CMA Engineers, Inc.

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DES Waste Management Division
29 Hazen Drive; PO Box 95
Concord, NH 03302-0095

Type I-A Permit Modification Application
Phase III Expansion and Revised Closure Plan
Mt. Carberry Secure Landfill
Bean Brook Road
Success, NH

NHDES Site #: 198706016
Project Type: LAND/LN
Project Number: 0000297

Prepared For:
Androscoggin Valley Regional Refuse Disposal District
Berlin, NH 03570
Phone Number (603) 752-3342
RP Contact Name: Sharon Gauthier
RP Contact Email: sgauthier@avrrdd.org

Prepared By:
CMA Engineers, Inc.
35 Bow Street
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Phone Number: (603) 431-6196
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Date of Report: April 1, 2020

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April 1, 2020

Ms. Jaime Colby, P.E.
Solid Waste Management Bureau
New Hampshire Department of Environmental Services
29 Hazen Drive, P.O. Box 95
Concord, New Hampshire 03302-0095

RE: **AVRRDD – Mt. Carberry Secure Landfill, Bean Brook Rd, Success, NH**
NHDES Permit No. DES-SW-88-029
Type IA Permit Modification Application to Solid Waste Management Facility
Phase IIIA Landfill Expansion
CMA #777

Dear Ms. Colby:

On behalf of the Androscoggin Valley Regional Refuse Solid Waste District, CMA Engineers, Inc. is submitting to the New Hampshire Department of Environmental Services (NHDES) the enclosed Type I-A Permit Modification Application for the proposed Phase IIIA landfill expansion to the Mt. Carberry Landfill. The Phase IIIA expansion is a horizontal expansion within a portion of the original permitted Phase III footprint. Please find enclosed a $35,000 check for the application fee. In addition to one mailed copy, an electronic copy has been uploaded to the NHDES One-Stop system.

A Notice of Filing and complete copy of this permit application has been provided to Coos County, New Hampshire Fish & Game, and the New Hampshire Natural Heritage Inventory. Notice of Filing letters have been provided to abutting landfill property owners. Letters have been mailed by certified mail. Due to current state and federal guidelines related to coronavirus, the letters were not sent for delivered signatures but will be tracked via the USPS tracking system.

If you have any questions, please do not hesitate to contact us, or Sharon Gauthier at AVRRDD.

Very truly yours,

CMA ENGINEERS, INC.

Paul Schmidt, P.E.
Senior Project Manager

PDS/ams

Enclosures

cc: Sharon Gauthier, AVRRDD Executive Director

Application for NHDES
Type I-A Permit Modification

for

Androscoggin Valley Regional Refuse Disposal District
Mt. Carberry Secure Landfill
Phase IIIA Expansion and Revised Closure Plan
Berlin, NH

April 2020

Prepared for:

Androscoggin Valley Regional Refuse Disposal District
3 Twelfth Street
Berlin, NH 03570

for Submittal to:

NHDES Waste Management Division
29 Hazen Drive
Concord, NH 03302

Prepared by:

CMA Engineers, Inc.
Civil and Environmental Engineers
35 Bow Street
Portsmouth, NH 03801

Androscoggin Valley Regional Refuse Disposal District

Application for NHDES Type I-A Permit Modification

Mt. Carberry Secure Landfill

Phase IIIA Expansion and Revised Closure Plan

April 2020

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Stormwater Report

Androscoggin Valley Regional Refuse Disposal District

Mt. Carberry Secure Landfill Phase IIIA Expansion

Success, New Hampshire

Stormwater Drainage Report
For Type I-A Permit Application

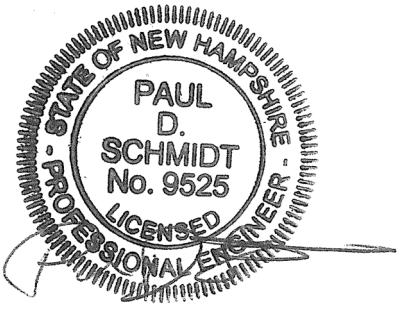
April 2020

Prepared for:

Androscoggin Valley Regional Refuse Disposal District
3 Twelfth Street
Berlin, NH 03570

for Submittal to:

NHDES Waste Management Division
Permitting & Design Review Section
29 Hazen Drive
Concord, NH 03302-0095



Prepared by:

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Androscoggin Valley Regional Refuse Disposal District

Mt. Carberry Secure Landfill Phase IIIA Expansion
Success, New Hampshire

Stormwater Drainage Report
For Type I-A Permit Application
April 2020

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PROJECT BACKGROUND

This stormwater drainage report has been prepared in support of the Androscoggin Valley Regional Refuse Disposal District (termed "the District" or AVRRDD herein) Mt. Carberry Secure Landfill (MCSL or landfill herein) Phase IIIA NHDES Type I-A permit modification application and to demonstrate that the proposed Phase IIIA expansion meets the stormwater management requirements set forth in Env-Sw 805.09. The Phase IIIA expansion involves the construction of a new landfill footprint adjacent to the existing footprint. Stormwater from the Phase IIIA expansion will be managed both by the best management practices (BMPs) and stormwater management devices that are currently constructed and in place and additional BMPs to be constructed as part of the proposed expansion.

The MCSL is located in Success, NH off of Route 16 and east of the City of Berlin. The District owns and operates (through its contractor) the landfill, which is a Subtitle D non-hazardous municipal solid waste, double lined secure landfill. The landfill originally received paper/pulp sludge from the paper mill beginning in 1989 when operations began and currently accepts municipal solid waste (MSW) and construction and demolition debris (C&D) waste.

As shown on the USGS Map in Appendix A, the site is situated north of Bean Brook Road and Cascade Alpine Brook and is accessible via Mt. Carberry Road off Hutchins Street in Berlin. The facility is not permitted to accept hazardous waste or other prohibited wastes. A maintenance garage and office, leachate storage pond, salt storage shed, landfill gas processing facility, scale house, and sand and gravel pits are also located at the landfill facility.

The MCSL is sited on a 1,263-acre parcel with adequate buffer on all sides. Other properties to the north, east and south are undeveloped. An aerial photo depicting the site is provided in Appendix A. The landfill has two existing phases that occupy the current 67-acre footprint, where Phase I comprises the western half and Phase II the eastern half. The landfill has been developed in stages over time, and filling is currently over both Phases I and II.

The Site had been selectively logged in the past and most of the trees appear to be 50 to 60 years old or younger. Cascade Alpine Brook runs across portions of the property to the southeast of the landfill site and eventually flows to the Androscoggin River to the west of the property. A portion of the stormwater from the developed area discharges to a drainage area northwest of the property that enters unnamed brooks that flow toward the City of Berlin and eventually to the Androscoggin River to the west.

The Mt. Carberry Landfill operates under permits issued from NHDES Waste Management Division (WMD) including its Solid Waste Facility Permit (DES-SW-91-011), a Groundwater Release Detection Permit (GWP-198706016-S-005), and a NHDES Air Resources Division Title V Operating Permit (TV-0057). The facility also operates and manages stormwater run-off in accordance with its NPDES-Multi Sector General Permit for industrial activities. Sequenced development of the site over time was subject to multiple Alteration of Terrain (previously called Site Specific) Permits with the two most recent being WPS-7428B for Phase III wetlands removal and compensation project and WPS-7453 for Stage 9 construction.

Areas of the landfill which have reached final grades or will not receive waste for an extended period of time are covered with temporary HDPE geomembrane as landfill cover to limit landfill gas emissions and to minimize water infiltration into the landfill. Areas within the landfill that are not covered by temporary geomembrane cover are graded to manage any stormwater as leachate within the landfill.

To meet the requirements of Env-Sw 805.09, results of the stormwater drainage calculations are provided for the 25-year, Type II, 24-hour storm event. Per the Rules, the calculations provided model the pre-development, post-development, and interim-development landfill conditions. In addition, stormwater drainage calculation results for the 2-year, 10-year, and 50-year storm events were also analyzed and provided for the pre, post, and interim conditions per RSA 485-A:17 and Env-Wq 1504.09. Based on previous discussions, full calculations for the 25-year storm event are provided for each analysis condition. The method used for runoff analysis is SCS TR-55: Urban Hydrology for Small Watersheds. The method used for stormwater routing is SCS TR-20. Hydrologic modeling was performed using Autodesk's Storm and Sanitary Analysis® 2018 modeling software. As prescribed by the Env-Wq 1504.09 (a)(1)b., a maximum sheet flow length of 100 feet was assumed for all drainage areas.

Rainfall amounts for each storm were obtained from the Northeast Regional Climate Center, utilizing the Extreme Precipitation Estimates for the 2, 10, 25, and 50-year, 24-hour storm events. The results of the analyses are summarized in the following sections while all drainage analysis output reports can be found in Appendix F. A copy of the Extreme Precipitation Tables used to generate the rainfall data has also been provided in Appendix F.

Pre-development topography used in the analysis was from digital elevation models prepared by NH Geographically Referenced Analysis and Information Transfer System (GRANIT), which is based on USGS mapping and is approximate.

Onsite wetlands were delineated by Stantec Consulting Services. NRCS Soil Survey data was used for soil classification and hydrologic soil group classifications outside the area to be developed. A

site-specific soil survey was completed within the area to be developed for Phase IIIA by North Country Soil Services. The soil data indicates that the soils on the property and adjacent areas that drain onto the property include Pillsbury-Peacham-Peru association (and other minor soil group components), gently sloping, very stony and Monadnock-Herman association (and other minor soil group components) hilly, very stony. These soils are included in hydrologic soil groups (HSG) B, C, and D, and most of the site is comprised of HSG C soil. The NRCS soil classification mapping is shown on the hydrologic soil maps included in Appendix D. The site specific soil survey reports are also included in Appendix D.

PROJECT DESCRIPTION

The Phase IIIA horizontal expansion will be adjacent to Phases I and II to the east. The expansion will provide capacity for an estimated additional 16.3 years, or through April 2041. The Phase IIIA closure grades will include filling over, and adjacent to, Phases I and II.

These stormwater calculations model presented herein evaluate three scenarios, as follows:

1. Site conditions prior to the existence of the landfill (pre-development);
2. Closed and capped landfill surface that is vegetated and includes intermediate bench swales and dropchutes to manage stormwater (post conditions); and
3. A worst-case interim operation condition where a significant area of the landfill area is covered with an exposed geomembrane for temporary intermediate cover (intermediate condition).

EXISTING CONDITIONS

The Mt. Carberry Landfill is situated on approximately 1,263 acres of land owned by "the District" in Success, NH. The landfill is currently active and utilized regionally by the District communities, other communities and several commercial haulers to dispose of MSW and construction and demolition (C&D) waste, paper mill sludge from the Gorham Paper and Tissue plant in Gorham, NH, and other permitted wastes. The current landfill is a double-lined, secure landfill with an active leachate conveyance system which sends leachate to the Berlin Water Pollution Control Facility (BPCF) via gravity sewer and inverted siphon pressure pipes. See Appendix A for Aerial Photograph.

The Androscoggin River is not a NHDES Rivers Management Protection Program Designated River and according to FEMA flood plain mapping, the flood plain of the Androscoggin River is over 1 mile from the landfill, and the landfill site is at a significantly higher elevation. FEMA flood mapping is not available in the immediate landfill area. A copy of the FEMA Flood Insurance Rate Map for the site is provided in Appendix H, which depicts available mapping at its closet point to the landfill, along Bean Brook Road approximately ½ mile to the west.

PRE-DEVELOPMENT CONDITIONS

The Pre-Development Drainage Plan depicts the pre-development drainage areas, hydrologic soil groups, and time of concentration paths prior to the existence of the landfill. The stormwater model output from the Autodesk Storm and Sanitary model and the corresponding Pre-Development Drainage Diagram are provided in Appendix F.1 of this report. The drainage diagram depicts the subbasins, nodes, ponds, and other stormwater features that are included in the output.

The woods curve number condition in the predevelopment phase is modeled as "fair" to reflect the regular logging operations occurring at the time. The following is a summary of the pre-development drainage areas.

Northeast Drainage Area: 63.00 acres

The Northeast Drainage Area consists of undeveloped wooded (logged) property that discharges to the northwest portion of the site and eventually to an unnamed tributary to the Androscoggin River. The time of concentration is modeled assuming the runoff sheet flows from a local high point, transitioning to shallow concentrated flow before flowing offsite. The soil in this area consists of primarily Hydrologic Soil Group (HSG) C soil and also consists of HSG B, and HSG D soils.

Northwest Drainage Area: 249.98 acres

The Northwest Drainage Area consists of undeveloped, wooded (logged) property that discharges to the northwest portion of the site and eventually to an unnamed tributary to the Androscoggin River. The time of concentration is modeled assuming the runoff sheet flows from a local high point, transitioning to shallow concentrated flow before flowing offsite. This area consists of predominately HSG C soils and also consists of HSG B, and HSG D soils.

Southeast Drainage Area: 115.72 acres

The Southeast Drainage Area consists of undeveloped wooded (logged) property that discharges to the southern portion of the site and eventually to Cascade Alpine Brook. The time of concentration is modeled assuming the runoff sheet flows from a local high point, transitioning to shallow concentrated flow before flowing offsite. This area consists of HSG C, HSG B, and HSG D wetland soil.

East Drainage Area: 49.63 acres

The East Drainage Area consists of undeveloped wooded (logged) property which discharges to the southern portion of the site and eventually to Cascade Alpine Brook. The time of concentration is modeled assuming the runoff sheet flows from a local high point, transitioning to shallow concentrated flow before draining ultimately to the Cascade Alpine Brook. This area consists of predominately HSG C soils and lesser amounts of HSG B soil.

West Drainage Area: 88.34 acres

The West Drainage Area consists of undeveloped wooded (logged) property which discharges to the southern portion of the site and eventually to Cascade Alpine Brook. The time of concentration is modeled assuming the runoff sheet flows from a local high point, transitioning to shallow concentrated flow before flowing offsite. This area consists of predominately HSG C soils with lesser amounts of HSG B soil.

Southwest Drainage Area: 22.18 acres

The Southwest Drainage Area consists of undeveloped wooded (logged) property which discharges to the southwest portion of the site and eventually to Cascade Alpine Brook. The time of concentration is modeled assuming the runoff sheet flows from a local high point, transitioning to shallow concentrated flow before flowing offsite. This area consists of predominately HSG C and B soils with lesser amounts of HSG D soil.

INTERMEDIATE DEVELOPMENT CONDITIONS

The intermediate development condition for the stormwater analysis models an operational phase of the landfill between current landfill grades and the full buildout of Phase IIIA. During this condition, the HDPE interim cap will be installed over portions of the landfill area to the limits of the anchor trench. Also included in this condition is the paved landfill access road between Hutchins Road and the landfill as well as the paved and gravel perimeter road around the landfill. The intermediate condition also includes temporary gravel roads used to access the eastern portions of the landfill. The future Phase IIIB expansion area to the east of the landfill is comprised of open sand and woodland areas and is underlain by primarily HSG C soil. The woods curve number condition has been updated from the predevelopment conditions from “fair” to “good” due to the absence of regular logging operations which were present in the predevelopment conditions.

The drainage areas in the interim development conditions are largely the same as the pre-development condition outside of the landfill footprint. Impervious area at the site increases in the intermediate development condition because of HDPE interim cap covers within the landfill and the landfill access and perimeter roads. The landfill perimeter road turns from pavement to gravel in the area to the east and southeast as well as to the southwest and southern portions of the site. Temporary and permanent gravel roads used to access the working face of the landfill also increase the total impervious area amounts. One stormwater detention pond is proposed to manage flow from the undeveloped area north of the landfill. Two gravel wetland stormwater treatment ponds are proposed to manage runoff from the developed areas including stormwater runoff from all of Phase IIIA. Refer to the attached Interim Development Drainage Diagram for further details. See below for additional information regarding the proposed stormwater improvements.

Primary drainage areas identified in the intermediate development conditions covered 585 acres of land, which is four acres less than what is assumed for the pre and post-development models. These four acres of land represent the estimated area within the landfill that includes the active disposal areas that are not covered with temporary intermediate geomembrane cover. Rain that falls within this four-acre active area will be managed through the landfill's leachate management system and therefore not included in the stormwater drainage model. The following is a summary of the interim development drainage areas.

Drainage Area SW1: 5.70 ac

Drainage Area SW1 abuts the northwest side of the landfill and is bounded by the gravel landfill perimeter road and paved access roads to the landfill. Between the roads is a wooded area that comprises the majority of the subbasin and is comprised of HSG C soils. Stormwater flow drains to the south of the subbasin to a low-lying area (Pond SW1) before discharging under the paved landfill access road through a 24-inch culvert and continuing south through subbasin SW4 and ultimately to the Cascade Alpine Brook, south of the landfill.

Drainage Area SW2: 1.16 ac

Drainage Area SW2 is located centrally on the west side of the landfill, near the toe of slope. This subbasin consists of developed landfill, impervious roadway, and a meadow area. This area assumes that the landfill surface is completely covered with the HDPE interim cap. Stormwater flow from this subbasin drains to the perimeter toe swale and a widened swale section (Pond SW2) before discharging under the paved perimeter road through a 24-inch culvert. This flow continues south through subbasin SW4, under Bean Brook Road and ultimately to the Cascade Alpine Brook to the south of the landfill.

Drainage Area SW3: 58.50 ac

Drainage Area SW3 is located to the south of the landfill and in a similar location as the Southwest subbasin of the pre-development model. Soil types in this subbasin are predominantly HSG C, with lesser amounts of HSG D soils. Stormwater flows across this subbasin is to the southwest to a low-lying area, modeled as Pond-SW3 that outlets under Bean Brook Road through a 30-inch diameter culvert. This stormwater ultimately drains to the Cascade Alpine Brook to the south of the landfill.

Drainage Area SW4: 17.30 ac

Drainage Area SW4 abuts the landfill to the southwest between the paved landfill perimeter road to the east, and Bean Brook Road to the south. This area also includes the 1-acre leachate storage pond which is not considered in the calculations because the pond outlets to the leachate sewer. Existing soil types in the subbasin are predominantly HSG C. Stormwater flow from this subbasin drains to the south to Bean Brook Road before

discharging through a 30" culvert under the road towards the Cascade Alpine Brook to the south of the landfill. Stormwater storage adjacent to Bean Brook Road is modeled as Pond-SW-4.

Drainage Area SW5: 6.36 ac

Drainage Area SW5 is on the northwestern side of the landfill and is comprised of the HDPE interim cap and grassed areas. This area also includes parts of the paved perimeter road. Existing soil types are not considered in the stormwater calculations for this subbasin since it consists of developed landfill and roadways. Stormwater flow in this subbasin drains off the landfill surface to the perimeter toe swale, flowing south to a widened swale section (Pond-SW5) prior to discharging under the perimeter road via 36-inch culvert. This flow then drains through subbasins SW1 and SW4 before ultimately draining to the Cascade Alpine Brook to the south of the landfill.

Drainage Area SW6: 11.30 ac

Drainage Area SW6 is located centrally and along the western face of the landfill and is comprised of the HDPE interim cap and grassed areas. This area also includes parts of the paved and gravel perimeter roads and landfill access road. Existing soil types are not considered in the stormwater calculations for this subbasin since it consists of developed landfill and roadways. Stormwater flow in this subbasin drains off the landfill surface to the perimeter toe swale either by sheet follow or an intermediate bench swale, then flowing south to a widened swale section (Pond-SW6) prior to discharging under the perimeter road via 30-inch culvert. This flow then drains through subbasins SW1 and SW4 before ultimately draining to the Cascade Alpine Brook to the south of the landfill.

Drainage Area S1: 2.83 ac

Drainage Area S1 is located in the southwestern area of the landfill and is comprised of the HDPE interim cap and grassed areas. This area also includes parts of the paved perimeter road. Existing soil types are not considered in the stormwater calculations for this subbasin since it consists of developed landfill and roadways. Stormwater flow in this subbasin drains off the landfill surface to the perimeter toe swale to widened swale section (Pond-S1) prior to discharging under the perimeter road via 30-inch culvert, ultimately draining to the Cascade Alpine Brook to the south of the landfill.

