\$5,000.00	\$5,000.00
6	ENGINEERING DESIGN	100%	LUMP SUM	\$10,000.00	\$10,000.00
7	CONSTRUCTION MANAGEMENT & INSPECTION	100%	LUMP SUM	\$10,000.00	\$10,000.00
	TOTAL ESTIMATED PROJECT COST:				\$28,250.00

Appendix C

Conceptual Plans