STORMWATER MANAGEMENT DESIGN MANUAL

City of Bluefield, West Virginia

This Design Manual is provided for guidance in the application and permitting process in obtaining a Stormwater Permit, specifically for land disturbance projects located within the City of Bluefield watershed.

Engineering Services/Stormwater Department
February 2020 (Rev. 2/21)

TABLE OF CONTENTS

(This page intentionally left blank.)

DEFINITIONS

Best Management Practices (BMPs) are physical, structural, and/or managerial practices that, when used singly or in combination, control site run-off, spillage and leaks, waste disposal and drainage from raw material storage and prevent or reduce the discharge of pollutants directly or indirectly to waters of the State. BMPs may include schedules of activities, prohibition of practices, design standards, educational activities and treatment requirements.

Bioretention- Water quality and water quantity stormwater management practice using chemical, biological and physical properties of plants, microbes and soils for the removal of pollutants from stormwater runoff.

CSO Community- Combined Sewer Overflow- A community in which the sanitary and storm sewers are combined and who own and operate permitted combined sewer overflow location(s).

Detention- The collection and storage of stormwater runoff in a surface or sub-surface facility for subsequent controlled discharge to a watercourse or water body.

Director- City of Bluefield's Engineering/Stormwater Director, or his/her designee.

Ecologically Sensitive Area- Ecologically Sensitive Areas- Stream banks, streams and wetlands, and as it pertains to stormwater in the City of Bluefield MS4, an ecologically sensitive area is any area that naturally contributes stormwater runoff directly to waters of the state of West Virginia or designated wetlands without being conveyed first through a stormwater conveyance system or conduit.

Engineered Infiltration- An underground device or system designed to accept stormwater and slowly exfiltrates stormwater into the underlying soil. This device or system is designed based on soil tests that define the infiltration rate.

Evaporation- Water that is changed or converted into a vapor.

Evapotranspiration- The sum of evaporation and transpiration of water from the earth's surface to the atmosphere. It includes evaporation of water plus the transpiration from plants.

Hot Spot- A project or location with a higher than normal potential for stormwater runoff pollutant loading, e.g., fueling stations, maintenance garages, and chemical storage facilities. Potential hot spots may be required to provide water quality treatment for associated pollutants before infiltration.

Illicit Discharge- Means any discharge to a storm drain or into the stormwater collection system that is not composed entirely of stormwater, except for; discharges pursuant to a NPDES permit, discharges resulting from firefighting activities, and other discharges exempted in this article.

Impervious Area- any portion of real property covered by buildings, pavement, gravel or other material that significantly inhibits the infiltration of stormwater into the ground. Non-vegetated clay or clay-like soil surfaces shall be considered impervious for the purposes of this article.

Infiltration- The process by which stormwater penetrates into soil or is absorbed by soil.

Inspection and Maintenance Agreement- A formal document or contract between the City of Bluefield and a property owner designed to guarantee that a stormwater management system is operated and maintained within a property once installed and specific maintenance activities are performed to ensure its proper function.

MS4- Municipal Separate Storm Sewer System- The city is a regulated MS4 under the NPDES program and is subject to Permit No. WV0116025. Conveyances for stormwater, including, but not limited to, roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, human made channels or storm drains owned or operated by any municipality, sewer or sewage board, state agency or federal agency or other public entity that discharges directly to surface waters of the State of West Virginia.

New Development- Is any construction activity upon previously undisturbed/undeveloped land.

NPDES- National Pollution Discharge Elimination System. The Clean Water Act prohibits the discharge of "pollutants" through a "point source" into a "water of the United States" without an NPDES permit. The permit contains limits on what can be discharged, monitoring and reporting requirements, and other provisions to ensure that the discharge does not harm water quality or public health.

NOI- Notice Of Intent- Construction stormwater permit application for the West Virginia DEP required for sites ranging in size from 1 to 3 acres.

Owner/Operator- The property owner, or his authorized representative, that submits an application for approval to disturb land or vegetation or for encroachment, and the person, if so designated by default or on legal documents, as the responsible party for maintenance of a stormwater management system(s) and/or facility(s). Certification statements must be signed by this person.

Pervious Area- All real property that is not impervious.

Post-Development Conditions- Those conditions which are expected to exist, or do exist, after alteration, of the natural topography, vegetation, and rate, volume or direction of stormwater runoff, (resulting from development activity).

Pre-Development Conditions- Those conditions, in terms of the existing topography, vegetation and rate, volume or direction of stormwater runoff, which exist at the time the applicant submits an application form for a land disturbance permit.

Re-Development- Is any construction of, or modification to, the impervious area of an existing property that requires, or would require, a Stormwater Erosion and Sediment Permit and/or a Stormwater Management and Comprehensive Drainage Permit under the existing ordinance.

Retention- The collection and storage of stormwater runoff without subsequent discharge to surface waters.

Sediment- Fine, particulate material, whether mineral or organic, that is in suspension and is being transported, or has been transported, from its site of origin by water or air.

Site Registration Application- Construction stormwater permit application for the West Virginia DEP required for sites larger than 3 acres.

Stormwater - Includes atmospheric precipitation, surface runoff water, groundwater discharge and floodwater.

Stormwater Management - The process of collection, conveyance, storage, treatment and/or disposal of stormwater to reasonably manage the magnitude and frequency of runoff to minimize the impact of the runoff upon the water quality of the receiving stream and the other hazards associated with stormwater, including, but not limited to, pollution and flooding.

Stormwater System - Includes all real property, fixtures and personal property of the city, including, but not limited to, stormwater sewers, drains, ditches, streets, retention/detention structures, floodwalls, dams, and river impoundments, used for collecting, conveying, storing, treating and/or disposal of stormwater and non-stormwater.

SWPPP- Stormwater Pollution Prevention Plan- Erosion and sediment control plan for a construction site.

TMDL- Total Maximum Daily Load- A calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. A TMDL is the sum of individual waste load allocations for point sources (WLA), load allocations for nonpoint sources and natural background (LA), and must consider seasonal variation and include a margin of safety.

Wetlands- Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions and delineated as freshwater wetlands by the U.S. Army Corps of Engineers.

(This page intentionally left blank.)

1.0 GENERAL INFORMATION

1.1 Background

The City of Bluefield (City) has been designated as an MS4 community and therefore is required to comply with the provisions of the State of West Virginia General National Pollution Discharge Elimination System (NPDES) Water Pollution Control Permit WV0116025. The City operates a stormwater utility under General Permit Registration Number WV0116025.

The City has enacted Chapter 42 Article III– "Stormwater Management and Surface Water Discharge Control" to protect and enhance water quality in the City watershed. Further, the City has prepared this Design Manual as authorized in Chapter 42 Article III of the Bluefield City Code.

1.2 Purpose

The purpose of this Design Manual is provide guidance in the application and permitting process in obtaining a Stormwater Permit from the City, specifically for land disturbance projects located within the Bluefield watershed.

This Design Manual provides technical guidance in the design of runoff control structures and for the design of stormwater management structures for projects constructed within the City watershed.

1.3 Intent

This Design Manual shall serve as a tool for the City Stormwater Department to ensure that new and/or redevelopment projects within the City watershed are designed and constructed to meet all federal, state and local requirements for stormwater management.

This Design Manual describes the standards and procedures used by the Director to implement provisions of Chapter 42 Article III of the City of Bluefield, WV Municipal Code, and the West Virginia Department of Environmental Protection (WVDEP) approved City of Bluefield Stormwater Management Program (SWMP).

These standards and procedures will:

1. Describe the submission requirements and approval process for land disturbance construction activity as it relates to stormwater management.
2. Convey the technical design standards to the engineering community, including standards which address flow rates, runoff volume, and pollutant load/concentration, as well as specific standards during construction and for the long-term performance of stormwater control structures.
3. Provide general information on approaches to improve water quality, prevent illicit discharges, and minimize stormwater runoff impacts due to development and/or redevelopment.
4. Convey other protection provisions related to stormwater discharges such as wetlands and watercourse conservation.

Every effort has been made in the creation of this Design Manual to cover the common issues that exist for land disturbance construction activities and to provide information needed by those involved in the design and implementation of such activities. However, these design standards along with City ordinances should be reviewed carefully by the owner/applicant to ensure that all requirements are being met. Construction activities may also be impacted by federal and/or state requirements such as the NPDES Construction General Permit (CGP) for Stormwater Discharges from sites greater than one (1) acre.

The design standards contained herein are not intended to restrain or inhibit engineering creativity, freedom of design, or engineering judgment. When shown to be applicable, it is encouraged that new methods, techniques, and innovative stormwater BMPs be submitted with supporting documentation. However, the use of such approaches should be substantiated with submitted documentation by design professionals showing that the proposed design is equal to, or exceeds the traditional methods in terms of performance and economic feasibility.

For land disturbance construction activities that require site specific designs pertaining to stormwater management and water quality; site plans, details, calculations, construction specifications, and other technical documents must be prepared and sealed by a Professional Engineer that is registered in the State of West Virginia, having sufficient knowledge and experience to accomplish all design elements of the site plan. Users who are not justly qualified by education or experience in the fields of stormwater control design, construction, or land

development should consult with a qualified professional in one or more of these areas prior to planning for construction activities.

1.4 Updates to the Design Manual

This Design Manual is subject to updates by the Director. As design technology and criteria evolve, or change, or it becomes evident that additional measures are needed to ensure the general welfare of the public, this Design Manual will be updated as required. Updates will be approved by the Director. Users of this Design Manual are encouraged to provide comments on the content of this Design Manual at any time, in writing, to the Director. The comments shall include proposed changes, reasoning, and justification (including any supporting technical documents supporting the changes). All comments will be considered during subsequent updates. An electronic copy of this Design Manual is available on the City of Bluefield's website at www.cityofbluefield.com/stormwater.

1.5 Authorization

This Design Manual has been published under the direction of the Director, who has been granted the authority to develop engineering design standards and enact programs and policies to ensure compliance with the NPDES Phase II General Permit for Stormwater Discharges from Regulated Small Municipal Separate Storm Sewer Systems (MS4s), Permit No. WV0116025, and the City of Bluefield's applicable ordinances.

1.6 NPDES MS4 General Permit No. WV0116025

The City is required to have an NPDES MS4 Permit to discharge stormwater. Because land disturbance construction activities contribute to the discharge of pollutants, the NPDES MS4 Permit requires that the City implement and regulate certain practices, programs, and procedures for the purpose of reducing or limiting the discharge of pollutants to waters of the State of West Virginia. The NPDES MS4 Permit requires that the City develop and implement a Stormwater Management Program (SWMP) to control the discharge of pollutants from the storm sewer system to the maximum extent practicable (MEP). The SWMP has several components that must be met and this Design Manual provides partial compliance with construction and post-construction

stormwater management and public education. The City manages and enforces the City Stormwater Ordinance, Chapter 42 Article III, and likewise has served as the author of this document.

1.7 The Need for Stormwater Management

Stormwater runoff from land development projects has the potential to alter the natural drainage patterns, flow rates, volume, and quality of the local water resources. Traditional solutions have removed stormwater from a site as efficiently as possible, while maintaining runoff quantity controls.

Recently, engineering practices have begun to shift to a more "green" approach to dealing with stormwater runoff. An effort to capture and infiltrate runoff is now required under the WVDEP General Permit, along with maintaining runoff quality.

Development and urbanization can have the following impacts on receiving waterbodies:

- Changes to Stream Flow
    - Increased runoff volumes
    - Increased peak runoff discharges
    - Greater runoff velocities
    - Increased flooding frequency
    - Lower dry weather flows (base flow) due to reduction in groundwater recharge
    - Increase in floodplain elevation
- Changes to Stream Geometry
    - Stream channel enlargement
    - Stream channel down cutting
    - Changes in channel bed due to sedimentation
- Degradation of Aquatic Habitat
    - Degradation of habitat structure
    - Decline in stream biological functions
- Water Quality Impacts
    - Reduced oxygen in streams

    - Microbial contamination
    - Hydrocarbons and toxic materials
    - Sedimentation
- Property Damage and Safety Concerns
- Unsightly Aesthetic Stream Channel Conditions and Restricted Use of Recreational Waters

The following sections of this Design Manual discuss the design considerations that are available and encouraged to lessen these impacts on water bodies.

1.8 Best Management Practices and Site Management

The first step in addressing stormwater management begins in the site planning and design stage of a land development project. By implementing BMPs during the site planning process, the amount of runoff and pollutants generated from a construction site can be reduced by minimizing the amount of impervious area and utilizing natural on-site treatments. The minimizing of adverse stormwater runoff impacts by the use of BMPs, and proper site planning, should be a major consideration of the design professional.

The reduction of runoff volume and stormwater pollutants can decrease the total number and size of stormwater management controls that must be implemented under the guidelines set forth in this Design Manual. BMPs can reduce the amount of total post-development impervious areas and maintain natural characteristics of the pre-development site conditions. Therefore, the post-development runoff coefficient and time of concentration are maintained more closely to the pre-development conditions. This reduces the overall hydrologic and hydraulic impact of the development. The following site planning BMPs are encouraged.

1.8.1 Maintaining Site Resources and Natural Undisturbed Areas

Conservation of site resources and natural undisturbed areas helps to reduce the post-development runoff volume and provides areas for natural stormwater management. Some natural site resources that should be maintained include, but are not limited to:

- Natural drainage ways

- Vegetated buffer areas along natural waterways
- Floodplains
- Areas of undisturbed vegetation
- Low areas within the site terrains
- Natural forested infiltration areas
- Wetlands

1.8.2 Low Impact Site Layout Techniques

Low impact site layout techniques involve identifying and analyzing the location and configuration of proposed impervious areas. Where applicable, the following options that create lower impact layouts should be used:

- Fit the design layout to follow the natural contours of the site to minimize clearing and grading and preserve natural drainage ways and patterns.
- Limit the amount of clearing and grading by identifying the smallest possible area on the site that would require land disturbance.
- Place development areas on the least sensitive areas of the site and avoid steeply sloped areas when possible.
- Utilize non-traditional designs to reduce the overall imperviousness of the site by providing more undisturbed open space and minimizing clear-cutting.
- Consider the utilization of cisterns and rain barrels to collect stormwater for reuse.
- Use of level spreaders or other energy dissipation devices at all discharge points. Level spreaders should also be considered for discharge points into ponds and other basin-type BMPs.

1.8.3 Minimization of Impervious Cover

The minimization of total impervious area directly relates to a reduction in stormwater runoff volume and the associated pollutants from a development site. The amount of impervious cover on a site can be reduced by the following techniques where applicable:

- Reduction of building footprints by constructing some buildings as multi-story.
- Reducing parking lot areas and use of porous/pervious pavement surfaces for desired overflow parking, where feasible.
- Increasing the amount of vegetated parking lot “islands” that can also be utilized for stormwater management practices, such as bio-retention areas.

- Disconnecting impervious surfaces by directing runoff to adjacent pervious areas so that runoff can be filtered and infiltrated.

1.9 Legal Aspects

If any portion of this Design Manual is ruled to be invalid or unconstitutional by any court with adequate jurisdiction over the City, then such portion shall be considered to have been selectively removed from the design standards without affecting this Design Manual's overall applicability and legal standing to the land disturbance process. This Design Manual will be revised on a periodic basis to reflect known changes to laws and regulations. All federal, state and local laws and/or regulations shall be considered in the use of this Design Manual. In each instance, the more restrictive requirement shall govern unless sound engineering judgment can determine and prove that the more restrictive requirements would be otherwise unnecessary. In most instances, laws and regulations that are phrased more explicitly shall apply over those items that are described in general terms.

1.10 Contact Information

The City should be contacted for any questions, clarifications, or other information related to stormwater management and this Design Manual.

Contact for the City of Bluefield Stormwater Information:

City of Bluefield Engineering Services/Stormwater Director
200 Rogers Street
Bluefield, WV 24701
Phone: 304-327-2401
Kerry Stauffer, Ph.D., P.E., P.S.
Email: kstauffer@bluewv.org

City Building Permit Application Submittals:

City of Bluefield Engineering Department
200 Rogers Street
Bluefield, WV 24701
Phone: 304-327-2401
Sara Ayers
Email: sayers@bluewv.org

West Virginia Department of Environmental Protection:

Division of Water and Waste Management
601 57th Street SE
Charleston, WV 25304-2345
Phone: 304-926-0499

1.11 Fees

See the City of Bluefield City Code Chapter 42 Article III for current stormwater rates. Single-family residential dwellings are charged a fixed monthly service charge that may be adjusted with amendments to the City ordinance. All properties other than single-family residential dwellings have a service charge assessed up to 2,000 square feet of impervious surface and every 1,000 square foot unit of impervious surface thereafter, based on the rate stated in Chapter 42 Article III.

The MS4 stormwater boundary for the City of Bluefield is available for public viewing at City of Bluefield, WV MS4 Boundary or can be accessed from the city's website; www.cityofbluefield.com/stormwater. Please note that this boundary extends past the Bluefield city limits. The MS4 boundary is based upon the drainage basins of the streams within the regulated MS4.

2.0 CERTIFICATION AND PLANNING

2.1 Introduction

This chapter provides developers, owners, engineers, contractors, and others with the information needed to obtain approval of stormwater management plans for land disturbance construction activities located within the City MS4 service area as required by the Bluefield City Code Chapter 42 Article III. This section describes conditions when approval is needed, application package requirements, and when and if waivers of such requirements are applicable for certain exempted activities.

Unless otherwise authorized by Chapter 42 Article III, or this Design Manual, the surface of land in the City MS4 service area shall not be disturbed or altered for any purpose whatsoever, nor any drainage channel, or component of the stormwater system impeded or encroached upon, without approval from the Director. Land disturbance construction activities cannot commence prior to approval from the Director and issuance of a City Stormwater Permit.

2.2 Stormwater Management Design Plan

Stormwater Management Design Plans for review and approval under this chapter may be initiated by: (1) the owner(s) of the property on which land disturbance construction activity is planned; or (2) the owner(s) authorized representative. This Design Manual describes the procedures and application submission requirements by the City of Bluefield, WV. A City Stormwater Permit must be obtained from the City's Stormwater Department office prior to beginning any construction activities within the city limits of Bluefield, WV. The Bluefield Stormwater Director reserves the right to deny or revoke a Stormwater Permit to applicants who fail to conform to the provisions of Bluefield's City Ordinance Chapter 42 Article III, and this Design Manual.

2.2.1 Plan Requirements

The Stormwater Management design plan submittal shall contain a Stormwater Management design plan that satisfies the requirements for *Controlling Runoff from New Development and Redevelopment* set forth in Permit No. WV0116025 and the *DEP Stormwater Manual*, and a Stormwater control practice maintenance plan.

2.2.2 Plan Content

The Stormwater Management design plan shall contain, at a minimum, a:

- Narrative description
- Existing site plan
- Proposed site plan
- Erosion and Sediment Control Plan
- Calculations

- Maps
- Photographs
- Any other supporting information necessary to demonstrate that the Stormwater Management practices used at the site will meet the requirements set forth in the *Controlling Runoff from New Development and Redevelopment* section of Permit No. WV0116025.

2.2.3 Identified "Hot Spots"

For projects that contain "Hot Spots", as defined in Permit No. WV0116025, the Stormwater Management design plan must include on-site treatment, prior to any discharge into a Stormwater Management facility, in order to ensure that water quality is protected. The design plan must describe how the specific pollutants of issue will be managed and prevented from entering the stormwater system.

2.2.4 Modifications of an Approved Stormwater Management Design Plan

No changes shall be made to an approved plan without review and written approval by the City. The City may request additional data and supporting documentation with a plan modification request. Any additional expenses incurred by the City as a result of a modification request must be paid by the applicant.

2.2.5 Additional Permit Requirements

Where necessary, additional permits may be required. Such as…

- A copy of an approved NPDES Construction Stormwater Permit, if applicable, from the WVDEP, for sites greater than 1 acre.
- Copies of all other required permits, such as, but not limited to; US Army Corps of Engineers, West Virginia Department of Natural Resources, etc., as applicable.
- A Flood Plain Permit approval, if applicable, from the City of Bluefield, WV.

2.3 Stormwater Management Design Plan Review Procedures

2.3.1 Preliminary Review for Completeness of Plan

The City shall have ten (10) calendar days from the receipt of an application for preliminary review to determine if the application is complete. A determination as to whether an

application is complete shall be made by the City in its sole discretion. If an application is deemed to be incomplete, the City shall notify the applicant and indicate what areas of the application are incomplete. Once an application is deemed to be complete, the City will begin the plan review.

2.3.2 Review Period

A thirty (30) day review period will begin once the application is deemed complete and accepted for review by the City. Approval or denial, and, in the case of denial, the reasons therefore, shall be communicated to the applicant by mail, or other documentable, acceptable methods, and be based on the plan's compliance with this Section and the requirements contained in Permit No. WV0116025. In the event that the City disapproves the plan, the applicant may modify the plan and resubmit the plan pursuant to this Section for re-review. Resubmittal of the application shall restart the thirty (30) day review period.

2.3.3 Appeal of Decisions of City

The applicant may appeal a City denial of a Stormwater Management Design Plan. Appeals shall be made to the City Board of Directors and must be filed in writing within thirty (30) days of an applicant's receipt of a denial. The appeal shall set forth the basis of the appeal and must be supported by the report of an engineer or landscape architect. The Board of Directors shall conduct a public hearing on the appeal, at which hearing the applicant bears the burden of proof.

2.3.4 Expiration of Plan Approval

The approval of a Stormwater Management Design Plan expires one (1) year from the date of approval unless approved Land Disturbing Activity has actually begun on the site.

2.4 Stormwater Management Design Plan Preparation and Certification

2.4.1 Certification by Plan Preparer

The Stormwater Management Design Plan shall be prepared by a Professional Engineer, a Professional Surveyor, or a licensed Landscape Architect, and must be signed by the

professional preparing the plan, who shall certify that the design of all Stormwater control practices meet the City's requirements.

2.4.2 Certification by Landowner

The Landowner shall certify that all land clearing, construction, land development, and drainage will be completed according to the approved plan.

2.5 Coordination with Other Approvals and Permits

Approvals issued in accordance with this Design Manual and the City's Ordinance do not replace, supersede or supplement any other necessary permits and/or approvals from other federal, state, and/or local agencies. These permits may include, but are not limited to, construction stormwater discharge permits and applicable state/federal permits for stream and wetland impacts**.**

2.6 Notice of Construction Commencement

After obtaining all of the required approvals set forth in this Section, the applicant must notify the City at least five (5) business days prior to the commencement of construction.

2.7 Stormwater Facility Maintenance Agreement

Prior to approval of a Stormwater Management Design Plan by the City, each owner shall submit a maintenance plan in accordance with the follow criteria:

2.7.1 Responsible Party

Any individual, partnership, co-partnership, firm, company, corporation, association, joint stock company, trust, estate, governmental entity, or any other legal entity; or its legal representatives, agents, or assigns that are named on a Stormwater facility maintenance agreement as responsible for long-term operation and maintenance of one or more Stormwater control practices.

2.7.2 Requirement for Maintenance Agreement and Plan

Landowner and the Responsible Party or Parties must both execute a Stormwater facility Maintenance Agreement Plan with the City prior to the final approval of a plan. The agreement may be recorded in the office of the Clerk of the County Commission for

Mercer County, West Virginia and the obligations set forth in the agreement shall run with the land. Additional details are provided in Section 3.4.

The Landowner or Responsible party must certify, or otherwise prove, that there is a maintenance contract in place with a qualified company or individual that performs maintenance on Stormwater Management facilities. Upon its sole discretion, the City may require that a copy of the maintenance contract be provided prior to approval of a Stormwater Management Design Plan.

2.8 Project Closeout

At the conclusion of construction activities, the owner is responsible for stabilizing the site with established vegetation, paved areas and/or stormwater conveyances clean of debris and sediment, and to ensure that the permanent stormwater controls are working properly, and that all temporary erosion and sediment control BMPs are removed. The following items are required to be submitted to the City of Bluefield Stormwater Department before a project can be considered complete.

- As-built drawings of project in an approved digital format
- Maintenance Agreement Plan, see Appendix D, referencing submitted as-built drawings and approved details

3.0 STORMWATER MANAGEMENT DESIGN PLAN REQUIREMENTS

3.1 Introduction

A technical report (see Chapter 4), prepared by a certified Professional Engineer registered in the State of West Virginia, shall be submitted as part of the Building Permit application submittal. The report shall consist of maps, supporting design calculations, Erosion and Sediment Control Plan (Section 3.2), Post Construction Stormwater Management Plan (Section 3.3), if required, and any other information necessary to obtain an approved Stormwater Permit.

An "Erosion and Sediment Control Plan," is required for all construction projects that disturb earth for stormwater management during construction. This plan is explained in detail in Section 3.2. The following activities shall be exempt from this requirement.

- Residential gardens and/or flower beds of less than 1,000 SF of actual disturbed area;
- Additions or modifications to existing detached single-family dwellings of a size less than 1,000 SF of actual disturbed area;
- Activities that result in an actual disturbed area of less than 1,000 SF. However, a phased construction project shall be measured by the size of all planned or contemplated phases. Each phase may be required to meet the requirements of this article.
- Any exemption provided under this section shall relieve only the requirement to apply for and obtain a Building Permit. The activity must still be conducted in such a manner that pollution from erosion and sedimentation as a result of the activity is prevented.