Drainage Area S2: 9.03 ac

Drainage Area S2 is located in the southern area of the landfill and is comprised of the HDPE interim cap and grassed areas. This area also includes parts of the paved perimeter road and the landfill access road. Existing soil types are not considered in the stormwater calculations for this subbasin since it consists of developed landfill and roadways. Stormwater flow in this subbasin drains off the landfill surface to the perimeter toe swale

to widened swale section (Pond-S2) prior to discharging under the perimeter road via 30-inch culvert, ultimately draining to the Cascade Alpine Brook to the south of the landfill.

Drainage Area S3: 7.51 ac

Drainage Area S3 is located at the southwestern corner of the landfill and is comprised of the HDPE interim cap and grassed areas. This area also includes parts of the paved perimeter road. Existing soil types are not considered in the stormwater calculations for this subbasin since it consists of developed landfill and roadways. Stormwater flow in this subbasin drains off the landfill surface to the perimeter toe swale to widened swale section (Pond-S3) prior to discharging under the perimeter road via 30-inch culvert, ultimately draining to the Cascade Alpine Brook to the south of the landfill.

Drainage Area NW2: 6.62 ac

Drainage Area NW2 is a primarily wooded area that abuts the landfill to the north and consists of HSG C and HSG D soils. This area receives drainage from the perimeter gravel access road and adjacent wooded and grassed areas. A swale along the southern portion of this area drains to a large detention pond (Pond NW2) that is located to the northwest of the landfill. The pond ultimately discharges north, towards the Androscoggin River.

Drainage Area NW3: 8.26

Drainage Area NW3 is located at the northwest corner of the landfill and consists of areas of HDPE interim cap, grassed landfill areas, and paved and gravel roads. Existing soil types are not considered in the stormwater calculations for this subbasin since it consists of developed landfill and roadways. This drainage area generates significantly increased runoff from the HDPE interim cap. Stormwater from this subbasin flows off the HDPE interim cap until it hits a gravel access road where it continues downslope to the toe swale. The toe swale widens in the culvert crossing area and the stormwater capacity of the widened area is modeled as Pond NW3. Stormwater is conveyed across the perimeter road to Pond NW2, which ultimately discharges to the Androscoggin River.

Drainage Area NW4: 10.99 ac

Drainage Area NW4 is the central area located along the northern face of the landfill. This subbasin consists of areas of HDPE interim cap, grassed landfill areas, and paved and gravel roads. Existing soil types are not considered in the stormwater calculations for this subbasin since it consists of developed landfill and roadways. This drainage area generates significantly increased runoff from the HDPE interim cap. Stormwater from this subbasin flows off the HDPE interim cap until it hits a gravel access road where it continues downslope to the toe swale. The toe swale widens in the culvert crossing area and the stormwater capacity of the widened area is modeled as Pond NW4. Stormwater is

conveyed across the perimeter road to Pond NW2, which ultimately discharges to the Androscoggin River.

Drainage Area NW6: 248.50 ac

Drainage Area NW6 is largely unchanged from the predevelopment condition where it was modeled as the "Northwest" drainage area. This subbasin is altered from its pre-development condition by the development of the landfill which altered the southeast corner. This area has also been altered by the paved landfill access road, paved perimeter roads, gravel parking areas, and the roadway and housing development on Enman Hill Road. Outside of the developed areas of this subbasin, soil types in native, wooded areas are predominantly HSG C soils with some HSG B soils. Stormwater flow from this subbasin drains to the north towards the Androscoggin River.

Drainage Area NW7: 3.02 ac

Drainage Area NW7 is a primarily grassed area that abuts the landfill to the north and consists of HSG C and HSG D soils. This area receives drainage from the adjacent wooded and grassed areas, and the area includes Pond NW5, a proposed detention pond with a grass bottom. Stormwater flows to this detention pond, and the stormwater then flows through a swale to Pond NW2. This stormwater ultimately discharges north, towards the Androscoggin River.

Drainage Area SE1: 20.91 ac

Drainage Area SE1 is located to the northeast of the landfill and represents a portion of the Southeast subbasin of the pre-development model. Soil types in this subbasin are predominantly HSG C, with lesser amounts of HSG D soils. Stormwater flows across this subbasin southwest to a swale before flowing to Pond NW5. This stormwater ultimately discharges north, towards the Androscoggin River.

Drainage Area SE2: 19.47 ac

Drainage Area SE2 is located to the northeast of the landfill and represents a portion of the Southeast subbasin of the pre-development model. This subbasin includes areas of impervious cover from an access road. Soil types in this subbasin are predominantly HSG C, with lesser amounts of HSG D soils. Stormwater flows across this subbasin south to a swale. Stormwater is routed through swales around the stormwater treatment ponds SE1 and SE2, ultimately draining to the Cascade Alpine Brook to the south of the landfill.

Drainage Area SE3: 26.27 ac

Drainage Area SE3 is located to the east of the landfill and represents a portion of the Southeast subbasin of the pre-development model. This subbasin includes areas of impervious cover from an access road. Soil types in this subbasin are predominantly HSG

C, with lesser amounts of HSG B and D soils. Stormwater flows across this subbasin south to a swale. Stormwater is routed through swales around the stormwater treatment ponds SE1 and SE2, ultimately draining to the Cascade Alpine Brook to the south of the landfill.

Drainage Area SE4: 4.93 ac

Drainage Area SE4 is located to the east of the landfill and represents a portion of the Southeast subbasin of the pre-development model. This subbasin includes areas of impervious cover from an access road. Soil types in this subbasin are predominantly HSG B, with lesser amounts of HSG C soils. Stormwater flows across this subbasin south to a swale. Stormwater is routed through swales around the stormwater treatment ponds SE1 and SE2, ultimately draining to the Cascade Alpine Brook to the south of the landfill.

Drainage Area SE5: 7.32 ac

Drainage Area SE5 is in the northeast corner of the landfill and is comprised of grassed areas and areas of HDPE interim cap. This area also includes the gravel landfill perimeter road. Existing soil types are not considered in the stormwater calculations for this subbasin since it consists of developed landfill and roadways. A perimeter roadway swale is proposed such that it collects stormwater from the eastern subbasins. From there, stormwater flow is to the southeast, within the roadway swale, to a proposed stormwater treatment pond (SE2). Stormwater discharge from this pond is ultimately drained to the Cascade Alpine Brook to the south of the landfill.

Drainage Area SE6: 2.36 ac

Drainage Area SE6 is in the northeast corner of the landfill and is comprised of grassed areas and areas of HDPE interim cap. This area also includes the gravel landfill perimeter road. Existing soil types are not considered in the stormwater calculations for this subbasin since it consists of developed landfill and roadways. A perimeter roadway swale is proposed such that it collects stormwater from the eastern subbasins. From there, stormwater flow is to the southeast, within the roadway swale, to a proposed stormwater treatment pond (SE2). Stormwater discharge from this pond is ultimately drained to the Cascade Alpine Brook to the south of the landfill.

Drainage Area SE7: 7.69 ac

Drainage Area SE7 is in the eastern area of the landfill and is comprised of grassed areas and areas of HDPE interim cap. This area also includes the gravel landfill perimeter road. Existing soil types are not considered in the stormwater calculations for this subbasin since it consists of developed landfill and roadways. A perimeter roadway swale is proposed such that it collects stormwater from the eastern subbasins. From there, stormwater flow is to the southeast, within the roadway swale, to a proposed stormwater treatment pond

(SE2). Stormwater discharge from this pond is ultimately drained to the Cascade Alpine Brook to the south of the landfill.

Drainage Area SE8: 14.13 ac

Drainage Area SE8 is in the central/southern area of the landfill and is comprised of grassed areas and areas of HDPE interim cap. This area also includes the landfill access road. Existing soil types are not considered in the stormwater calculations for this subbasin since it consists of developed landfill and roadways. A perimeter roadway swale is proposed such that it collects stormwater from the eastern subbasins. Intermediate drainage benches direct stormwater from this subbasin to the perimeter roadway swale. From there, stormwater flow is to the southeast, within the roadway swale, to a proposed stormwater treatment pond (SE2). Stormwater discharge from this pond is ultimately drained to the Cascade Alpine Brook to the south of the landfill.

Drainage Area SE10: 3.42 ac

Drainage Area SE10 is in the southeastern area of the landfill and is comprised of grassed areas and areas of HDPE interim cap. This area also includes the gravel landfill perimeter road. Existing soil types are not considered in the stormwater calculations for this subbasin since it consists of developed landfill and roadways. Stormwater flows off the landfill and under the perimeter roadway through a 24" culvert to a stormwater treatment pond (SE1). Stormwater discharge from this pond is ultimately drained to the Cascade Alpine Brook to the south of the landfill.

Drainage Area SE11: 3.48 ac

Drainage Area SE11 is in the southeastern area of the landfill and is comprised of grassed areas and areas of HDPE interim cap. This area also includes the gravel landfill perimeter road. Existing soil types are not considered in the stormwater calculations for this subbasin since it consists of developed landfill and roadways. Stormwater flows off the landfill and under the perimeter roadway through a 24" culvert to a stormwater treatment pond (SE1). Stormwater discharge from this pond is ultimately drained to the Cascade Alpine Brook to the south of the landfill.

Drainage Area SE12: 4.97 ac

Drainage Area SE12 is a primarily grassed area that abuts the landfill to the east and consists of HSG C and D soils. This area includes Pond SE2, a proposed gravel wetland stormwater treatment pond with a lined bottom. Stormwater flows through the sediment forebay, through the treatment bays and ties into other stormwater conveyance to its ultimate discharge to the Cascade Alpine Brook to the south of the landfill.

Drainage Area SE13: 2.03 ac

Drainage Area SE13 is a primarily grassed area that abuts the landfill to the east and consists of HSG C soils. This area also includes gravel roadway areas. The stormwater from this area is routed through swales, ultimately draining to the Cascade Alpine Brook to the south of the landfill.

Drainage Area SE14: 2.20 ac

Drainage Area SE14 is a primarily grassed area to the east and consists of HSG C soils. This area includes Pond SE1, a proposed gravel wetland stormwater treatment pond with a lined bottom. Stormwater flows through the sediment forebay, through the treatment bays and ties into other stormwater conveyance to its ultimate discharge to the Cascade Alpine Brook to the south of the landfill.

Drainage Area SE15: 10.09 ac

Drainage Area SE15 is a primarily grassed area that abuts the landfill to the east and consists of HSG C soils and areas of sand resulting from permitted wetland filling. This area also includes gravel roadway areas. The stormwater from this area is routed through swales around the stormwater treatment ponds, ultimately draining to the Cascade Alpine Brook to the south of the landfill.

Drainage Area N1: 57.90 ac

Drainage Area N1 is located to the north of the landfill and is largely the same when compared to the pre-development condition, previously the Northeast Drainage Area. Soils in this area consist of HSG C and HSG B soils. The drainage area is nearly the same in size and has the same discharge point as the pre-development condition. The site remains largely wooded but contains some paved and gravel roads. The time of concentration path will sheet flow from a local high point traveling west through woods, then to shallow concentrated flow until it discharges offsite, ultimately to the Androscoggin River.

Within the areas outside of the landfill footprint that are considered "undeveloped", the curve number (CN) for "woods" cover was changed from "woods fair" to "woods good" due to logging operations that are no longer applicable during the interim development condition but were present during the pre-development condition.

Per Env-Sw 805.09, the proposed Phase IIIA interim development condition will maintain peak off-site stormwater flow rates below pre-development for the 25-year, 24-hour storm event. Env-Wq 1507.06 requires that the 10-year, 24-hour post development peak flow not exceed the pre-development peak flow. This condition is met when looking at the combined flows off-site to the north and separately to the south. Both the existing and proposed stormwater features, including

culverts, swales and ponds are appropriately sized to accommodate the additional runoff for the storm events.

The following summary table compares both the pre-development and interim development flows for the 2, 10, 25, and 50-year, 24-hour storm events. The two outfall locations are consistent with the locations presented in the pre-development condition. The north outfall evaluates flow to the north that eventually drains into the Androscoggin River and the south outfall evaluates flow to Cascade Alpine Brook.

Table 1: Pre- and Intermediate- Development Peak Flow Comparison

Pre-& Intermediate- Development Discharge Flow Summary (cfs)

Design Storm (Year)	2	10	25	50	2	10	25	50
Out – North	63.94	173.03	272.75	370.81	63.23	166.76	262.20	357.78
Out – South	53.29	137.52	213.18	288.41	54.11	99.73	139.26	174.24

POST DEVELOPMENT CONDITIONS

The post development condition for the stormwater analysis is represented as the final overfilled and capped landfill through Phase IIIA. The final landfill cap will consist of a flexible membrane liner that is overlain by a drainage geocomposite, 12 inches of select drainage sand, 6 inches of a moisture retention soil, 4 inches of topsoil and a vegetative cover. A curve number of 74 was assumed to model runoff from the final grassed landfill cap surface, which is bounded by the limits of the anchor trench. Also included in this condition is the paved landfill access road between Hutchins Road and the landfill and the paved and gravel perimeter road around the landfill. The woods curve number condition of "good" is unchanged from the intermediate condition.

The drainage areas in the post development condition are largely the same as the interim development condition. Total impervious area of the site will decrease in the post development condition due to the removal of the landfill's HDPE interim cap, which consists of exposed geomembrane. The paved access road, paved and gravel perimeter roads, and proposed stormwater treatment ponds will remain similar to the intermediate condition. There are no new impervious surfaces being added between the intermediate and the post-development conditions.

The total drainage area for the post-development condition is 589 acres which is consistent with the pre-development conditions. The post development drainage areas discharge to similar locations as the intermediate development conditions, except as described below. The following is a summary of the post development drainage areas.

Drainage Area SW1: 5.73 ac

Drainage Area SW1 is unchanged from the intermediate-development condition. The drainage area is identical in size, as is the surface conditions and the discharge point.

Drainage Area SW2: 1.16 ac

Drainage Area SW2 is located on the west side of the landfill and is unchanged from the intermediate-development condition other than the replacement of the HDPE interim cap with the grassed landfill cap. This change significantly reduces the surface water generated by this subbasin. Flow paths and discharge points remain unchanged compared to the intermediate condition.

Drainage Area SW3: 58.54 ac

Drainage Area SW3 is unchanged from the intermediate-development condition. The drainage area is identical in size, as is the surface conditions and the discharge point.

Drainage Area SW4: 17.27 ac

Drainage Area SW4 is unchanged from the intermediate-development condition. The drainage area is identical in size, as is the surface conditions and the discharge point.

Drainage Area SW5: 15.54 ac

Drainage Area SW5 is located in the central/western area of the landfill and is larger than the intermediate-development condition. This subbasin consists of the grassed landfill cap. Stormwater is managed in this subbasin by intermediate bench swales and a dropchute that conveys stormwater to the perimeter toe swale. Once in the toe swale, stormwater flows south to a widened swale area (Pond-SW5), which outlets under the gravel perimeter road through a 36-inch culvert. The drainage area, flow path, and land surface have all been altered from the intermediate-development condition with the final capping of the landfill, though the discharge point remains the same. There is a small meadow area consisting of HSG C soil outside the limits of the landfill in this subbasin.

Drainage Area SW6: 10.081 ac

Drainage Area SW6 is located in the central/western area of the landfill and is smaller than the intermediate-development condition. This subbasin consists of the grassed landfill cap and a gravel access road. Stormwater is managed in this subbasin by intermediate bench swales that convey stormwater to the roadway swale. Once in the roadway swale, stormwater flows south to a widened swale area (Pond-SW6), which outlets under the gravel perimeter road through a 36-inch culvert. The drainage area, flow path, and land surface have all been altered from the intermediate-development condition with the final capping of the landfill, though the discharge point remains the same. Existing soil types are

not considered in the stormwater calculations for this subbasin since it consists of developed landfill and roadways.

Drainage Area S1: 2.83 ac

Drainage Area S1 is located on the southern side of the landfill and is unchanged from the intermediate-development condition other than the replacement of the HDPE interim cap with the grassed landfill cap. This change significantly reduces the surface water generated by this subbasin. Flow paths and discharge points remain unchanged compared to the intermediate condition.

Drainage Area S2: 11.16 ac

Drainage Area S2 is located in the southern area of the landfill and is larger than the intermediate-development condition. This subbasin consists of the grassed landfill cap and a gravel access road. Stormwater is managed in this subbasin by intermediate bench swales that convey stormwater to the roadway swale. Once in the swale, stormwater flows south to a widened swale area (Pond-S2). The drainage area, flow path, and land surface have all been altered from the intermediate-development condition with the final capping of the landfill, though the discharge point remains the same. There is a small meadow area consisting of HSG C soil outside the limits of the landfill in this subbasin.

Drainage Area S3: 7.51 ac

Drainage Area S3 is located on the southern side of the landfill and is unchanged from the intermediate-development condition other than the replacement of the HDPE interim cap with the grassed landfill cap. This change significantly reduces the surface water generated by this subbasin. Flow paths and discharge points remain unchanged compared to the intermediate condition.

Drainage Area NW2: 6.62 ac

Drainage Area NW2 is unchanged from the intermediate-development condition. The drainage area is identical in size, as is the surface conditions and the discharge point.

Drainage Area NW3: 8.50 ac

Drainage Area NW3 is located in the northwestern area of the landfill and is larger than the intermediate-development condition. This subbasin consists of the grassed landfill cap, a meadow area, and the perimeter road. Stormwater is managed in this subbasin by intermediate bench swales a dropchute, and a roadway swale that convey stormwater to a widened swale area (Pond-NW3), which outlets under the gravel perimeter road to Pond-NW2. The drainage area and land surface have all been altered from the intermediate-development condition with the final capping of the landfill, though the flow path and

discharge point remain the same. The perimeter roadway swale is represented as a meadow area consisting of HSG C soil outside the limits of the landfill in this subbasin.

Drainage Area NW4: 6.40 ac

Drainage Area NW4 is located in the northern area of the landfill and is smaller than the intermediate-development condition. This subbasin consists of the grassed landfill cap, a meadow area, and the perimeter road. Stormwater is managed in this subbasin by intermediate bench swales and a dropchute that convey stormwater to a widened swale area (Pond-NW4), which outlets under the gravel perimeter road to Pond-NW2. The drainage area, flow path, and land surface have all been altered from the intermediate-development condition with the final capping of the landfill, though and discharge point remain the same. The perimeter roadway swale is represented as a meadow area consisting of HSG C soil outside the limits of the landfill in this subbasin.

Drainage Area NW5: 6.49 ac

Drainage Area NW5 is located in the northern area of the landfill. This subbasin consists of the grassed landfill cap, a meadow area, and the perimeter road. Stormwater is managed in this subbasin by intermediate bench swales and a dropchute that convey stormwater to a widened swale area (Pond-NW4), which outlets under the gravel perimeter road to Pond-NW2. The perimeter roadway swale is represented as a meadow area consisting of HSG C soil outside the limits of the landfill in this subbasin.

Drainage Area NW6: 249.54 ac

Drainage Area NW6 is unchanged from the intermediate-development condition. The drainage area is identical in size, as is the surface conditions and the discharge point.

Drainage Area NW7: 3.02 ac

Drainage Area NW7 is unchanged from the intermediate-development condition. The drainage area is identical in size, as is the surface conditions and the discharge point.

Drainage Area SE1: 20.91 ac

Drainage Area SE1 is unchanged from the intermediate-development condition. The drainage area is identical in size, as is the surface conditions and the discharge point.

Drainage Area SE2: 19.47 ac

Drainage Area SE2 is unchanged from the intermediate-development condition. The drainage area is identical in size, as is the surface conditions and the discharge point.

Drainage Area SE3: 20.43 ac

Drainage Area SE3 is unchanged from the intermediate-development condition. The drainage area is identical in size, as is the surface conditions and the discharge point.

Drainage Area SE4: 4.93 ac

Drainage Area SE4 is unchanged from the intermediate-development condition. The drainage area is identical in size, as is the surface conditions and the discharge point.

Drainage Area SE5: 3.03 ac

Drainage Area SE5 is located in the northeastern area of the landfill and is smaller than the intermediate-development condition. This subbasin consists of the grassed landfill cap, a meadow area, and the perimeter road. Stormwater is managed in this subbasin by intermediate bench swales and a dropchute that convey stormwater to the perimeter roadway swale, which outlets under the perimeter roadway to Pond-SE2. The drainage area, flow path, and land surface have all been altered from the intermediate-development condition with the final capping of the landfill. The perimeter roadway swale is represented as a meadow area consisting of HSG C soil outside the limits of the landfill in this subbasin.

Drainage Area SE6: 2.68 ac

Drainage Area SE6 is located in the northeastern area of the landfill and is larger than the intermediate-development condition. This subbasin consists of the grassed landfill cap, a meadow area, and the perimeter road. Stormwater is managed in this subbasin by intermediate bench swales and a dropchute that convey stormwater to the perimeter roadway swale, which outlets under the perimeter roadway to Pond-SE2. The drainage area, flow path, and land surface have all been altered from the intermediate-development condition with the final capping of the landfill. The perimeter roadway swale is represented as a meadow area consisting of HSG C soil outside the limits of the landfill in this subbasin.

Drainage Area SE7: 4.34 ac

Drainage Area SE7 is located in the eastern area of the landfill and is smaller than the intermediate-development condition. This subbasin consists of the grassed landfill cap, a meadow area, and the perimeter road. Stormwater is managed in this subbasin by intermediate bench swales and a dropchute that convey stormwater to the perimeter roadway swale, which outlets under the perimeter roadway to Pond-SE2. The drainage area, flow path, and land surface have all been altered from the intermediate-development condition with the final capping of the landfill. The perimeter roadway swale is represented as a meadow area consisting of HSG C soil outside the limits of the landfill in this subbasin.

Drainage Area SE8: 4.86 ac

Drainage Area SE8 is located in the eastern area of the landfill and is smaller than the intermediate-development condition. This subbasin consists of the grassed landfill cap, a meadow area, and the perimeter road. Stormwater is managed in this subbasin by intermediate bench swales and a dropchute that convey stormwater to the perimeter roadway swale, which outlets under the perimeter roadway to Pond-SE2. The drainage

area, flow path, and land surface have all been altered from the intermediate-development condition with the final capping of the landfill. The perimeter roadway swale is represented as a meadow area consisting of HSG C soil outside the limits of the landfill in this subbasin.

Drainage Area SE9: 4.45 ac

Drainage Area SE9 is located in the eastern area of the landfill. This subbasin consists of the grassed landfill cap, a meadow area, and the perimeter road. Stormwater is managed in this subbasin by intermediate bench swales and a dropchute that convey stormwater to the perimeter roadway swale, which outlets under the perimeter roadway to Pond-SE2. The perimeter roadway swale is represented as a meadow area consisting of HSG C soil outside the limits of the landfill in this subbasin.

Drainage Area SE9S: 9.33 ac

Drainage Area SE9S is located in the central area of the landfill. This subbasin consists of the grassed landfill cap and the access road. Stormwater is managed in this subbasin by intermediate bench swales, a roadway swale, and a dropchute that convey stormwater to the perimeter roadway swale, which outlets under the perimeter roadway to Pond-SE2.

Drainage Area SE10: 3.42 ac

Drainage Area SE10 is located on the southern side of the landfill and is unchanged from the intermediate-development condition other than the replacement of the HDPE interim cap with the grassed landfill cap. This change significantly reduces the surface water generated by this subbasin. Flow paths and discharge points remain unchanged compared to the intermediate condition.

Drainage Area SE11: 3.61 ac

Drainage Area SE11 is located in the southeastern area of the landfill and is larger than the intermediate-development condition. This subbasin consists of the grassed landfill cap, a meadow area, and the perimeter road. Stormwater is managed in this subbasin by intermediate bench swales and a dropchute that convey stormwater to the perimeter roadway swale, which outlets under the perimeter roadway to Pond-SE1. The drainage area, flow path, and land surface have all been altered from the intermediate-development condition with the final capping of the landfill. The perimeter roadway swale is represented as a meadow area consisting of HSG C soil outside the limits of the landfill in this subbasin.

Drainage Area SE12: 5.05 ac

Drainage Area SE12 is unchanged from the intermediate-development condition. The drainage area is identical in size, as is the surface conditions and the discharge point.

Drainage Area SE13: 2.03 ac

Drainage Area SE13 is unchanged from the intermediate-development condition. The drainage area is identical in size, as is the surface conditions and the discharge point.

Drainage Area SE14: 2.20 ac

Drainage Area SE14 is unchanged from the intermediate-development condition. The drainage area is identical in size, as is the surface conditions and the discharge point.

Drainage Area SE15: 10.06 ac

Drainage Area SE15 is unchanged from the intermediate-development condition. The drainage area is identical in size, as is the surface conditions and the discharge point.

Drainage Area N1: 57.87 ac

Drainage Area N1 is unchanged from the intermediate-development condition. The drainage area is identical in size, as is the surface conditions and the discharge point.

In the post-development condition, intermediate drainage benches, dropchutes, swales, ponds and culverts function adequately to manage surface runoff after the landfill is closed and capped through the development of Phase IIIA. The proposed landfill cap and the facility's stormwater management system is designed to appropriately manage surface water to ensure that post development stormwater flows do not exceed the pre-development flows for the 2-, 10-, 25-, and 50-year, 24-hour storm.

Compared to the interim condition, the total impervious area will be reduced following construction of the final capping system which replaces the exposed interim geomembrane cover. The final cover system of the landfill will have a grassed surface.

The post development flows do not exceed any pre-development offsite flows for all design storms. A summary of peak off-site flows for the pre-development and post development conditions is presented below.

Table 2: Pre- and Post- Development Peak Flow Comparison

Pre-& Post Development Discharge Flow Summary (cfs)

Design Storm (Year)	2	10	25	50	2	10	25	50
Out – North	63.94	173.03	272.75	370.81	55.17	161.55	259.06	355.21
Out – South	53.29	137.52	213.18	288.41	16.86	66.98	107.52	140.42

EXISTING AND PROPOSED STORMWATER TREATMENT AND CONTROL PRACTICES

Existing Stormwater Treatment Practices

Existing landfill development has been constructed and progressed over time. Major landfill expansion construction projects have been permitted under multiple Alteration of Terrain permits (referred to as site-specific permits at the time). These expansions included the construction of multiple stormwater management practices that currently as described below.

Existing Northwest Pond

Approximately 30% of the stormwater flow from the landfill surface (subbasins NE3 and NE4) drains to the north towards the large northwest pond (Pond-NE2). In addition to the landfill stormwater runoff, the pond also manages runoff from non-landfill areas around the pond. The pond has an area of approximately 55,000 square feet and an approximate volume of 200,000 cubic feet. Stormwater exits through a 15-inch culvert on the north side of the pond ultimately draining to the Androscoggin River to the west of the site. This pipe is located at an elevation 2 feet above the bottom of the pond and there is spillway on the north side set at an elevation 7 feet above the pond outlet pipe invert.

Existing Widened Swale Sections

The perimeter toe swale of the landfill is widened in areas around the outlet culverts that conveys stormwater under the perimeter access road. There are a total of nine (9) locations around the perimeter of the landfill where stormwater is culverted under the perimeter access road. These widened areas provide for some stormwater capacity and are modeled as storage nodes that correspond to their respective drainage area within the landfill footprint. Perimeter toe swales manage flow from landfill and perimeter access roads.

Existing Eastern Area

Surface water runoff from eastern areas of the landfill currently drains to a large open area to the east of the landfill that is the development area of the Phase IIIA expansion. This large drainage area (approximately 101 acres) drains to an area at the bottom that periodically ponds and drains through an HDPE outlet structure and under the perimeter access road through a 30-inch culvert. Stormwater flow from the Eastern Area ultimately discharges to the Cascade Alpine Brook. The proposed drainage from the Phase IIIA discharges to the same location.

Other Areas

The culvert inlets for Drainage Areas SW3 and SW4 are modeled as storage nodes as topography indicates there is stormwater storage capacity in these areas.

Proposed Stormwater Treatment Practices

Additional stormwater control practices are proposed for construction and operation of the proposed Phase IIIA expansion. A stormwater detention pond, NW-5 is proposed to manage flow from the north of the landfill which needs to be re-directed due to the construction of the new landfill cell. Two gravel wetland stormwater treatment ponds, SE-1 and SW-2, are proposed to treat all the new landfill runoff from the construction and operation of Phase IIIA. The treatment ponds and other stormwater structures outside the landfill are the same between the interim and the post development models. Only the areas inside the landfill differ, where the interim condition reflects runoff during operation of the landfill and the post development condition reflects the proposed closure plan.

Pond NW5

Proposed Pond NW5 is a stormwater detention pond that will have a grass-lined surface and be underlain by a geomembrane liner to minimize infiltration of water gradient from the lined landfill and thereby minimize potential impact to groundwater flow below the landfill. The pond is designed to capture overland runoff from drainage areas to the northeast of the landfill. The pond includes a control outlet structure that discharges through an 18" culvert to the adjacent existing swale. Stormwater is routed through the swale to the existing stormwater retention pond north of exiting Phase I and ultimately discharges to the north.

Pond SE1

Proposed Pond SE1 is a subsurface gravel wetland with a geomembrane liner. The pond is designed to treat landfill runoff from the eastern side of the landfill, including most of the new proposed Phase IIIA area. Stormwater is routed from the perimeter roadway swale to the pond through 30" culverts that pass under the perimeter roadway on the eastern side of the landfill. The pond includes one sediment forebay and a two-stage gravel wetland treatment pond prior to discharge to the adjacent swale. Flow from this pond joins discharge from Pond SE2 prior to ultimate discharge to the main culvert to the south.

Pond SE2

Proposed Pond SE2 is a subsurface gravel wetland with a geomembrane liner. The pond is designed to treat landfill runoff from the southeastern area of the landfill. Stormwater is routed from the perimeter roadway swale to the pond through 24" culverts that pass under the perimeter roadway on the southeastern corner of the landfill. The pond includes one sediment forebay and a two stage gravel wetland treatment pond prior to discharge to the adjacent swale. Flow from this pond joins discharge from Pond SE1 prior to ultimate discharge to the main culvert to the south.

CONCLUSIONS

The current existing stormwater BMPs and management devices at the MCSL have performed successfully to date. Additional improvements are proposed to provide for stormwater management for the construction of Phase IIIA and for development of the landfill, including an interim condition during operation of the landfill where most of the landfill is covered with interim geomembrane cover, and a post development condition following full closure of the landfill.

The main improvements include a stormwater retention basin to the north to address flow which must be redirected due to the construction, and two gravel wetland stormwater treatment ponds to manage and treat runoff from the proposed expansion area.

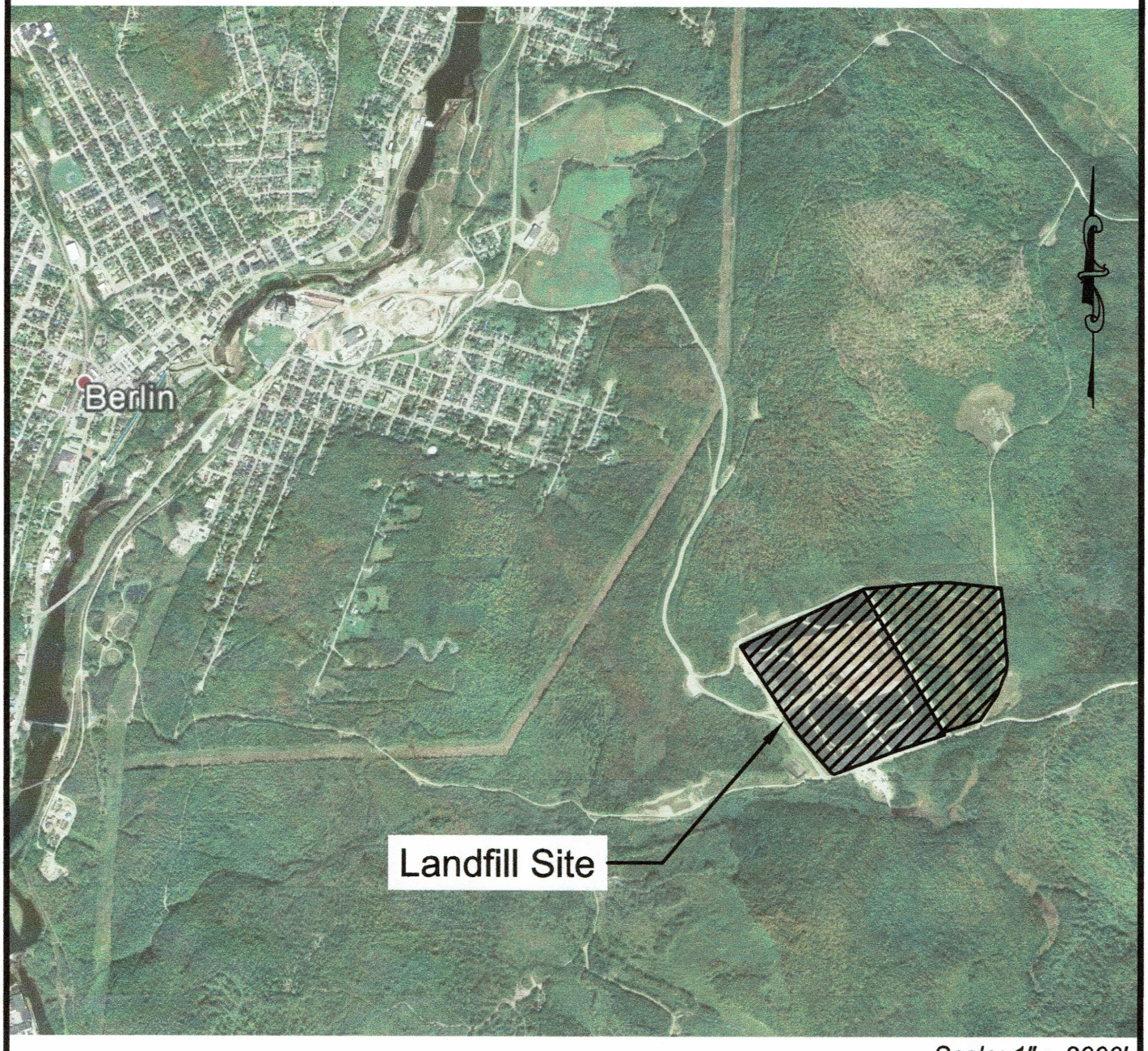
For all conditions evaluated, the existing and proposed stormwater management devices are adequately sized to manage the storms evaluated, up to the 50-year, 24-hour design storm. The calculated post-development stormwater peak offsite flows, calculated separately for flow to the north and flow to the south, are below the pre-development peak offsite flows for both the interim and final conditions evaluation.

PHASED FINAL DESIGN AND CONSTRUCTION

This preliminary stormwater design was completed for evaluation of the full buildout of the proposed Phase IIIA landfill expansion, which will be developed in three stages (Stage 13, 14, and 15). A separate final design, permitting and construction will be required for each of these Stages, which will be approximately 5 years apart. Each of these design and construction projects will require submittal and approval of a Type II permit modification application and an Alteration of Terrain permit which will include additional detailed design and permit compliance requirements.

APPENDIX A

AERIAL PHOTOGRAPH AND USGS PLAN



Scale: 1" = 2000'

CMA
ENGINEERS
CIVIL/ENVIRONMENTAL ENGINEERS

35 Bow Street
Portsmouth, NH 03801
603/431-6196

1 Sundial Avenue Suite 510N
Manchester, NH 03103
603/627-0708

10 Free Street
Portland, Maine 04101
207/541-4223

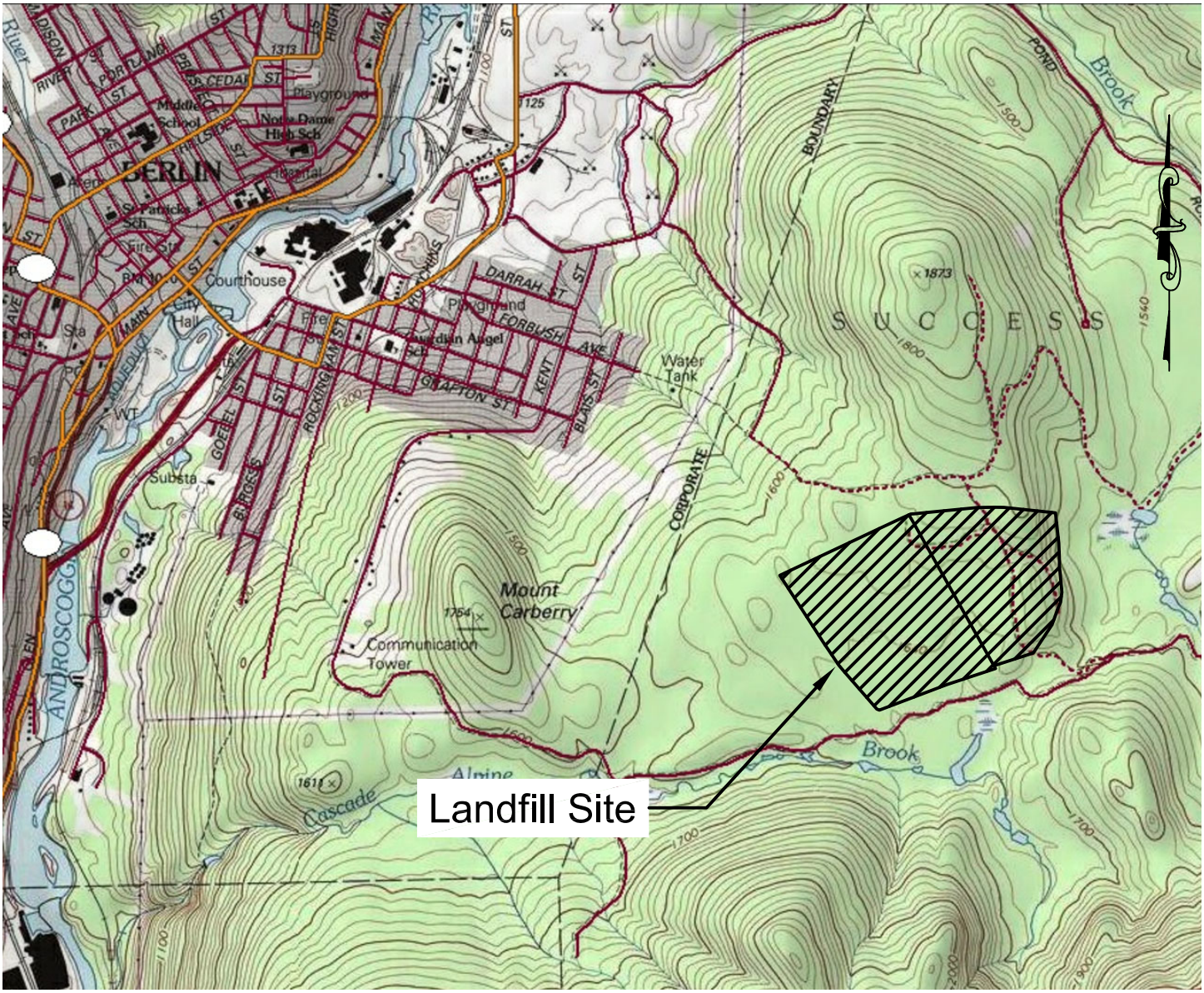
info@cmaengineers.com

www.cmaengineers.com

Androscoggin Valley Regional
Refuse Disposal District
Mt. Carberry Landfill

- Aerial Photo Plan -

Appendix A



0 2,000' 4,000'

Scale: 1" = 2,000'

CMA ENGINEERS
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Androscoggin Valley Regional Refuse Disposal District
Mt. Carberry Landfill
Success, New Hamsphire