A "Post Construction Stormwater Management Plan," applies to certain projects that meet the criteria that require post construction stormwater management. This plan is explained in detail in Section 3.3. The following activities shall be exempt from the requirements of this section, except that no activity shall be exempt from the management of the discharge of sediment, or any other form of water pollution, that may leave any site.

- Agricultural land management activities;
- Additions or modifications to existing detached single-family dwellings of a size less than 1,000 square feet;
- Activities that result in impervious surface area of less than 3,000 square feet, regardless of the ratio of impervious area to total site area. However, a phased construction project shall be measured by the size of all planned or contemplated phases. Each phase may be required to meet the requirements of this article

3.2 Erosion and Sediment Control Plan (E&S Plan)

All land disturbance construction activities, except those described above, require an approved erosion and sediment control plan. The E&S Plan for the project shall be submitted for review and approval as part of the Stormwater Management Design Plan application process. The E&S Plan requires that the owner, or the owner's representative, install E&S control measures prior to

starting any project and maintain them for the duration of the project so as to prevent the discharge of pollutants and sediment-laden runoff from the site, and to ensure, as applicable, that the construction activities will not cause any non-compliance for any discharge from the City MS4 stormwater conveyance system to waters of the State of West Virginia. E & S Plans shall be designed to control all runoff from the site. The E&S Plan shall, at a minimum, meet the requirements of the 2006 (Revised August 29, 2016) WVDEP Erosion and Sediment Control Best Management Practice Manual. However, the Director may not accept all BMPs proposed in the 2006 DEP Manual and may require BMPs above the requirements of the DEP manual. The Director will review the proposed E&S Plan in accordance with this Design Manual, and Local knowledge, for plan approval.

If, at any time during construction, the E&S Plan is determined inadequate by the City, steps must be taken immediately by the owner or the owner's representative to correct the inadequacy and prevent future noncompliance. If steps are not taken in a timely manner, the City may take action on behalf of the owner to correct the inadequacies and invoice the owner the cost of time and materials for protecting the public storm sewer system and the environment.

3.2.1 E&S Plan Additional Details and General Notes

The following details, where applicable, shall also be provided on all land disturbance, as specified in Section 3.1…

- Rock construction entrances (RCE's) are required for all construction sites
- A concrete washout area is required to be designated on the E&S Plan
- All sites must utilize a sediment trap or basin appropriately sized in accordance with the 2006 WVDEP Erosion and Sediment Control Best Management Practice Manual to treat construction stormwater runoff before allowing it to enter the storm sewer system
    - Discharges from a sediment trap or basin must be from an approved outlet structure
    - Sediment traps or basins must have a control structure in place to limit the discharge flow rate to no greater than the existing discharge flow rate
    - The Director may waive this requirement when site conditions warrant such action
    - All dewatering via a pump must discharge through a dewatering filter bag. No direct connections to the storm sewer or sanitary sewer are permitted

- Storing of construction materials or portable toilets is not permitted on storm inlets or within structures of the storm system, such as ditches
- Post Construction Stormwater management structures are not permitted to be utilized as construction site erosion and sediment controls unless they are designed to be used as such and proper practices take place to ensure that the long term functioning of the system will not be negatively affected
- Temporary Seeding shall be applied to stabilize disturbed areas that will not be used or constructed upon for periods longer than seven (7) days
    - Temporary seeding prevents and limits costly maintenance and repairs of sediment control devices. Maintenance to these structures is greatly reduced when disturbed earth is temporarily seeded while grading and construction operations are not taking place
- Sweeping of roadways at the end of a work shift is not an acceptable BMP. Sweeping should be used as a last resort BMP when the onsite BMPs fail to contain sediment to the site
- Failed BMPs shall be repaired or replaced immediately
- The owner shall designate to the City an on-site contact person to discuss any deficiencies with the E&S Plan that may be noted during any inspection that requires corrective actions.

3.3 Post Construction Stormwater Management Plan

The Post Construction Stormwater Management Plan is comprised of two (2) requirements. The first requirement is the "First 1-Inch Capture Requirement" and is covered further in section 3.3.1. The second requirement is the Runoff Rate Requirement and is covered further in section 3.3.2. Both requirements shall be met in order to obtain approval for the post construction stormwater management plan.

3.3.1 First 1-inch Capture Requirement

The first requirement is the volumetric flow reduction requirement known as the "First 1-Inch Capture Requirement" as described in the NPDES General Permit Part II, section 7.e) 11)(a) and as follows;

- The first 1-inch of rainfall from any rain event preceded by 48 hours of no measurable precipitation is to be captured and managed on site with no discharge to surface waters

- The first 1-inch capture volume to be managed shall be calculated by taking the disturbed site's area in square feet and multiplying by 1 inch
    - For example, a project with 10,000 square feet of disturbed area will be calculated by 10,000 sq. ft. x (1 inch/12 inch/foot) = 833 cubic feet of storage needed for this project
- Alternative approaches to the "First 1-Inch Capture Requirement" that allow for discharge to surface waters are as follows
    - Stormwater is treated via extended engineered infiltration and drained through an underdrain, or
    - Off-site mitigation within the same watershed approved by the Director.
- Reductions to the "First 1-Inch Capture Requirement" - as listed in the General Permit No. WV0116025, dated August 11, 2014, under section II d) 13) (b); the following incentive standards may be applied to the projects that require the "First 1-Inch Capture Requirement" to allow a reduction of 0.2 inches for each type of development a project may qualify. Reductions are additive up to 0.4 inches. If reductions are approved, the minimum volume of stormwater a developer will be responsible for capturing is 0.6 inches.
    - Redevelopment
    - Brownfield Re-development
    - High density (>7 units per acre)
    - Vertical Density, (Floor to Area Ratio of 2, or >18 units per acre)
    - Mixed use and Transit Oriented Development (within ½ mile of transit)

3.3.2 Runoff Rate Requirement

The second requirement is the runoff rate requirement. The Rational Method is the preferred method to be used to calculate the runoff and required storage volume. Calculations must be submitted with the Stormwater Management Plan. The minimum "time of concentration" to be used in the calculations shall be six (6) minutes.

Detention structures for new development shall be designed in such a manner that the post-construction peak runoff rate of flow shall be equal to or less than the pre-construction peak runoff rate of flow for the 2-year/24-hour, 10-year/24-hour, and the 50-year/24-hour storms.

A "10% Peak Runoff Rate Reduction" is required for the 2-year/24-hour, the 10-year/24-hour, and the 50-year/24-hour storms for re-development projects. However, no reduction shall be required beyond the peak runoff rate of flow that would occur from

the parcel in its natural, undeveloped state. Further, note that storage provided to meet the "10% Peak Runoff Rate Reduction Requirement" can be used to satisfy the storage required for the "First One-Inch Capture Requirement". It is not intended for the amount of storage to equal the sum of the two volumes of storages required.

Runoff volume reduction can be achieved by the following.

- Canopy interception
- Soil amendments
- Evaporation
- Evapotranspiration
- Rainfall harvesting such as rain tanks and cisterns
- Grass channels and swales
- Reforestation
- Green/live roofs
- Rooftop disconnections
- Permeable pavers
- Pervious concrete
- Engineered infiltration through bio-retention cells

3.4 Permanent Maintenance Plan

As previously stated, the owner/operator, a Homeowners Association (HOA), or other responsible party, as applicable, must enter into a permanent Maintenance Agreement (Inspection and Maintenance Agreement for Private Stormwater Facilities – See Appendix B) with the City. This Maintenance Agreement is a legal document, recorded in the permanent land records with the Mercer County Courthouse, in addition to being fully described on the final plat. This agreement requires that periodic maintenance be performed on the stormwater management system. The owner must be listed in the Maintenance Agreement and is ultimately responsible for adherence to the maintenance requirements. The Director will provide oversight of these agreements to ensure adherence by the owner or other responsible party. The City will inspect systems, as the Director deems necessary, to ensure maintenance is being performed in accordance with this Agreement.

The Stormwater facility maintenance agreement shall be in a form approved by the City, and shall include, at a minimum:

- Designate a local party that can be contacted by the City in the event that maintenance must be performed. This can be an on-site manager or other person or entity that is readily available to perform maintenance.

- A requirement that the agreement runs with the land and successors and assigns must assume responsibility for maintenance obligations.

- Right of Entry for City: Grant the City and/or its representatives the right of entry for the purposes of inspection of all Stormwater Best Management Practices at reasonable times and in a reasonable manner.

- Maintenance Plan: shall include a list of inspection and maintenance tasks, a schedule for routine inspection and maintenance, actions to be taken when maintenance is required, and other items specified by the City.

3.5 Additional Requirements

3.5.1 Sites Greater Than One (1) Acre

For sites greater than one (1) acre, verification must be provided to City that coverage under a WVDEP Construction Stormwater Permit has been obtained.

- A Notice of Intent is required by the WVDEP for sites one (1) to three (3) acres.
- Site Registration Application and approval is required by the WVDEP for sites greater than three (3) acres.

3.5.2 Sites Within the 100-Year Floodplain

For sites within the 100-year floodplain, verification must be provided to the City of Bluefield that an approved Floodplain Permit has been obtained.

3.5.3 Sites that Impact a Natural Stream Channel

Any work that will impact a stream, or change the physical characteristics of a stream, must be approved by the United States Army Corps of Engineers (USACE) and the West Virginia Department of Natural Resources Public Lands Corporation (WVDNR). Approval from USACE and WVDNR must be provided to the City.

3.6 Hot Spots

For developments that pose a particular threat to water quality, additional requirements or BMPs will be required to ensure that protection from specific pollutants is provided. "Hot Spots" are establishments including, but not limited to, the following:

- Refueling Stations
- Vehicle Maintenance Shops
- Chemical Storage
- Road Salt Storage
- Restaurants

3.7 Ecologically Sensitive Areas

The City considers all stream banks and riparian corridors as ecologically sensitive areas. The following areas shall not be disturbed.

- A 20 foot setback from the edge of stream banks is required for all commercial developments.
- A 10 foot setback from the edge of stream banks is required for all residential projects.
- Streambanks shall not be mowed or cleared to prevent erosion and damage to stream.
- Pesticides shall not be applied within 50 feet of a stream, and shall be used strictly in accordance with manufacturer's specifications.
- No structure shall be built within the setback distance of any stream without approval from the Director.

4.0 TECHNICAL REPORT

4.1 Narrative

A detailed description of the project and the process used to arrive at the system design and verification that the standards of this Design Manual, and applicable City ordinances are met shall be included in the technical report. Information to be included shall be; owner, engineer,

description of existing conditions, description of proposed conditions, scope of work, phasing of a project, if applicable, and any known obstacles or difficulties discovered during design.

4.2 Site Plan/Overview Map

A site plan shall be of a noted scale and show the project location relative to neighboring properties. A north arrow shall be present as well as any public roadways. Existing utilities shall be shown and distinguished from proposed work. Property lines shall be clearly shown. Limits of construction shall be clearly shown.

4.3 Calculations

Calculations shall be submitted as part of the technical report. Calculations shall be provided for site runoff and for the sizing of all stormwater systems and structures. This information shall be detailed and with enough information that the calculations can be understood during the review process. Calculations shall also be provided in a cohesive, organized, and easy to follow format. Any assumed conditions or interpolated values should be clearly noted.

Acceptable methods for determining stormwater runoff include the Rational Method, the Modified Rational Method, NRCS Method, or TR-55. The following information will be required for each design submittal.

- Hydrologic analysis for both pre-development and post-development conditions
- Stormwater management system sizing and any other system elements
- Construction stormwater erosion and sediment control BMPs sizing/placement

4.4 Reference and Supporting Material

Copies of any tables or charts used for calculations and site the publication where this information can be found shall be included. Information and values should be obtained from recent publications and/or latest editions of publications of reputable sources.

5.0 Waiver for Providing Stormwater Management

Every applicant shall provide for stormwater management as required by the Bluefield City Code, Chapter 42 Article III, and this Design Manual.

Offsite mitigation may be considered once a written request for consideration has been submitted to the Director with reasonable proof that the minimum on-site stormwater management requirements are not feasible due to the unique natural or existing physical characteristics of the site. The applicant must then also demonstrate, to the satisfaction of the Director, that the waiver will not result in any of the following impacts to downstream waterways:

- Deterioration of existing culverts, bridges, dams, and other structures
- Degradation of biological functions or habitat
- Accelerated stream bank or streambed erosion
- Increased threat of flood damage to public health, life and/or property

6.0 Construction Materials and Methods

Stormwater system components not privately owned shall be constructed by the City unless approval is obtained from the Director by satisfying all requirements of the Bluefield City Code, Chapter 42 Article III. The design of stormwater systems or system components is required to be completed by a licensed Professional Engineer registered in the State of West Virginia. The design of stormwater systems and/or stormwater components must be reviewed and approved by the City prior to the start of any project.

6.1 Materials and Methods

6.1.1 Pipe

Stormwater pipe shall be of the following materials

- HDPE - High Density Polyethylene Pipe
- PVC - Polyvinylchloride SDR35

- RCP - Reinforced Concrete Pipe
- Elliptical RCP

6.1.2 Structures

Stormwater system structure specifications are as follows.

- Precast concrete structures required (manholes, drop inlets, catch basins)
- Cast in place concrete structures, if approved
  - Minimum 4,000 psi concrete.
- Structures shall be installed at all changes in direction
- Structures shall be installed at all changes in slope
- All structures shall provide maintenance access
- The maximum distance between access structures shall be...
  - 300 feet for 12-inch to 36-inch pipe
  - 500 feet for pipes greater than 36-inch

6.1.3 Construction Standards

The following construction standards shall be adhered to.

- The reduction in pipe diameter downstream is not allowed unless part of an approved retention system.
- The minimum pipe cover within roadways shall be three (3) feet.
- The minimum pipe cover outside of roadways is based on manufacturer specifications and shall be provided with plan.
- The minimum separation between existing utilities shall be three (3) feet, unless approved by the Director.
- Driveway culverts shall be a minimum diameter of 12-inches.
- Erosion control/energy dissipaters are required at all new system outfalls and shall be designed in accordance with the WV DEP BMP Manual 2012.

6.1.4 Required Easements for Stormwater Systems

The following easements are required for all stormwater components.

- A 20 foot easement (10 feet both sides of pipe centerline) for 15-inch to 48-inch pipe
- A 25 foot easement, or stormwater pipe diameter/width plus 20 feet, whichever is greater, for pipes greater than 48-inches

- For depths to top of buried stormwater pipe or components greater than 6 feet, an additional 5 feet of easement width is required for each 5 feet increment of additional depth.

- All open channels/ditches will require a minimum easement of the maximum width of the channel or ditch plus fifteen (15) feet, the centerline of which is the centerline of the ditch.
- All easements shall be shown on a recorded plat.

6.1.5 Detention/Retention Ponds and Reservoirs

The following guidelines shall be met for all detention/retention ponds and reservoirs.

- Ponds with vegetated embankments shall be less than 15-feet in height, from the natural bed of a stream or watercourse, measured at the downstream toe of the barrier, and shall have side slopes no steeper than 3 Horizontal (H) to 1 Vertical (V). Embankments protected with Erosion Control Blankets or Turf Reinforcement Matting shall be no steeper than 2H:1V. Geotechnical slope stability analysis is required for embankments greater than 10-feet in height which have steeper slopes than those indicated above. Access inside a pond shall be provided with at least one side slope at 3H:1V, or flatter.
- A minimum freeboard of 1-foot above the design storm high water elevation shall be provided for all impoundments.
- The bottom of detention structures shall be graded towards the outlet structure(s) to prevent standing water conditions with a minimum 0.5% bottom slope.
- The maximum depth of permanent storage facilities with a permanent pool shall be determined by site conditions, design constraints, and environmental needs. The facility should provide a permanent pool of water with a depth sufficient to discourage weed and mosquito growth without creating undue potential for anaerobic bottom conditions. A minimum depth of six (6) inches is reasonable. Aeration or other means shall be used, as necessary, to prevent anaerobic conditions.
- The owner of any detention structure is solely responsible for maintaining the facility in a manner that does not present a safety hazard to the public and/or the environment.
- Nothing in this Design Manual shall be construed to supersede the rules and regulations of the WVDEP Dam Safety Division. Where a discrepancy exists, the WVDEP Dam Safety Rules shall take precedence.

6.1.6 Underground Detention Systems and Infiltration Systems

Underground detention systems shall be designed using the following criteria:

- Underground detention systems shall be located downstream of other stormwater controls providing treatment.
    - The maximum contributing drainage area to be served by a single underground detention vault or tank is five (5) acres.
    - All systems shall be designed and located to facilitate maintenance. Systems shall be cleaned out (sediment removal) by the owner at least once a year, but more frequently if necessary.
    - The minimum pipe diameter for underground detention tanks is 24 inches or equivalent.
    - Underground detention systems must meet structural requirements for overburden support and traffic loading if appropriate.
    - Access must be provided over the inlet pipe and outflow structure. Access openings can consist of a standard frame, grate and solid cover, or preferably a removable panel.
- Any development that uses a parking area or other feature for detention storage capacity shall clearly identify the limits and depths of the proposed detention pool.
- Basin configurations which create stagnant water conditions shall be avoided.
- Post-development discharge rates for redevelopment projects shall achieve a 10% reduction compared to the pre-development discharge rates for the 2, 10, and 50-year frequency 24-hour duration storm events. The same hydrologic procedures shall be used in determining both the pre-development and post-development peak flow rates.
- Post-development discharge rates for new development projects shall not exceed the pre-development discharge rates for the 2, 10, and 50-year frequency 24-hour duration storm events. The same hydrologic procedures shall be used in determining both the pre-development and post-development peak flow rates.
- Post-development discharge velocities shall be reduced to provide non-erosive flow velocities from structures, channels or other control measures.
- Detention systems used for water quantity control shall be designed to drain after the cessation of a rain event within 72 hours (assuming no additional rainfall occurs) via infiltration or an underdrain.
- Infiltration system design shall be based on soils characteristics of the first twelve (12) inches below the proposed bottom of the system (not necessarily the first twelve (12) inches below ground surface).

- Areas draining to these systems must be stabilized, and vegetative filters established prior to runoff entering the system. Infiltration practices shall not be used if a suspended solids filter system does not accompany the infiltration system. If vegetation is the intended filter, there shall be at least a twenty (20) feet length of vegetative filter prior to stormwater runoff entering the infiltration system. Fore-bays or other engineered devices for sediment removal may be necessary.
- Each system shall be designed to prevent clogging by fine material and for ease of maintenance.
- Infiltration systems shall be designed to completely drain of water after the cessation of a rain event within 72 hours (assuming no additional rainfall occurs).
- Soils must have adequate permeability to allow water to infiltrate. Infiltration systems are limited to soils having an infiltration rate of at least 0.30 inches per hour. If the infiltration rate is greater than 0.3 inches/hour but less than 2.0 inches/hour, then an underdrain system must be installed. Initial consideration will be based on a review of the appropriate soil survey, and proposed depths of excavation. The soil survey may serve as a basis for rejection. On-site soil borings and textural classifications are recommended to verify the actual site and seasonal high water table conditions when infiltration is to be utilized.
- Infiltration systems installed deeper than three (3) feet deep are recommended to be located at least twenty-five (25) feet from the nearest basement wall unless additional engineering practices are put into place to protect the foundation from the additional pore water pressure.
- The design of an infiltration system shall have a properly sized overflow or bypass for larger storm events. Measures to provide a non-erosive velocity of flow along its length, and at the outfall, shall also be included as necessary. Additional control systems will typically be necessary prior to a release to a stream or waterway to meet water quality requirements.
- The slope of the bottom of the infiltration system shall not exceed one-half of one (0.5) percent. Also, the system shall not be installed in fill material as piping along the fill/natural ground interface may cause slope failure.
- An infiltration system shall not be installed on or atop a slope whose natural or existing angle of incline exceeds twenty (26.5) percent.
- If an underdrain system is required, access points will be provided at no greater than every one hundred (100) feet along the infiltration system to allow for access and maintenance.
- In cases where such criteria or limitations make the use of infiltration systems inappropriate, the Director shall be contacted for guidance on the appropriate controls to employ or other mutually accepted best management practices.

7.0 Stormwater Facility Ownership and Maintenance

7.1 Ownership of a Stormwater Management Facility

Stormwater systems installed, including all associated BMPs (water quantity and quality basins/devices/non-structural practices), in new and re-development projects shall be privately owned and maintained by the owner(s) of the parcel(s), or a homeowners association (HOA), or other responsible party under or on which it exists.

Ownership of the proposed stormwater facilities shall be clearly designated before a City of Bluefield Stormwater Permit will be issued. Ownership shall also be recorded on the final plat. Ownership shall imply responsibility for routine inspections and maintaining the stormwater system, including all ponds and other BMPs used for controlling runoff quantity and quality. Ownership does not imply that the owner(s) may in any way alter the size, or function of any component of the stormwater system without consent from the City of Bluefield. Owners found altering such components will be required to remove any alterations.

7.2 Maintenance of Privately Owned Stormwater Management Facilities

Each component of the stormwater management plan (pipes, inlets, control structures) shall have a maintenance plan (activities and associated schedule) as part of the application package for a City of Bluefield Building Permit approval. The plan shall also cover temporary measures used during construction, in addition to the long term maintenance of the system.

The owner, HOA, or other responsible party, as applicable, must enter into a permanent maintenance agreement (Operating and Maintenance Agreement for Stormwater Facilities) with the City of Bluefield. This Agreement is a legal document, recorded in the Mercer County Courthouse, in addition to being fully described on the final plat. A sample copy of the COB Inspection and Maintenance Agreement is provided in Appendix B. The Agreement must be signed and executed prior to the issuance of a Certificate of Occupancy. This Agreement requires maintenance to be performed by the owner, HOA, or other responsible party. However, the owner must be listed and shall be ultimately responsible for adherence to the maintenance

requirements. The Director will provide oversight of these Agreements to ensure adherence by the owner, HOA, or other responsible party. The Director will inspect a system as he deems necessary to ensure maintenance is being performed in accordance with this Agreement.

8.0 Inspections and Enforcement

8.1 Stormwater Management Inspections

The City of Bluefield Stormwater Department will inspect construction sites from initial land clearing to final stabilization. The purpose of these inspections is to check for compliance with conditions of the approved Building Permit. Inspections to confirm that regular maintenance is being performed by the owner will also be performed on stormwater management systems and facilities throughout their useful life. For each system or facility installed or retrofitted during an approved construction project, the applicant must have submitted a maintenance plan approved by the City of Bluefield. The City of Bluefield Stormwater Department inspectors will be checking for adherence to the maintenance plan and notify the owner of any necessary changes that may arise after installation. The City of Bluefield Stormwater Department inspections are not to be construed as a relaxation of the requirements on owners to conduct self-inspections in accordance with any applicable federal, state or local stormwater requirements.

8.1.1 Inspector Duties/Responsibilities

The City of Bluefield Stormwater Department Inspectors shall inspect and enforce the requirements of the City of Bluefield's Stormwater Ordinance and the project's approved Building Permit. The job duties/responsibilities of the City of Bluefield Stormwater Department Inspector shall include, but not be limited to, the following:

- Conduct and document construction site inspections to ensure compliance with the approved City of Bluefield Building Permit (see Appendix C for a sample of the City of Bluefield Stormwater Inspection Report). The frequency of inspections will be determined by the City of Bluefield Stormwater Department staff on an as needed basis.

- Ensure that the approved City of Bluefield Building Permit and the approved construction plans are on the project site and are properly being followed and implemented.
- Conduct post-construction inspections to ensure that permanent maintenance is being performed in accordance with the maintenance plans for the various stormwater management facilities in the approved stormwater management plan.
- Document each construction or post-construction inspection with a report.
- Issue enforcement orders, as necessary, to the owner, or other responsible party, when any portion of the work does not comply with the approved City of Bluefield Building Permit, or work is occurring without appropriate approval.
- Perform a final inspection upon completion of the stormwater system to determine if the system is constructed in accordance with the approved City of Bluefield Building Permit.
- Take immediate action if the owner fails to comply with the approved City of Bluefield Building Permit. The inspector shall address the situation and notify the owner of deficiencies with a timeframe for correction. The timeframe is based on the inspector's judgement and the severity of the deficiency.
- Maintain accurate and comprehensive project inspection files ensuring all relevant information is entered in the files to be maintained in the City of Bluefield Stormwater Department.

8.1.2 Inspection Process and Procedures

As per the COB's Stormwater Ordinance, an authorized representative/designee (inspector) of the COB may enter upon all properties for regular inspections, periodic investigations, enforcement and to effectuate the provisions of the Stormwater Ordinance and this Design Manual. Upon refusal by any owner, HOA, or other responsible party, to permit a COB Stormwater Department Inspector to enter upon the property or continue an inspection, the inspector shall terminate the inspection, and/or confine the inspection to portions of the property to which no objection is raised, and the aforementioned responsible party is certifying that all practices regarding stormwater control are in compliance with all federal, state, and local requirements and they are accepting full responsibility for all conditions resulting from their construction practices.