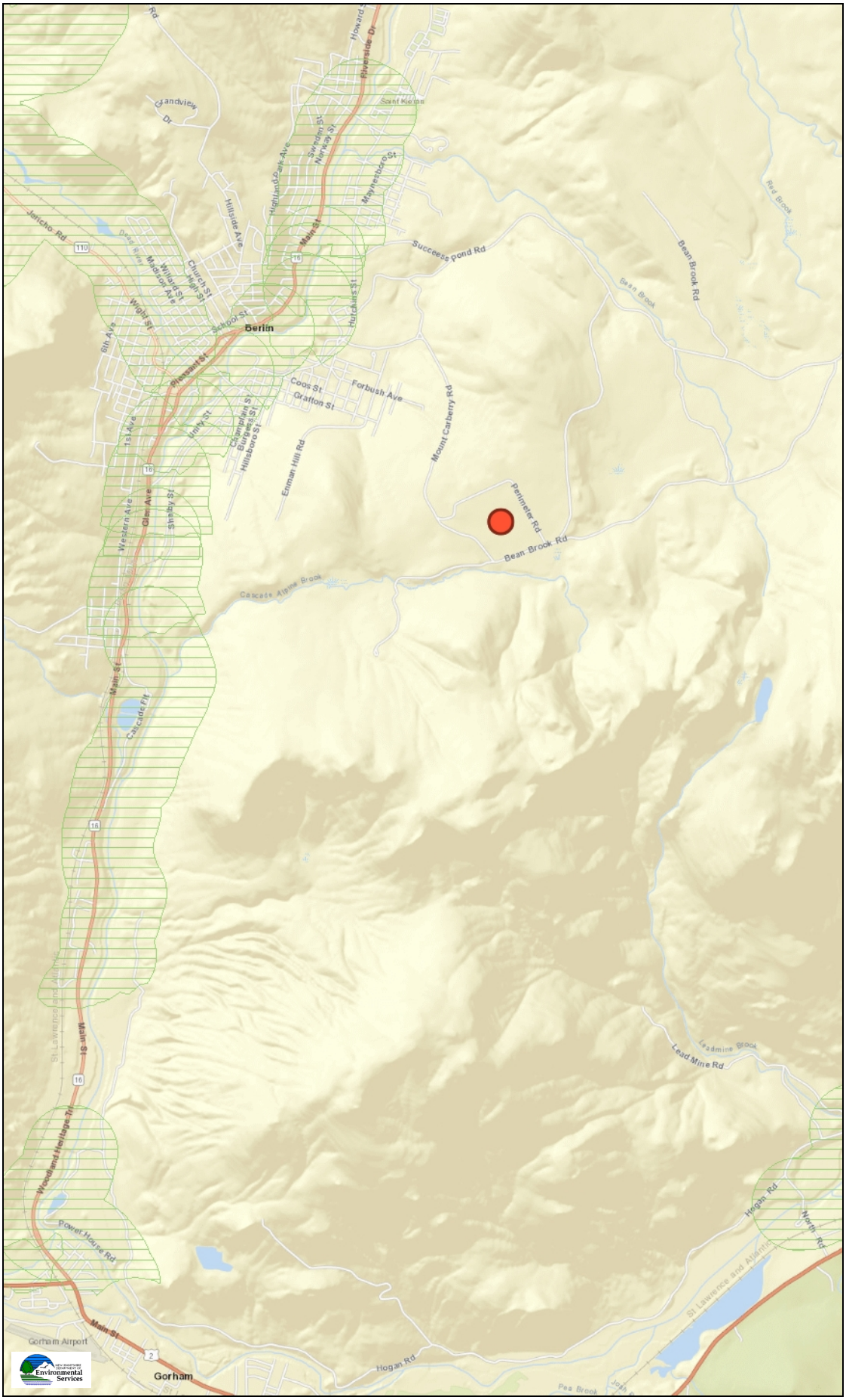
- USGS Plan -

Appendix A

APPENDIX B

WEB GIS – SURFACE WATER IMPAIRMENTS

AVRRDD Phase IIIA Expansion
NHDES WEB GIS Surface Water Impairments



Legend

Surface Waters with Impairn
2016 with Quarter Mile Buffe

Map Scale

1: 50,000

© NH DES, http://des.nh.gov

Map Generated: 3/16/2020

Notes

APPENDIX C

NATURAL HERITAGE BUREAU CORRESPONDENCE

CONFIDENTIAL – NH Dept. of Environmental Services review

Memo

NH Natural Heritage Bureau
NHB Datacheck Results Letter

To: Nicholas Messina
35 Bow St
Portsmouth, NH 03801

From: Amy Lamb, NH Natural Heritage Bureau
Date: 2/24/2020 (valid for one year from this date)
Re: Review by NH Natural Heritage Bureau
NHB File ID: NHB20-0456 Town: Success Location: Tax Maps: Map 16, Lot 1
Description: AVRRDD is proposing a horizontal expansion to the Mt. Carberry Landfill in Success, NH. This Phase IIIA expansions includes a new 23-acre landfill phase with three stages abutting and to the east of the existing landfill limits. The proposed development includes earthwork, site development, stormwater management, and ancillary structures including leachate piping, drainage, landfill gas, and other structures.
cc: Kim Tuttle

As requested, I have searched our database for records of rare species and exemplary natural communities, with the following results.

Comments: Please contact the NH Fish & Game Department.

Vertebrate species	State[1]	Federal	Notes
Bald Eagle (*Haliaeetus leucocephalus*)	SC	T	Contact the NH Fish & Game Dept and the US Fish & Wildlife Service (see below).

[1]Codes: "E" = Endangered, "T" = Threatened, "SC" = Special Concern, "--" = an exemplary natural community, or a rare species tracked by NH Natural Heritage that has not yet been added to the official state list. An asterisk (*) indicates that the most recent report for that occurrence was more than 20 years ago.

Contact for all animal reviews: Kim Tuttle, NH F&G, (603) 271-6544.

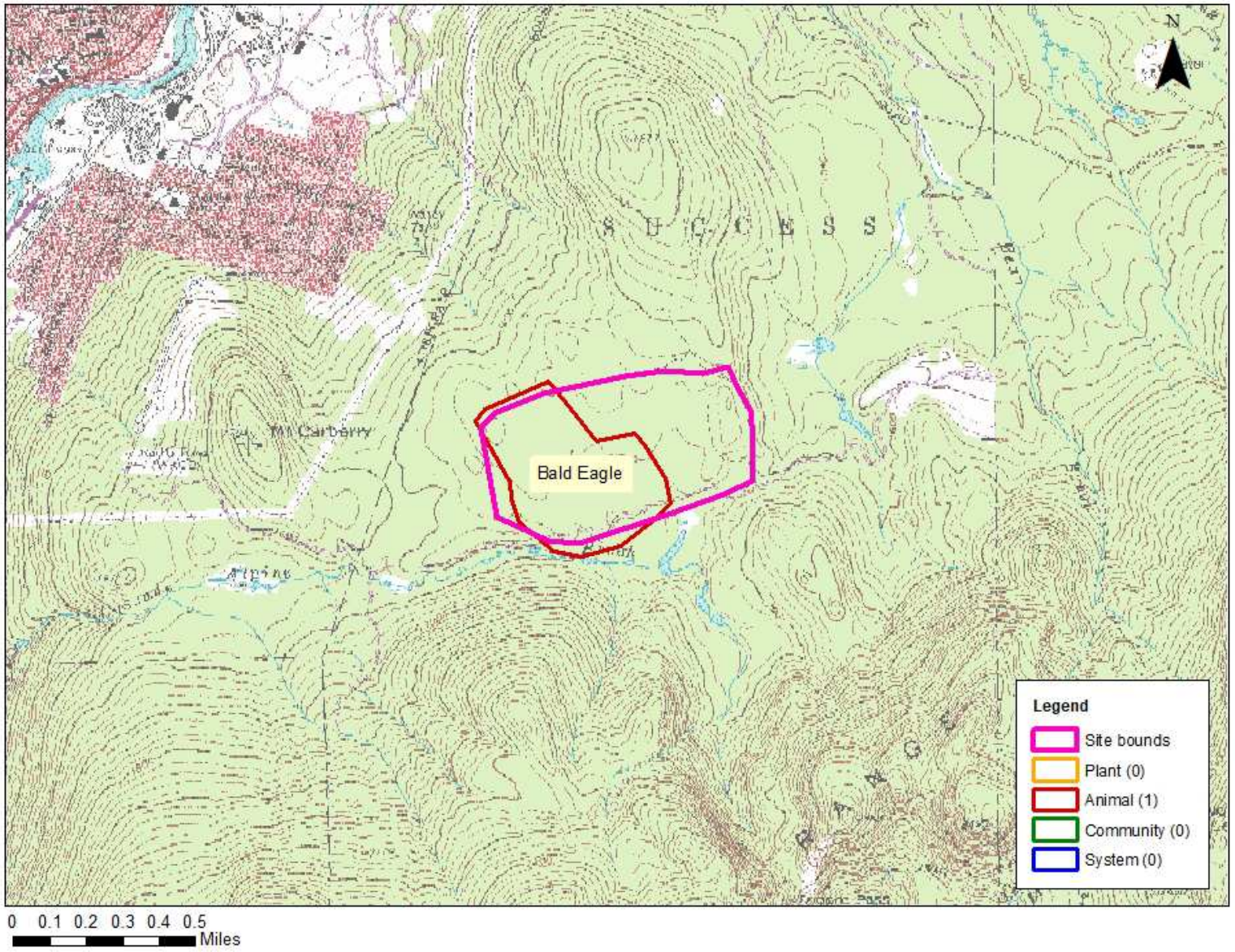
A negative result (no record in our database) does not mean that a sensitive species is not present. Our data can only tell you of known occurrences, based on information gathered by qualified biologists and reported to our office. However, many areas have never been surveyed, or have only been surveyed for certain species. An on-site survey would provide better information on what species and communities are indeed present.

Department of Natural and Cultural Resources
Division of Forests and Lands
(603) 271-2214 fax: 271-6488

DNCR/NHB
172 Pembroke Rd.
Concord, NH 03301

CONFIDENTIAL – NH Dept. of Environmental Services review

NHB20-0456



New Hampshire Natural Heritage Bureau - Animal Record

Bald Eagle (*Haliaeetus leucocephalus*)

Legal Status		Conservation Status	
Federal:	Listed Threatened	Global:	Demonstrably widespread, abundant, and secure
State:	Special Concern	State:	Imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Not ranked
Comments on Rank: --

Detailed Description: 2012: 1 eagle observed on 2/25.2011: 2 eagles observed on 2/26.2010: 3 eagles observed on 1/9.2009: 1 eagle observed on 2/28.2007: 4 eagles observed on 2/24.2006: 3 eagles observed on 1/7.2005: 4 eagles observed on 1/8. 4 eagles observed on 2/26.
General Area: --
General Comments: --
Management Comments: --

Location

Survey Site Name: Berlin landfill
Managed By: James River Corp.

County: Coos
Town(s): Success
Size: 97.9 acres
Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: --

Dates documented

First reported:	2005-01-08	Last reported:	2012-02-25

The U.S. Fish & Wildlife Service has jurisdiction over Federally listed species. Please contact them at 70 Commercial Street, Suite 300, Concord NH 03301 or at (603) 223-2541.

CONFIDENTIAL – NH Dept. of Environmental Services review

APPENDIX D

NRCS WEB SOIL SURVEY

North Country Soil Services
Environmental Professionals

August 1, 2017

Mr. Brad Sullivan, P.E.
CMA Engineers
35 Bow Street
Portsmouth, NH 03801

Re: Site-Specific Soil Mapping of Phase III- Mt Carberry Landfill, Berlin, NH

Dear Mr. Sullivan:

The Site-Specific Soil mapping of the Phase III of the Mt Carberry Landfill parcel located off of Bean Brook Road in Berlin, New Hampshire has been completed and compiled. Enclosed is a copy of the compilation of the field mapping of the approximately 60 acres of undisturbed portions of the site for the use in engineering the site. Refer to the enclosed Field Sheet of the Site-Specific Soil Map of the project area. The findings of my soils investigation are explained in more detail below. The soil mapping of the project site was conducted on July 18, 19, 25 and 26, 2017.

Methods:

The soil mapping of the subject property was conducted in accordance with the standards set forth in the Society of Soil Scientists of Northern New England (SSSNNE) Publication No.3 "Site-Specific Soil Mapping Standards for New Hampshire and Vermont, Version 4.0" dated February 2011.

This investigation has been prepared from data collected by on-site observations. A tile spade and soils auger were used to dig holes to 40 inches or more in depth to examine and identify the soils' characteristics. These holes were placed when changes in slope, vegetation or soil surface are observed. When changes are noted from one hole to the next involving soil drainage or parent material, a soil boundary is placed on the map between the holes to reflect the transition between the soils as it occurs on the landscape. The soil boundaries were located at several points along their length using a compass and hip-chain. The slopes of the soil map units were measured in the field using a clinometer. The minimum size of the Site-Specific Soil Survey map units is typically 2,000 square feet with the exception being poorly or very poorly drained soil areas that are jurisdictional wetlands.

Findings:

The on-site investigation revealed that the portions of the project site had been disturbed by the construction of the existing landfill, road system and placement of fill materials. The project area has areas of loamy compact glacial till and human disturbed soils. The human disturbed areas were excavated, regraded or filled with sandy or loamy soil materials, boulders or woody debris. Refer to the enclosed Site-Specific Soil Map of the project area for the location of the individual soil map units.

A large portion of the investigated area is gently sloping to steep somewhat poorly

P.O. Box 442
West Ossipee, NH 03890
Voice: (603) 539-9152 e-mail: _wetsoil1@roadrunner.com_

to well drained loamy glacial till. On the easterly portion of the subject parcel is an area of nearly level to steep human disturbed soils that have been filled with woody debris, boulders and loamy fill materials.

In accordance with the Site-Specific Soil Mapping standards, these identified individual soil map units have been correlated to the New Hampshire State-Wide Numerical Soils Legend maintained by the New Hampshire State office of the Natural Resource Conservation Service (NRCS).

State-Wide Numerical Soils Legend
143- Monadnock, very stony
199- Dumps, bark chips and organic matter
200- Udorthents, refuse substratum
299- Udorthents, smoothed
395- Chocorua
400- Udorthents, sandy or gravelly
559- Skerry, very stony
647- Pillsbury (poorly drained), very stony
900- Endoaquents, sandy or gravelly
947- Colonel, very stony

Soil Map Unit Descriptions:

The individual soil map unit descriptions of the soils identified on the subject parcel are as follows.

143B- Monadnock very stony sandy loam, 3 to 8 percent slopes

This map unit consists of well drained soils that formed in loamy glacial till. It occurs on the top of knolls within the mapping area.

Typically, the surface layer is dark reddish brown sandy loam about 2 inches thick. The subsoil is reddish gray, dark reddish brown, reddish brown, strong brown, dark yellowish brown, yellowish brown and light olive brown fine sandy loam, sandy loam and loamy sand about 26 inches thick. The substratum, to a depth of 40 inches or more, is light olive brown and olive brown gravelly loamy fine sand and gravelly loamy sand.

Included with this mapping are small areas of moderately well drained Skerry soils, slopes less than 3 percent and areas of stony surfaces. These inclusions make up as much as 20 percent of the map unit.

143C- Monadnock very stony sandy loam, 8 to 15 percent slopes

This map unit consists of well drained soils that formed in loamy glacial till. It occurs on the shoulders of the upland areas within the mapping area.

Typically, the surface layer is dark reddish brown sandy loam about 2 inches thick. The subsoil is reddish gray, dark reddish brown, reddish brown, strong brown, dark yellowish brown, yellowish brown and light olive brown fine sandy loam, sandy loam and loamy sand about 26 inches thick. The substratum, to a depth of 40 inches or more, is

light olive brown and olive brown gravelly loamy fine sand and gravelly loamy sand.

Included with this mapping are small areas of moderately well drained Skerry soils, areas of stony surfaces, slopes less than 8 percent and greater than 15 percent. These inclusions make up as much as 25 percent of the map unit.

143D- Monadnock very stony sandy loam, 15 to 25 percent slopes

This map unit consists of well drained soils that formed in loamy glacial till. It occurs on the shoulders of the upland areas within the mapping area.

Typically, the surface layer is dark reddish brown sandy loam about 2 inches thick. The subsoil is reddish gray, dark reddish brown, reddish brown, strong brown, dark yellowish brown, yellowish brown and light olive brown fine sandy loam, sandy loam and loamy sand about 26 inches thick. The substratum, to a depth of 40 inches or more, is light olive brown and olive brown gravelly loamy fine sand and gravelly loamy sand.

Included with this mapping are small areas of moderately well drained Skerry soils, areas of stony surfaces, slopes less than 15 percent and greater than 25 percent. These inclusions make up as much as 25 percent of the map unit.

143E- Monadnock very stony sandy loam, 25 to 45 percent slopes

This map unit consists of well drained soils that formed in loamy glacial till. It occurs on the shoulders of the upland areas within the mapping area.

Typically, the surface layer is dark reddish brown sandy loam about 2 inches thick. The subsoil is reddish gray, dark reddish brown, reddish brown, strong brown, dark yellowish brown, yellowish brown and light olive brown fine sandy loam, sandy loam, loamy sand and gravelly loamy sand about 26 inches thick. The substratum, to a depth of 40 inches or more, is light olive brown and olive brown gravelly loamy fine sand and gravelly loamy sand.

Included with this mapping are small areas of moderately well drained Skerry soils, areas of stony surfaces, slopes less than 25 percent and greater than 45 percent. These inclusions make up as much as 25 percent of the map unit.

199B- Dumps, bark chips, and organic matter, 0 to 8 percent slopes

This map unit consists of loamy soil materials with boulders, stones, stumps and woody debris. Undisturbed material is at a depth of more than 40 inches. There are no identifiable diagnostic horizons at a depth within 40 inches. It occurs as an apparent stump dump on the southeasterly portion of the mapping area

Included with this mapping are small areas of slopes greater than 8 percent. These inclusions make up as much as 10 percent of the map unit.

199C- Dumps, bark chips, and organic matter, 8 to 15 percent slopes

This map unit consists of loamy soil materials with boulders, stones and woody debris. Undisturbed material is at a depth of more than 40 inches. There are no

identifiable diagnostic horizons at a depth within 40 inches. It occurs as an apparent stump dump on the southeasterly portion of the mapping area

Included with this mapping are small areas of slopes less than 8 percent. These inclusions make up as much as 10 percent of the map unit.

199D- Dumps, bark chips, and organic matter, 15 to 25 percent slopes

This map unit consists of loamy soil materials with boulders, stones, stumps and woody debris. Undisturbed material is at a depth of more than 40 inches. There are no identifiable diagnostic horizons at a depth within 40 inches. It occurs as an apparent stump dump on the southeasterly portion of the mapping area

Included with this mapping are small areas of slopes less than 15 percent and greater than 25 percent. These inclusions make up as much as 20 percent of the map unit.

199E- Dumps, bark chips, and organic matter, 25 to 50 percent slopes

This map unit consists of loamy soil materials with boulders, stones, stumps and woody debris. Undisturbed material is at a depth of more than 40 inches. There are no identifiable diagnostic horizons at a depth within 40 inches. It occurs as an apparent stump dump on the southeasterly portion of the mapping area

Included with this mapping are small areas of slopes less than 25 percent and greater than 50 percent. These inclusions make up as much as 20 percent of the map unit.

200E-Udorthents, refuse substratum, 25 to 50 percent slopes

This map unit represents alternating layers of soil and refuse/debris. There are no identifiable diagnostic horizons at a depth within 40 inches. It occurs as the side slope of the landfill on the westerly edge of the mapping area

Included with this mapping are small areas of slopes less than 25 percent and sandy fill materials. These inclusions make up as much as 20 percent of the map unit.

299B- Udorthents, smoothed, 3 to 8 percent slopes

This map unit consists of somewhat poorly to well drained soils that formed in loamy and loamy sand fill materials. Undisturbed material is at a depth of more than 40 inches. There are no identifiable diagnostic horizons at a depth within 40 inches. The soils range from fine sandy loam to loamy sand and their gravelly analogs.

Included with this mapping are small areas of slopes less than 3 percent and greater than 8 percent. These inclusions make up as much as 20 percent of the map unit.

299C- Udorthents, smoothed, 8 to 15 percent slopes

This map unit consists of moderately well to well drained soils that formed in loamy and loamy sand fill materials. Undisturbed material is at a depth of more than 40

inches. There are no identifiable diagnostic horizons at a depth within 40 inches. The soils range from fine sandy loam to loamy sand and their gravelly analogs.

Included with this mapping are small areas of slopes less than 8 percent and greater than 15 percent. These inclusions make up as much as 20 percent of the map unit.

299D- Udorthents, smoothed, 15 to 25 percent slopes

This map unit consists of moderately well to well drained soils that formed in loamy and loamy sand fill materials. Undisturbed material is at a depth of more than 40 inches. There are no identifiable diagnostic horizons at a depth within 40 inches. The soils range from fine sandy loam to loamy sand and their gravelly analogs.

Included with this mapping are small areas of slopes less than 15 percent and greater than 25 percent. These inclusions make up as much as 20 percent of the map unit.

299E- Udorthents, smoothed, 25 to 50 percent slopes

This map unit consists of moderately well to well drained soils that formed in loamy and loamy sand fill materials. Undisturbed material is at a depth of more than 40 inches. There are no identifiable diagnostic horizons at a depth within 40 inches. The soils range from fine sandy loam to loamy sand and their gravelly analogs.

Included with this mapping are small areas of slopes less than 25 percent and bouldery surfaces. These inclusions make up as much as 20 percent of the map unit.

395A- Chocorua mucky peat, 0 to 3 percent slopes

This map unit consists of very poorly drained soils that formed in organic materials over sandy glaciofluvial deposits. It occurs in a very broad swale in the extreme southeasterly corner of the mapping area.

Typically, the surface layer is black mucky peat about 24 inches thick. The substratum, to a depth of 40 inches or more, is light gray to dark greenish gray very fine sand to sand.

Included within this mapping are small areas of mucky peat less than 16 inches thick. These inclusions make up 10 percent of the map unit.

400B- Udorthents, sandy or gravelly, 3 to 8 percent slopes

This map unit consists of somewhat poorly drained soils that formed in excavated loamy sand glacial till. Undisturbed material is at the surface. It occurs in excavated swales within the mapping area. The soils range from loamy fine sand to loamy sand and their gravelly analogs.

Included with this mapping are small areas of slopes less than 3 percent. These inclusions make up as much as 10 percent of the map unit.

400C- Udorthents, sandy or gravelly, 8 to 15 percent slopes

This map unit consists of somewhat poorly drained soils that formed in excavated loamy sand glacial till. Undisturbed material is at the surface. It occurs in excavated swales within the mapping area. The soils range from loamy fine sand to loamy sand and their gravelly analogs.

Included with this mapping are small areas of slopes less than 8 percent. These inclusions make up as much as 10 percent of the map unit.

400E- Udorthents, sandy or gravelly, 25 to 50 percent slopes

This map unit consists of somewhat poorly to moderately well drained soils that formed in excavated loamy sand glacial till. Undisturbed material is at the surface. The soils range from loamy fine sand to loamy sand and their gravelly analogs.

Included with this mapping are small areas of slopes less than 25 percent. These inclusions make up as much as 10 percent of the map unit.

559B- Skerry very stony fine sandy loam, 3 to 8 percent slopes

This map unit consists of moderately well drained soils that formed in loamy sand glacial till. It occurs on the upland areas within the mapping area.

Typically, the surface layer is dark reddish brown sandy loam about 2 inches thick. The subsoil is reddish gray, dark reddish brown, reddish brown, strong brown, dark yellowish brown, yellowish brown, olive brown and light olive brown fine sandy loam, sandy loam, loamy sand and gravelly loamy sand about 23 inches thick. The substratum, to a depth of 40 inches or more, is light olive brown and olive brown gravelly loamy fine sand and gravelly loamy sand.

Included with this mapping are small areas of somewhat poorly drained Colonel soils, areas of stony surfaces, slopes less than 3 percent and greater than 8 percent. These inclusions make up as much as 25 percent of the map unit.

559C- Skerry very stony fine sandy loam, 8 to 15 percent slopes

This map unit consists of moderately well drained soils that formed in loamy sand glacial till. It occurs on the upland areas within the mapping area.

Typically, the surface layer is dark reddish brown sandy loam about 2 inches thick. The subsoil is reddish gray, dark reddish brown, reddish brown, strong brown, dark yellowish brown, yellowish brown, olive brown and light olive brown fine sandy loam, sandy loam, loamy sand and gravelly loamy sand about 23 inches thick. The substratum, to a depth of 40 inches or more, is light olive brown and olive brown gravelly loamy fine sand and gravelly loamy sand.

Included with this mapping are small areas of somewhat poorly drained Colonel soils, areas of stony surfaces, slopes less than 8 percent and greater than 15 percent. These inclusions make up as much as 20 percent of the map unit.

559D- Skerry very stony fine sandy loam, 15 to 25 percent slopes

This map unit consists of moderately well drained soils that formed in loamy sand glacial till. It occurs on the upland areas within the mapping area.

Typically, the surface layer is dark reddish brown sandy loam about 2 inches thick. The subsoil is reddish gray, dark reddish brown, reddish brown, strong brown, dark yellowish brown, yellowish brown, olive brown and light olive brown fine sandy loam, sandy loam, loamy sand and gravelly loamy sand about 23 inches thick. The substratum, to a depth of 40 inches or more, is light olive brown and olive brown gravelly loamy fine sand and gravelly loamy sand.

Included with this mapping are small areas of somewhat poorly drained Colonel soils, areas of stony surfaces and slopes less than 8 percent. These inclusions make up as much as 20 percent of the map unit.

647B- Pillsbury (poorly drained) very stony sandy loam, 0 to 8 percent slopes

This map unit consists of poorly drained soils that formed in loamy sand till. It occurs in swales and depressions within the mapping area.

Typically, the surface layer is black or very dark brown sandy loam about 4 inches thick. The subsoil is gray, dark reddish brown, dark brown, brown, grayish brown, olive brown and light olive brown sandy loam and loamy sand about 16 inches thick. The substratum, to a depth of 40 inches or more, is light olive brown and grayish brown loamy sand and gravelly loamy sand.

Included with this mapping are small areas of somewhat poorly drained Colonel soils and areas of stony surfaces. These inclusions make up as much as 20 percent of the map unit.

900B- Endoaquents, sandy or gravelly, 3 to 8 percent slopes

This map unit consists of poorly drained soils that formed in excavated loamy sand glacial till. Undisturbed material is at the surface. It occurs in excavated swales within the mapping area. The soils range from loamy fine sand to loamy sand and their gravelly analogs.

Included with this mapping are small areas of slopes less than 3 percent. These inclusions make up as much as 10 percent of the map unit.

947B- Colonel very stony sandy loam, 3 to 8 percent slopes

This map unit consists of somewhat poorly drained soils that formed in loamy sand till. It occurs on upland areas within the mapping area.

Typically, the surface layer is black or very dark brown sandy loam about 2 inches thick. The subsoil is dark reddish gray, dark reddish brown, dark brown, brown, grayish brown, olive brown and light olive brown sandy loam and loamy sand about 18 inches thick. The substratum, to a depth of 40 inches or more, is light olive brown and grayish brown loamy sand and gravelly loamy sand.

Included with this mapping are small areas of poorly drained Pillsbury soils, moderately well drained Skerry soils, areas of stony surfaces, slopes less than 3 percent and greater than 8 percent. These inclusions make up as much as 25 percent of the map unit.

Hydrologic Soil Group Correlation:

In order to correlate the soil map units identified on the investigated portion of the project site to the appropriate hydrologic soil group we referenced the Society of Soil Scientists of Northern New England "Ksat Values for New Hampshire Soils, Special Publication No. 5, September 2009". The link to the above referenced publication is http://www.sssnne.org/publications.html . Below is the correlation of the identified soil map units to the appropriate hydrologic soil group.

Map Unit	Hydrologic Soil Group
143- Monadnock, very stony	B
199- Dumps, bark chips and organic matter	No Group- unsuitable
200- Udorthents, refuse substratum	No Group- unsuitable
299- Udorthents, smoothed	B
395- Chocorua	D
400- Udorthents, sandy or gravelly	C
559- Skerry, very stony	C
647- Pillsbury (poorly drained), very stony	C
900- Endoaquents, sandy or gravelly	D
947- Colonel, very stony	C

If you have any questions regarding the soils map or the investigation please do not hesitate to contact me at (603) 539-9152 or via e-mail at *wetsoil1@roadrunner.com* . Once the final plan is prepared I will review and sign the plan for submission. I thank you very much for the opportunity to provide my professional services to you.

Sincerely,

Gregory W. Howard, CSS
Soil Scientist

STATE OF NEW HAMPSHIRE
GREGORY
W.
HOWARD
NO. 032
CERTIFIED SOIL SCIENTIST
8/1/17

encl.
cc: File

CMAEngineersMtCarberryLandfillSoil.word

P-802
P-06-11
P-06-06
P-805 A&B
P-06-18
P-122
P-06-05
P-06-09
P-115 A,B&C
CMW-201 B
CMW-201 A
P-112 A,B&C
P-06-04
P-06-07
P-114
P-06-02
P-06-03
P-06-12
P-123
P-814
P-06-08
P-104 A&B
P-105 A&B
P-814 A&B
P-817R
P-817
P-501
P-125
P-126
P-124 A,B&C
P-06-10

CELL B
STAGE 9
CELL A
STAGE 8
CELL B
CELL A
CELL A
STAGE 7
CELL B
CELL A
STAGE 1

947B
559B
559C
559D
400E/dcccc
400B/ecccd
299B/dcccc
900B/fcccd
299C/dcccc
400E/eeccd
143D
143C
143B
143E
400B/dcccc
299B/dcaccc
400C/fcccc
299B/dccccc
299D/ccabb
299B/ccabb
299E/ccccb
400A/dcccc
199B
199D
199E
199C
395A
200E
900B/fcccd
299B/dcccc
299E/dcccc
299D/dcccc

existing 12" cpp inv in: 1666.82 inv out: 1662.29
30" CMP Inv. in: 1668.48
30" CMP Inv. out: 1666.99
24" CMP Inv. in: 1654.62
24" CMP Inv. out: 1653.43
24" CMP Inv. in: 1624.70
24" CMP Inv. out: 1623.92
18" CPP Inv. in: 1636.65
18" CPP Inv. out: 1632.02
18" CPP Inv. in: 1646.94
18" CPP Inv. out: 1646.54
18" PVC Inv. in: 1630.71
18" PVC Inv. out: 1630.02
20" PP Inv. in: 1655.35
20" Steel Inv. in: 1654.77
existing 30" cpp inv in(s):1619.8 inv out(s): 1618.1

LCMH 8-1B
RIM: 1630.73
12" HPDE in NORTH: 1624.68
12" HDPE out WEST: 1622.93
12" HDPE in NE: 1624.43
SUMP: 1622.58
leachate inlet structure

LCMH 8-1A
RIM: 1627.73
18" HPDE in NORTH: 1619.78

LANDFILL ANCHOR TRENCH
CONSERVATION EASEMENT
CONSERVATION EASEMENT
CONSERVATION EASEMENT
SOIL MAPPING AREA

Site-Specific Soils
Gregory W. Howard, CSS

see next sheet

no.	revision	date	by

CMA ENGINEERS
Civil/Environmental/Structural
Portsmouth, NH • Manchester, NH • Portland, ME
603/431-6196 • 603/627-0708 • 207/541-4223
cmaengineers.com

Androscoggin Valley Regional Refuse Disposal District
Mt. Carberry Secure Landfill

Soil Mapping Area
Site Plan

date: 6/30/17	designed by: PDS	approved by: PDS/BWS	scale: 100' 0 100' 200' Scale: 1" = 100'
project no: 771	drawn by: BWS	file name: 771-Site Plan For Soil Survey Mapping-170630.dwg	

drawing no.

sheet: of

F:\CADD\PROJECTS\771\dwg\Engineer\771-Site Plan For Soil Survey Mapping-170630.dwg Date Plotted: Jun 30, 2017 – 2:29pm Plotted By: BSULLIVAN

North Country Soil Services

Environmental Professionals

November 20, 2018

Mr. Paul Schmidt, P.E.
CMA Engineers
35 Bow Street
Portsmouth, NH 03801

Re: Site-Specific Soil Mapping of Phase III- Mt Carberry Landfill, Berlin, NH

Dear Mr. Schmidt:

The Site-Specific Soil mapping of the Phase III of the Mt Carberry Landfill parcel located off of Bean Brook Road in Berlin, New Hampshire has been completed and compiled. Enclosed is a copy of the compilation of the field mapping of the approximately 75 acres of undisturbed portions of the site for the use in engineering the site. Refer to the enclosed Field Sheet of the Site-Specific Soil Map of the project area. The findings of my soils investigation are explained in more detail below. The soil mapping of the project site was conducted on July 18, 19, 25 and 26, 2017 and November 5, 2018.

Methods:

The soil mapping of the subject property was conducted in accordance with the standards set forth in the Society of Soil Scientists of Northern New England (SSSNNE) Publication No.3 "Site-Specific Soil Mapping Standards for New Hampshire and Vermont, Version 4.0" dated February 2011 and "Site-Specific Soil Mapping Standards for New Hampshire and Vermont, Version 5.0" dated December 2017.

This investigation has been prepared from data collected by on-site observations. A tile spade and soils auger were used to dig holes to 40 inches or more in depth to examine and identify the soils' characteristics. These holes were placed when changes in slope, vegetation or soil surface are observed. When changes are noted from one hole to the next involving soil drainage or parent material, a soil boundary is placed on the map between the holes to reflect the transition between the soils as it occurs on the landscape. The soil boundaries were located at several points along their length using a compass and hip-chain. The slopes of the soil map units were measured in the field using a clinometer. The minimum size of the Site-Specific Soil Survey map units is typically 2,000 square feet with the exception being poorly or very poorly drained soil areas that are jurisdictional wetlands.

Findings:

The on-site investigation revealed that the portions of the project site had been disturbed by the construction of the existing landfill, road system and placement of fill materials. The project area has areas of loamy compact glacial till, loamy compact glacial till with variable depth to bedrock and human disturbed soils. The human disturbed areas were excavated, regraded or filled with sandy or loamy soil materials, boulders or woody debris. Refer to the enclosed Site-Specific Soil Map of the project area for the location of the individual soil map units.

P.O. Box 442
West Ossipee, NH 03890
Voice: (603) 539-9152 e-mail: *wetsoil1@roadrunner.com*

A large portion of the investigated area is gently sloping to steep somewhat poorly to well drained loamy glacial till. On the easterly portion of the subject parcel is an area of nearly level to steep human disturbed soils that have been filled with woody debris, boulders and loamy fill materials.

In accordance with the Site-Specific Soil Mapping standards, these identified individual soil map units have been correlated to the New Hampshire State-Wide Numerical Soils Legend maintained by the New Hampshire State office of the Natural Resource Conservation Service (NRCS).

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143- Monadnock, very stony
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299- Udorthents, smoothed
395- Chocorua
400- Udorthents, sandy or gravelly
470- Tunbridge-Peru Complex
559- Skerry, very stony
647- Pillsbury (poorly drained), very stony
900- Endoaquents, sandy or gravelly
947- Colonel, very stony

Soil Map Unit Descriptions:

The individual soil map unit descriptions of the soils identified on the subject parcel are as follows.

143B- Monadnock very stony sandy loam, 3 to 8 percent slopes

This map unit consists of well drained soils that formed in loamy glacial till. It occurs on the top of knolls within the mapping area.

Typically, the surface layer is dark reddish brown sandy loam about 2 inches thick. The subsoil is reddish gray, dark reddish brown, reddish brown, strong brown, dark yellowish brown, yellowish brown and light olive brown fine sandy loam, sandy loam and loamy sand about 26 inches thick. The substratum, to a depth of 40 inches or more, is light olive brown and olive brown gravelly loamy fine sand and gravelly loamy sand.

Included with this mapping are small areas of moderately well drained Skerry soils, slopes less than 3 percent and areas of stony surfaces. These inclusions make up as much as 20 percent of the map unit.

143C- Monadnock very stony sandy loam, 8 to 15 percent slopes

This map unit consists of well drained soils that formed in loamy glacial till. It occurs on the shoulders of the upland areas within the mapping area.

Typically, the surface layer is dark reddish brown sandy loam about 2 inches thick.

The subsoil is reddish gray, dark reddish brown, reddish brown, strong brown, dark yellowish brown, yellowish brown and light olive brown fine sandy loam, sandy loam and loamy sand about 26 inches thick. The substratum, to a depth of 40 inches or more, is light olive brown and olive brown gravelly loamy fine sand and gravelly loamy sand.

Included with this mapping are small areas of moderately well drained Skerry soils, areas of stony surfaces, slopes less than 8 percent and greater than 15 percent. These inclusions make up as much as 25 percent of the map unit.

143D- Monadnock very stony sandy loam, 15 to 25 percent slopes

This map unit consists of well drained soils that formed in loamy glacial till. It occurs on the shoulders of the upland areas within the mapping area.

Typically, the surface layer is dark reddish brown sandy loam about 2 inches thick. The subsoil is reddish gray, dark reddish brown, reddish brown, strong brown, dark yellowish brown, yellowish brown and light olive brown fine sandy loam, sandy loam and loamy sand about 26 inches thick. The substratum, to a depth of 40 inches or more, is light olive brown and olive brown gravelly loamy fine sand and gravelly loamy sand.

Included with this mapping are small areas of moderately well drained Skerry soils, areas of stony surfaces, slopes less than 15 percent and greater than 25 percent. These inclusions make up as much as 25 percent of the map unit.

143E- Monadnock very stony sandy loam, 25 to 45 percent slopes

This map unit consists of well drained soils that formed in loamy glacial till. It occurs on the shoulders of the upland areas within the mapping area.

Typically, the surface layer is dark reddish brown sandy loam about 2 inches thick. The subsoil is reddish gray, dark reddish brown, reddish brown, strong brown, dark yellowish brown, yellowish brown and light olive brown fine sandy loam, sandy loam, loamy sand and gravelly loamy sand about 26 inches thick. The substratum, to a depth of 40 inches or more, is light olive brown and olive brown gravelly loamy fine sand and gravelly loamy sand.

Included with this mapping are small areas of moderately well drained Skerry soils, areas of stony surfaces, slopes less than 25 percent and greater than 45 percent. These inclusions make up as much as 25 percent of the map unit.

199B- Dumps, bark chips, and organic matter, 0 to 8 percent slopes

This map unit consists of loamy soil materials with boulders, stones, stumps and woody debris. Undisturbed material is at a depth of more than 40 inches. There are no identifiable diagnostic horizons at a depth within 40 inches. It occurs as an apparent stump dump on the southeasterly portion of the mapping area

Included with this mapping are small areas of slopes greater than 8 percent. These inclusions make up as much as 10 percent of the map unit.

199C- Dumps, bark chips, and organic matter, 8 to 15 percent slopes

This map unit consists of loamy soil materials with boulders, stones and woody debris. Undisturbed material is at a depth of more than 40 inches. There are no identifiable diagnostic horizons at a depth within 40 inches. It occurs as an apparent stump dump on the southeasterly portion of the mapping area

Included with this mapping are small areas of slopes less than 8 percent. These inclusions make up as much as 10 percent of the map unit.

199D- Dumps, bark chips, and organic matter, 15 to 25 percent slopes

This map unit consists of loamy soil materials with boulders, stones, stumps and woody debris. Undisturbed material is at a depth of more than 40 inches. There are no identifiable diagnostic horizons at a depth within 40 inches. It occurs as an apparent stump dump on the southeasterly portion of the mapping area

Included with this mapping are small areas of slopes less than 15 percent and greater than 25 percent. These inclusions make up as much as 20 percent of the map unit.

199E- Dumps, bark chips, and organic matter, 25 to 50 percent slopes

This map unit consists of loamy soil materials with boulders, stones, stumps and woody debris. Undisturbed material is at a depth of more than 40 inches. There are no identifiable diagnostic horizons at a depth within 40 inches. It occurs as an apparent stump dump on the southeasterly portion of the mapping area

Included with this mapping are small areas of slopes less than 25 percent and greater than 50 percent. These inclusions make up as much as 20 percent of the map unit.

200E-Udorthents, refuse substratum, 25 to 50 percent slopes

This map unit represents alternating layers of soil and refuse/debris. There are no identifiable diagnostic horizons at a depth within 40 inches. It occurs as the side slope of the landfill on the westerly edge of the mapping area

Included with this mapping are small areas of slopes less than 25 percent and sandy fill materials. These inclusions make up as much as 20 percent of the map unit.

299B- Udorthents, smoothed, 3 to 8 percent slopes

This map unit consists of somewhat poorly to well drained soils that formed in loamy and loamy sand fill materials. Undisturbed material is at a depth of more than 40 inches. There are no identifiable diagnostic horizons at a depth within 40 inches. The soils range from fine sandy loam to loamy sand and their gravelly analogs.