8.2 Owner Inspection Responsibilities

In accordance with any applicable federal, state or local stormwater requirements including, but not limited to, the NPDES Construction General Permit (CGP); the owner, HOA, or other responsible party is responsible for conducting construction and post-construction site inspections. Records of such inspections shall be maintained by the owner, HOA, or other responsible party for a minimum of five (5) years and must be made available to the City of Bluefield, upon request. The City of Bluefield will maintain said inspection records, if such are submitted to the City of Bluefield, as required in the Inspection and Maintenance Agreement.

8.3 Enforcement

If the City of Bluefield determines that a project is in non-compliance with the City of Bluefield's Stormwater Management Ordinance, or this Design Manual, the City of Bluefield may direct conformity by proceeding with the appropriate enforcement action. The types of enforcement tools available to the City of Bluefield include a Written Warning or Notice of Violation (NOV), which can be accompanied with a Civil/Criminal Penalty. The enforcement mechanism to be utilized will depend on the circumstances as described in the following sections.

8.3.1 Written Warnings

Written Warnings will be issued when deficiencies are first noted. Timeframes for correction will be included on the warning. Written Warnings may be issued for violations that do not involve a safety issue or an imminent threat of serious damage to the environment and/or public or private property.

8.3.2 Notices of Violation (NOV)

If a Written Warning has been previously issued and there is either subsequent non-compliance issues or failure to complete the items on the Written Warning within a specified time period, then a Notice of Violation may be issued. In addition, for violations that involve a safety issue or an imminent threat of serious damage to the

environment and/or public or private property, a Notice of Violation may be issued. The following are examples of violations that will warrant a Notice of Violation:

- Construction activities have been initiated but no BMPs are in place, or the BMPs in place are not functioning to prevent sediment from leaving the site.
- Failure to have work inspected and approved before restarting construction activities after a stoppage of work.
- Any violation of City of Bluefield Municipal Code.
- Discharge of any pollutants to storm sewers, streams, water bodies, etc.

A Notice of Violation (NOV) should at a minimum include, but not be limited to, the following:

- Nature of the violation(s) and City Code(s) reference.
- Proposed penalty.
- Required corrective actions and dates they are required to be completed by.
- The time period for correcting the violation(s).

9.0 Acknowledgments

Many thanks to Mr. Kenneth Hacker of the Morgantown Utility Board (MUB) for sharing the MUB Stormwater Design Manual, of which this manual was exclusively patterned. Also, thanks to Mr. Michael Eisen of GAI Consultants for permission to present an example Stormwater Pollution Prevention Plan (SWPPP).

Appendices

Appendix A – COB Stormwater Permit Application

Appendix B – COB Stormwater Management Permitting Flow Chart

Appendix C – Stormwater Management Design Plan Example

Appendix D – COB Inspection and Maintenance Agreement

Appendix E – COB Construction Site Stormwater Inspection Form

Appendix A

COB Stormwater Permit Application

CITY OF BLUEFIELD, WV
STORMWATER PERMIT APPLICATION

200 Rogers St, Bluefield, WV 24701 | Stormwater Director, Kerry Stauffer: (304)-327-2401*2461

PERMIT INFORMATION *(Please Print Clearly or Type)* :			
Applicant Name:		Street Address:	
City:		State	Zip:
Phone (Home):	Phone (Office):	Phone (Cell):	
E-Mail Address:			
1. PROJECT INFORMATION:			
☐ Single Family Dwelling	☐ Other (multifamily, Comm., Industrial, Parking, Etc.)	☐ Site Plan Attached	☐ Stormwater Management Plan Attached	☐ Erosion and Sediment Control Plan Attached
2. TYPE OF CONSTRUCTION:			
☐ House	☐ Multifamily	☐ Comm. / Indust.	☐ Parking	☐ Other (Explain in 7)
3. PROJECT ADDRESS:			
Street Address:	City:	State:	Zip:
4. LOT SURFACE COMPOSITION:			
A. Pre Pervious: Sq. Ft.	B. Post Pervious: Sq. Ft.	C. Post Impervious: Sq. Ft.	
D. Pre Impervious: Sq. Ft.	E. Total Site Area: Sq. Ft.	F. Percent Impervious: %	
* ALL GRAVEL SUBJECT TO VEHICLE TRAFFIC SHALL BE CONSIDERED IMPERVIOUS.			
5. CONTRACTOR INFORMATION:			
Contractor:		Site Representative:	
Street Address:			
City:		State:	Zip:
Phone (Office):		Phone (Cell):	
E-Mail Address:			
6. DEP Approval Required: *1-3 Acres – Notice of Intent; 3+ Acres – WVDEP Construction Stormwater Permit*			
Yes or No?:	If Yes, then provided copy?:		
7. ADDITIONAL INFORMATION ABOUT PROJECT *(Please Explain in detail)* :			
Printed Name:	Signature:	Date:	
PROJECT EVALUATION *(For Office Use Only)* :			
PROJECT REQUIREMENTS:			
☐ Erosion & Sediment Control	☐ Stormwater Management Plan	☐ Other (See Comments)	
ROOF DRAINS/DISCHARGE PIPE SHALL CONNECT TO:			
☐ Ext. Storm Line	☐ Dry Well	☐ Ditch	☐ Stream	☐ Ground	☐ Other (See Comments)
WATERSHED INFORMATION			
Receiving Stream:		Impairment or TMDL:	
COMMENTS:			
Service #:	Permit #:	Date Received:	
Reviewed By:		Date Reviewed:	

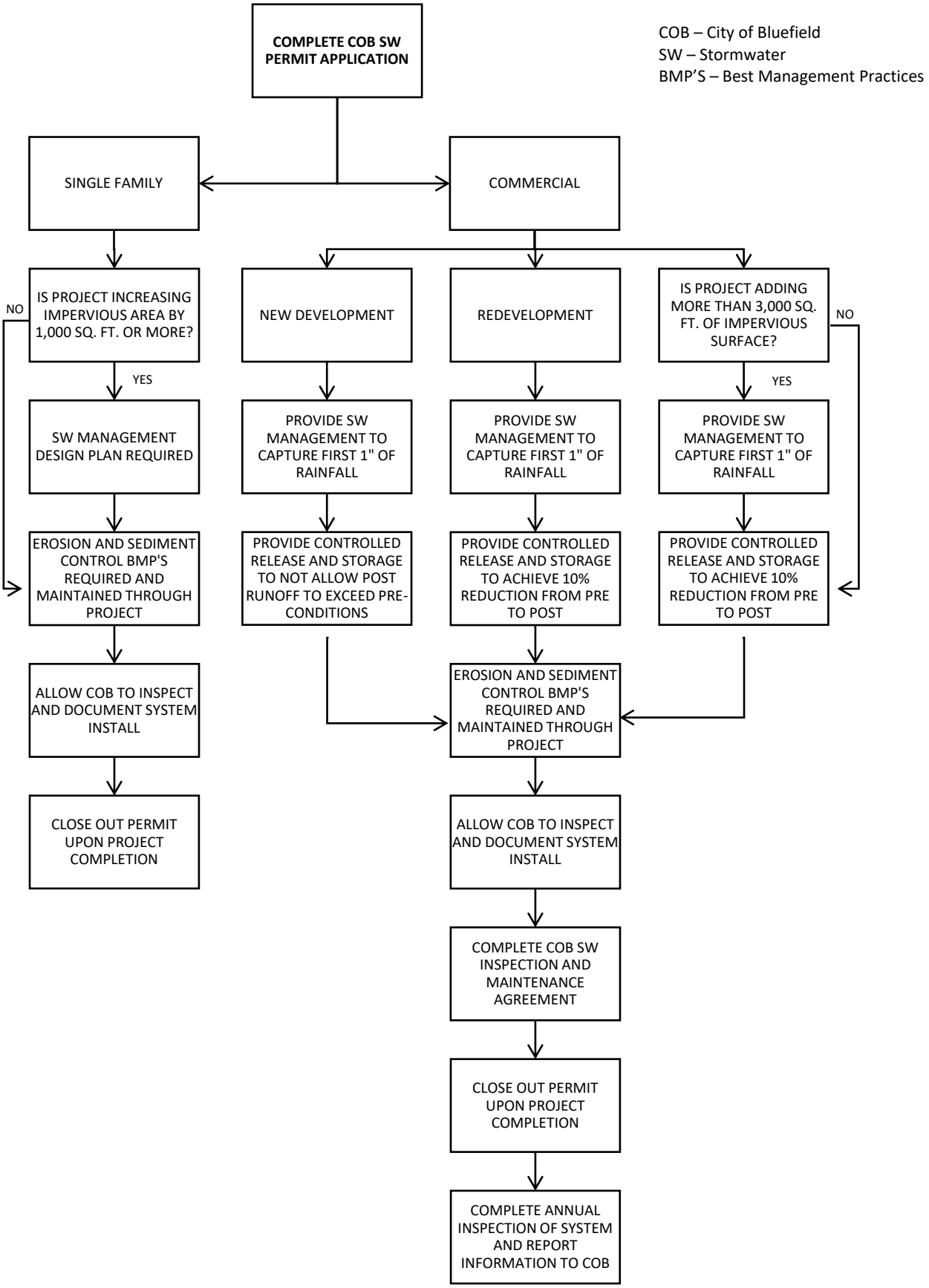
Revised 2020-01-27

Appendix B

COB Stormwater Management Permitting Flow Chart

CITY OF BLUEFIELD STORMWATER PERMITTING FLOW CHART

COB – City of Bluefield
SW – Stormwater
BMP'S – Best Management Practices



Appendix C

Stormwater Management Design Plan Example

gai consultants

Stormwater Pollution Prevention Plan

Bluefield State College Student Housing
City of Bluefield, Mercer County, West Virginia

GAI Project Number: EXAMPLE

Date

Prepared by: GAI Consultants, Inc.
Southpointe Office
6000 Town Center Blvd.
Canonsburg, Pennsylvania 15317

Prepared for: Client

Table of Contents

1.0 Site Evaluation, Assessment and Planning

1.1 Site Description

Bluefield State College plans to develop four college dormitories located at the intersection of Pulaski Street and Rock Street in the City of Bluefield, Mercer County, West Virginia 24701. The area where the dormitories will be constructed is currently occupied by an asphalt parking lot. Stormwater management is provided by an underground detention system at the southern part of the site.

The site is in the City of Bluefield, Mercer County, West Virginia. See Appendix A for location information.

1.2 Contact Information

Operator:

Company:
Responsible person(s):
Company Address:
City, State, Zip Code:
Telephone Number:
SWPPP Contact:
Office Telephone Number:

1.3 Construction Sequence/Schedule

See Sheet 9.0 of the plans.

1.4 Receiving Waters

The Project is located within the Upper New Watershed. The stormwater associated with the site runoff discharges into a storm sewer on-site.

The site is located outside the 100-year floodplain. The FEMA map for the site in City of Bluefield, Mercer County, West Virginia, Map Number 54055C0240D, 3/2/2005, can be found in Appendix A.

1.5 Sensitive Areas to be Protected

Sensitive areas include but are not limited to streams, stream buffers, wetlands, specimen trees, natural vegetation, steep slopes, or highly erodible soils. There are no known sensitive areas within the limits of the project area that are anticipated to be disturbed because of construction.

1.6 Soils, Slopes and Vegetation

The Soil Survey of Cabell County, West Virginia indicates that the site has been previously developed a parking lot. One (1) soil map unit was identified within the study area as shown in Appendix A. Soil units that were mapped within the study area include:

Urban land-Gilpin-Berks complex, 15 to 35 percent slopes (UgE). Residuum weathered from sandstone and siltstone and/or residuum weathered from acid shale. Well drained.

See Soils Report in Appendix A.

1.7 Construction Site Estimates

The following are estimates of the construction site.

Summary of Site Imperviousness (Within Drainage Areas)	
Pre-Developed Total Area (ac) =	2.96
Pre-Developed Total Impervious (ac) =	1.29
Pre-Developed Imperviousness =	43.6%
Post-Developed Total Area (ac) =	2.96
Post-Developed Total Impervious (ac) =	1.46
Post-Developed Imperviousness =	49.3%

The existing (pre-construction) drainage area consists of vegetated land cover, predominantly open space lawn area in good condition and asphalt pavement. The post-construction drainage area will also consist of open space lawn area in good condition and the new buildings. The composite curve number for the pre-construction and post-construction drainage areas are enclosed in Appendix C.

1.8 Potential Pollutants

Potential pollutants from the site could include sediments resulting from soil disturbance and oils and greases from construction vehicle activities.

1.9 Endangered Species

A desktop review of threatened and endangered species for the site was conducted using the US Fish and Wildlife Service *Known and Potential Distribution of Federally Listed Endangered and Threatened Species and Proposed Species in West Virginia (Last Updated October 2013)*.

The following mammals are known to exist in Mercer County, WV: the Indiana Bat *(Myotis sodalist)* and the Virginia Big-eared Bat *(Corynorhinus (=Plecotus) townsendii virginianus)*.

The following plant is known the existing in Mercer County, WV: the Virginia spiraea *(Spiraea virginiana)*.

No amphibians, fishes, crustaceans, or mollusks are known to exist in Mercer County, WV.

The existing site land cover is primarily open space with good condition grass cover and asphalt pavement and the proposed site land cover will also consist of open space lawn area in good condition and the new buildings. Stormwater associated with construction activity will be treated for sediment through the implementation of the BMP controls shown on the drawings prior to being discharged from the site. Due to the BMP controls, impacts to threatened and endangered species, due to construction activities or stormwater discharge, are not anticipated.

2.0 Good Housekeeping

2.1 Waste Management

2.1.1 Waste Materials

Site waste shall be collected and stored in appropriate containers (i.e., dumpsters) at the staging area. The containers shall have lids to minimize windblown trash and minimize the accumulation of water. The containers shall be in an area that stormwater does not collect or drain to and meet all federal, state, and municipal regulations. The containers shall be emptied once they are near capacity. Containers shall not be allowed to overflow. Waste shall be appropriately disposed of at an off-site location approved to receive the waste material.

Waste material shall not be buried on-site.

2.1.2 Hazardous Waste Materials

Hazardous waste materials are not anticipated at this site.

In the event of hazardous waste materials, the following measures shall be followed. Hazardous waste materials shall be stored in shipping containers and sealed. Hazardous waste containers shall have a secondary containment in the case of a spill. Hazardous waste shall be disposed of properly and in accordance with all federal, state, and municipal regulations. Hazardous waste shall not be buried or disposed of in the waste material dumpsters. Hazardous waste containers shall be inspected weekly for signs of spills. The hazardous waste containers shall be kept clean, organized, and stocked with cleanup supplies and a list of emergency contact information at all times.

2.1.3 Sanitary Waste

Portable toilets should be provided on-site in the staging area during the entire length of the construction phase. The portable toilets shall be in an area away from traffic flow and stormwater collection areas. The portable toilets should be serviced to maintain sanitary conditions.

2.1.4 Recycling

Recycling is encouraged to the extent possible. Site recycling materials shall be collected and stored in a container (i.e., dumpster) at the staging area. The container shall have a lid or suitable cover to minimize windblown materials and minimize the accumulation of water. The container shall be in an area that stormwater does not collect or drain to and meet all federal, state, and municipal regulations. The containers shall be emptied once they are near capacity. Containers shall not be allowed to overflow.

2.2 Staging Areas

A staging area should be maintained on-site throughout the construction phase. The staging area should be used as a place to store equipment, materials, waste, and additional construction related material. The staging area shall be in an area away from concentrated stormwater drainage paths. The contractor is responsible for storing and securing all tools, materials, and waste.

2.3 Washout Areas

A washout area shall be constructed on-site if any concrete mixers will be on-site. The washout area shall be above grade with a minimum width of 10 feet. The base and sides of the washout area shall be covered with a plastic sheeting at least 10 mils thick without any holes or tears. The wash area shall be inspected for any leaks, holes, and tears in the plastic on a daily basis. If the washout area gets to 75%

capacity, the area should be cleaned out. Once all concrete mixing activities are completed, the concrete waste should be allowed to harden, be broken up, and then disposed of properly.

The contractor shall prevent green concrete and concrete wash water from discharging from the site.

Water from equipment and vehicle washing, wheel washing, concrete and bituminous washout, and washout from paints, oil, and other construction materials is production waste water and cannot be disposed of on-site or discharged without an individual NPDES permit. It must be contained and removed for processing and proper disposal.

2.4 Vehicles

2.4.1 Fueling

On-site fuel tanks shall be located in the staging area with a secondary containment area around the tank. Fueling vehicles shall primarily take place within the staging area. In the event equipment fueling is necessary within the work area it shall be accomplished through use of a mobile fuel tank (e.g., truck bed tank), properly maintained and utilizing spill prevention and tank overflow procedures. If any fuel is spilled it shall be cleaned up immediately and disposed of properly. Fuel dispensers shall be locked during non-construction hours.

2.4.2 Maintenance

On-site maintenance shall primarily take place within the staging area. In the event of major maintenance, the vehicle should be transported off-site for maintenance. Hydraulic hose breaks or similar maintenance that must occur in the work area shall be accomplished using appropriate safety protocols. Any liquids leaked during maintenance shall be cleaned up and disposed of properly.

2.4.3 Washing

Vehicle washing shall be performed off-site. No vehicle washing on-site, except in the event necessary for required field maintenance.

2.5 Spill Prevention

All vehicles shall be maintained and checked for leaking fluids. Drip pan(s) should be placed under vehicles with known leaks that are left on-site overnight. All employees shall be trained in containment and cleanup of spills as well as proper disposal in accordance with federal, state, and municipal regulations. Hazardous materials shall be stored in accordance with Section 2.1.2 of this document and federal, state and municipal regulations. Contractor shall maintain on-site a spill kit, capable of handling the anticipated typical spill and means for containing the largest potential spill. The construction spill kit shall be restocked immediately after use.

Contractor is responsible for contacting the Operator immediately upon discovery of a spill on land or in a waterway. The Operator will perform required reporting or will designate contractor responsible for the spill to make required calls to emergency and regulatory entities. The contractor is to be familiar with the Operator's standard operating procedure for spill reporting.

For spills of oils, gasoline, diesel fuel, or other hazardous liquids into waterways to a point of a visible sheen on the water surface, contact the numbers below and follow their instructions. For spills on land, contact the designated Operator personnel. Contain the material and cleanup to federal, state, and municipal regulations. Contaminated soil is to be contained, treated, and/or disposed of at a state approved facility.

Discharge of oil in such quantities that may be harmful (i.e., any amount of oil that violates applicable water quality standards, cause a film or sheen upon or discoloration of surface

water or adjoining shorelines, or causes a sludge or emulsion to be deposited beneath the surface of the water or adjoining shorelines) must be *immediately* reported to the National Response Center (800-424-8802). Formal written incident reporting to EPA is not required for an oil spill less than 1,000 gallons for a single event or less than 42 gallons in each of two (2) events within a 12 month period. *Oil spills which do not flow off-site or otherwise impact the surface waters of the United States are not subject to reporting to the National Response Center.* Any oil spill must be cleaned up immediately to eliminate the potential for contact with stormwater that could transport oil contamination to impact the waters of the United States.

Emergency Reporting Contact Numbers

Agency	Location	Telephone
WVDEP Emergency Response Spill Alert System	Parkersburg, WV	(800) 642-3074
WVDEP Elkview Emergency Response Unit	Elkview, WV	(304) 558-5938
National Response Center	Washington, D.C.	(800) 424-8802
Bluefield Fire Department	101 Bluefield Avenue Bluefield, WV 24701	911 or (304) 327-8652
Mercer County Emergency Management Services	1500 West Main Street Princeton, WV 24740	911 or (304) 487-8448
U. S Environmental Protection Agency, Region III	1650 Arch Street Philadelphia, PA 19103-2029	(215) 814-5000 (Main Office) or (800) 438-2474 (Spill Reporting)
US Coast Guard Sector Ohio Valley Command Center	600 Martin Luther King Jr. Mazzoli Federal Bldg., Rm 421 Louisville, KY 40202-2251	(502) 779-5422

See Appendix B – Spill Reporting Form for reporting spills.

An SPCC plan shall be developed for sites with one above ground storage tank of 660 gallons or more total above ground tank storage of 1,330 gallons or below ground storage of 42,000 gallons of fuel.

2.6 Allowable Non-Stormwater Discharge

Non-stormwater discharges shall not be allowed.

2.7 Additional BMPs

Utilize orange safety fence or barrier tape to identify safety concerns or features to be protected.

3.0 Erosion and Sediment Control

3.1 Minimize Disturbed Area

3.1.1 Minimize Clearing

Description. Clearing and grubbing shall be performed to the limits shown on the plans. Do not exceed limits and minimize if possible.

3.1.2 Topsoil

Description. Topsoil stripped from the immediate construction area will be stockpiled in the locations specified on the plans. The stockpile will be temporarily stabilized with erosion controls as described in Section 3.4.

Installation. Topsoil stockpiles will be established during grading activities. Temporary stabilization will be applied immediately after the slopes of the stockpile have been graded and construction equipment transverses the slopes.

Maintenance & Inspection. The area will be inspected weekly for erosion and immediately after storm events. Areas on or around the stockpile that have eroded will be stabilized immediately with erosion controls.

3.2 Construction Sequence

For construction sequence, refer to Construction Drawings.

3.3 Stormwater Controls

3.3.1 Storm Sewer Conveyance and Underground Detention System

Description: Smooth lined corrugated polyethylene pipe will be installed underground to convey runoff from one inlet box to the next and safely off-site.

Installation: Pipes should be installed from downstream to upstream at a minimum slope of 1%. All joints shall be watertight.

Maintenance & Inspection: Storm sewer should be inspected quarterly and within 24 hours of rain events greater than three inches in twenty four hours. Accumulated sediment should be removed immediately.

3.4 Stabilize Soil

3.4.1 Temporary Stabilization

Description: Temporary erosion control measures consist of seeding and mulching used to produce a quick ground cover to reduce erosion on exposed soils that may be re-disturbed or permanently stabilized at a later date. This method shall be initiated as soon as practicable in portions of the site where construction activities have temporarily ceased, but in no case more than seven days after the construction activities in that portion of the site have temporarily ceased. Where the initiation of stabilization measures by the seventh day after construction temporarily ceases is precluded by natural causes, such as snow cover, stabilization measures shall be initiated as soon as conditions allow. Temporary stabilization measures do not have to be initiated by the seventh day on portions of the site where construction activity will resume within 14 days of when the activities temporarily ceased (e.g., the total time period that construction activity is temporarily halted is less than 14 days).

Installation: To control erosion on bare soil surfaces, plants must be able to germinate and grow. Seedbed preparation is essential. If the area has been recently loosened or disturbed, no further roughening is required. When the area is compacted, crusted, or hardened, the soil surface must be loosened by disking, raking, harrowing, or other acceptable means.

For seed mixtures and further installation instructions, refer to the Construction Drawings.

Maintenance & Inspection: In areas where seeds have not germinated adequately (70% density of uniform perennial vegetative cover) within 30 days of seeding and mulching, the areas must be prepared and reseeded immediately, or as soon as weather allows, to prevent erosion

damage. It is extremely important to determine why germination did not take place and make any necessary corrective actions.

3.4.2 Permanent Stabilization

Description: Permanent seeding is the establishment of perennial vegetative cover on disturbed areas by planting seed. This is done to reduce erosion and decrease sediment yield from disturbed areas. This method shall be initiated as soon as practicable in portions of the site where construction activities have permanently ceased, but in no case more than seven days after the construction activity in that portion of the site has permanently ceased. Where the initiation of stabilization by the seventh day after construction permanently ceases is precluded by natural causes, such as snow cover, stabilization measures shall be initiated as soon as conditions allow.

Installation: For seed mixtures and installation instructions, refer to the Construction Drawings.

Maintenance & Inspection: In areas where seeds have not germinated adequately (70% density of uniform perennial vegetative cover) within 30 days of seeding and mulching, the areas must be prepared and reseeded immediately, or as soon as weather allows, to prevent erosion damage. It is extremely important to determine why germination did not take place and make any necessary corrective actions.

3.5 Perimeter Controls and Sediment Controls

3.5.1 Silt Fence

Description: A temporary sediment barrier consisting of a synthetic filter fabric stretched across and attached to supporting posts and entrenched. Used to intercept and detain small amounts of sediment from disturbed areas during construction operations in order to prevent sediment from leaving the site. Silt fence is appropriate for use in areas where the size of the drainage area is no more than one-quarter acre per 100 feet of silt fence length; the maximum gradient above the barrier should be less than 2:1.

Installation:

1. The height of a silt fence shall be a minimum of 16 inches above the original ground surface and shall not exceed 34 inches above ground elevation.

2. The filter fabric shall be purchased in a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, the silt fence shall be spliced together only at a support post, by twisting the last post of each run around the other, and securely sealed. (see drawing)

3. A trench shall be excavated approximately 4 inches wide and 4 inches deep on the upslope side of the proposed location of the measure.

4. The filter fabric shall be fastened securely to the upslope side of the posts using one inch long (minimum) heavy-duty wire staples or tie wires and eight inches of the fabric shall be extended into the trench. The fabric shall not be stapled to existing trees. The most common type of silt fence has the stakes attached to the fabric at the factory.

5. The 4-inch by 4-inch trench shall be backfilled and the soil compacted over the filter fabric.

6. Silt fence shall be removed when it has served its useful purpose, but not before the upslope area has been permanently stabilized.