Included with this mapping are small areas of slopes less than 3 percent and greater than 8 percent. These inclusions make up as much as 20 percent of the map unit.

299C- Udorthents, smoothed, 8 to 15 percent slopes

This map unit consists of moderately well to well drained soils that formed in loamy and loamy sand fill materials. Undisturbed material is at a depth of more than 40 inches. There are no identifiable diagnostic horizons at a depth within 40 inches. The soils range from fine sandy loam to loamy sand and their gravelly analogs.

Included with this mapping are small areas of slopes less than 8 percent and greater than 15 percent. These inclusions make up as much as 20 percent of the map unit.

299D- Udorthents, smoothed, 15 to 25 percent slopes

This map unit consists of moderately well to well drained soils that formed in loamy and loamy sand fill materials. Undisturbed material is at a depth of more than 40 inches. There are no identifiable diagnostic horizons at a depth within 40 inches. The soils range from fine sandy loam to loamy sand and their gravelly analogs.

Included with this mapping are small areas of slopes less than 15 percent and greater than 25 percent. These inclusions make up as much as 20 percent of the map unit.

299E- Udorthents, smoothed, 25 to 50 percent slopes

This map unit consists of moderately well to well drained soils that formed in loamy and loamy sand fill materials. Undisturbed material is at a depth of more than 40 inches. There are no identifiable diagnostic horizons at a depth within 40 inches. The soils range from fine sandy loam to loamy sand and their gravelly analogs.

Included with this mapping are small areas of slopes less than 25 percent and bouldery surfaces. These inclusions make up as much as 20 percent of the map unit.

395A- Chocorua mucky peat, 0 to 3 percent slopes

This map unit consists of very poorly drained soils that formed in organic materials over sandy glaciofluvial deposits. It occurs in a very broad swale in the extreme southeasterly corner of the mapping area.

Typically, the surface layer is black mucky peat about 24 inches thick. The substratum, to a depth of 40 inches or more, is light gray to dark greenish gray very fine sand to sand.

Included within this mapping are small areas of mucky peat less than 16 inches thick. These inclusions make up 10 percent of the map unit.

400B- Udorthents, sandy or gravelly, 3 to 8 percent slopes

This map unit consists of somewhat poorly drained soils that formed in excavated loamy sand glacial till. Undisturbed material is at the surface. It occurs in excavated swales within the mapping area. The soils range from loamy fine sand to loamy sand and their gravelly analogs.

Included with this mapping are small areas of slopes less than 3 percent. These inclusions make up as much as 10 percent of the map unit.

400C- Udorthents, sandy or gravelly, 8 to 15 percent slopes

This map unit consists of somewhat poorly drained soils that formed in excavated loamy sand glacial till. Undisturbed material is at the surface. It occurs in excavated swales within the mapping area. The soils range from loamy fine sand to loamy sand and their gravelly analogs.

Included with this mapping are small areas of slopes less than 8 percent. These inclusions make up as much as 10 percent of the map unit.

400E- Udorthents, sandy or gravelly, 25 to 50 percent slopes

This map unit consists of somewhat poorly to moderately well drained soils that formed in excavated loamy sand glacial till. Undisturbed material is at the surface. The soils range from loamy fine sand to loamy sand and their gravelly analogs.

Included with this mapping are small areas of slopes less than 25 percent. These inclusions make up as much as 10 percent of the map unit.

470B- Tunbridge-Peru Complex, 3 to 8 percent slopes

This map unit consists of somewhat poorly drained to moderately well drained soils that formed in loamy glacial till with variable depths to bedrock. The moderately deep well drained Tunbridge soils have bedrock at depths that range from 20 to 40 inches. The very deep moderately well drained Peru soils have bedrock that is greater than 40 inches. These gently sloping soils occur as areas so intermingled that mapping them separately was not practical. It occurs on the upper and lower slopes of uplands within the mapping area.

Typically, the surface layer is dark reddish brown sandy loam about 2 inches thick. The subsoil is reddish gray, dark reddish brown, reddish brown, strong brown, dark yellowish brown, yellowish brown, olive brown and light olive brown fine sandy loam, sandy loam, loamy sand and gravelly loamy sand about 23 inches thick. The substratum, to a depth of 40 inches or more, is light olive brown and olive brown gravelly loamy fine sand and gravelly loamy sand.

Included with this mapping are small areas of slopes less than 3 percent and greater than 8 percent, somewhat poorly drained Colonel soils and areas of very stony surfaces. These inclusions make up as much as 40 percent of the map unit.

470C- Tunbridge-Peru Complex, 8 to 15 percent slopes

This map unit consists of somewhat poorly drained to moderately well drained soils that formed in loamy glacial till with variable depths to bedrock. The moderately deep well drained Tunbridge soils have bedrock at depths that range from 20 to 40 inches. The very deep moderately well drained Peru soils have bedrock that is greater than 40 inches. These gently sloping soils occur as areas so intermingled that mapping them separately was not practical. It occurs on the upper and lower slopes of uplands

within the mapping area.

Typically, the surface layer is dark reddish brown sandy loam about 2 inches thick. The subsoil is reddish gray, dark reddish brown, reddish brown, strong brown, dark yellowish brown, yellowish brown, olive brown and light olive brown fine sandy loam, sandy loam, loamy sand and gravelly loamy sand about 23 inches thick. The substratum, to a depth of 40 inches or more, is light olive brown and olive brown gravelly loamy fine sand and gravelly loamy sand.

Included with this mapping are small areas of slopes less than 8 percent, somewhat poorly drained Colonel soils and areas of very stony surfaces. These inclusions make up as much as 40 percent of the map unit.

559B- Skerry very stony fine sandy loam, 3 to 8 percent slopes

This map unit consists of moderately well drained soils that formed in loamy sand glacial till. It occurs on the upland areas within the mapping area.

Typically, the surface layer is dark reddish brown sandy loam about 2 inches thick. The subsoil is reddish gray, dark reddish brown, reddish brown, strong brown, dark yellowish brown, yellowish brown, olive brown and light olive brown fine sandy loam, sandy loam, loamy sand and gravelly loamy sand about 23 inches thick. The substratum, to a depth of 40 inches or more, is light olive brown and olive brown gravelly loamy fine sand and gravelly loamy sand.

Included with this mapping are small areas of somewhat poorly drained Colonel soils, areas of stony surfaces, slopes less than 3 percent and greater than 8 percent. These inclusions make up as much as 25 percent of the map unit.

559C- Skerry very stony fine sandy loam, 8 to 15 percent slopes

This map unit consists of moderately well drained soils that formed in loamy sand glacial till. It occurs on the upland areas within the mapping area.

Typically, the surface layer is dark reddish brown sandy loam about 2 inches thick. The subsoil is reddish gray, dark reddish brown, reddish brown, strong brown, dark yellowish brown, yellowish brown, olive brown and light olive brown fine sandy loam, sandy loam, loamy sand and gravelly loamy sand about 23 inches thick. The substratum, to a depth of 40 inches or more, is light olive brown and olive brown gravelly loamy fine sand and gravelly loamy sand.

Included with this mapping are small areas of somewhat poorly drained Colonel soils, areas of stony surfaces, slopes less than 8 percent and greater than 15 percent. These inclusions make up as much as 20 percent of the map unit.

559D- Skerry very stony fine sandy loam, 15 to 25 percent slopes

This map unit consists of moderately well drained soils that formed in loamy sand glacial till. It occurs on the upland areas within the mapping area.

Typically, the surface layer is dark reddish brown sandy loam about 2 inches thick. The subsoil is reddish gray, dark reddish brown, reddish brown, strong brown, dark yellowish brown, yellowish brown, olive brown and light olive brown fine sandy loam, sandy loam, loamy sand and gravelly loamy sand about 23 inches thick. The substratum, to a depth of 40 inches or more, is light olive brown and olive brown gravelly loamy fine sand and gravelly loamy sand.

Included with this mapping are small areas of somewhat poorly drained Colonel soils, areas of stony surfaces and slopes less than 8 percent. These inclusions make up as much as 20 percent of the map unit.

647B- Pillsbury (poorly drained) very stony sandy loam, 0 to 8 percent slopes

This map unit consists of poorly drained soils that formed in loamy sand till. It occurs in swales and depressions within the mapping area.

Typically, the surface layer is black or very dark brown sandy loam about 4 inches thick. The subsoil is gray, dark reddish brown, dark brown, brown, grayish brown, olive brown and light olive brown sandy loam and loamy sand about 16 inches thick. The substratum, to a depth of 40 inches or more, is light olive brown and grayish brown loamy sand and gravelly loamy sand.

Included with this mapping are small areas of somewhat poorly drained Colonel soils and areas of stony surfaces. These inclusions make up as much as 20 percent of the map unit.

900B- Endoaquents, sandy or gravelly, 3 to 8 percent slopes

This map unit consists of poorly drained soils that formed in excavated loamy sand glacial till. Undisturbed material is at the surface. It occurs in excavated swales within the mapping area. The soils range from loamy fine sand to loamy sand and their gravelly analogs.

Included with this mapping are small areas of slopes less than 3 percent. These inclusions make up as much as 10 percent of the map unit.

947B- Colonel very stony sandy loam, 3 to 8 percent slopes

This map unit consists of somewhat poorly drained soils that formed in loamy sand till. It occurs on upland areas within the mapping area.

Typically, the surface layer is black or very dark brown sandy loam about 2 inches thick. The subsoil is dark reddish gray, dark reddish brown, dark brown, brown, grayish brown, olive brown and light olive brown sandy loam and loamy sand about 18 inches thick. The substratum, to a depth of 40 inches or more, is light olive brown and grayish brown loamy sand and gravelly loamy sand.

Included with this mapping are small areas of poorly drained Pillsbury soils, moderately well drained Skerry soils, areas of stony surfaces, slopes less than 3 percent and greater than 8 percent. These inclusions make up as much as 25 percent of the map

unit.

Hydrologic Soil Group Correlation:

In order to correlate the soil map units identified on the investigated portion of the project site to the appropriate hydrologic soil group we referenced the Society of Soil Scientists of Northern New England "Ksat Values for New Hampshire Soils, Special Publication No. 5, September 2009". The link to the above referenced publication is http://www.sssnne.org/publications.html . Below is the correlation of the identified soil map units to the appropriate hydrologic soil group.

Map Unit	Hydrologic Soil Group
143- Monadnock, very stony	B
199- Dumps, bark chips and organic matter	No Group- unsuitable
200- Udorthents, refuse substratum	No Group- unsuitable
299- Udorthents, smoothed	B
395- Chocorua	D
400- Udorthents, sandy or gravelly	C
470- Tunbridge-Peru Complex	C
559- Skerry, very stony	C
647- Pillsbury (poorly drained), very stony	C
900- Endoaquents, sandy or gravelly	D
947- Colonel, very stony	C

If you have any questions regarding the soils map or the investigation please do not hesitate to contact me at (603) 539-9152 or via e-mail at *wetsoil1@roadrunner.com* . Once the final plan is prepared I will review and sign the plan for submission. I thank you very much for the opportunity to provide my professional services to you.

Sincerely,

Gregory W. Howard, CSS
Soil Scientist

STATE OF NEW HAMPSHIRE
GREGORY
W.
HOWARD
NO. 032
CERTIFIED SOIL SCIENTIST
11/20/18

encl.
cc: File

CMAEngineersMtCarberryLandfillSoil2.word

State-Wide Numerical Soils Legend

143- Monadnock, very stony
199- Dumps, bark chips and organic matter
200- Udorthents, refuse substratum
299- Udorthents, smoothed
395- Chocorua
400- Udorthents, sandy or gravelly
470- Tunbridge-Peru Complex
559- Skerry, very stony
647- Pillsbury (poorly drained), very stony
900- Endoaquents, sandy or gravelly
947- Colonel, very stony

Supplemental Symbols

The five components of the Disturbed Soil Mapping Unit Supplement are as follows:

Symbol 1: Drainage Class

a - Excessively Drained
b - Somewhat Excessively Drained
c - Well Drained
d - Moderately Well Drained
e - Somewhat Poorly Drained
f - Poorly Drained
g - Very Poorly Drained
h - Not Determined

Symbol 2: Parent Material (of naturally formed soil only, if present)

a - No natural soil within 60"
b - Glaciofluvial Deposits (outwash/terraces of sand or sand and gravel)
c - Glacial Till Material (active ice)
d - Glaciolacustrine very fine sand and silt deposits (glacial lakes)
e - Loamy/sandy over Silt/Clay deposits
f - Marine Silt and Clay deposits (ocean waters)
g - Alluvial Deposits (floodplains)
h - Organic Materials-Fresh water Bogs, etc
j - Organic Materials-Tidal Marsh

Symbol 3: Restrictive/Impervious Layers

a - None
b - Bouldery surface with more than 15% of the surface covered with boulders
c - Mineral restrictive layer(s) are present in the soil profile less than 40 inches below the soil surface such as hard pan, platy structure or clayey texture with consistence of at least firm (i.e. more than 20 newtons). For other examples of soil characteristics that qualify for restrictive layers, see "Soil Manual for Site evaluations in NH" 2nd Ed., (page 3-17, figure 3-14)
d - Bedrock in the soil profile; 0-20 inches
e - Bedrock in the soil profile; 20-60 inches
f - Areas where depth to bedrock is so variable that a single soil type cannot be applied, will be mapped as a complex of soil types
g - Subject to Flooding
h – Man-made impervious surface including pavement, concrete, or built-up surfaces (i.e. buildings) with no morphological restrictive layer within control section

Symbol 4: Estimated Ksat* (most limiting layer excluding symbol 3h above).
a - High.
b - Moderate
c - Low
d - Not determined
*See "Guidelines for Ksat Class Placement" in Chapter 3 of the Soil Survey Manual, USDA

Symbol 5: Hydrologic Soil Group*
a - Group A
b - Group B
c - Group C
d - Group D
e - Not determined
*excluding man-made surface impervious/restrictive layers

CERTIFICATION

This Site-Specific Soil Map is a representation of a compilation of field data collected during July 18, 19, 25 and 26, 2017 and November 5, 2018 by North Country Soil Services. The Site-Specific Soil Map meets the standards set forth by Site-Specific Soil Mapping Standards for New Hampshire and Vermont, SSSNNE Special Publication No. 3, Version 4.0, February 2011 and Version 5.0 December 2017.

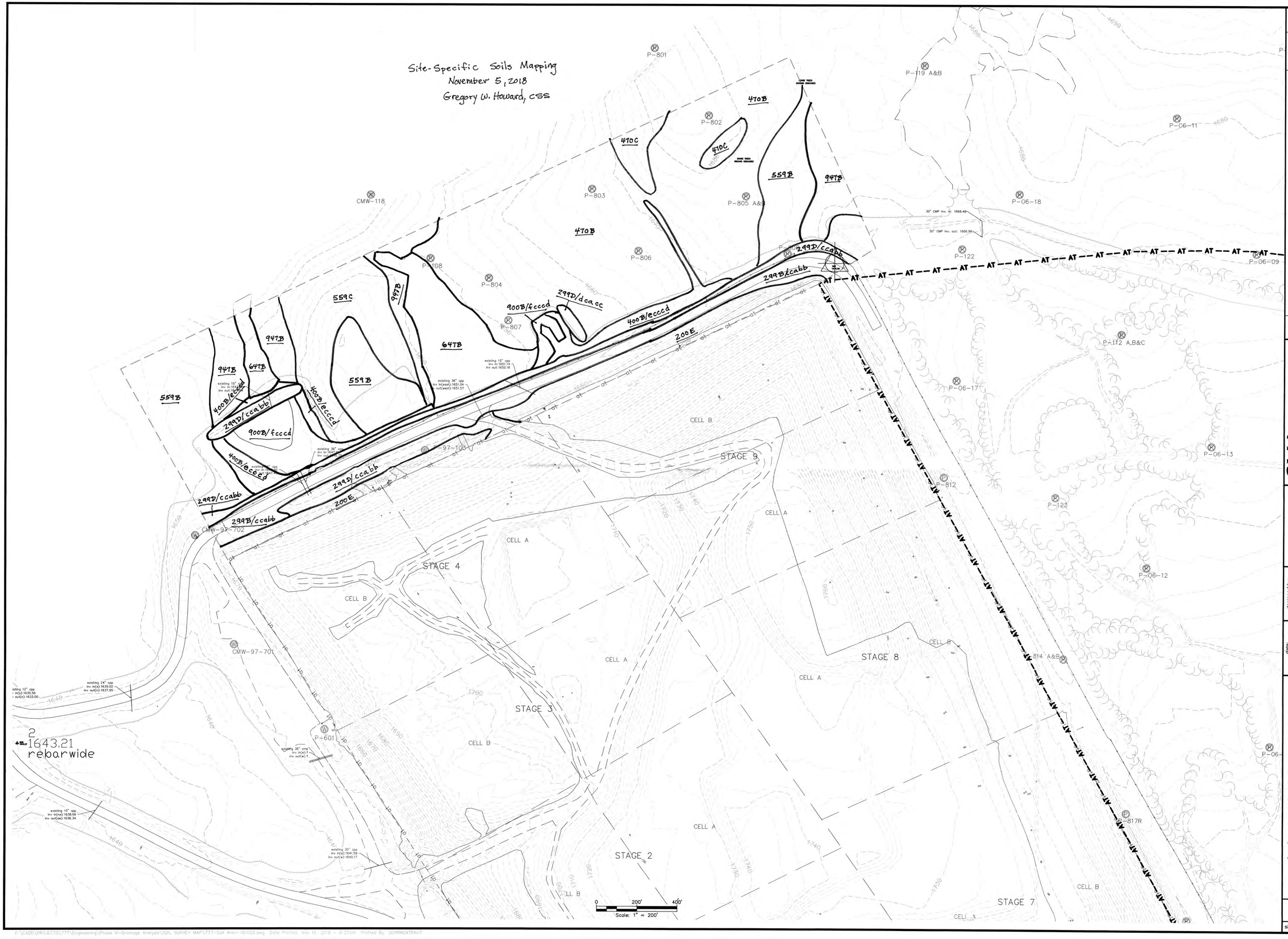
This map product is within the technical standards of the National Cooperative Soil Survey. It is a special purpose product intended for engineering of the project site. It was produced by a professional soil scientist, and is not a product of the USDA Natural Resource Conservation Service. There is a report that accompanies this map.

Every Aspect of this plan is based on my best knowledge and opinion thereof as of the date of this mapping.

_____ _____

Date Gregory W. Howard, Certified Soil Scientist #32

Site-Specific Soils Mapping
November 5, 2018
Gregory W. Howard, CSS



F:\CADD\PROJECTS\777\Engineering\Phase III-Drainage Analysis\SOIL SURVEY MAP\777-Soil Area-181029.dwg, Date Plotted: Nov 16, 2018 - 9:27am Plotted By: SEHRMENTRAUT

no.	revision	date	by

CMA ENGINEERS
Civil/Environmental/Structural
Portsmouth, NH • Manchester, NH • Portland, ME
603/431-6196 • 603/627-0708 • 207/541-4223
cmaengineers.com

designed by: PDS
drawn by: SJE
approved by: ###
date: October 2018
project no: 777
file name: 777-Soil Area-181029.dwg
scale: 100' 200' Scale: 1" = 100'

Androscoggin Valley Regional Refuse Disposal District
Mount Carberry Secure Landfill
Berlin, NH

Additional Soil Mapping

drawing no. #-##
sheet: 1 of 1

PDS

North Country Soil Services
Environmental Professionals

Letter of Transmittal

RECEIVED
DEC 7 2018
CMA ENGINEERS

Date: December 4, 2018

To: Mr. Paul Schmidt, P.E.
CMA Engineers
35 Bow Street
Portsmouth, NH 03801

From: Gregory W. Howard
North Country Soil Services
Voice: (603) 539-9152
e-mail: *wetsoil1@roadrunner.com*

Re: Site-Specific Soil Mapping of Phase III- Mt Carberry Landfill, Berlin, NH

We are sending the following:

Copies	Date	Description
1	12/4/2018	Site-Specific Soils mapping of Mount Carberry Landfill conducted by NCSS 11/5/2018

Dear Paul,

I have made the edits of the two soil maps located below the anchor trench on the north side of the landfill. If you have any questions please contact me. Thank you for patience.