7. Turn the end of a run of Silt Fence slightly uphill to prevent runoff from going around the end.

Maintenance & Inspection: Silt fences shall be inspected once every seven calendar days and within 24 hours of a rainfall/snowmelt event of 0.25 inches or more in a 24-hour period. Any required repairs or maintenance shall be made immediately. Close attention shall be paid to the repair of damaged silt fence resulting from end runs and undercutting. If the fence is not installed on the contour (perpendicular to the flow of the water) both of these conditions can occur. Should the fabric on a silt fence decompose or become ineffective prior to the end of the expected usable life and the barrier still is necessary, the fabric shall be replaced promptly. Sediment deposits should be removed after each storm event. They must be removed when deposits reach approximately one half the height of the barrier. If any section of silt fence is knocked down during a rain event (because it was installed in an area of concentrated flow) then other measures such as a sediment trap and diversion or super silt fence must be installed.

3.5.2 Super Silt Fence

Description: A temporary sediment barrier consisting of a synthetic filter fabric stretched across and attached to the supporting posts of a chain link fence, installed behind the fabric, and entrenched. Used to intercept and detain small amounts of sediment from disturbed areas during construction operations in order to prevent sediment from leaving the site. Silt fence is appropriate for use in areas where the size of the drainage area is no more than one-quarter acre per 100 feet of silt fence length; the maximum gradient above the barrier should be less than 2:1. Super silt fence is used in locations where the maximum slope lengths for reinforced silt fence cannot be met and sufficient room for construction of sediment traps or basins does not exist.

Installation: Fencing shall be 48 inches in height and constructed in accordance with the WV DOT, Division of Highways specification for Chain Link Fencing. The DOT specification for a 6-foot fence shall be used, substituting 48-inch fabric and 6 foot length posts. The filter fabric shall meet the requirements of 715.11.5/AASHTO M 288, Section 7, Class 1.

1. The poles do not need to set in concrete.

2. Chain link fence shall be fastened securely to the fence posts with wire ties or staples.

3. Geotextile fabric shall be fastened securely to the chain link fence with ties spaced every 24" at the top and midsection.

4. Geotextile fabric shall be embedded a minimum of 12" into the ground.

5. When two sections of geotextile fabric adjoin each other, they shall be overlapped by 6" and folded.

6. Metal posts as specified by DOH can be replaced by pressure treated 4" x 4" posts.

Maintenance & Inspection: Silt fences shall be inspected once every seven calendar days and within 24 hours of a rainfall/snowmelt event of 0.25 inches or more in a 24-hour period. Any required repairs or maintenance shall be made immediately. Close attention shall be paid to the repair of damaged silt fence resulting from end runs and undercutting. If the fence is not installed perpendicular to the flow of the water, these conditions will occur. Should the fabric on a silt fence decompose or become ineffective, the fabric shall be promptly replaced. Sediment deposits shall be removed when deposits reach approximately one-half the height of the barrier.

3.5.3 Inlet Protection

Description. A sediment barrier and/or an excavated impounding area around a storm drain drop inlet that is used to trap sediment before sediment-laden runoff enters a storm drainage system. Drainage areas must be no greater than one (1) acre per inlet when inlet protection is used. The

drainage areas must be relatively flat with slopes of five (5) percent or less and slopes not to exceed one (1) percent in immediate proximity of the inlet.

Installation. When using silt fence drip inlet protection, the stakes, recommended, for use are 2-inch x 4-inch wood, or an equivalent metal stake, and should have a minimum height of three (3) feet. The stakes should be evenly spaced about the perimeter of the inlet at a maximum of three (3) feet apart and driven into the ground approximately eighteen (18) inches. For needed stability, the stakes should be framed with wooden strips approximately one (1) foot above the inlet drop crest. The fabric should be fastened to stakes by means of staples or wire and the joints overlapped to next stake. It is recommended that a sediment trapping sump of one (1) to two (2) feet depth and side slopes of 2:1, be provided.

Maintenance/Inspection. Inlet shall be inspected once every seven calendar days and within 24 hours of a rainfall/snowmelt event of 0.25 inches or more in a 24-hour period. More frequent inspections may be required due to damage from traffic. Sediment shall be removed from the trap once accumulation has reached half the design depth of trap. The structure should remain in place and operational until the drainage area is stabilized.

3.5.4 Slope and Channel Protection

Description. Rolled Erosion Control Products (RECPs) are temporary or permanent erosion control nets, blankets, and three-dimensional matrixes made from a wide variety of natural (such as jute, coir, and straw) and manmade materials alone or in combination. RECPs help prevent erosion in several ways. They can be a direct replacement for straw or hay mulch and provide uniform protection from raindrop erosion, moderating temperature and moisture extremes, and preventing detachment of the soil by sheet flow. They can hold seed and mulch in place on slopes and in channels so that vegetation can become established. And they can be used to permanently reinforce turf to protect channels and stream banks in high flow conditions.

Slope Installations. At the top of slope, anchor the RECPs according to one of the method detailed in Section (A) on page 3.13-5 in West Virginia E&S BMP Manual. Securely fasten all RECPs to the soil by installing stakes/staples at a minimum rate of 1.5/yd2. For the most effective RECP installation use stake/staple patterns and densities as recommended by the manufacturer. For adjacent and consecutive rolls of RECPs follow seaming instructions detailed in Section (B) on page 3.13-5 in West Virginia E&S BMP Manual. The terminal end of the RECPs installation must be anchored using one of the methods detailed in Section (C) on page 3.13-5 in West Virginia E&S BMP Manual.

Channel Installations. Construct an anchor trench at the beginning of the channel across its entire width according to Section (A) (2) on page 3.13-5 in West Virginia E&S BMP Manual. Follow the manufacturer's installation guidelines in constructing additional anchor trenches or stake/staple check slots at intervals along the channel reach and at the terminal end of the channel, according to paragraph (A) on page 3.13-5 in West Virginia E&S BMP Manual respectively. Unroll RECPs down the center of the channel in the primary water flow direction. Securely fasten all RECPs to the soil by installing stakes/staples at a minimum rate of 2/yd2. Significantly higher anchor rates and longer stakes/staples may be necessary in sandy, loose, or wet soils and in severe applications. For adjacent and consecutive rolls of RECPs follow seaming instructions detailed in Section (B) on page 3.13-5 in West Virginia E&S BMP Manual. All terminal ends of the RECPs must be anchored using one of the methods detailed in Section (C) on page 3.13-5 in West Virginia E&S BMP Manual. With any RECP installation, ensure sufficient staples to resist uplift from hydraulics, wind, mowers, and foot traffic. For the most effective installation of RECPs, it is recommended to use stake/staple patterns and densities as recommended by the manufacturer.

Maintenance/Inspection. During the initial period after installation, RECPs shall be inspected once every seven calendar days and within 24 hours of a rainfall/snowmelt event of 0.25 inches or more in a 24-hour period. Basic monitoring should consist of visual inspections to determine mat integrity and attachment performance. Rill development beneath the mat or edge lifting is evidence of inadequate attachment. Until the vegetation is fully established, the ground surface should be inspected for signs of rill or gully erosion below the matting. Any signs of erosion, tearing of the matting, or areas where the matting is no longer anchored firmly to the ground should be repaired. Repair any damaged areas immediately by restoring soil to finished grade, re-applying soil amendments and seed, and replacing the RECPs. Additional staking and trenching can be employed to correct defects. Recently placed mats may be replaced, but once vegetation becomes established, replacement is not a reasonable option unless large failures have occurred. If the RECPs are vegetated, the vegetation should be watered as needed. Getting grass established as quickly as possible is very important.

3.5.5 Compost Filter Socks

Description: A temporary sediment barrier consisting of a synthetic filter fabric filled with compost. Used to intercept and detain small amounts of sediment from disturbed areas during construction operations in order to prevent sediment from leaving the site.

- Temporary seeding and mulching is required within four days when areas will not be re-disturbed for more than 14 days.
- Permanent seeding and mulching is required within four days of reaching final grade.
- Permanent stabilization is required within four days after construction has been complete.

Installation: Socks should be the diameter specified on the plan constructed in accordance with the manufacturer's recommendations.

Compost filter sock shall be placed at existing level grade. Both ends of the sock shall be extended at least 8 feet up slope at 45 degrees to the main sock alignment. Maximum slope length above any sock shall not exceed manufacturer's recommendations. Traffic shall not be permitted to cross filter socks.

Maintenance & Inspection: Close attention shall be paid to the repair of damaged socks resulting from end runs and undercutting. If the sock is not installed perpendicular to the flow of the water, these conditions will occur. Should the fabric on a sock decompose or become ineffective, additional socks shall be promptly added. Accumulated sediment shall be removed when it reaches ½ the above ground height of the sock. Biodegradable filter sock shall be replaced after 6 months; photodegradable socks after 1 year. Polypropylene socks shall be replaced according to manufacturer's recommendations. Upon stabilization of the area tributary to the sock, stakes shall be removed. The sock may be left in place and vegetated or removed. In the latter case, the mesh shall be cut open and the mulch spread as a soil supplement.

- Inspection of all erosion and sediment controls within disturbed areas shall occur once every seven calendar days and within 24 hours of a rainfall/snowmelt event of 0.25 inches or more in a 24-hour period.
- Repairs of maintenance to BMPs shall be performed within 24 hours; however, permittees must implement alternate BMPs prior to storm events while awaiting repair of the primary enhanced BMP.

3.6 Construction Entrance/Exit

3.6.1 Stabilized Construction Entrance

Description: Construction entrances are stabilized to reduce the amount of sediment transported onto paved roads by vehicles or equipment by constructing a stabilized pad of stone at entrances to construction sites.

Installation:

1. Use 2-4 inch stone for low volume entrances, larger stone (4-6 inch) for heavy use or material delivery entrances.
2. Length is as required, but not less than 70 feet (except on a single residence lot where a 30 foot minimum length would apply).
3. Thickness should be not less than 6 inches.
4. The width shall be a minimum of 10 feet, but not less than the full width at points where ingress or egress occurs.
5. Geotextile fabric shall be placed over the entire area prior to the placing of stone.

Maintenance: The entrance shall be maintained in a condition that will prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic top dressing with additional stone as conditions demand and repair and/or cleanout of any measures used to trap sediment. All sediment spilled, dropped, washed or tracked onto public rights-of-way must be removed immediately.

3.7 Additional BMPs

3.7.1 Dust Control

Description: Dust control is the prevention or reduction of wind erosion of exposed soils during construction and other land disturbing activities. This practice is applied in locations where dust can cause damage either on-site or off-site, if no preventive actions are taken. Used oil may not be applied for dust control.

Methods:

1. **Vegetative Cover**. For areas of little to no construction traffic, vegetative cover can be a very effective method of dust control. In areas where construction will be halted for 14 days or longer, temporary seeding is required. In areas where construction is complete, permanent seeding is required as soon as practicable.
2. **Watering.** In areas of exposed soils, during grading or along access roads, water may be used to wet the soils to prevent wind erosion. Water can be applied on an as needed basis, but in amounts that will not cause soil erosion.

4.0 Employee Training

Frequent tailgate meetings or job site analyses (JSA) shall be used to train staff on how to avoid damaging stormwater BMPs, maintenance of BMPs, jobsite hazards, jobsite upkeep, and other construction related activities. The tailgate meeting or JSA should be used to discuss all erosion and sediment control BMPs as well as waste material and construction material storage. During the meetings emergency procedures should be reviewed and discussed for the specific construction site and conditions.

See Appendix B – Training Forms.

5.0 Inspection

5.1 Inspections

5.1.1 Inspector(s)

The inspector shall be qualified and have experience in the installation and maintenance aspects of erosion and sediment control BMP's.

5.1.2 Inspection Details

Inspections shall be conducted a minimum of once every seven (7) calendar days to verify that all BMPs have been installed, maintained, and are functioning properly. In the event of storm of one-half (0.50) inch or greater, an inspection shall be performed within 24 hours of the storm. Inspectors shall also note of any problem areas including: unmaintained BMPs, areas of heavy erosion, and areas in need of additional erosion and sediment controls. Any problems that are causing or have the potential of causing a breach of the BMPs shall be reported immediately to the contractor, to the owner, and to the engineer.

See Appendix B – Field Inspection Forms.

Completed inspection forms are to be stored with the SWPPP and maintained for a period of three years after termination of construction activities.

5.2 Corrective Actions Log

Document repair of BMPs and other maintenance on a weekly basis. For BMP's that require maintenance or repair, corrective action shall be taken within 3 days of the inspection. For sediment ponds corrective action shall be taken within 10 days of the inspection. For missing BMPs or BMPs not meeting the intended function, new BMPs shall be install within 10 days of the inspection.

See Appendix B – Corrective Action Log

6.0 Record Keeping

6.1 Record Keeping

Blank forms can be found in Appendices. Completed forms may be stored in the Appendices.

Appendix B	Spill Reporting Forms
Appendix B	Training Forms
Appendix B	Field Inspection Forms
Appendix B	Corrective Action Log

For each spill, written documentation of the spill is required. The following information is to be included in this documentation:

a) Name of Responsible Party (Owner, Operator, or Facility)
b) Name of Person making the call
c) Date and time of spill (actual/discovered)
d) Location where spill occurred
e) Type of spill (oil, lubricant, etc.)
f) Estimated volume
g) Did any spill leave the property?
    1) If so, where was it discharged?

2) What is the ditch into which the spill has, or may enter?

h) Suspected failure that caused spill

i) Assessment of imminent danger to personnel or property

j) Damage and injuries caused by spill

k) Actions taken to contain, stop, remove or cleanup spill

l) Identification of any local emergency unit(s) contacted

This information will also be needed when reporting a spill.

6.2 Internal Reporting

In case of spills, unauthorized discharges, or fill in streams contact the Operator's responsible contact in Section 1.2.

After the emergency contact has been reached, notify applicable agency(s) in accordance with Section 2.5 as directed by Operator.

If emergency contact cannot be reached, then contact applicable agency.

7.0 Stormwater Management

7.1 Stormwater Management Detention and Water Quality

The site was examined to identify the locations where stormwater runoff leaves the site. A Point of Interest (POI) is shown on the drainage area maps enclosed with the report at each of the locations where a POI was identified.

POI A and POI B

Drainage Area A contributes to POI A. Drainage Area A is the central drainage area on-site and is located in the existing storm system that will be tied into at the southeast end of the site. Drainage Area B is at the southwest end of the site and sheet flows to an existing drainage swale offsite.

A reduction in the post-developed peak flows is provided up to the 25-year storm at POI A and POI B. For Drainage Area A, Underground Detention Basin 1 is proposed to attenuate those peak rates below their pre-developed levels. For Drainage Area B, there is a natural decrease in flow based on the proposed development.

Water Quality

The 1-inch 24 hour storm runoff volume is managed on-site to provide an elevated level of water quality on site. The underground detention system was oversized to provide excess storage to control the water quality volume. Please refer to Appendix G for supporting Calculations that show where credit for this storage is taken.

Detention

A summary of the pre-developed and post-developed runoff at POI A and POI B including all controlled and un-controlled runoff, as well as a summary of the performance of Detention Basin 1 is shown on the following table. Please refer to Appendices C through F for supporting calculations.

Drainage Area A (POI A), Peak Flow Summary

Return Period	Pre A Total (cfs) (1)	UGD-1 Inflows (cfs) (2)	UGD-1 Outflows (cfs) (3)	Bypass A (cfs) (4)	Post A* Routed Total (cfs) (5)
2-Year	4.84	3.67	2.79	1.70	4.29
10-Year	7.74	5.70	3.88	2.66	6.14
25-Year	9.54	6.96	4.51	3.26	7.23

Drainage Area B (POI B), Peak Flow Summary

Return Period	Pre B Total (cfs) (1)	Post B Total (cfs) (2)
2-Year	0.42	0.38
10-Year	0.80	0.71
25-Year	1.05	0.94

POI A, Peak Flow Summary

Return Period	Pre A Total (cfs) (1)	Post A Total (cfs) (2)	Difference (cfs) (3)	Percent Decrease (4)
2-Year	4.84	4.29	-0.55	11.4%
10-Year	7.74	6.14	-1.60	20.7%
25-Year	9.54	7.23	-2.31	24.2%

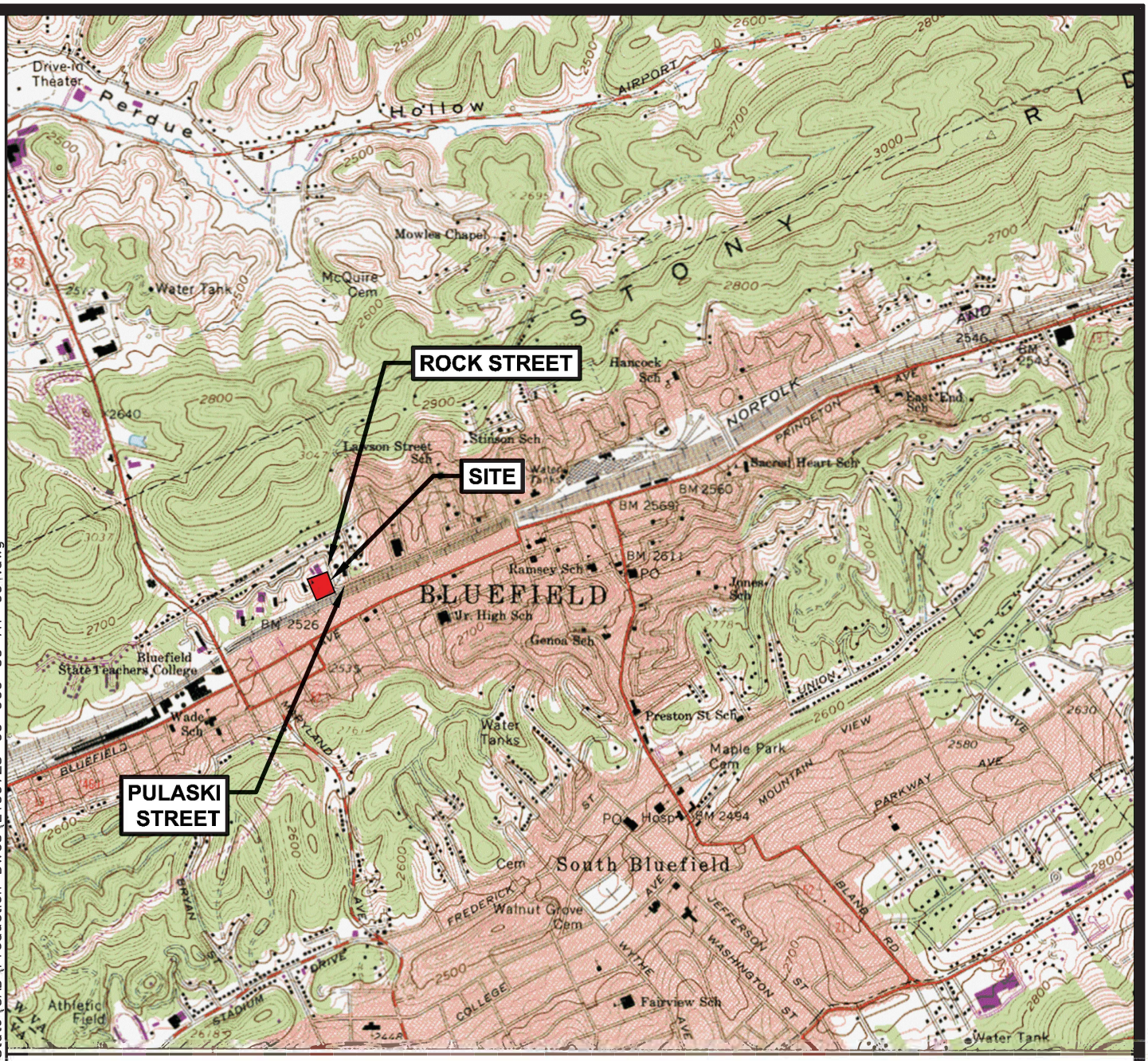
POI B, Peak Flow Summary

Return Period	Pre B Total (cfs) (1)	Post B Total (cfs) (2)	Difference (cfs) (3)	Percent Decrease (4)
2-Year	0.42	0.38	-0.04	9.5%
10-Year	0.80	0.71	-0.09	11.3%
25-Year	1.05	0.94	-0.11	10.5%

Basin 1, Routing Summary

Return Period	Basin 1 Inflows (cfs) (A)	Basin 1 Routed Outflows (cfs) (B)	Max Water Surface Elevation (C)	Storage Volume @ Max W.S.E. (ac-ft) (D)
2-Year	3.67	2.79	2529.27	0.051
10-Year	5.70	3.88	2529.96	0.073
25-Year	6.96	4.51	2530.43	0.089

APPENDIX A
USGS Site Location Map, FEMA Map, and Soils Report



MAP REFERENCE:

BLUEFIELD QUADRANGLE
MERCER COUNTY, WV
U.S.G.S. 7.5 MINUTE SERIES

SCALE: 1" = 2000'

1000' 0 500' 1000'

DRAWING TITLE	GAI DRAWING NUMBER:
SITE LOCATION MAP	**001**

PROJECT

BLUEFIELD STATE COLLEGE
CITY OF BLUEFIELD
MERCER COUNTY, WV

CLIENT

EDWARD TUCKER ARCHITECTS, INC.
1401 SIXTH AVENUE
HUNTINGTON, WEST VIRGINIA 25701

gai consultants

GAI FILE NUMBER:

DRAWN BY:	CHECKED BY:	APPROVED BY:
SHEET NO.:	SCALE:	ISSUE DATE:
1 OF 1	1"=2000'	10/24/2019

This drawing was produced with computer aided drafting technology and is supported by electronic drawing files. Do not revise this drawing via manual drafting methods.

ISSUING OFFICE: Charleston | 300 Summers Street, Suite 1100, Charleston, WV 25301

GAI CAD FILE PATH: Z:\Infra\2019\E190725.00 - Bluefield State\CAD\Production DWGs\E190725-00-000-00-A1-001.dwg

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles, Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0 National Geodetic Vertical Datum of 1929 (NGVD 29). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations tables in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations tables should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures.** Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures in this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 17. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the National Geodetic Vertical Datum of 1929. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3191

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit their website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was provided in digital format by the Region 1 Planning and Development Council. This information was compiled by Bluff, Mercer County 2002 roads and U.S. Geological Survey Digital Line Graphs to U.S. Geological Survey Digital Orthophoto Quadrangles produced at a scale of 1:12,000 from photography dated 1998 or later.

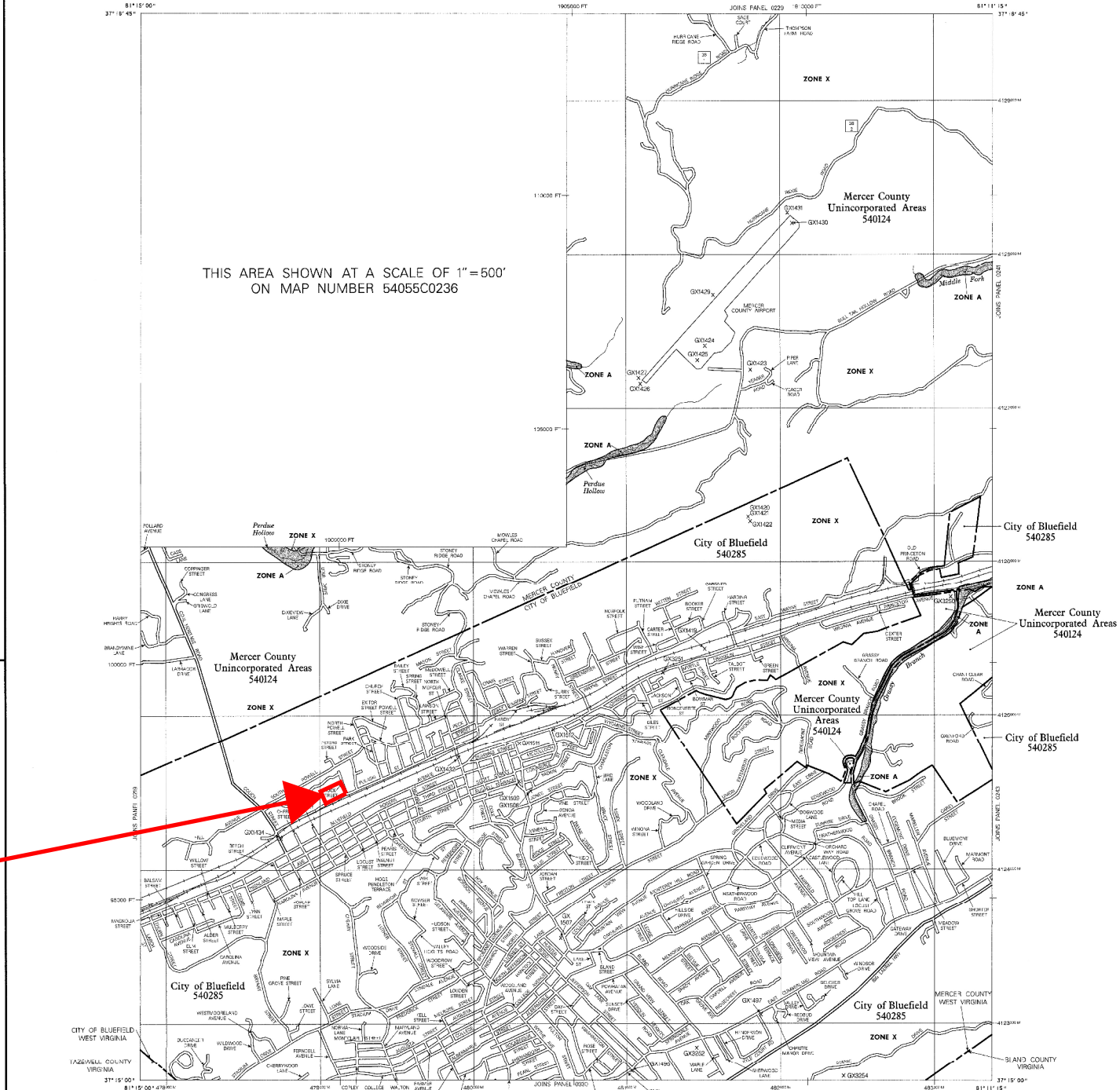
This map reflects more detailed and up to date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and their website at http://www.msc.fema.gov.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- Floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 Base Flood Elevation line and value; elevation in feet*
- (EL 987) Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the National Geodetic Vertical Datum of 1929

- A — A Cross section line
- 23 — 23 Transect line
- 97°07'30", 32°22'30" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
- 4278000 mE 1000-meter Universal Transverse Mercator grid values, zone 17
- 600000 FT 5000-foot grid ticks: West Virginia State Plane coordinate system, south zone (FIPSZONE 4702), Lambert Conformal Conic projection
- DX5510 X Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
March 2, 2005

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'
500 0 1000 2000 FEET
150 0 300 600 METERS

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0240D

FIRM
FLOOD INSURANCE RATE MAP
MERCER COUNTY, WEST VIRGINIA AND INCORPORATED AREAS

PANEL 240 OF 330

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BLUEFIELD, CITY OF	540186	0240	D
MERCER, COUNTY	540124	0240	D

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
54055C0240D

EFFECTIVE DATE
MARCH 2, 2005

Federal Emergency Management Agency

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Mercer and Summers Counties Area, West Virginia

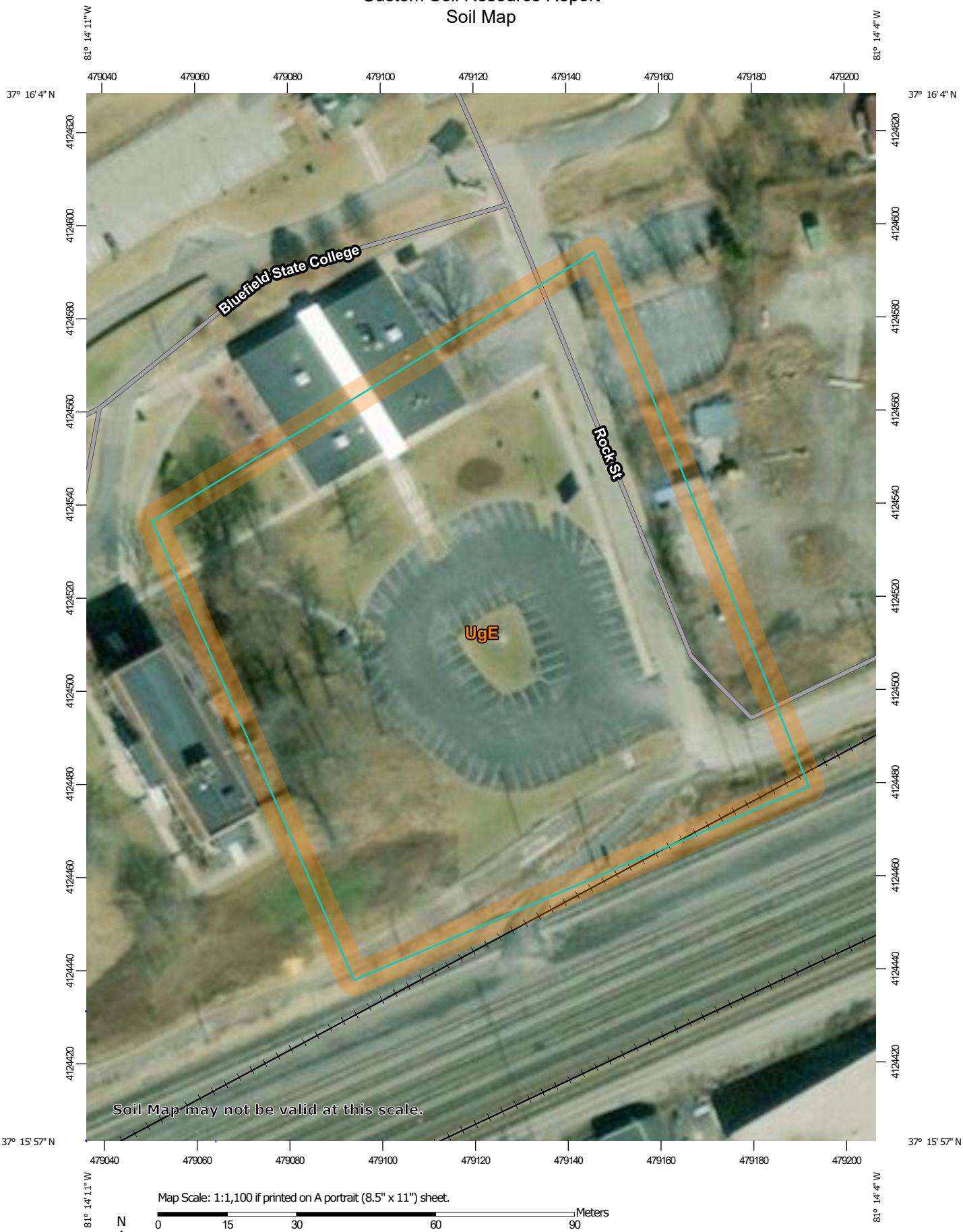
Bluefield State College Student Housing

October 18, 2019

Contents

(NOTE: This Soils Report is partial an intended as an Example only.)

Custom Soil Resource Report
Soil Map



Map Scale: 1:1,100 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

Mercer and Summers Counties Area, West Virginia

UgE—Urban land-Gilpin-Berks complex, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: k9zt
Elevation: 90 to 460 feet
Mean annual precipitation: 35 to 44 inches
Mean annual air temperature: 40 to 61 degrees F
Frost-free period: 150 to 179 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 40 percent
Gilpin and similar soils: 20 percent
Berks and similar soils: 15 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Typical profile

H1 - 0 to 6 inches: bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Other vegetative classification: Not Suited (NS)
Hydric soil rating: No

Description of Gilpin

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Mountainflank, mountaintop
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Acid residuum weathered from shale and siltstone and/or acid residuum weathered from sandstone

Typical profile

A - 0 to 6 inches: loam
B - 6 to 27 inches: silty clay loam
C - 27 to 35 inches: channery silty clay loam
R - 35 to 39 inches: bedrock

Properties and qualities

Slope: 25 to 35 percent
Depth to restrictive feature: 35 to 39 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Hydrologic Soil Group: C
Other vegetative classification: Not Suited (NS)
Hydric soil rating: No

Description of Berks

Setting

Landform: Hillslopes, structural benches, ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Upper third of mountainflank, center third of mountainflank, mountainflank, mountaintop
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and siltstone and/or residuum weathered from acid shale

Typical profile

A - 0 to 7 inches: channery silt loam
B - 7 to 28 inches: very channery silt loam
C - 28 to 35 inches: very channery silt loam
R - 35 to 39 inches: bedrock

Properties and qualities

Slope: 25 to 35 percent
Depth to restrictive feature: 35 to 39 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Hydrologic Soil Group: B
Other vegetative classification: Not Suited (NS)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 25 percent
Hydric soil rating: No

APPENDIX B
Spill Reporting Forms, Training Forms, Field Inspection Forms, and Corrective Action Log

gai consultants
transforming ideas into reality

SWPPP Corrective Action Log

Project Name: Bluefield State College Student Housing

Inspection Date:	Inspector Name:	BMP Deficiency Description:	Corrective Action Needed:	Date Action Taken/Responsible Person:

Stormwater Field Inspection Form

General Information

Project Name: Bluefield State College Student Housing	
Location: City of Bluefield, Mercer County, West Virginia	
Date of Inspection:	Start/End Time:
Inspector's name:	
Inspector's title:	
Inspector's contact information:	
Construction phase:	
□ Scheduled □ Pre-storm event □ During storm event □ Post-storm event	

Weather Information

Has there been a storm event since the last inspection: □ Yes □ No If yes, provide: Storm Start Date/Time: Storm Duration(hrs): Approx. Amount of Precipitation(in.):
Weather at time of this inspection: □ Clear □ Cloudy □ Rain □ Sleet □ Fog □ Snowing □ High Winds □ Other: Temperature:
Have any discharges occurred since the last inspection?: □ Yes □ No If yes, describe:
Are there any discharges at the time of inspection?: □ Yes □ No If yes, describe:

Site BMPs	**Implemented? (First Visit Only)***	**Condition***	**Maintenance Required?***	**Notes**
Buffer Zones Around Sensitive Areas	**Y N**	**G F P**	**Y N**	
Stabilized Construction Entrance	**Y N**	**G F P**	**Y N**	
Ditch Relief Culverts	**Y N**	**G F P**	**Y N**	
Conveyance Channels	**Y N**	**G F P**	**Y N**	
Energy Dissipaters	**Y N**	**G F P**	**Y N**	
Silt Fence/ Super Silt Fence	**Y N**	**G F P**	**Y N**	
Compost Filter Sock	**Y N**	**G F P**	**Y N**	
Erosion Control Matting	**Y N**	**G F P**	**Y N**	
Seeding	**Y N**	**G F P**	**Y N**	

Washout Area	**Y N**	**G F P**	**Y N**	
In-Stream BMPs	**Y N**	**G F P**	**Y N**	
Trash Properly Covered?	**Y N**	**G F P**	**Y N**	
Are all inactive slopes stabilized?	**Y N**	**G F P**	**Y N**	
Are potential stormwater contaminants properly covered?	**Y N**	**G F P**	**Y N**	
Are discharge points free of sediment deposits?	**Y N**	**G F P**	**Y N**	

***Y = Yes N = No G = Good F = Fair P = Poor**

Will existing BMPs need to be modified or removed, or other BMPs installed? □ Yes □ No

If yes, list the action items to be completed:

Actions to be completed	**Date completed/Initials**
1.	
2.	
3.	
4.	
5.	
6.	

Is the site in compliance with the SWPPP and the permit requirements? □ Yes □ No

If no, indicate tasks necessary to bring site into compliance on the "Actions to be completed" table above, and include dates each job will be completed.

If no, should the SWPPP be modified? □ Yes □ No

Notes: _____
_____
_____
_____
_____
_____
_____

Sign the following certification:

"I certify that this report is true, accurate, and complete, to the best of my knowledge and belief."

Inspection completed on: _____ by: _____
(print & signature)

Title/Qualification of Inspector: _____

TRAINING LOG

Sediment and Erosion Control Training

Project Name: _____

Instructor's Name: _____

Location: _____

Date: _____ **Length:** _____

Training Topics:

☐ **Erosion Control BMPs** ☐ **Good Housekeeping BMPs** ☐ **Other (Specify)**

☐ **Sediment Control BMPs** ☐ **SWPPP Provisions**

☐ **Non-Storm Water BMPs** ☐ **Conducting Inspections**

☐ **Emergency Procedures** ☐ **Turbidity Monitoring**

Attendee Roster: *(attach additional pages as necessary)*

Name of Attendee	Company/Agency

Instructor's Signature: _____

Title: _____

SPILL REPORT FORM

1. Person Reporting the Spill:

Name, Title, and Phone Number: _____

_____

2. Contractor:

Name and Title of Person Responsible for Spill Response: _____

Phone Number:_____

3. General Spill Information:

Name of Spilled Substance: _____

Quantity Spilled (Estimate): _____

Date of Spill: _____/_____/_____

Time Spill Started: _____ AM / PM Time Spill Ended: _____ AM / PM

4. Spill Location and Conditions:

Project Title: _____

Street Address, City: _____

Weather Conditions: _____

If spill to water, name of water body (if ditch or culvert, identify the water body that the structure discharges to): _____

Identify the Discharge Point: _____

Estimate the Depth and Width of the Water Body: _____

Estimate Flow Rate (i.e. slow, moderate, or fast): _____

Describe Environmental Damage (i.e., fish kill?): _____

5. Actions taken:

Describe the actions taken to stop, contain, manage, and/or clean up the spill.

_____

_____

_____

_____

List all agencies contacted; include names, dates, time, and phone numbers for people you spoke with: _____

_____

_____

_____

6. Person Responsible for Managing Termination/Closure of Incident or Spill:

Name and Phone: _____

Address and Fax: _____

7. Additional Notes/Information (continue on back if necessary):

APPENDIX C
Land Cover Calculations and NOAA Rainfall Amounts

gai consultants
transforming ideas into reality

Pre-Development Land Cover

Drainage Area A

Land Cover Type	HSG C Soils (acres)	CN
Open Space	1.27	74
Impervious Cover	1.29	98
Total	**2.56**	**86.1**

Drainage Area B

Land Cover Type	HSG C Soils (acres)	CN
Open Space	0.33	74
Gravel	0.07	89
Total	**0.40**	**76.6**

Post-Development Land Cover

Bypass A

Land Cover Type	HSG C Soils (acres)	CN
Open Space	0.37	74
Gravel		89
Impervious Cover	0.47	98
Total	**0.84**	**87.4**

UGD-1

Land Cover Type	HSG C Soils (acres)	CN
Open Space	0.72	74
Gravel	0.06	89
Impervious Cover	0.99	98
Total	**1.77**	**87.9**

Drainage Area B

Land Cover Type	HSG C Soils (acres)	CN
Open Space	0.28	74
Gravel	0.07	89
Impervious Cover		98
Total	**0.35**	**77.0**

NOAA Atlas 14, Volume 2, Version 3
Location name: Bluefield, West Virginia, USA*
Latitude: 37.2668°, Longitude: -81.2352°
Elevation: m/ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.286** (0.257-0.320)	**0.339** (0.305-0.379)	**0.403** (0.361-0.450)	**0.452** (0.403-0.505)	**0.515** (0.455-0.577)	**0.562** (0.490-0.632)	**0.609** (0.525-0.689)	**0.654** (0.556-0.748)	**0.716** (0.595-0.830)	**0.762** (0.621-0.895)
10-min	**0.455** (0.409-0.510)	**0.541** (0.486-0.604)	**0.644** (0.577-0.719)	**0.721** (0.643-0.805)	**0.819** (0.723-0.916)	**0.892** (0.779-1.00)	**0.964** (0.832-1.09)	**1.03** (0.879-1.18)	**1.12** (0.935-1.30)	**1.19** (0.971-1.40)
15-min	**0.569** (0.511-0.637)	**0.679** (0.610-0.758)	**0.814** (0.730-0.908)	**0.911** (0.812-1.02)	**1.04** (0.915-1.16)	**1.13** (0.985-1.27)	**1.22** (1.05-1.38)	**1.31** (1.11-1.49)	**1.42** (1.18-1.64)	**1.50** (1.22-1.76)
30-min	**0.778** (0.699-0.871)	**0.936** (0.841-1.05)	**1.15** (1.03-1.29)	**1.32** (1.17-1.47)	**1.53** (1.35-1.71)	**1.70** (1.48-1.91)	**1.86** (1.60-2.11)	**2.02** (1.72-2.31)	**2.24** (1.86-2.60)	**2.41** (1.96-2.83)
60-min	**0.969** (0.871-1.09)	**1.17** (1.05-1.31)	**1.48** (1.32-1.65)	**1.71** (1.53-1.91)	**2.04** (1.80-2.28)	**2.29** (2.00-2.58)	**2.56** (2.21-2.90)	**2.83** (2.41-3.24)	**3.21** (2.67-3.72)	**3.51** (2.86-4.13)
2-hr	**1.11** (1.00-1.24)	**1.34** (1.21-1.50)	**1.69** (1.52-1.88)	**1.97** (1.76-2.19)	**2.36** (2.08-2.63)	**2.67** (2.34-3.00)	**3.00** (2.59-3.38)	**3.34** (2.84-3.81)	**3.82** (3.17-4.44)	**4.21** (3.42-4.97)
3-hr	**1.18** (1.07-1.31)	**1.42** (1.29-1.58)	**1.78** (1.61-1.97)	**2.07** (1.87-2.30)	**2.47** (2.20-2.75)	**2.81** (2.47-3.14)	**3.16** (2.73-3.55)	**3.53** (3.01-4.01)	**4.04** (3.36-4.69)	**4.46** (3.62-5.26)
6-hr	**1.42** (1.30-1.56)	**1.70** (1.56-1.87)	**2.11** (1.93-2.32)	**2.44** (2.21-2.68)	**2.90** (2.60-3.20)	**3.28** (2.91-3.64)	**3.68** (3.21-4.11)	**4.10** (3.52-4.63)	**4.68** (3.92-5.39)	**5.16** (4.22-6.03)
12-hr	**1.70** (1.57-1.85)	**2.02** (1.87-2.20)	**2.47** (2.28-2.69)	**2.83** (2.60-3.09)	**3.34** (3.04-3.66)	**3.76** (3.38-4.13)	**4.19** (3.71-4.63)	**4.64** (4.05-5.18)	**5.28** (4.50-5.98)	**5.82** (4.85-6.67)
24-hr	**2.11** (1.98-2.25)	**2.51** (2.35-2.68)	**3.01** (2.82-3.21)	**3.41** (3.19-3.63)	**3.96** (3.69-4.22)	**4.40** (4.08-4.69)	**4.84** (4.47-5.17)	**5.30** (4.85-5.66)	**5.91** (5.37-6.33)	**6.38** (5.76-6.86)
2-day	**2.53** (2.39-2.68)	**3.00** (2.83-3.18)	**3.57** (3.37-3.78)	**4.01** (3.79-4.25)	**4.61** (4.33-4.88)	**5.07** (4.75-5.38)	**5.53** (5.16-5.88)	**5.99** (5.56-6.38)	**6.59** (6.07-7.06)	**7.05** (6.45-7.59)
3-day	**2.71** (2.57-2.87)	**3.21** (3.04-3.40)	**3.80** (3.59-4.01)	**4.25** (4.02-4.49)	**4.85** (4.58-5.13)	**5.31** (4.99-5.62)	**5.77** (5.40-6.12)	**6.22** (5.79-6.61)	**6.80** (6.29-7.26)	**7.22** (6.65-7.75)
4-day	**2.89** (2.74-3.05)	**3.42** (3.24-3.61)	**4.03** (3.82-4.25)	**4.49** (4.26-4.74)	**5.10** (4.82-5.38)	**5.56** (5.24-5.87)	**6.01** (5.64-6.36)	**6.44** (6.03-6.84)	**7.00** (6.50-7.46)	**7.40** (6.85-7.91)
7-day	**3.39** (3.22-3.58)	**4.00** (3.80-4.21)	**4.67** (4.44-4.92)	**5.18** (4.91-5.46)	**5.83** (5.52-6.15)	**6.31** (5.95-6.66)	**6.77** (6.37-7.16)	**7.21** (6.76-7.64)	**7.77** (7.23-8.26)	**8.16** (7.57-8.70)
10-day	**3.90** (3.70-4.11)	**4.60** (4.37-4.86)	**5.36** (5.08-5.65)	**5.93** (5.62-6.25)	**6.67** (6.31-7.04)	**7.22** (6.81-7.63)	**7.74** (7.28-8.19)	**8.24** (7.72-8.75)	**8.88** (8.27-9.46)	**9.34** (8.66-9.98)
20-day	**5.37** (5.12-5.66)	**6.31** (6.00-6.64)	**7.26** (6.90-7.63)	**7.99** (7.59-8.39)	**8.91** (8.45-9.37)	**9.61** (9.09-10.1)	**10.3** (9.68-10.8)	**10.9** (10.2-11.5)	**11.7** (10.9-12.4)	**12.3** (11.4-13.1)
30-day	**6.69** (6.40-7.01)	**7.82** (7.47-8.19)	**8.86** (8.46-9.28)	**9.65** (9.21-10.1)	**10.6** (10.1-11.2)	**11.4** (10.8-11.9)	**12.1** (11.4-12.7)	**12.7** (12.0-13.4)	**13.5** (12.7-14.2)	**14.0** (13.1-14.8)
45-day	**8.44** (8.07-8.83)	**9.83** (9.40-10.3)	**11.1** (10.6-11.6)	**12.0** (11.5-12.6)	**13.2** (12.6-13.9)	**14.1** (13.4-14.8)	**14.9** (14.1-15.7)	**15.7** (14.8-16.5)	**16.6** (15.6-17.5)	**17.2** (16.1-18.3)
60-day	**10.2** (9.77-10.7)	**11.9** (11.4-12.4)	**13.2** (12.7-13.8)	**14.3** (13.6-14.9)	**15.5** (14.8-16.2)	**16.3** (15.6-17.1)	**17.1** (16.3-17.9)	**17.8** (16.9-18.7)	**18.6** (17.6-19.6)	**19.2** (18.1-20.2)

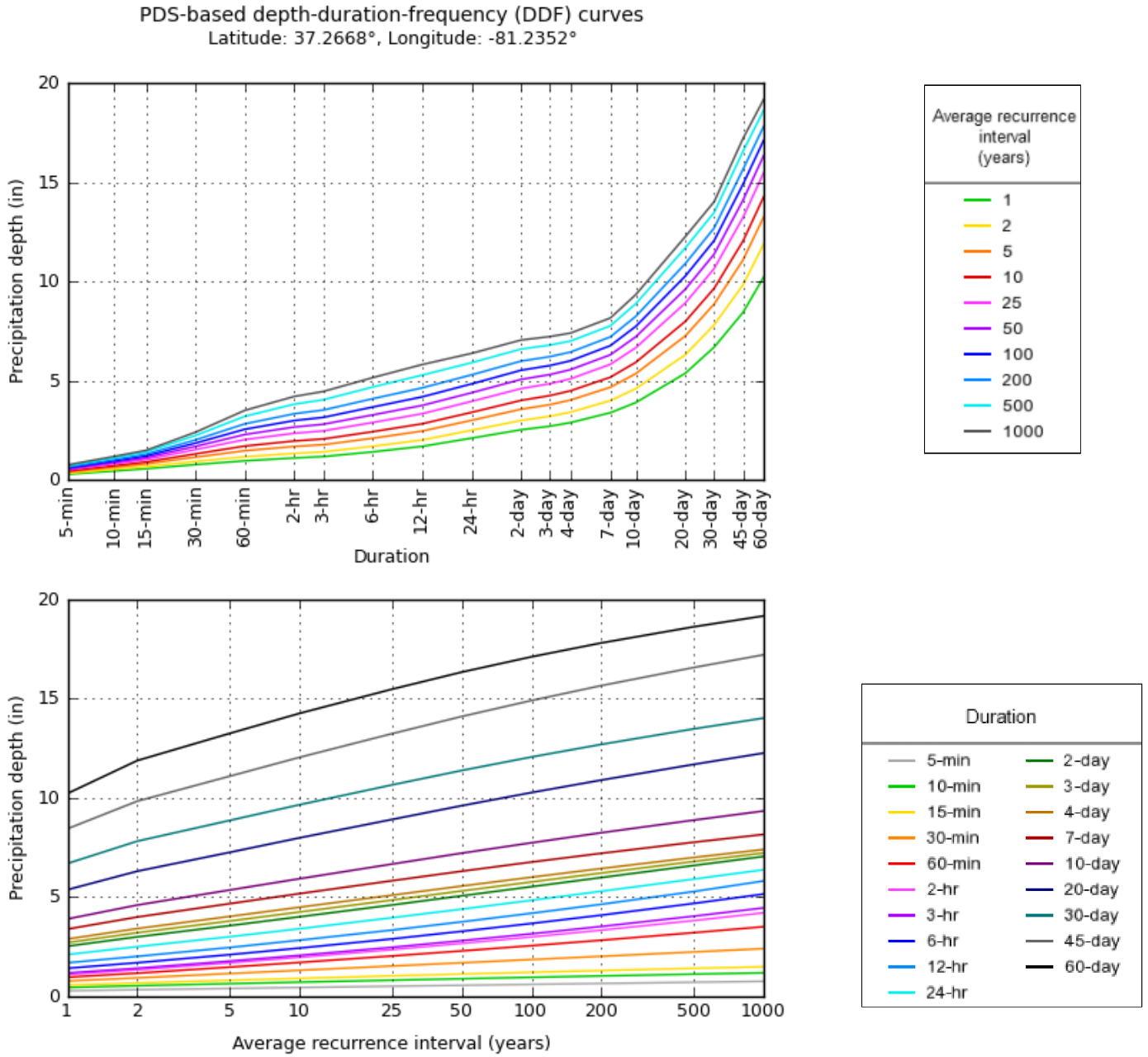
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds re not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical



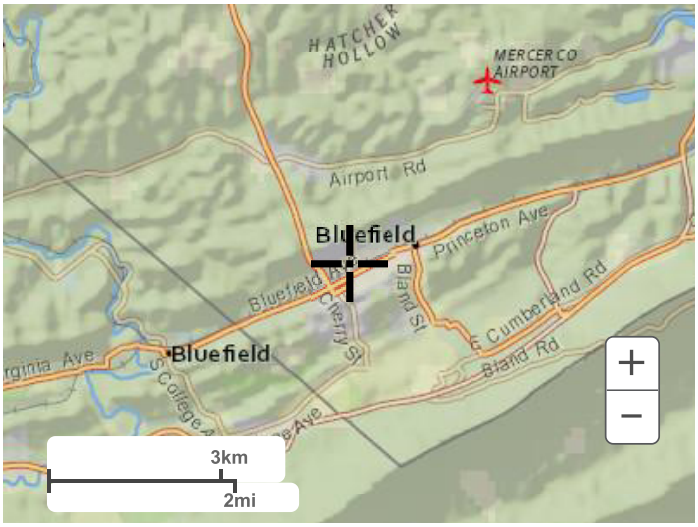
NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Mon Oct 28 13:33:16 2019

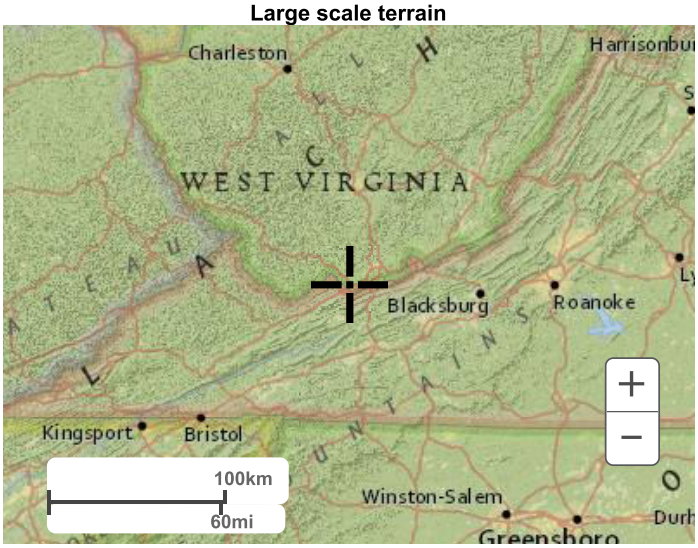
Back to Top

Maps & aerials

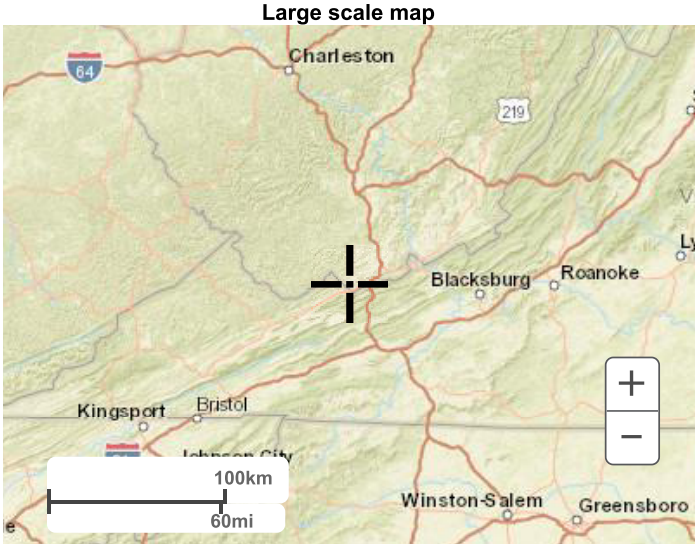
Small scale terrain



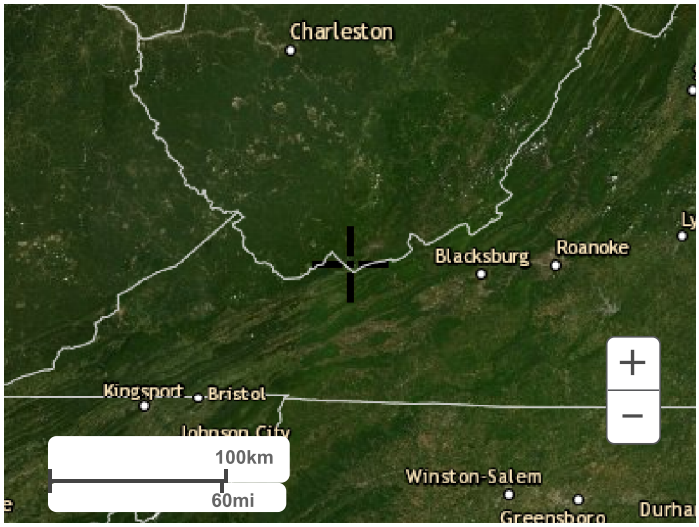
Large scale terrain



Large scale map



Large scale aerial



Back to Top

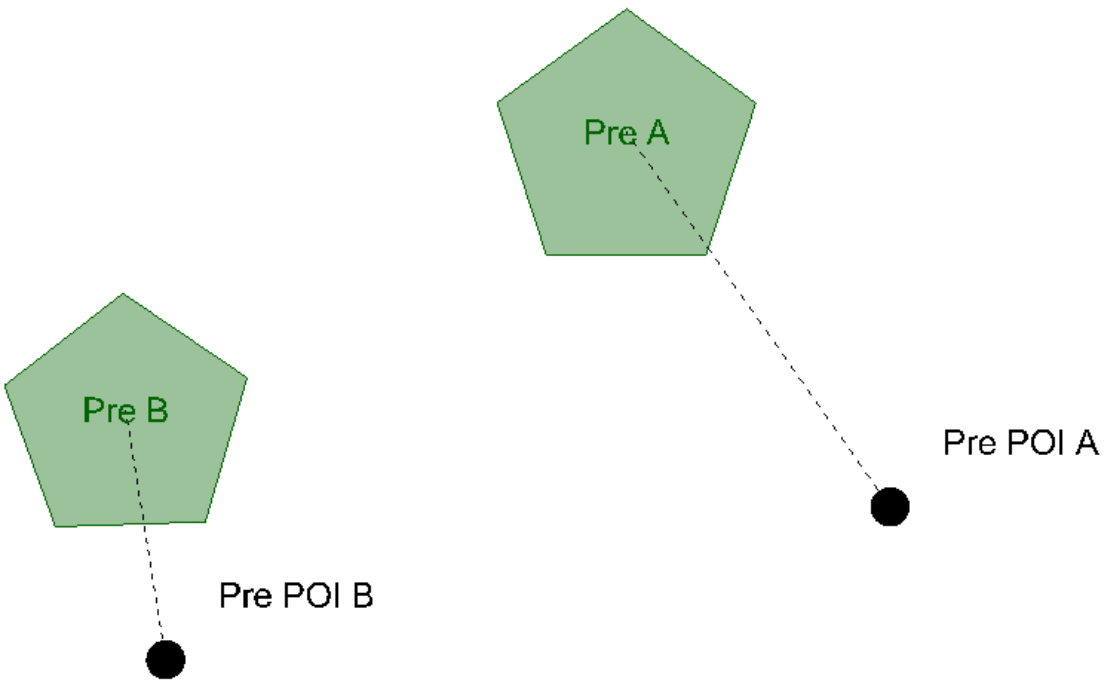
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

APPENDIX D
Pre-Developed Stormwater Management Peak Flow, and Time of Concentration Calculations

gai consultants
transforming ideas into reality®

Pre-Development Routing Diagram



Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
Pre A	Pre 002	2	0.268	11.950	4.84
Pre A	Pre 010	10	0.432	11.950	7.74
Pre A	Pre 025	25	0.537	11.950	9.54
Pre B	Pre 002	2	0.024	11.950	0.42
Pre B	Pre 010	10	0.045	11.950	0.80
Pre B	Pre 025	25	0.058	11.950	1.05

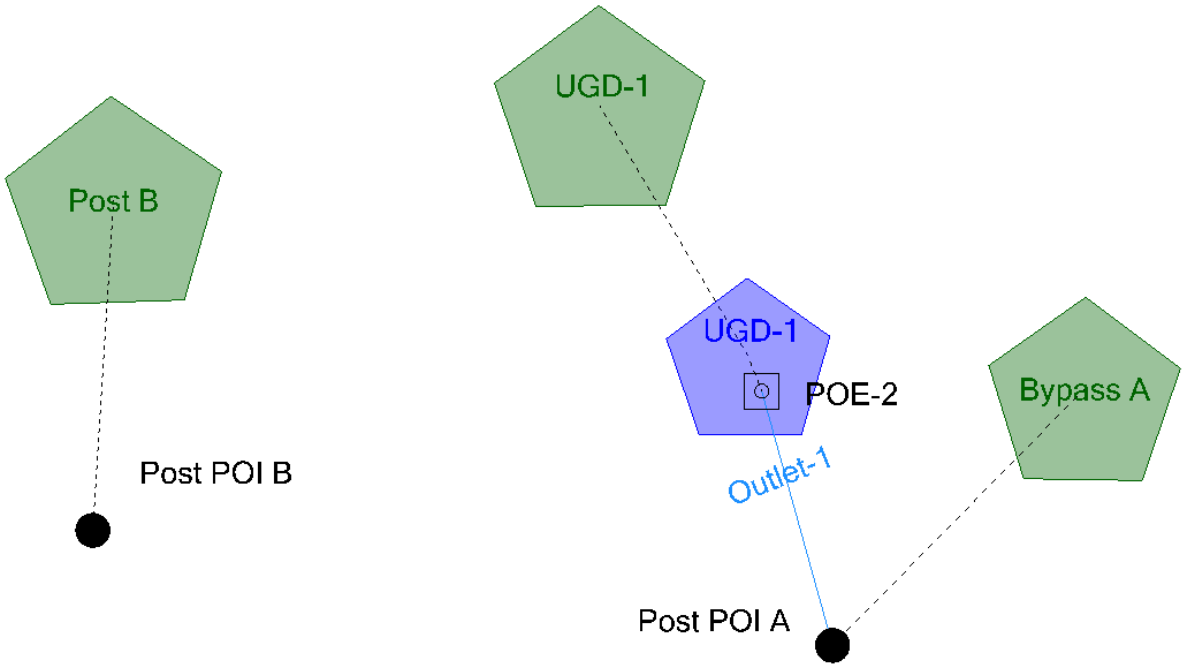
Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
Pre POI A	Pre 002	2	0.268	11.950	4.84
Pre POI A	Pre 010	10	0.432	11.950	7.74
Pre POI A	Pre 025	25	0.537	11.950	9.54
Pre POI B	Pre 002	2	0.024	11.950	0.42
Pre POI B	Pre 010	10	0.045	11.950	0.80
Pre POI B	Pre 025	25	0.058	11.950	1.05

APPENDIX E

Post-Developed Stormwater Management Peak Flow, Time of Concentration, and Detention Calculations

Post-Development Routing Diagram



Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
Post B	Post 002	2	0.022	11.950	0.38
Post B	Post 010	10	0.040	11.950	0.71
Post B	Post 025	25	0.052	11.950	0.94
UGD-1	Post 002	2	0.204	11.950	3.67
UGD-1	Post 010	10	0.321	11.950	5.70
UGD-1	Post 025	25	0.395	11.950	6.96
Bypass A	Post 002	2	0.094	11.950	1.70
Bypass A	Post 010	10	0.149	11.950	2.66
Bypass A	Post 025	25	0.184	11.950	3.26

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
Post POI A	Post 002	2	0.281	12.000	4.29
Post POI A	Post 010	10	0.453	12.000	6.14
Post POI A	Post 025	25	0.562	12.000	7.23
Post POI B	Post 002	2	0.022	11.950	0.38
Post POI B	Post 010	10	0.040	11.950	0.71
Post POI B	Post 025	25	0.052	11.950	0.94

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
UGD-1 (IN)	Post 002	2	0.204	11.950	3.67	(N/A)	(N/A)
UGD-1 (OUT)	Post 002	2	0.187	12.050	2.79	2,529.27	0.051
UGD-1 (IN)	Post 010	10	0.321	11.950	5.70	(N/A)	(N/A)
UGD-1 (OUT)	Post 010	10	0.303	12.050	3.88	2,529.96	0.073
UGD-1 (IN)	Post 025	25	0.395	11.950	6.96	(N/A)	(N/A)
UGD-1 (OUT)	Post 025	25	0.377	12.050	4.51	2,530.43	0.089

STORMWATER RETENTION / DETENTION PIPE SYSTEM SIZING WORKSHEET

THE MOST ADVANCED NAME IN DRAINAGE SYSTEMS
Version 7.8

Enter or Select values in the Yellow fields ONLY

Project Name:	Bluefield State College Student Housing
Location (City, State):	City of Bluefield, WV
Prepared For:	
Date Prepared:	
Engineer:	
Contractor:	
Regional Engineer:	
Area Sales Representative:	
Surface Application:	

UNITS		
Unit of Measure	Imperial (ft, in) / **Metric (mm, m)**	
SYSTEM		
Joint Type	Plain End ST	
Design Storage Volume		CF
Average Cover Height[4]	2.00	FT

HEADER	
Header Diameter	48
Number of Headers	2
Perforate Headers?	Yes
Include Header(s) in Storage Volume?	No

LATERALS

	Lateral Diameter (in)	Lateral Length (ft)	Number of Laterals	# of Sticks / Lateral	Approx. Length of End Stick
Group 1	48	322	1	17	8.2-ft
Group 2	48			0	0-ft
Group 3	24			0	0-ft

Perforate Laterals? Yes

BACKFILL

Stone Porosity? 40 %

*Enter "0" to not include the backfill in the storage volume

Additional Stone Layer Allowing Storage (ASV)? in.

	STORAGE VOLUME				APPROXIMATE SYSTEM SIZE		EXCAVATION						
	COMPONENT			Total System			Pipe Diameter	Width	Length	Disturbed Surface Area	Excav-ation[2]	Estimated Backfill[3]	ASV
	Product Volume (CF)	Stone (CF)	ASV (CF)	(CF)	Width (FT)	Length (FT)	(IN)	(FT)	(FT)	(SYD)	(CYD)	(CYD)	(CYD)
Group 1	3,979	2,167	0	6,146	4	333	48	7	336	279	647	500	0
Group 2	0	0	0	0	0	0	48	0	0	0	0	0	0
Group 3	0	0	0	0	0	0	24	0	0	0	0	0	0
TOTALS	**3,979**	**2,167**	**0**	**6,145.72**						279	647	500	0
				#DIV/0!									

NOTES

1 - Full Stick: Assumed a standard lay length of 19'-8".
2 - Excavation: Based on manufacturer's recommended trench width and bedding depth. Estimated volumes assume a flat system based on the user-entered Average Cover Height.
3 - Backfill: Does not account for pipe corrugations - calculated for conservative quanitites. Not for use with take-offs or ordering purposes.
4 - Cover Height: For traffic installations, 1-ft of minimum cover is required for diameters 12-36", 2-ft for 42-60". Maximum cover shall not exceed 8-ft without consulting Applications Engineering.
5 - Bill of Materials: Does not differentiate between ST and WT fittings or between A and H profile connections. Determined on a project-specific basis.
6 - Quantities: Assumes all Groups are same diameter. Run separate calculations to determine quantities and costs for different Group diameters.

Subsection: Level Pool Pond Routing Summary
Label: UGD-1 (IN)

Return Event: 2 years
Storm Event: 002

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	2,527.70 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	3.67 ft³/s	Time to Peak (Flow, In)	11.950 hours
Flow (Peak Outlet)	2.79 ft³/s	Time to Peak (Flow, Outlet)	12.050 hours

Elevation (Water Surface, Peak)	2,529.27 ft
Volume (Peak)	0.051 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.204 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.187 ac-ft
Volume (Retained)	0.017 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.1 %

Subsection: Level Pool Pond Routing Summary
Label: UGD-1 (IN)

Return Event: 10 years
Storm Event: 010

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	2,527.70 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	5.70 ft³/s	Time to Peak (Flow, In)	11.950 hours
Flow (Peak Outlet)	3.88 ft³/s	Time to Peak (Flow, Outlet)	12.050 hours

Elevation (Water Surface, Peak)	2,529.96 ft
Volume (Peak)	0.073 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.321 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.303 ac-ft
Volume (Retained)	0.017 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.1 %

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	2,527.70 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	6.96 ft³/s	Time to Peak (Flow, In)	11.950 hours
Flow (Peak Outlet)	4.51 ft³/s	Time to Peak (Flow, Outlet)	12.050 hours

Elevation (Water Surface, Peak)	2,530.43 ft
Volume (Peak)	0.089 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.395 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.377 ac-ft
Volume (Retained)	0.017 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.1 %

Requested Pond Water Surface Elevations	
Minimum (Headwater)	2,527.30 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	2,533.80 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Orifice-Circular	Orifice - 1	Forward	Culvert - 1	2,528.20	2,535.00
Rectangular Weir	Weir - 1	Forward	Culvert - 1	2,533.20	2,535.00
Culvert-Circular	Culvert - 1	Forward	TW	2,527.70	2,535.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Culvert - 1 Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	18.0 in
Length	20.00 ft
Length (Computed Barrel)	20.00 ft
Slope (Computed)	0.021 ft/ft

Outlet Control Data	
Manning's n	0.012
Ke	0.500
Kb	0.016
Kr	0.500
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	0.000
T2 ratio (HW/D)	1.187
Slope Correction Factor	-0.500

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	2,527.70 ft	T1 Flow	7.58 ft³/s
T2 Elevation	2,529.48 ft	T2 Flow	8.66 ft³/s

Structure ID: Orifice - 1 Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	2,528.20 ft
Orifice Diameter	12.0 in
Orifice Coefficient	0.600

Structure ID: Weir - 1 Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	2,533.20 ft
Weir Length	4.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

Subsection: Elevation-Volume-Flow Table (Pond)
Label: UGD-1

Return Event: 2 years
Storm Event: 002

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	2,527.70 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Elevation (ft)	Outflow (ft³/s)	Storage (ac-ft)	Area (acres)	Infiltration (ft³/s)	Flow (Total) (ft³/s)	2S/t + O (ft³/s)
2,527.70	0.00	0.000	0.000	0.00	0.00	0.00
2,528.20	0.00	0.016	0.000	0.00	0.00	7.85
2,528.70	0.76	0.032	0.000	0.00	0.76	16.47
2,529.20	2.68	0.049	0.000	0.00	2.68	26.23
2,529.70	3.52	0.065	0.000	0.00	3.52	34.92
2,530.20	4.21	0.081	0.000	0.00	4.21	43.47
2,530.70	4.84	0.097	0.000	0.00	4.84	51.95
2,531.20	5.40	0.114	0.000	0.00	5.40	60.36
2,531.70	5.92	0.130	0.000	0.00	5.92	68.74
2,532.20	6.41	0.146	0.000	0.00	6.41	77.08
2,532.70	6.87	0.146	0.000	0.00	6.87	77.54
2,533.20	7.30	0.146	0.000	0.00	7.30	77.97
2,533.70	11.37	0.146	0.000	0.00	11.37	82.03
2,534.20	17.73	0.146	0.000	0.00	17.73	88.40
2,534.70	22.55	0.146	0.000	0.00	22.55	93.22
2,535.00	23.74	0.146	0.000	0.00	23.74	94.40

Subsection: Elevation vs. Volume Curve
Label: UGD-1

Return Event: 2 years
Storm Event: 002

Elevation-Volume

Pond Elevation (ft)	Pond Volume (ac-ft)
2,527.70	0.000
2,532.20	0.146
2,535.00	0.146

Pond Routing Calculations (Total Out)

Time (hours)	Flow (Total In) (ft³/s)	2S/t - O (ft³/s)	2S/t + O (ft³/s)	Infiltration (ft³/s)	Flow (Outlet) (ft³/s)	Volume (ac-ft)
11.000	0.10	3.85	3.85	0.00	0.00	0.008
11.050	0.11	4.06	4.06	0.00	0.00	0.008
11.100	0.11	4.28	4.28	0.00	0.00	0.009
11.150	0.12	4.52	4.52	0.00	0.00	0.009
11.200	0.13	4.77	4.77	0.00	0.00	0.010
11.250	0.14	5.05	5.05	0.00	0.00	0.010
11.300	0.16	5.35	5.35	0.00	0.00	0.011
11.350	0.17	5.67	5.67	0.00	0.00	0.012
11.400	0.18	6.02	6.02	0.00	0.00	0.012
11.450	0.19	6.39	6.39	0.00	0.00	0.013
11.500	0.21	6.79	6.79	0.00	0.00	0.014
11.550	0.28	7.28	7.28	0.00	0.00	0.015
11.600	0.40	7.94	7.96	0.00	0.01	0.016
11.650	0.60	8.75	8.94	0.00	0.10	0.018
11.700	0.89	9.81	10.23	0.00	0.21	0.021
11.750	1.23	11.21	11.93	0.00	0.36	0.024
11.800	1.68	13.01	14.12	0.00	0.55	0.028
11.850	2.39	15.32	17.08	0.00	0.88	0.033
11.900	3.45	17.79	21.16	0.00	1.68	0.040
11.950	3.67	20.08	24.91	0.00	2.42	0.046
12.000	3.31	21.55	27.06	0.00	2.76	0.050
12.050	2.54	21.82	27.39	0.00	2.79	0.051
12.100	1.29	20.52	25.65	0.00	2.56	0.048
12.150	0.81	18.69	22.63	0.00	1.97	0.043
12.200	0.64	17.18	20.14	0.00	1.48	0.039
12.250	0.57	16.11	18.39	0.00	1.14	0.036
12.300	0.52	15.39	17.20	0.00	0.91	0.034
12.350	0.48	14.88	16.39	0.00	0.76	0.032
12.400	0.44	14.39	15.80	0.00	0.70	0.031
12.450	0.41	13.93	15.24	0.00	0.65	0.030
12.500	0.36	13.49	14.71	0.00	0.61	0.029
12.550	0.34	13.07	14.19	0.00	0.56	0.028
12.600	0.31	12.68	13.72	0.00	0.52	0.027
12.650	0.30	12.32	13.29	0.00	0.48	0.026
12.700	0.28	12.01	12.90	0.00	0.45	0.026
12.750	0.28	11.73	12.57	0.00	0.42	0.025
12.800	0.27	11.49	12.28	0.00	0.39	0.025
12.850	0.26	11.28	12.02	0.00	0.37	0.024
12.900	0.25	11.09	11.79	0.00	0.35	0.024
12.950	0.24	10.92	11.58	0.00	0.33	0.023
13.000	0.23	10.77	11.39	0.00	0.31	0.023
13.050	0.22	10.62	11.22	0.00	0.30	0.023
13.100	0.22	10.50	11.06	0.00	0.28	0.022
13.150	0.21	10.38	10.92	0.00	0.27	0.022

Pond Routing Calculations (Total Out)

Elevation (ft)
2,528.04
2,528.06
2,528.08
2,528.11
2,528.13
2,528.16
2,528.21
2,528.26
2,528.34
2,528.44
2,528.56
2,528.73
2,528.94
2,529.13
2,529.25
2,529.27
2,529.17
2,529.02
2,528.89
2,528.80
2,528.74
2,528.70
2,528.66
2,528.63
2,528.60
2,528.57
2,528.54
2,528.52
2,528.49
2,528.47
2,528.46
2,528.44
2,528.43
2,528.42
2,528.41
2,528.40
2,528.39
2,528.38
2,528.37
2,528.36
2,528.36
2,528.35
2,528.35
2,528.34
2,528.34

Pond Routing Calculations (Total Out)

Time (hours)	Flow (Total In) (ft³/s)	2S/t - O (ft³/s)	2S/t + O (ft³/s)	Infiltration (ft³/s)	Flow (Outlet) (ft³/s)	Volume (ac-ft)
11.000	0.20	8.93	9.16	0.00	0.12	0.019
11.050	0.21	9.07	9.33	0.00	0.13	0.019
11.100	0.22	9.20	9.49	0.00	0.15	0.019
11.150	0.23	9.34	9.66	0.00	0.16	0.020
11.200	0.25	9.47	9.82	0.00	0.17	0.020
11.250	0.27	9.62	10.00	0.00	0.19	0.020
11.300	0.29	9.76	10.18	0.00	0.21	0.021
11.350	0.31	9.92	10.36	0.00	0.22	0.021
11.400	0.33	10.08	10.56	0.00	0.24	0.021
11.450	0.35	10.24	10.76	0.00	0.26	0.022
11.500	0.37	10.41	10.96	0.00	0.28	0.022
11.550	0.50	10.68	11.28	0.00	0.30	0.023
11.600	0.72	11.17	11.89	0.00	0.36	0.024
11.650	1.04	12.03	12.93	0.00	0.45	0.026
11.700	1.53	13.41	14.61	0.00	0.60	0.029
11.750	2.07	15.27	17.01	0.00	0.87	0.033
11.800	2.79	17.17	20.13	0.00	1.48	0.039
11.850	3.87	19.41	23.82	0.00	2.20	0.045
11.900	5.46	22.90	28.74	0.00	2.92	0.053
11.950	5.70	27.19	34.06	0.00	3.43	0.063
12.000	5.07	30.43	37.96	0.00	3.77	0.071
12.050	3.85	31.60	39.35	0.00	3.88	0.073
12.100	1.95	29.96	37.40	0.00	3.72	0.070
12.150	1.22	26.44	33.13	0.00	3.34	0.062
12.200	0.96	22.81	28.62	0.00	2.91	0.053
12.250	0.85	19.90	24.62	0.00	2.36	0.046
12.300	0.77	18.02	21.53	0.00	1.75	0.041
12.350	0.72	16.79	19.51	0.00	1.36	0.038
12.400	0.66	15.98	18.17	0.00	1.10	0.035
12.450	0.61	15.41	17.24	0.00	0.91	0.034
12.500	0.54	15.00	16.56	0.00	0.78	0.033
12.550	0.50	14.59	16.04	0.00	0.72	0.032
12.600	0.46	14.19	15.55	0.00	0.68	0.031
12.650	0.44	13.81	15.09	0.00	0.64	0.030
12.700	0.42	13.46	14.67	0.00	0.60	0.029
12.750	0.41	13.15	14.29	0.00	0.57	0.028
12.800	0.39	12.88	13.96	0.00	0.54	0.028
12.850	0.38	12.63	13.65	0.00	0.51	0.027
12.900	0.37	12.40	13.38	0.00	0.49	0.027
12.950	0.36	12.19	13.12	0.00	0.47	0.026
13.000	0.34	12.00	12.89	0.00	0.45	0.026
13.050	0.33	11.82	12.67	0.00	0.43	0.025
13.100	0.32	11.65	12.47	0.00	0.41	0.025
13.150	0.31	11.50	12.28	0.00	0.39	0.025