Sincerely,

Gregory W. Howard, CWS

P.O. Box 442
West Ossipee, NH 03890
Voice: (603) 539-9152 e-mail: *wetsoil1@roadrunner.com*



sheet 1 of 1	drawing no. ###	Androscoggin Valley Regional Refuse Disposal District Mount Carberry Secure Landfall Berlin, NH Additional Soil Mapping	date: October 2018 · designed by: PDS · project no: 777 · drawn by: SJE · file name: 777-Soil Area-181029.dwg · approved by: ### · scale: 0 100' 200' Scale: 1" = 100'

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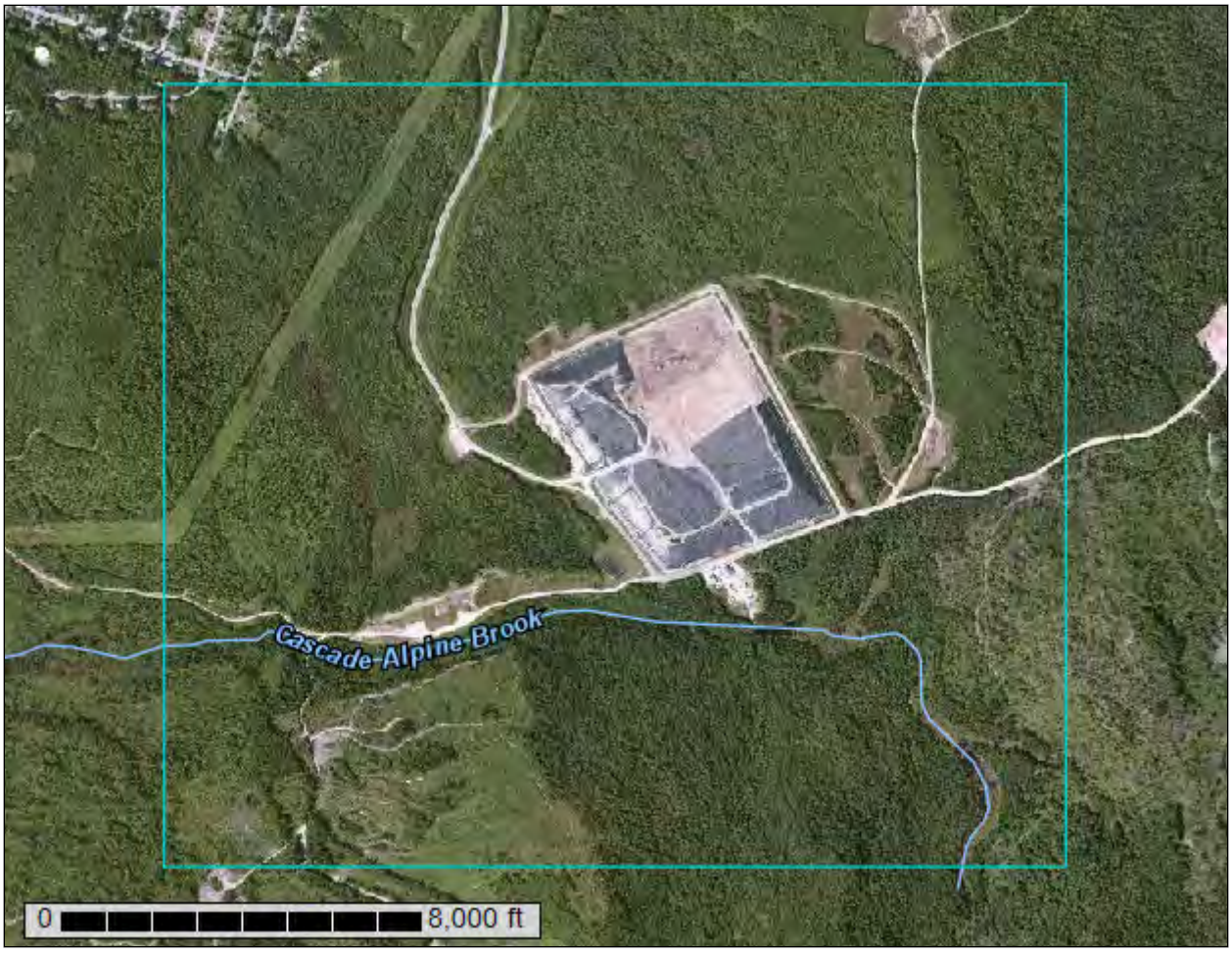
United States Department of Agriculture

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 Coos County Area, New Hampshire



March 2, 2017

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

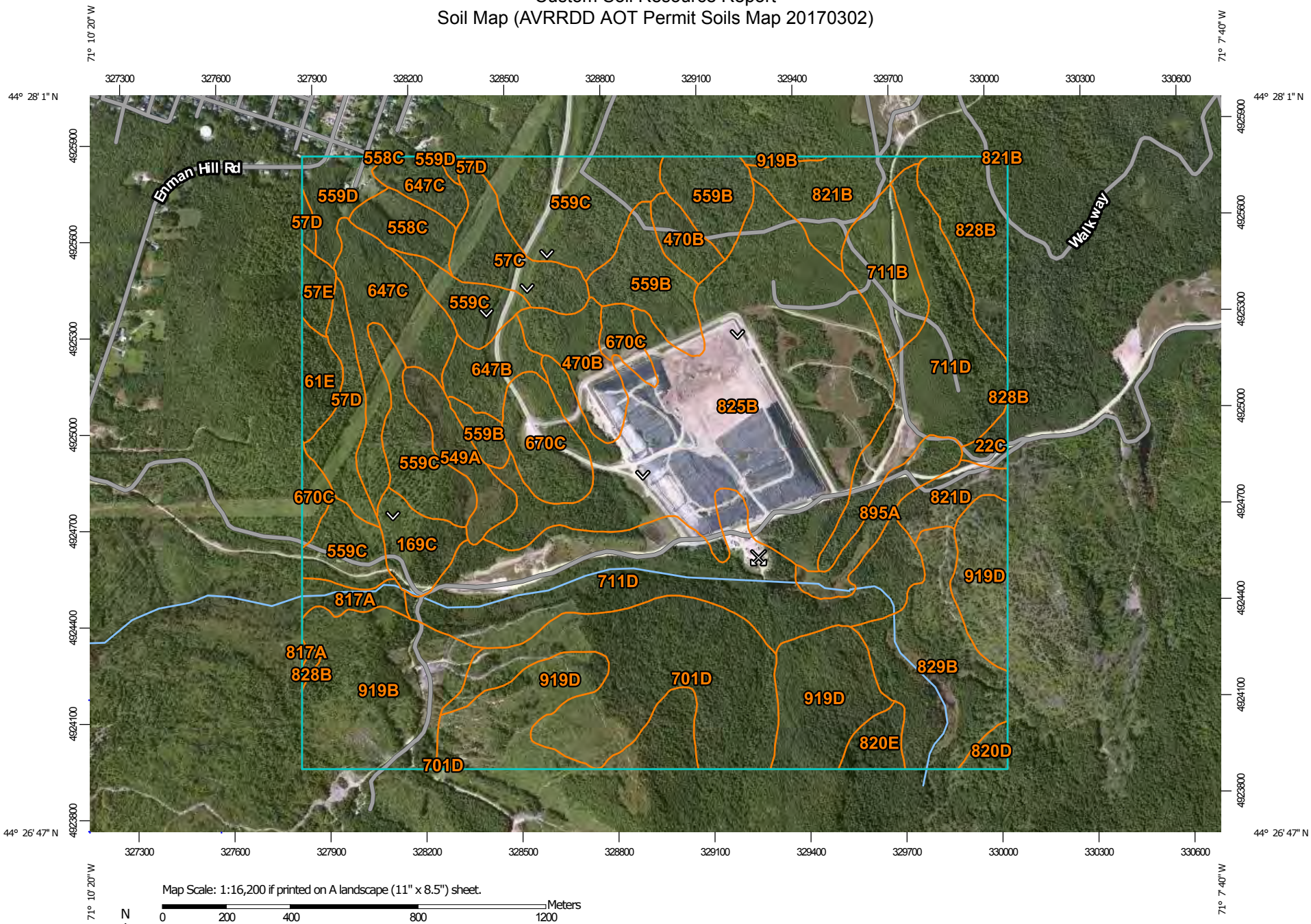
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map (AVRRDD AOT Permit Soils Map 20170302)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Coos County Area, New Hampshire
Survey Area Data: Version 22, Sep 15, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 19, 2010—Jul 16, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (AVRRDD AOT Permit Soils Map 20170302)

Coos County Area, New Hampshire (NH607)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
22C	Colton gravelly fine sandy loam, 8 to 15 percent slopes	3.8	0.4%
57C	Becket fine sandy loam, 8 to 15 percent slopes, very stony	21.1	2.0%
57D	Becket fine sandy loam, 15 to 25 percent slopes, very stony	18.6	1.8%
57E	Becket fine sandy loam, 25 to 35 percent slopes, very stony	5.4	0.5%
61E	Tunbridge-Lyman-Rock outcrop complex, 25 to 60 percent slopes	8.4	0.8%
169C	Sunapee fine sandy loam, 8 to 15 percent slopes, very stony	13.5	1.3%
470B	Tunbridge-Peru complex, 3 to 8 percent slopes	26.0	2.5%
549A	Peacham mucky peat, 0 to 8 percent slopes, very stony	14.6	1.4%
558C	Skerry fine sandy loam, 8 to 15 percent slopes	11.6	1.1%
559B	Skerry fine sandy loam, 3 to 8 percent slopes, very stony	40.0	3.8%
559C	Skerry fine sandy loam, 8 to 15 percent slopes, very stony	81.5	7.8%
559D	Skerry fine sandy loam, 15 to 25 percent slopes, very stony	12.7	1.2%
647B	Pillsbury fine sandy loam, 0 to 8 percent slopes, very stony	13.4	1.3%
647C	Pillsbury fine sandy loam, 8 to 15 percent slopes, very stony	42.2	4.0%
670C	Tunbridge-Berkshire-Lyman complex, 8 to 15 percent slopes	29.8	2.9%
701D	Becket-Skerry association, moderately steep, very stony	77.6	7.4%
711B	Monadnock-Hermon association, undulating, very stony	20.5	2.0%
711D	Monadnock-Hermon association, hilly, very stony	147.5	14.1%
817A	Moosilauke-Waumbek association, nearly level, very stony	7.1	0.7%

Coos County Area, New Hampshire (NH607)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
820D	Lyman-Tunbridge-Rock outcrop complex, moderately steep	3.4	0.3%
820E	Lyman-Tunbridge-Rock outcrop complex, steep	7.2	0.7%
821B	Marlow-Peru association, gently sloping, very stony	21.0	2.0%
821D	Marlow-Peru association, 15 to 35 percent slopes, very stony	11.2	1.1%
825B	Pillsbury-Peacham-Peru association, gently sloping, very stony	175.2	16.8%
828B	Skerry-Peru association, gently sloping, very stony	26.7	2.6%
829B	Waumbek-Hermon association, undulating, very stony	46.1	4.4%
895A	Bucksport muck, 0 to 2 percent slopes	14.7	1.4%
919B	Tunbridge-Lyman-Marlow association, gently sloping, very stony	55.9	5.4%
919D	Tunbridge-Lyman-Marlow association, moderately steep, very stony	86.9	8.3%
Totals for Area of Interest		**1,043.8**	**100.0%**

Map Unit Descriptions (AVRRDD AOT Permit Soils Map 20170302)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties

and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Coos County Area, New Hampshire

22C—Colton gravelly fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 9ds2
Elevation: 820 to 2,300 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 90 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Colton and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Colton

Setting

Landform: Terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified sandy and gravelly outwash

Typical profile

H1 - 0 to 6 inches: gravelly fine sandy loam
H2 - 6 to 18 inches: stratified very gravelly sandy loam
H3 - 18 to 65 inches: extremely gravelly coarse sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 99.90 in/hr)
Depth to water table: About 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Adams

Percent of map unit: 10 percent
Landform: Terraces
Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Sheepscot

Percent of map unit: 5 percent
Landform: Terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

57C—Becket fine sandy loam, 8 to 15 percent slopes, very stony

Map Unit Setting

National map unit symbol: 9dx6
Elevation: 820 to 2,490 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 90 to 135 days
Farmland classification: Farmland of local importance

Map Unit Composition

Becket and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Becket

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Basal melt-out till derived from granite and gneiss and/or basal melt-out till derived from schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
Oa - 2 to 4 inches: highly decomposed plant material
H1 - 4 to 26 inches: fine sandy loam
H2 - 26 to 38 inches: gravelly sandy loam
H3 - 38 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 8 to 15 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 16 to 39 inches to densic material

Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 24 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Skerry

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Peru

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Monadnock

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Marlow

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Tunbridge

Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder

Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Pillsbury

Percent of map unit: 1 percent
Landform: Depressions, hillslopes
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

57D—Becket fine sandy loam, 15 to 25 percent slopes, very stony

Map Unit Setting

National map unit symbol: 9dx7
Elevation: 820 to 2,490 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 90 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Becket and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Becket

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Basal melt-out till derived from granite and gneiss and/or basal melt-out till derived from schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
Oa - 2 to 4 inches: highly decomposed plant material
H1 - 4 to 26 inches: fine sandy loam
H2 - 26 to 38 inches: gravelly sandy loam
H3 - 38 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 15 to 25 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 16 to 39 inches to densic material

Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 24 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Skerry

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Monadnock

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Peru

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Marlow

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Pillsbury

Percent of map unit: 1 percent
Landform: Depressions, hillslopes
Landform position (two-dimensional): Toeslope, footslope

Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Tunbridge

Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

57E—Becket fine sandy loam, 25 to 35 percent slopes, very stony

Map Unit Setting

National map unit symbol: 9dx8
Elevation: 820 to 2,490 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 90 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Becket and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Becket

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Basal melt-out till derived from granite and gneiss and/or basal melt-out till derived from schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
Oa - 2 to 4 inches: highly decomposed plant material
H1 - 4 to 26 inches: fine sandy loam
H2 - 26 to 38 inches: gravelly sandy loam
H3 - 38 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 25 to 35 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 16 to 39 inches to densic material

Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 24 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Skerry

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Monadnock

Percent of map unit: 4 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Peru

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Tunbridge

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Marlow

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder

Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

61E—Tunbridge-Lyman-Rock outcrop complex, 25 to 60 percent slopes

Map Unit Setting

National map unit symbol: 2trph
Elevation: 430 to 2,490 feet
Mean annual precipitation: 31 to 95 inches
Mean annual air temperature: 27 to 52 degrees F
Frost-free period: 60 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Tunbridge, very stony, and similar soils: 42 percent
Lyman, very stony, and similar soils: 31 percent
Rock outcrop: 17 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tunbridge, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy supraglacial till derived from granite and gneiss and/or loamy supraglacial till derived from phyllite and/or loamy supraglacial till derived from mica schist

Typical profile

Oe - 0 to 3 inches: moderately decomposed plant material
Oa - 3 to 5 inches: highly decomposed plant material
E - 5 to 8 inches: fine sandy loam
Bhs - 8 to 11 inches: fine sandy loam
Bs - 11 to 26 inches: fine sandy loam
BC - 26 to 28 inches: fine sandy loam
R - 28 to 38 inches: bedrock

Properties and qualities

Slope: 25 to 60 percent
Percent of area covered with surface fragments: 1.5 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 14.03 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Lyman, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy supraglacial till derived from granite and gneiss and/or loamy supraglacial till derived from phyllite and/or loamy supraglacial till derived from mica schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: loam
E - 3 to 5 inches: fine sandy loam
Bhs - 5 to 7 inches: loam
Bs1 - 7 to 11 inches: loam
Bs2 - 11 to 18 inches: channery loam
R - 18 to 28 inches: bedrock

Properties and qualities

Slope: 25 to 60 percent
Percent of area covered with surface fragments: 1.5 percent
Depth to restrictive feature: 11 to 24 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 14.03 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 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank, free face, free face, side slope

Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Igneous and metamorphic rock

Typical profile

R - 0 to 10 inches: bedrock

Properties and qualities

Slope: 25 to 60 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Capacity of the most limiting layer to transmit water (Ksat): Very low to very high (0.00 to 14.17 in/hr)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Minor Components

Peru, very stony

Percent of map unit: 6 percent
Landform: Hills, mountains
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainflank, side slope
Microfeatures of landform position: Open depressions, open depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Moosilauke, very stony

Percent of map unit: 3 percent
Landform: Hills, mountains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Mountainflank, side slope
Microfeatures of landform position: Open depressions, open depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Monadnock, very stony

Percent of map unit: 1 percent
Landform: Hills, mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

169C—Sunapee fine sandy loam, 8 to 15 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2trs8
Elevation: 690 to 2,200 feet
Mean annual precipitation: 31 to 95 inches
Mean annual air temperature: 27 to 52 degrees F
Frost-free period: 90 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Sunapee, very stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sunapee, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainflank, mountainbase, side slope, nose slope, interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy supraglacial meltout till derived from phyllite and/or granite and gneiss and/or mica schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 3 inches: fine sandy loam
E - 3 to 5 inches: gravelly fine sandy loam
Bhs - 5 to 6 inches: gravelly fine sandy loam
Bs1 - 6 to 8 inches: gravelly fine sandy loam
Bs2 - 8 to 17 inches: gravelly fine sandy loam
Bs3 - 17 to 26 inches: gravelly fine sandy loam
C1 - 26 to 38 inches: gravelly sandy loam
C2 - 38 to 65 inches: gravelly sandy loam

Properties and qualities

Slope: 8 to 15 percent
Percent of area covered with surface fragments: 1.1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.03 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None

Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 7.8 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Lyme, very stony
Percent of map unit: 6 percent
Landform: Hills, mountains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Mountainbase, mountainflank, interfluve, side slope, nose slope
Microfeatures of landform position: Open depressions, open depressions, closed depressions, closed depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Berkshire, very stony
Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Mountainflank, mountainbase, side slope, nose slope, interfluve
Microfeatures of landform position: Rises, rises
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Peru, very stony
Percent of map unit: 2 percent
Landform: Hills, mountains
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainflank, mountainbase, interfluve, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Monadnock, very stony
Percent of map unit: 2 percent
Landform: Hills, mountains
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Mountainbase, mountainflank, side slope, nose slope, interfluve
Microfeatures of landform position: Rises, rises
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

470B—Tunbridge-Peru complex, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9dtl
Elevation: 820 to 2,490 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 90 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Tunbridge and similar soils: 40 percent
Peru and similar soils: 35 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tunbridge

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex

Typical profile

H1 - 0 to 2 inches: silt loam
H2 - 2 to 25 inches: silt loam
H3 - 25 to 34 inches: cobbly fine sandy loam
R - 34 to 38 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to high (0.01 to 6.00 in/hr)
Depth to water table: About 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Peru

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Lodgment till derived from granite and gneiss

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
H1 - 2 to 4 inches: fine sandy loam
H2 - 4 to 18 inches: fine sandy loam
H3 - 18 to 65 inches: fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 18 to 39 inches to densic material
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Monadnock

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Berkshire

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Marlow

Percent of map unit: 5 percent
Landform: Hillslopes

Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Lyman

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Skerry

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Waumbek

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

549A—Peacham mucky peat, 0 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2ty6t
Elevation: 430 to 1,970 feet
Mean annual precipitation: 31 to 95 inches
Mean annual air temperature: 27 to 52 degrees F
Frost-free period: 70 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Peacham, very stony, and similar soils: 78 percent
Minor components: 22 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peacham, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Mountainbase, interfluve, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Organic material over loamy lodgment till derived from schist and/or loamy lodgment till derived from granite and gneiss and/or loamy lodgment till derived from phyllite

Typical profile

Oe - 0 to 2 inches: mucky peat
Oa - 2 to 10 inches: muck
Bg - 10 to 15 inches: fine sandy loam
Cdg1 - 15 to 31 inches: fine sandy loam
Cdg2 - 31 to 65 inches: sandy loam

Properties and qualities

Slope: 0 to 8 percent
Percent of area covered with surface fragments: 1.1 percent
Depth to restrictive feature: 12 to 35 inches to densic material
Natural drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Hydric soil rating: Yes