Pond Routing Calculations (Total Out)

Elevation (ft)
2,528.33
2,528.35
2,528.36
2,528.37
2,528.38
2,528.40
2,528.43
2,528.49
2,528.59
2,528.73
2,528.89
2,529.08
2,529.34
2,529.65
2,529.88
2,529.96
2,529.84
2,529.60
2,529.34
2,529.12
2,528.96
2,528.86
2,528.79
2,528.74
2,528.70
2,528.68
2,528.65
2,528.62
2,528.60
2,528.57
2,528.55
2,528.54
2,528.52
2,528.51
2,528.49
2,528.48
2,528.47
2,528.46
2,528.45
2,528.44
2,528.43
2,528.42
2,528.42
2,528.41
2,528.40

Pond Routing Calculations (Total Out)

Time (hours)	Flow (Total In) (ft³/s)	2S/t - O (ft³/s)	2S/t + O (ft³/s)	Infiltration (ft³/s)	Flow (Outlet) (ft³/s)	Volume (ac-ft)
11.000	0.26	9.79	10.21	0.00	0.21	0.021
11.050	0.27	9.88	10.32	0.00	0.22	0.021
11.100	0.29	9.98	10.44	0.00	0.23	0.021
11.150	0.31	10.10	10.58	0.00	0.24	0.021
11.200	0.33	10.22	10.73	0.00	0.26	0.022
11.250	0.35	10.37	10.91	0.00	0.27	0.022
11.300	0.38	10.52	11.10	0.00	0.29	0.022
11.350	0.40	10.69	11.30	0.00	0.31	0.023
11.400	0.43	10.87	11.52	0.00	0.32	0.023
11.450	0.45	11.06	11.75	0.00	0.34	0.024
11.500	0.48	11.26	11.99	0.00	0.37	0.024
11.550	0.64	11.58	12.38	0.00	0.40	0.025
11.600	0.92	12.20	13.14	0.00	0.47	0.026
11.650	1.33	13.28	14.45	0.00	0.58	0.029
11.700	1.94	15.00	16.55	0.00	0.78	0.033
11.750	2.61	16.81	19.55	0.00	1.37	0.038
11.800	3.48	18.86	22.90	0.00	2.02	0.043
11.850	4.79	21.60	27.13	0.00	2.76	0.050
11.900	6.71	26.42	33.10	0.00	3.34	0.061
11.950	6.96	32.21	40.08	0.00	3.94	0.075
12.000	6.15	36.62	45.32	0.00	4.35	0.085
12.050	4.66	38.42	47.43	0.00	4.51	0.089
12.100	2.36	36.72	45.43	0.00	4.36	0.085
12.150	1.47	32.59	40.54	0.00	3.98	0.076
12.200	1.16	28.13	35.22	0.00	3.54	0.065
12.250	1.02	24.17	30.31	0.00	3.07	0.056
12.300	0.93	20.82	26.12	0.00	2.65	0.048
12.350	0.86	18.68	22.61	0.00	1.97	0.043
12.400	0.79	17.29	20.33	0.00	1.52	0.039
12.450	0.73	16.37	18.81	0.00	1.22	0.036
12.500	0.65	15.72	17.74	0.00	1.01	0.035
12.550	0.60	15.25	16.97	0.00	0.86	0.033
12.600	0.55	14.89	16.40	0.00	0.76	0.032
12.650	0.53	14.53	15.96	0.00	0.72	0.031
12.700	0.51	14.20	15.56	0.00	0.68	0.031
12.750	0.49	13.89	15.19	0.00	0.65	0.030
12.800	0.47	13.61	14.85	0.00	0.62	0.029
12.850	0.46	13.36	14.54	0.00	0.59	0.029
12.900	0.44	13.12	14.26	0.00	0.57	0.028
12.950	0.43	12.90	13.99	0.00	0.54	0.028
13.000	0.41	12.70	13.74	0.00	0.52	0.027
13.050	0.40	12.50	13.50	0.00	0.50	0.027
13.100	0.38	12.32	13.28	0.00	0.48	0.026
13.150	0.37	12.15	13.07	0.00	0.46	0.026

Pond Routing Calculations (Total Out)

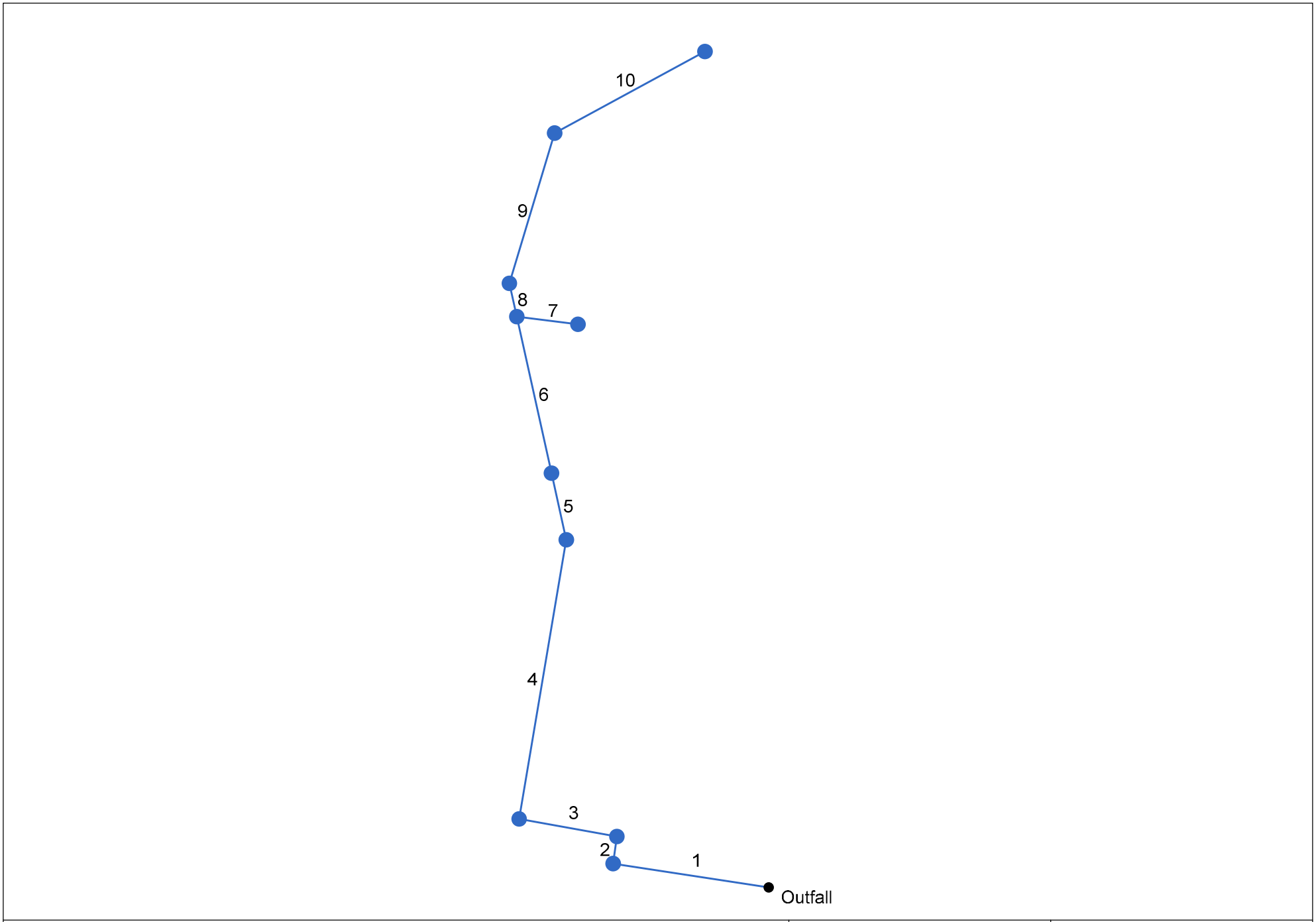
Elevation (ft)
2,528.39
2,528.40
2,528.41
2,528.43
2,528.44
2,528.46
2,528.51
2,528.58
2,528.70
2,528.86
2,529.03
2,529.25
2,529.60
2,530.00
2,530.31
2,530.43
2,530.32
2,530.03
2,529.72
2,529.43
2,529.19
2,529.01
2,528.90
2,528.82
2,528.77
2,528.73
2,528.70
2,528.67
2,528.65
2,528.63
2,528.61
2,528.59
2,528.57
2,528.56
2,528.54
2,528.53
2,528.52
2,528.50
2,528.49
2,528.48
2,528.47
2,528.46
2,528.46
2,528.45
2,528.44

APPENDIX F
Post-Developed Stormwater Management Conveyance Design Calculations

gai consultants
transforming ideas into reality®

C Factor	0.30	0.95		
Drainage Area	Grass	Imperv	Sub-Total	Avg. C Factor
Roof Leader 1		0.07	0.07	0.95
Roof Leader 2		0.07	0.07	0.95
Roof Leader 3		0.07	0.07	0.95
Roof Leader 4		0.07	0.07	0.95
Roof Leader 5		0.07	0.07	0.95
Roof Leader 6		0.07	0.07	0.95
Roof Leader 7		0.07	0.07	0.95
Roof Leader 8		0.07	0.07	0.95
SI 103		0.01	0.01	0.95
SI 104	0.01		0.01	0.30
SI 105	0.01	0.16	0.17	0.91
SI 106	0.01		0.01	0.30
SI 107	0.06	0.03	0.09	0.52
SI 108				
SI 109	0.01	0.05	0.06	0.84
SI 110	0.28	0.05	0.33	0.40
SI 113	0.03	0.02	0.05	0.56
SI 114	0.10	0.15	0.25	0.69
SI 117	0.07	0.11	0.18	0.70
EX CB	0.05	0.02	0.07	0.49
Swale 1	0.14		0.14	0.30

Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: Bluefield_State_Storm_Sewers.stm	Number of lines: 10	Date: 11/25/2019

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	46.000	0.01	0.75	0.95	0.01	0.43	6.0	7.4	5.6	2.41	18.41	7.17	15	8.13	2528.20	2531.94	2528.51	2532.56	2537.00	2537.82	UGD-1 TO SI-103
2	1	8.000	0.01	0.74	0.30	0.00	0.42	6.0	7.3	5.6	2.36	6.46	4.40	15	1.00	2532.14	2532.22	2532.66	2532.83	2537.82	2537.92	SI-103 TO SI-104
3	2	29.000	0.17	0.73	0.91	0.15	0.42	6.0	7.2	5.6	2.36	6.46	4.39	15	1.00	2532.42	2532.71	2532.94	2533.32	2537.92	2536.28	SI-104 TO SI-105
4	3	83.000	0.01	0.56	0.30	0.00	0.27	6.0	6.9	5.7	1.51	6.46	3.85	15	1.00	2532.91	2533.74	2533.32	2534.23	2536.28	2539.35	SI-105 TO SI-106
5	4	20.000	0.09	0.55	0.52	0.05	0.26	6.0	6.8	5.7	1.50	6.46	3.85	15	1.00	2533.94	2534.14	2534.35	2534.63	2539.35	2537.75	SI-106 TO SI-107
6	5	47.000	0.00	0.46	0.00	0.00	0.22	6.0	6.6	5.7	1.25	22.37	4.57	15	12.00	2534.34	2539.98	2534.63	2540.42	2537.75	2546.74	SI-107 TO SI-108
7	6	18.000	0.06	0.06	0.84	0.05	0.05	6.0	6.0	5.9	0.30	22.37	1.99	15	12.00	2540.18	2542.34	2540.42	2542.55	2546.74	2544.78	SI-108 TO SI-109
8	6	10.000	0.33	0.40	0.40	0.13	0.17	6.0	6.6	5.8	0.96	22.37	4.40	15	12.00	2540.18	2541.38	2540.42	2541.76	2546.74	2546.74	SI-108 TO SI-110
9	8	46.000	0.00	0.07	0.00	0.00	0.03	6.0	6.2	5.8	0.20	22.37	2.26	15	12.00	2541.62	2547.14	2541.76	2547.31	2546.74	2556.48	SI-110 TO MH-11
10	9	50.000	0.07	0.07	0.49	0.03	0.03	6.0	6.0	5.9	0.20	19.76	3.58	15	9.36	2547.34	2552.02	2547.43	2552.19	2556.48	2559.66	MH-111 TO MH-1

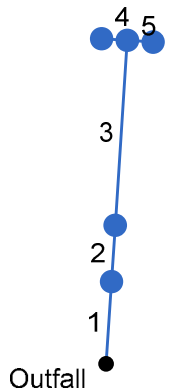
Project File: Bluefield_State_Storm_Sewers.stm

Number of lines: 10

Run Date: 11/25/2019

NOTES:Intensity = 45.87 / (Inlet time + 10.50) ^ 0.73; Return period =Yrs. 25 ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: Bluefield_State_Storm_Sewers_2.stm	Number of lines: 5	Date: 11/25/2019

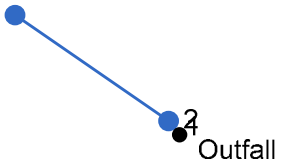
Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	16.000	0.00	0.46	0.00	0.00	0.39	6.0	6.2	5.9	2.30	22.37	7.81	15	12.00	2528.20	2530.12	2528.47	2530.73	2537.33	2541.71	SI-114 TO MH-11
2	1	11.000	0.00	0.46	0.00	0.00	0.39	6.0	6.1	5.9	2.30	22.37	5.29	15	12.00	2530.32	2531.64	2530.73	2532.25	2541.71	2545.81	MH-115 TO MH-1
3	2	36.000	0.18	0.46	0.70	0.13	0.39	6.0	6.0	5.9	2.31	22.37	5.30	15	12.00	2531.84	2536.16	2532.25	2536.77	2545.81	2545.47	MH-116 TO SI-11
4	3	5.000	0.14	0.14	0.95	0.13	0.13	6.0	6.0	5.9	0.78	1.94	4.43	6	12.00	2536.36	2536.96	2536.77	2537.40	2545.47	2546.00	SI-116 TO RL-7/8
5	3	5.000	0.14	0.14	0.95	0.13	0.13	6.0	6.0	5.9	0.78	1.94	4.43	6	12.00	2536.36	2536.96	2536.77	2537.40	2545.47	2546.00	SI-116 TO RL-5/6

Project File: Bluefield_State_Storm_Sewers_2.stm | Number of lines: 5 | Run Date: 11/25/2019

NOTES:Intensity = 45.87 / (Inlet time + 10.50) ^ 0.73; Return period =Yrs. 25 ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: Bluefield_State_Storm_Sewers_3.stm	Number of lines: 2	Date: 11/19/2019

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	4.000	0.00	0.00	0.00	0.00	0.00	6.0	6.1	0.0	4.51	10.51	5.16	18	1.00	2527.20	2527.24	2527.89	2528.05	2533.97	2533.78	MH-101 TO MH-1
2	1	42.000	0.00	0.00	0.00	0.00	0.00	6.0	6.0	0.0	4.51	10.50	4.75	18	1.00	2527.28	2527.70	2528.05	2528.51	2533.78	2535.00	MH-102 TO OCS

Project File: Bluefield_State_Storm_Sewers_3.stm

Number of lines: 2

Run Date: 11/19/2019

NOTES:Intensity = 45.87 / (Inlet time + 10.50) ^ 0.73; Return period =Yrs. 25 ; c = cir e = ellip b = box

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Nov 19 2019

Swale 1

Triangular

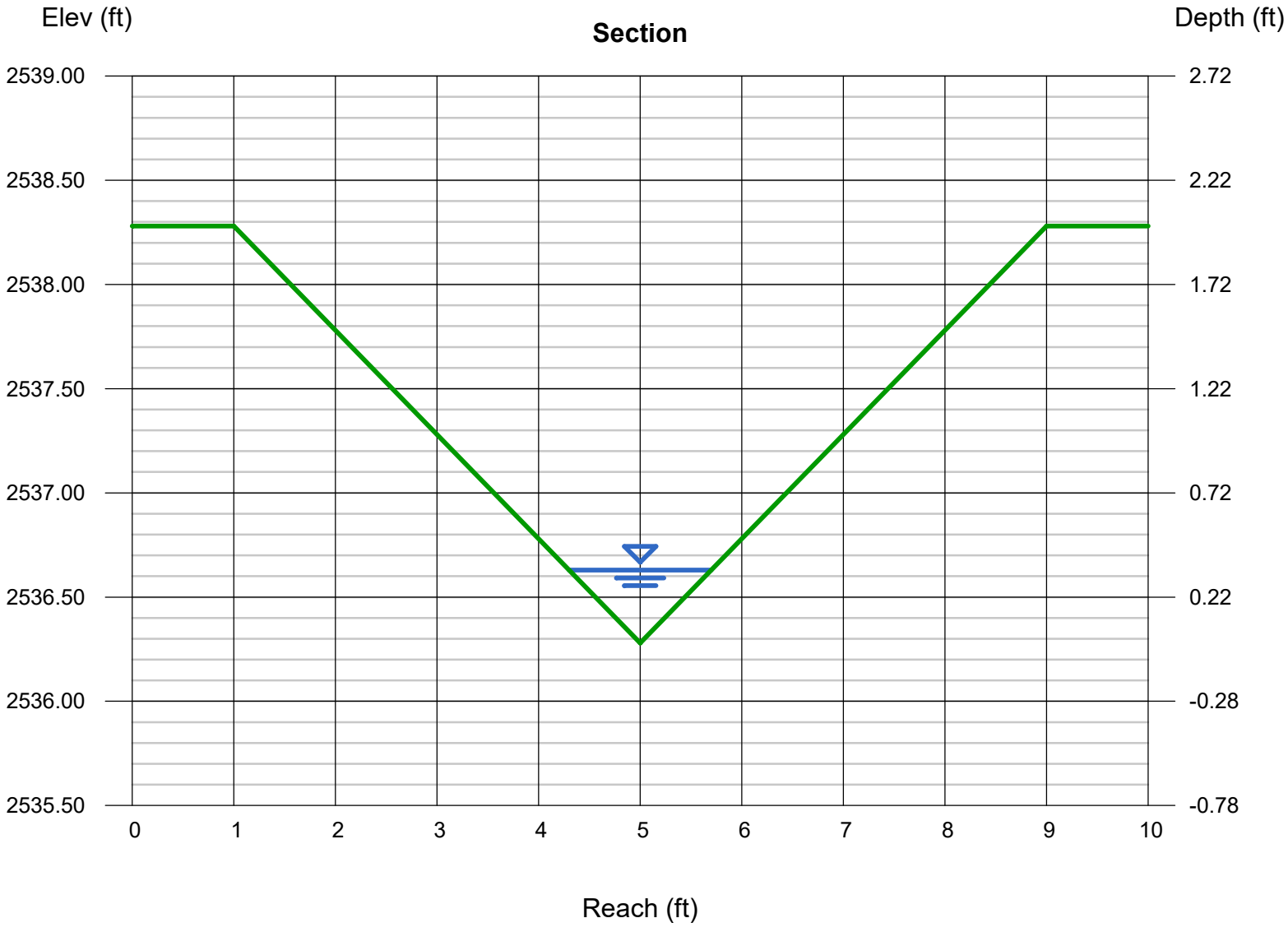
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 2536.28
Slope (%)	= 14.50
N-Value	= 0.150

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.26

Highlighted

Depth (ft)	= 0.35
Q (cfs)	= 0.260
Area (sqft)	= 0.24
Velocity (ft/s)	= 1.06
Wetted Perim (ft)	= 1.57
Crit Depth, Yc (ft)	= 0.26
Top Width (ft)	= 1.40
EGL (ft)	= 0.37



North American Green
5401 St. Wendel-Cynthiana Rd.
Poseyville, Indiana 47633
Tel. 800.772.2040
>Fax 812.867.0247
www.nagreen.com
ECMDS v7.0

CHANNEL ANALYSIS

> > >Swale 1

Name	Swale 1
Discharge	0.26
Peak Flow Period	0.08
Channel Slope	0.145
Channel Bottom Width	0
Left Side Slope	2
Right Side Slope	2
Low Flow Liner	
Retardence Class	D 2-6 in
Vegetation Type	Mix (Sod and Bunch)
Vegetation Density	Good 75-95%
Soil Type	Silt Loam (SM)

P300

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissable Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
P300 Unvegetated	Straight	0.26 cfs	3.63 ft/s	0.19 ft	0.03	2.3 lbs/ft2	1.71 lbs/ft2	1.35	STABLE	E
Underlying Substrate	Straight	0.26 cfs	3.63 ft/s	0.19 ft	0.03	1.68 lbs/ft2	0.76 lbs/ft2	2.2	STABLE	E
P300 Reinforced Vegetation	Straight	0.26 cfs	3.3 ft/s	0.2 ft	0.034	10 lbs/ft2	1.8 lbs/ft2	5.56	STABLE	E
Underlying Substrate	Straight	0.26 cfs	3.3 ft/s	0.2 ft	0.034	2.3 lbs/ft2	0.8 lbs/ft2	2.86	STABLE	E

North American Green
5401 St. Wendel-Cynthiana Rd.
Poseyville, Indiana 47633
Tel. 800.772.2040
>Fax 812.867.0247
www.nagreen.com
ECMDS v7.0

ANALYSIS COMPUTATIONS

> > > >View Computation

Inputs	
Channel Discharge (Q):	0.26 cfs
Peak Flow Period (H):	0.08 hours
Channel Slope (S_0):	0.145 ft/ft
Bottom Width (B):	0 ft
Left Side Slope (Z_L):	2 (H : V)
Right Side Slope (Z_R):	2 (H : V)
Existing Channel Bend:	No
Bend Coefficient (K_b):	1
Channel Bend Radius:	
Retardance Class of Vegetation:	D 2-6 in
Vegetation Type:	Mix (Sod and Bunch)
Vegetation Density:	Good 75-95%
Soil Type:	Silt Loam (SM)
Channel Lining Options	
P300 Protection Type	Permanent

Basic Relationships
A = Cross sectional area, ft^2 (m^2) = (B * D) + (Z_L / 2 * D^2) + (Z_R / 2 * D^2)
Where:
B = Base width of channel, ft (m)
D = Flow depth, ft (m)
Z_L = Left side bank slope (H : 1 V)
Z_R = Right side bank slope (H : 1 V)
P = Wetted perimeter, ft (m) = B + Z_L * D + Z_R * D
R = Hydraulic radius, ft (m) = A / P
V = Flow velocity, ft/s (m/s) = Q / A
Where:
Q = Channel discharge, cfs (cms)
Tau_a Average bed shear stress, psf (Pa) = 62.4 * R * S_0
Where:
S_0 = Gradient of channel, ft/ft (m/m)
Tau_0 = Maximum bed shear stress, psf (Pa) = 62.4 * D * S_0

Unvegetated Conditions Computations:
n = Manning's n = a * Tau_a^b
and (iteratively solved)
n = 1.486 / Q * A * $R^{(2/3)}S_0^{0.5}$
Where:
n = Manning's n
a = Product specific coefficient from performance testing
b = Product specific coefficient from performance testing
SF_P = Product factor of safety = Tau_T / Tau_0

Where:
Tau_T = Permissible shear stress from testing, psf (Pa)
Tau_p = In place permissible shear, psf (Pa) = Tau_T / alpha * (Tau_S + alpha / 4.3)
Where:
alpha = unit conversion constant, 0.14 English, 6.5 Metric
Tau_S = Permissible shear stress of soil
SFL = Factor of safety of installed liner = Tau_p / Tau_a

Vegetated Computations:
n = Manning's n = alpha * C_n* $Tau_{a-0.4}$
and (iteratively solved)
$n = 1.486 / Q * A * R_{(2/3)}S_0^{0.5}$
Where:
alpha = Unit conversion constant, 0.213 English, 1.0 Metric
C_n = Vegetation retardance coefficient
SF_P = Product factor of safety = Tau_{TV} / Tau_0
Where:
Tau_{TV} = Permissible shear stress from testing, psf (Pa)
Tau_p = In place permissible shear, psf (Pa) = Tau_S / (1 – C_{FTRM}) * (n / n_S)2
Where:
C_{FTRM} = Coefficient of TRM performance derived from testing Tau_S = Permissible shear stress of soil
n_S = Manning's of soil bed if left unprotected
SF_L = Factor of safety of installed liner = Tau_p / Tau_a

P300

Phase	Mannings N	Predicted flow depth (D)	Cross sectional area (A)	Wetted perimeter (P)	Hydraulic radius (R)	Flow velocity (V)	Froude number (FR)	Calculated Shear Stress	SFP/SFL
P300 Unvegetated	0.03	0.19 ft	0.07 ft2	0.85 ft	0.08 ft	3.63 ft/s	2.26	1.71 lbs/ft2	1.35 (SFP)
Underlying Substrate	0.03	0.19 ft	0.07 ft2	0.85 ft	0.08 ft	3.63 ft/s	2.26	0.76 lbs/ft2	2.2 (SFL)
P300 Reinforced Vegetation	0.034	0.2 ft	0.08 ft2	0.89 ft	0.09 ft	3.3 ft/s	1.94	1.8 lbs/ft2	5.56 (SFP)
Underlying Substrate	0.034	0.2 ft	0.08 ft2	0.89 ft	0.09 ft	3.3 ft/s	1.94	0.8 lbs/ft2	2.86 (SFL)

APPENDIX G
Water Quality Calculations

gai consultants
transforming ideas into reality®

Inflow Runoff Volume for 1-Inch Storm Event

Project Name: **Bluefield State College Student Housing**
Drainage Area: **Bioretention Area 1**
Rainfall: **1.00** in.

Bioretention Area 1 Inflow Volume:

Cover Type/Condition	Soil Type	Area (Ac)	CN	S	Ia (0.2 x S)	Q Runoff[1] (in)	Runoff Volume[2] (cu ft)
Open Space (Lawns), Good Condition	C	0.44	74	3.514	0.703	0.023	37.0
Impervious	C	0.92	98	0.204	0.041	0.791	2,641.3
Gravel	C	0.06	89	1.236	0.247	0.285	62.1
	Total	**1.42**					**2,740.4**

BMP Volume Management Calculations

UGD-1 Volume

Note that credit for volume taken from amended soil beneath UGD-1 and storage above 25-year storm elevation (2530.43), but below weir elevation (2533.20).

6 inch amended soil below facility (20% voids) yields additional = (2257 SF) * (0.5 FT) * (0.2) = **226 CF**

Excess storage within pipe not used for rate control (between elevations 2530.43 and 2532.20) yields additional = (5.37 SF) * (322) = **1729 CF**

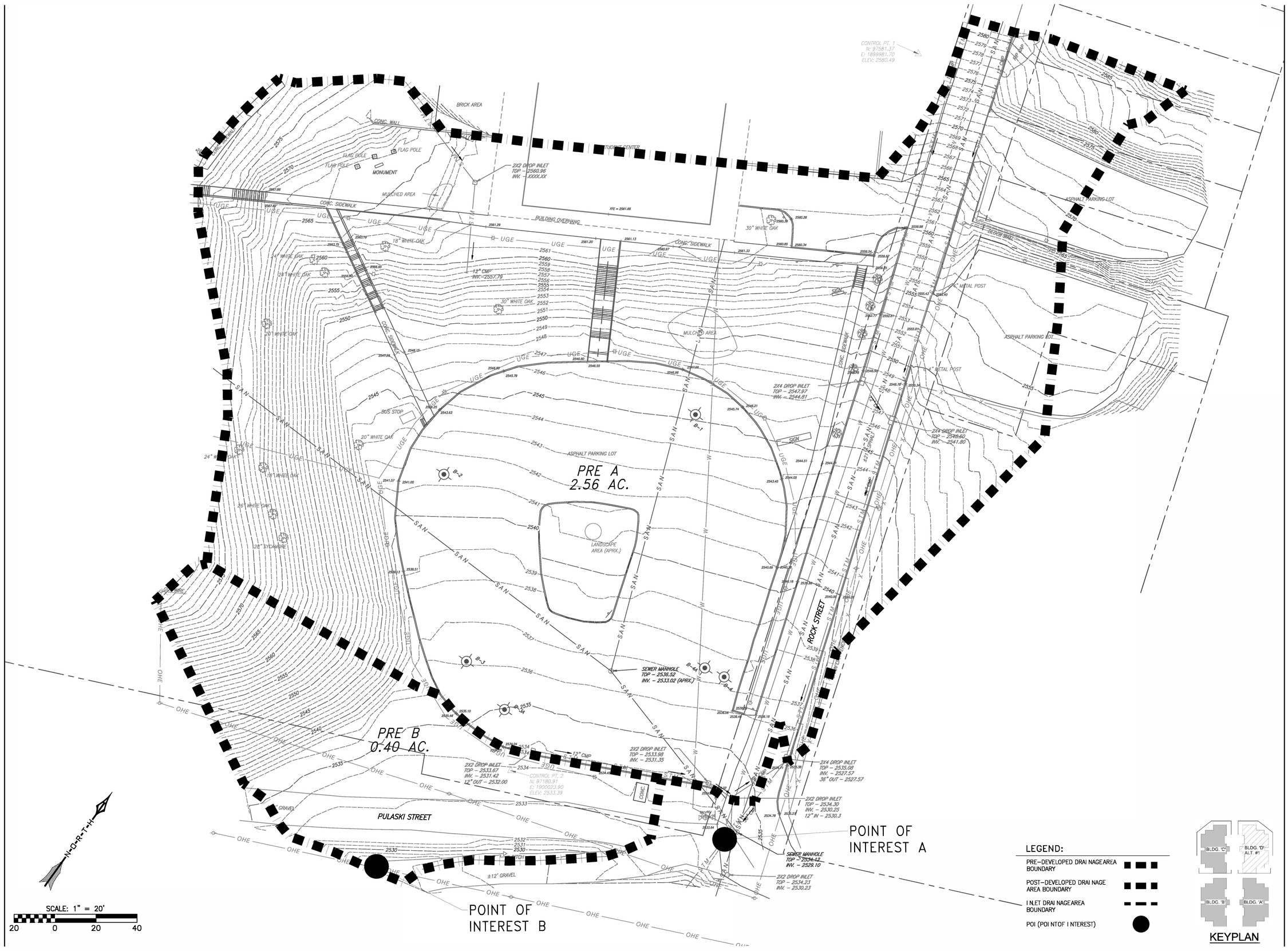
Stone adjacent to top 1.77 ft of pipe (40% voids) = (805 CF) * (0.4) = **322 CF**

1 ft of stone above top of pipe and below weir elevation (40% voids) = (2257 SF) * (1 FT) * (0.4) = **903 CF**

Total volume control = 226 CF + 1729 CF + 322 CF + 903 CF = 3180 CF

3180 CF Provided > 2740 CF Volume Needed to control 1" storm on-site

ENCLOSURES



HERITAGE VILLAGE FOR COLLEGIATE HOUSING OF BLUEFIELD

Bluefield State College

BLUEFIELD, WV

gai consultants
300 Summers Street, Suite 11
Charleston

CMTA
2429 Members Way, Lexington, Kentucky 40504
859.253.0892 1.859.231.8357 www.cmtaengrs.com

SHEET REVISIONS

#	DATE	DESCRIPTION
2	12/12/19	Addendum 2

100% CONSTRUCTION DOCUMENTS ISSUED FOR BIDDING

PRE-DEVELOPED DRAINAGE AREA MAP

E1.0

ETA PROJECT #:

DATE: 11/29/19

HERITAGE VILLAGE FOR COLLEGIATE HOUSING OF BLUEFIELD

Bluefield State COLLEGE

BLUEFIELD, WV

gai consultants
300 Summers Street, Suite 1100

CMTA
2429 Members Way, Lexington, Kentucky 40504
859.253.0892 f 859.231.8307 www.cmtaengrs.com

SHEET REVISIONS

#	DATE	DESCRIPTION
2	12/12/19	Addendum 2

100% CONSTRUCTION DOCUMENTS ISSUED FOR BIDDING

UGD-1
1.77 AC.

BYPASS A
0.84 AC.

POST B
0.35 AC.

PROPOSED 48" PERFORATED "R" UNDERGROUND DETENTION SYSTEM (UGD-1); 322 LF TOTAL INCLUDING HEADERS

CONTROL PT. 1
N: 97581.37
E: 1899981.70
ELEV: 2580.49

POINT OF INTEREST A

POINT OF INTEREST B

ROCK STREET

PULASKI STREET

BUILDING A

BUILDING C

BUILDING D

MONUMENT

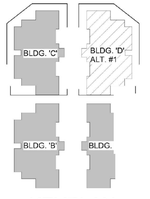
MULCHED AREA

BUILDING OVERHANG

FFE = 2561.66

LEGEND:

- PRE-DEVELOPED DRAINAGE AREA BOUNDARY
- POST-DEVELOPED DRAINAGE AREA BOUNDARY
- INLET DRAINAGE AREA BOUNDARY
- POI (POINT OF INTEREST)



KEYPLAN

N O R T H

SCALE: 1" = 20'

20 0 20 40

POST-DEVELOPED DRAINAGE AREA MAP

C2.0

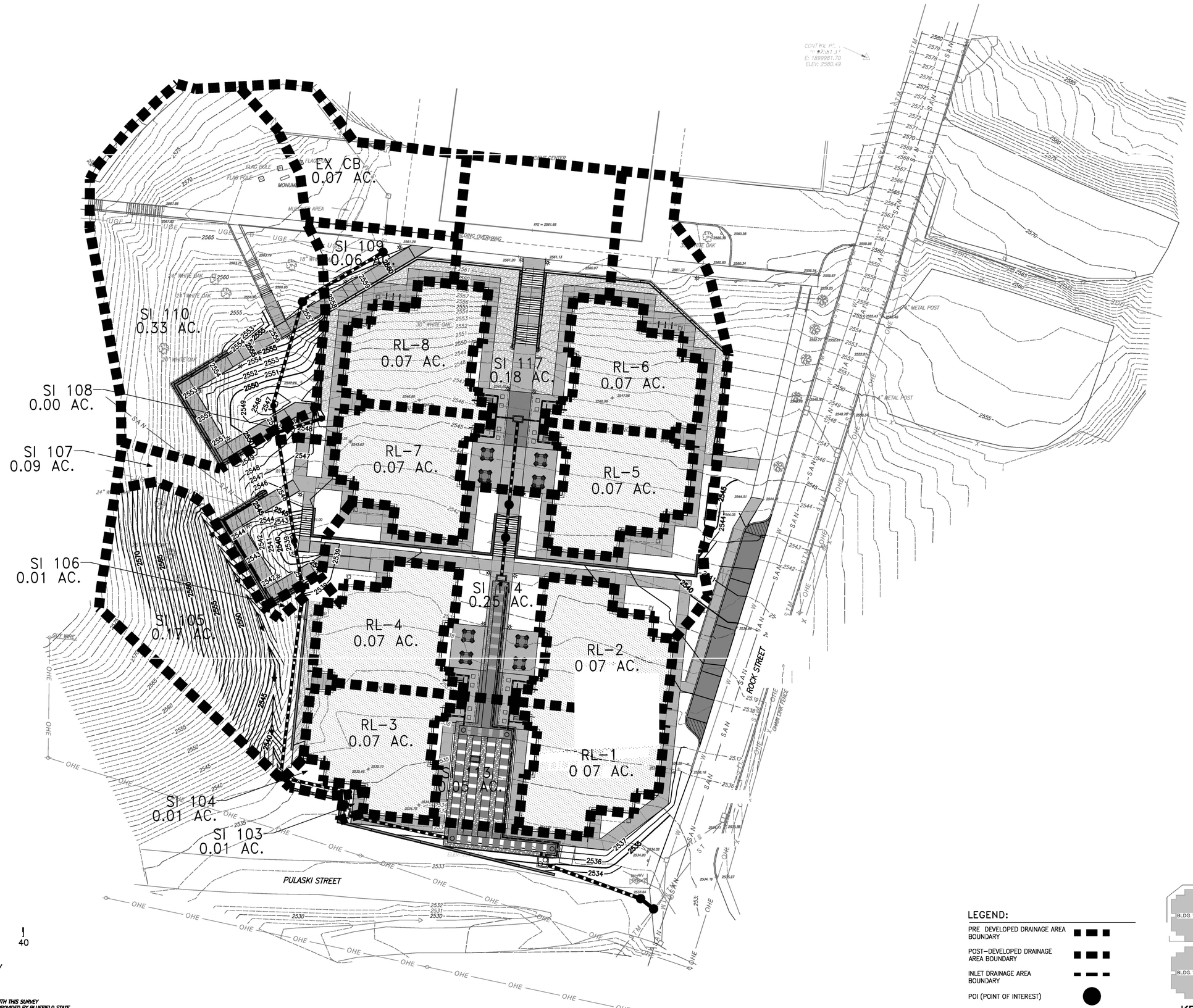
ETA PROJECT #:

DATE: 11/29/19

HERITAGE VILLAGE FOR COLLEGIATE HOUSING OF BLUEFIELD

Bluefield State COLLEGE

BLUEFIELD, WV



N O R T H

SCALE: 1" = 20'

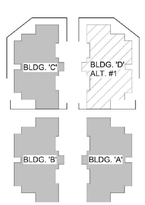
20 0 20 40

SURVEY BY EAGLE SURVEYING, CHARLESTON, WV
SEPTEMBER --, 2019
NAD83 WVSPC SOUTH ZONE
GRID NORTH

NOTES:
1. NO BOUNDARY SURVEY WAS CONDUCTED WITH THIS SURVEY
2. UTILITY INFORMATION TAKEN FROM PLANS PROVIDED BY BLUEFIELD STATE COLLEGE MAINTENANCE DEPARTMENT

LEGEND:

- PRE DEVELOPED DRAINAGE AREA BOUNDARY
- POST-DEVELOPED DRAINAGE AREA BOUNDARY
- INLET DRAINAGE AREA BOUNDARY
- POI (POINT OF INTEREST)



KEYPLAN

CMTA
2429 Members Way, Lexington, Kentucky 40504
859.253.0850 f 859.231.8357 www.cmtaengrs.com

SHEET REVISIONS

100% CONSTRUCTION DOCUMENTS ISSUED FOR BIDDING

INLET DRAINAGE AREA MAP

C3.0

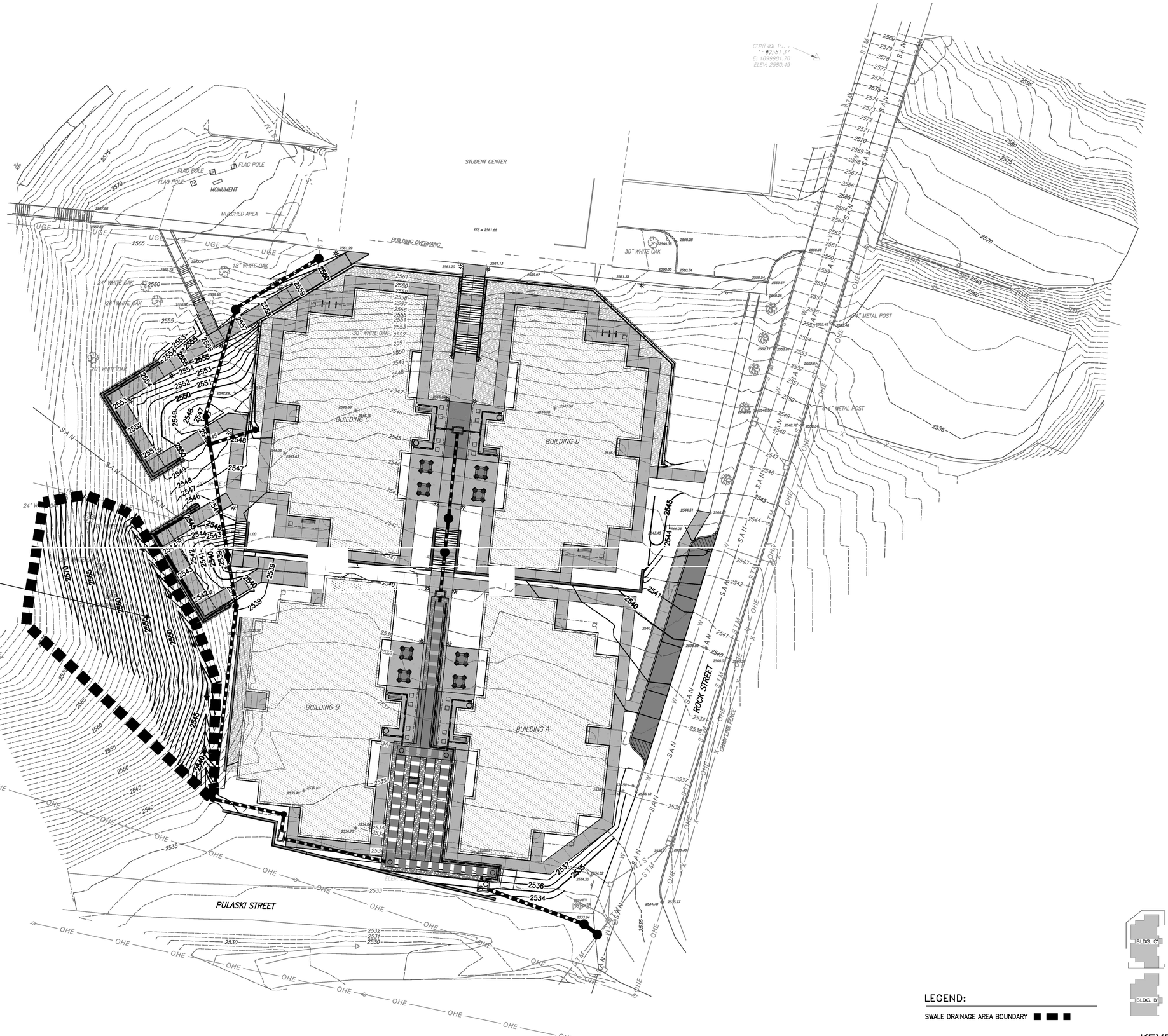
ETA PROJECT #:

DATE: 11/29/19

HERITAGE VILLAGE FOR COLLEGIATE HOUSING OF BLUEFIELD

Bluefield State COLLEGE

BLUEFIELD, WV

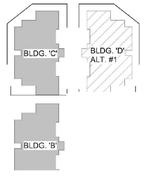


SURVEY BY EAGLE SURVEYING, CHARLESTON, WV
SEPTEMBER --, 2019
NAD83 WVSPC SOUTH ZONE
GRID NORTH

NOTES:
1. NO BOUNDARY SURVEY WAS CONDUCTED WITH THIS SURVEY
2. UTILITY INFORMATION TAKEN FROM PLANS PROVIDED BY BLUEFIELD STATE COLLEGE MAINTENANCE DEPARTMENT

LEGEND:

SWALE DRAINAGE AREA BOUNDARY



KEYPLAN

gai consultants
300 Summers Street, Suite 1100
Charleston
WV

CMTA
2429 Members Way, Lexington, Kentucky 40504
t 859.253.0892 f 859.231.8307 www.cmtaengrs.com

SHEET REVISIONS

100% CONSTRUCTION DOCUMENTS ISSUED FOR BIDDING

SWALE DRAINAGE AREA MAP

C4.0

ETA PROJECT #:

DATE: 11/29/19

Appendix D

COB Inspection and Maintenance Agreement

INSPECTION AND MAINTENANCE AGREEMENT
FOR PRIVATE STORMWATER MANAGEMENT FACILITIES

This agreement, made this ___ day of _____ , 20__ by and between _____ hereinafter referred to as the "OWNER(S)" of the following property (hereafter, "the subject property"): _____ and further described on Exhibit A attached hereto and incorporated herein by reference and the City of Bluefield, hereinafter referred to as "COB".

WITNESSETH:

We, the OWNER(S), with full authority to execute deeds, mortgages and other covenants, and with intent to make a covenant that runs with the land, do hereby covenant and pledge as follows:

1. The OWNERS(S) of said property shall provide for the maintenance of the stormwater management facility serving the subject property and more particularly described on Exhibit B attached hereto and incorporated herein by reference to ensure that the facility is and remains in good working condition in accordance with approved design standards, rules, regulations and applicable laws.

2. The stormwater management facility shall be inspected annually by the OWNER(S) to the standards announced by COB, and COB shall be timely provided with an inspection report upon the completion of said inspection.

3. The OWNER(S) of said property shall promptly repair and restore all grade surfaces, walls, drains, structures, vegetation, erosion, and sediment control measures and other protective devices to ensure protection of the receiving stream(s) in the watershed. Such repairs or restorations shall be in accordance with approved plans, rules and regulations and applicable laws and shall be reported to COB in the annual inspection report described above.

4. The OWNER(S) hereby grant COB or its agent the right of entry at reasonable times and in a reasonable manner for the purpose of inspecting, operating, installing, constructing, reconstructing, maintaining or repairing the facility.

5. COB shall provide to OWNER(S) written reports of any inspection performed upon or regarding the stormwater management facility serving the subject property.

6. Should the OWNER(S) fail to maintain the facility or otherwise correct any defects within a reasonable period of time following written notice by COB, COB or its designated agent may, with prior notice, enter upon the property and perform the necessary maintenance or repairs to restore the facility to good working condition in accordance with approved design standards, rules, regulations and applicable laws. COB shall assess the OWNER(S) served by the facility, and the OWNER(S) shall pay, the full cost of this work, and any applicable penalties, legal fees and court costs.

7. The OWNER(S) hereby indemnify and save COB harmless from any and all costs and/or claims for damages to persons or property arising from the construction, maintenance, use and repair of the facility, including, but not limited to, repairs performed by COB and/or its agent/contractor pursuant to paragraph 6, above except that OWNER(S) shall not indemnify and save COB harmless from the negligence or wrongful willful acts of COB or its employees, contractors, subcontractors, agents or representatives.

8. This AGREEMENT and the Covenants contained herein shall apply to and bind the OWNER(S) heirs, executors, successors and assigns and shall bind all present and subsequent owners of the subject property with respect to all obligations hereunder during all periods of time that the OWNER(S) or their respective heirs, executors, successors and assigns actually own said property.

9. The OWNER(S) shall record this AGREEMENT in the land records of Mercer County, West Virginia, and the OWNER(S) shall provide to COB proof of such recording.

10. It is further understood and agreed between the parties hereto that the duties and responsibilities of the OWNER(S) as set forth herein with respect to real estate constitute an affirmative burden on the real estate having the force and effect of a covenant running with the land.

CITY OF BLUEFIELD

By: _____

Dane Rideout, City Manager

OWNER:

By: _____

Name: _____

Title: _____

STATE OF WEST VIRGINIA,

COUNTY OF MERCER, to-wit:

The foregoing instrument was acknowledged before me this ____ day of _____, 20__, by _____.

My commission expires: _____.

_____

Notary Public in and for the

State of West Virginia

STATE OF WEST VIRGINIA,

COUNTY OF MERCER, to-wit:

The foregoing instrument was acknowledged before me this ____ day of _____, 20____, by Dane Rideout, City Manager of the City of Bluefield, acting for and on behalf of the City of Bluefield, a municipal corporation.

My commission expires: _____.

_____

Notary Public in and for the

State of West Virginia

This instrument prepared by: City of Bluefield

200 Rogers Street

Bluefield, WV 24701

Appendix E

Stormwater Site Inspection Form

CITY OF BLUEFIELD EROSION & SEDIMENT CONTROL INSPECTION REPORT			
Inspector Name:	Date:	Time:	Weather:

FACILITY INFORMATION	
Name:	Address:
Primary Contact:	Phone #:

INSPECTION

Yes	No	N/A	Inspection Issue:
☐	☐	☐	Silt Fence Properly Installed and Maintained?
☐	☐	☐	Construction Entrance or Exit Properly Installed and Maintained?
☐	☐	☐	Storm Water Inlets Protected or Managed Where Admissable?
☐	☐	☐	Run-Off Detention Functioning Properly?
☐	☐	☐	Hydroseed or Hay Areas Left Undisturbed More Than 21 Days?
☐	☐	☐	Existing Vegetation Being Preserved?
☐	☐	☐	On-Site Soil/Gravel/Mulch Stockpiles Being Monitored?
☐	☐	☐	Velocity Reduction In-Place Where Admissable
☐	☐	☐	On-Site Trash Maintenance?
☐	☐	☐	Spill Prevention/Control In-Place?
☐	☐	☐	Any Potential Pollutants Stored in Adequate Locations?
☐	☐	☐	Equipment Maintained and Free of Leaks?
☐	☐	☐	Waste Bins Free of Leaks/Leachate?
☐	☐	☐	On-Site Storm Water Inlets Free of Any Potential Infiltration?
☐	☐	☐	Brush Barriers Properly Installed and Maintained?

Comments:

REPORT CHECKED BY

Signature: _____

Date: _____