Minor Components

Cabot, very stony

Percent of map unit: 11 percent
Landform: Hills, mountains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Mountainbase, interfluve, base slope
Microfeatures of landform position: Rises, rises
Down-slope shape: Concave, convex
Across-slope shape: Concave, convex
Hydric soil rating: Yes

Wonsqueak

Percent of map unit: 8 percent
Landform: Hills, mountains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Mountainbase, interfluve, base slope

Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Bucksport

Percent of map unit: 2 percent
Landform: Hills, mountains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Mountainbase, interfluve, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Searsport

Percent of map unit: 1 percent
Landform: Hills, mountains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Mountainbase, interfluve, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

558C—Skerry fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 9dvh
Elevation: 820 to 2,490 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 90 to 135 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Skerry and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Skerry

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Basal melt-out till derived from granite and gneiss and/or basal melt-out till derived from schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
Oe - 2 to 4 inches: moderately decomposed plant material

H1 - 4 to 8 inches: fine sandy loam
H2 - 8 to 26 inches: gravelly fine sandy loam
H3 - 26 to 31 inches: gravelly loamy sand
H4 - 31 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 18 to 39 inches to densic material
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Peru

Percent of map unit: 8 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Becket

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Monadnock

Percent of map unit: 4 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Pillsbury

Percent of map unit: 3 percent
Landform: Depressions, hillslopes
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Side slope, base slope

Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

559B—Skerry fine sandy loam, 3 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: 9dvk
Elevation: 820 to 2,490 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 90 to 135 days
Farmland classification: Farmland of local importance

Map Unit Composition

Skerry and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Skerry

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Basal melt-out till derived from granite and gneiss and/or basal melt-out till derived from schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
Oe - 2 to 4 inches: moderately decomposed plant material
H1 - 4 to 8 inches: fine sandy loam
H2 - 8 to 26 inches: gravelly fine sandy loam
H3 - 26 to 31 inches: gravelly loamy sand
H4 - 31 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 18 to 39 inches to densic material
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Peru

Percent of map unit: 8 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Becket

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Pillsbury

Percent of map unit: 4 percent
Landform: Depressions, hillslopes
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Monadnock

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

559C—Skerry fine sandy loam, 8 to 15 percent slopes, very stony

Map Unit Setting

National map unit symbol: 9dvl
Elevation: 820 to 2,490 feet
Mean annual precipitation: 40 to 50 inches

Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 90 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Skerry and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Skerry

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Basal melt-out till derived from granite and gneiss and/or basal melt-out till derived from schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
Oe - 2 to 4 inches: moderately decomposed plant material
H1 - 4 to 8 inches: fine sandy loam
H2 - 8 to 26 inches: gravelly fine sandy loam
H3 - 26 to 31 inches: gravelly loamy sand
H4 - 31 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 8 to 15 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 18 to 39 inches to densic material
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Peru

Percent of map unit: 8 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Becket

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Monadnock

Percent of map unit: 4 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Pillsbury

Percent of map unit: 3 percent
Landform: Depressions, hillslopes
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

559D—Skerry fine sandy loam, 15 to 25 percent slopes, very stony

Map Unit Setting

National map unit symbol: 9dvm
Elevation: 820 to 2,490 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 90 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Skerry and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Skerry

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave

Parent material: Basal melt-out till derived from granite and gneiss and/or basal melt-out till derived from schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
Oe - 2 to 4 inches: moderately decomposed plant material
H1 - 4 to 8 inches: fine sandy loam
H2 - 8 to 26 inches: gravelly fine sandy loam
H3 - 26 to 31 inches: gravelly loamy sand
H4 - 31 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 15 to 25 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 18 to 39 inches to densic material
Natural drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Peru

Percent of map unit: 8 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Becket

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Monadnock

Percent of map unit: 4 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex

Hydric soil rating: No

Pillsbury

Percent of map unit: 3 percent
Landform: Depressions, hillslopes
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

647B—Pillsbury fine sandy loam, 0 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2ty6x
Elevation: 360 to 2,070 feet
Mean annual precipitation: 31 to 95 inches
Mean annual air temperature: 27 to 52 degrees F
Frost-free period: 90 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Pillsbury, very stony, and similar soils: 79 percent
Minor components: 21 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pillsbury, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Mountainbase, base slope, interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy lodgment till derived from gneiss and/or loamy lodgment till derived from mica schist and/or loamy lodgment till derived from granite

Typical profile

Oe - 0 to 1 inches: mucky peat
A - 1 to 6 inches: fine sandy loam
Bg1 - 6 to 13 inches: cobbly fine sandy loam
Bg2 - 13 to 23 inches: cobbly fine sandy loam
Cd - 23 to 65 inches: cobbly fine sandy loam

Properties and qualities

Slope: 0 to 8 percent
Percent of area covered with surface fragments: 1.1 percent
Depth to restrictive feature: 21 to 43 inches to densic material
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.01 to 1.42 in/hr)

Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 3.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Hydric soil rating: Yes

Minor Components

Peru, very stony

Percent of map unit: 9 percent
Landform: Hills, mountains
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainbase, interfluve, base slope
Microfeatures of landform position: Rises, rises
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Peacham, very stony

Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Mountainbase, base slope, interfluve
Microfeatures of landform position: Closed depressions, closed depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Wonsqueak

Percent of map unit: 4 percent
Landform: Hills, mountains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Mountainbase, base slope, interfluve
Microfeatures of landform position: Closed depressions, closed depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Lyman, very stony

Percent of map unit: 3 percent
Landform: Hills, mountains
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Mountainbase, interfluve, base slope
Microfeatures of landform position: Rises, rises
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

647C—Pillsbury fine sandy loam, 8 to 15 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2trrf
Elevation: 850 to 1,900 feet
Mean annual precipitation: 31 to 95 inches
Mean annual air temperature: 27 to 52 degrees F
Frost-free period: 90 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Pillsbury, very stony, and similar soils: 79 percent
Minor components: 21 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pillsbury, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Mountainbase, base slope, interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy lodgment till derived from gneiss and/or loamy lodgment till derived from mica schist and/or loamy lodgment till derived from granite

Typical profile

Oe - 0 to 1 inches: mucky peat
A - 1 to 6 inches: fine sandy loam
Bg1 - 6 to 13 inches: cobbly fine sandy loam
Bg2 - 13 to 23 inches: cobbly fine sandy loam
Cd - 23 to 65 inches: cobbly fine sandy loam

Properties and qualities

Slope: 8 to 15 percent
Percent of area covered with surface fragments: 1.1 percent
Depth to restrictive feature: 21 to 43 inches to densic material
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.01 to 1.42 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 3.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: D
Hydric soil rating: Yes

Minor Components

Peru, very stony
Percent of map unit: 9 percent
Landform: Hills, mountains
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainbase, interfluve, base slope
Microfeatures of landform position: Rises, rises
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Peacham, very stony
Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Mountainbase, base slope, interfluve
Microfeatures of landform position: Closed depressions, closed depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Wonsqueak
Percent of map unit: 4 percent
Landform: Hills, mountains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Mountainbase, base slope, interfluve
Microfeatures of landform position: Closed depressions, closed depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Lyman, very stony
Percent of map unit: 3 percent
Landform: Hills, mountains
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Mountainbase, interfluve, base slope
Microfeatures of landform position: Rises, rises
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

670C—Tunbridge-Berkshire-Lyman complex, 8 to 15 percent slopes

Map Unit Setting
National map unit symbol: 9dy5
Elevation: 820 to 2,490 feet
Mean annual precipitation: 40 to 50 inches

Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 90 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Tunbridge and similar soils: 45 percent
Berkshire and similar soils: 20 percent
Lyman and similar soils: 15 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tunbridge

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex

Typical profile

H1 - 0 to 2 inches: silt loam
H2 - 2 to 25 inches: silt loam
H3 - 25 to 34 inches: cobbly fine sandy loam
R - 34 to 38 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to high (0.01 to 6.00 in/hr)
Depth to water table: About 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Berkshire

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Ablation till derived from granite and gneiss

Typical profile

Oe - 0 to 4 inches: moderately decomposed plant material
H1 - 4 to 10 inches: fine sandy loam

H2 - 10 to 24 inches: very fine sandy loam
H3 - 24 to 65 inches: very fine sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Hydric soil rating: No

Description of Lyman

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Ablation till derived from mica schist and/or ablation till derived from granite and gneiss

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
H1 - 1 to 4 inches: fine sandy loam
H2 - 4 to 13 inches: fine sandy loam
H3 - 13 to 16 inches: gravelly fine sandy loam
R - 16 to 20 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Low to high (0.01 to 5.95 in/hr)
Depth to water table: About 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Sunapee

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Monadnock

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Peru

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Marlow

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Skerry

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

701D—Becket-Skerry association, moderately steep, very stony

Map Unit Setting

National map unit symbol: 9dyb
Elevation: 820 to 2,490 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 90 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Becket and similar soils: 65 percent
Skerry and similar soils: 15 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Becket

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Basal melt-out till derived from granite and gneiss and/or basal melt-out till derived from schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
Oa - 2 to 4 inches: highly decomposed plant material
H1 - 4 to 26 inches: fine sandy loam
H2 - 26 to 38 inches: gravelly sandy loam
H3 - 38 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 16 to 39 inches to densic material
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 24 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Skerry

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Basal melt-out till derived from granite and gneiss and/or basal melt-out till derived from schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
Oe - 2 to 4 inches: moderately decomposed plant material
H1 - 4 to 8 inches: fine sandy loam
H2 - 8 to 26 inches: gravelly fine sandy loam
H3 - 26 to 31 inches: gravelly loamy sand
H4 - 31 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 18 to 39 inches to densic material
Natural drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Monadnock

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Pillsbury

Percent of map unit: 5 percent

Landform: Depressions, hillslopes
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Tunbridge

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Marlow

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

711B—Monadnock-Hermon association, undulating, very stony

Map Unit Setting

National map unit symbol: 9dyd
Elevation: 820 to 2,490 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 90 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Monadnock and similar soils: 45 percent
Hermon and similar soils: 30 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Monadnock

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex

Parent material: Ablation till derived from granite and gneiss

Typical profile

Oe - 0 to 3 inches: moderately decomposed plant material
H1 - 3 to 8 inches: fine sandy loam
H2 - 8 to 25 inches: gravelly fine sandy loam
H3 - 25 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 15 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Hermon

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy-skeletal supraglacial meltout till derived from granite and gneiss

Typical profile

Oe - 0 to 3 inches: moderately decomposed plant material
H1 - 3 to 9 inches: fine sandy loam
H2 - 9 to 16 inches: very gravelly loamy sand
H3 - 16 to 65 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 15 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (1.98 to 19.98 in/hr)
Depth to water table: About 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Berkshire

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Becket

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Sunapee

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Lyme

Percent of map unit: 3 percent
Landform: Depressions, hillslopes
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Waumbek

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Moosilauke

Percent of map unit: 2 percent
Landform: Ground moraines, depressions
Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Lyman

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

711D—Monadnock-Hermon association, hilly, very stony

Map Unit Setting

National map unit symbol: 9dyf
Elevation: 820 to 2,490 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 90 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Monadnock and similar soils: 45 percent
Hermon and similar soils: 30 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Monadnock

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Ablation till derived from granite and gneiss

Typical profile

Oe - 0 to 3 inches: moderately decomposed plant material
H1 - 3 to 8 inches: fine sandy loam
H2 - 8 to 25 inches: gravelly fine sandy loam
H3 - 25 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Hermon

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy-skeletal supraglacial meltout till derived from granite and gneiss

Typical profile

Oe - 0 to 3 inches: moderately decomposed plant material
H1 - 3 to 9 inches: fine sandy loam
H2 - 9 to 16 inches: very gravelly loamy sand
H3 - 16 to 65 inches: very gravelly loamy sand

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (1.98 to 19.98 in/hr)
Depth to water table: About 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Sunapee

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Becket

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Berkshire

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Waumbek

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Lyme

Percent of map unit: 3 percent
Landform: Depressions, hillslopes
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Lyman

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Moosilauke

Percent of map unit: 2 percent
Landform: Ground moraines, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Concave
Across-slope shape: Concave

Hydric soil rating: Yes

817A—Moosilauke-Waumbek association, nearly level, very stony

Map Unit Setting

National map unit symbol: 9f0l
Elevation: 790 to 2,490 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 90 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Moosilauke and similar soils: 65 percent
Waumbek and similar soils: 15 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Moosilauke

Setting

Landform: Ground moraines, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Drift derived from granite and gneiss and/or outwash

Typical profile

H1 - 0 to 7 inches: loam
H2 - 7 to 18 inches: gravelly sandy loam
H3 - 18 to 65 inches: very gravelly sand

Properties and qualities

Slope: 0 to 8 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A/D

Hydric soil rating: Yes

Description of Waumbek

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Ablation till derived from granite and gneiss

Typical profile

H1 - 0 to 9 inches: sandy loam
H2 - 9 to 24 inches: gravelly sandy loam
H3 - 24 to 65 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 8 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (2.00 to 20.00 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Skerry

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Sunapee

Percent of map unit: 4 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Lyme

Percent of map unit: 3 percent

Landform: Depressions, hillslopes
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Peru

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Peacham

Percent of map unit: 3 percent
Landform: Depressions, hillslopes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Pondicherry

Percent of map unit: 2 percent
Landform: Bogs, swamps, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

820D—Lyman-Tunbridge-Rock outcrop complex, moderately steep

Map Unit Setting

National map unit symbol: 9f0n
Elevation: 820 to 6,290 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 30 to 46 degrees F
Frost-free period: 30 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Lyman and similar soils: 40 percent
Tunbridge and similar soils: 25 percent
Rock outcrop: 20 percent
Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lyman

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Ablation till derived from mica schist and/or ablation till derived from granite and gneiss

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
H1 - 1 to 4 inches: fine sandy loam
H2 - 4 to 13 inches: fine sandy loam
H3 - 13 to 16 inches: gravelly fine sandy loam
R - 16 to 20 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Low to high (0.01 to 5.95 in/hr)
Depth to water table: About 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Tunbridge

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex

Typical profile

H1 - 0 to 2 inches: silt loam
H2 - 2 to 25 inches: silt loam
H3 - 25 to 34 inches: cobbly fine sandy loam
R - 34 to 38 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock

Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to high (0.01 to 6.00 in/hr)
Depth to water table: About 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Rock Outcrop

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Minor Components

Moosilauke

Percent of map unit: 5 percent
Landform: Ground moraines, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Monadnock

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Sunapee

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

820E—Lyman-Tunbridge-Rock outcrop complex, steep

Map Unit Setting

National map unit symbol: 9f0p
Elevation: 820 to 6,290 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 30 to 46 degrees F
Frost-free period: 30 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Lyman and similar soils: 40 percent
Tunbridge and similar soils: 25 percent
Rock outcrop: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lyman

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Ablation till derived from mica schist and/or ablation till derived from granite and gneiss

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
H1 - 1 to 4 inches: fine sandy loam
H2 - 4 to 13 inches: fine sandy loam
H3 - 13 to 16 inches: gravelly fine sandy loam
R - 16 to 20 inches: unweathered bedrock

Properties and qualities

Slope: 35 to 60 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Low to high (0.01 to 5.95 in/hr)
Depth to water table: About 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Tunbridge

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex

Typical profile

H1 - 0 to 2 inches: silt loam
H2 - 2 to 25 inches: silt loam
H3 - 25 to 34 inches: cobbly fine sandy loam
R - 34 to 38 inches: unweathered bedrock

Properties and qualities

Slope: 35 to 50 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to high (0.01 to 6.00 in/hr)
Depth to water table: About 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Rock Outcrop

Properties and qualities

Slope: 35 to 60 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Minor Components

Monadnock

Percent of map unit: 8 percent
Landform: Hillslopes

Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Sunapee

Percent of map unit: 7 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

821B—Marlow-Peru association, gently sloping, very stony

Map Unit Setting

National map unit symbol: 9f0q
Elevation: 820 to 2,490 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 90 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Marlow and similar soils: 55 percent
Peru and similar soils: 25 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Marlow

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Basal lodgement till derived from granite and gneiss and/or basal lodgement till derived from schist

Typical profile

Oa - 0 to 5 inches: highly decomposed plant material
H1 - 5 to 9 inches: gravelly fine sandy loam
H2 - 9 to 19 inches: fine sandy loam
H3 - 19 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 15 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 19 to 27 inches to densic material
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 24 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Peru

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Lodgment till derived from granite and gneiss

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
H1 - 2 to 4 inches: fine sandy loam
H2 - 4 to 18 inches: fine sandy loam
H3 - 18 to 65 inches: fine sandy loam

Properties and qualities

Slope: 0 to 15 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 18 to 39 inches to densic material
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Sunapee

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Berkshire

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Skerry

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Monadnock

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Pillsbury

Percent of map unit: 2 percent
Landform: Depressions, hillslopes
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Tunbridge

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Peacham

Percent of map unit: 1 percent
Landform: Depressions, hillslopes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

821D—Marlow-Peru association, 15 to 35 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2w9ng
Elevation: 360 to 2,660 feet
Mean annual precipitation: 31 to 95 inches
Mean annual air temperature: 27 to 52 degrees F
Frost-free period: 90 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Marlow, very stony, and similar soils: 50 percent
Peru, very stony, and similar soils: 36 percent
Minor components: 14 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Marlow, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountainflank, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy lodgment till derived from granite and/or loamy lodgment till derived from mica schist and/or loamy lodgment till derived from phyllite

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 5 inches: fine sandy loam
E - 5 to 8 inches: fine sandy loam
Bs1 - 8 to 15 inches: fine sandy loam
Bs2 - 15 to 19 inches: fine sandy loam
BC - 19 to 33 inches: gravelly fine sandy loam
Cd - 33 to 65 inches: fine sandy loam

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 1.1 percent
Depth to restrictive feature: 20 to 41 inches to densic material

Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.01 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 5.1 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Peru, Very Stony

Setting
Landform: Hills, mountains
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainflank, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy lodgment till derived from granite and/or loamy lodgment till derived from mica schist and/or loamy lodgment till derived from phyllite

Typical profile
Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 5 inches: fine sandy loam
E - 5 to 6 inches: fine sandy loam
Bs1 - 6 to 7 inches: fine sandy loam
Bs2 - 7 to 13 inches: fine sandy loam
Bs3 - 13 to 18 inches: fine sandy loam
BC - 18 to 21 inches: fine sandy loam
Cd1 - 21 to 37 inches: fine sandy loam
Cd2 - 37 to 65 inches: fine sandy loam

Properties and qualities
Slope: 15 to 35 percent
Percent of area covered with surface fragments: 1.1 percent
Depth to restrictive feature: 21 to 43 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.01 to 1.42 in/hr)
Depth to water table: About 17 to 34 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Colonel, very stony

Percent of map unit: 5 percent
Landform: Open depressions on mountains, open depressions on hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Mountainflank, nose slope, side slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Hydric soil rating: No

Tunbridge, very stony

Percent of map unit: 4 percent
Landform: Hills, mountains
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Mountainflank, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Brayton, very stony

Percent of map unit: 3 percent
Landform: Open depressions on mountains, open depressions on hills
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Mountainflank, side slope, nose slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Lyman, very stony

Percent of map unit: 2 percent
Landform: Hills, mountains
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Mountainflank, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

825B—Pillsbury-Peacham-Peru association, gently sloping, very stony

Map Unit Setting

National map unit symbol: 9f0t
Elevation: 790 to 2,490 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 90 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Pillsbury and similar soils: 45 percent
Peacham and similar soils: 20 percent
Peru and similar soils: 15 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pillsbury

Setting

Landform: Depressions, hillslopes
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Basal lodgement till derived from granite and gneiss and/or basal lodgement till derived from schist

Typical profile

H1 - 0 to 7 inches: gravelly sandy loam
H2 - 7 to 23 inches: gravelly sandy loam
H3 - 23 to 65 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 15 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 16 to 39 inches to densic material
Natural drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: Yes

Description of Peacham

Setting

Landform: Depressions, hillslopes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Basal lodgement till derived from granite and gneiss and/or basal lodgement till derived from schist

Typical profile

Oa - 0 to 11 inches: muck
H1 - 11 to 23 inches: silt loam

H2 - 23 to 65 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 11 to 27 inches to densic material
Natural drainage class: Very poorly drained
Runoff class: High
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: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: D
Hydric soil rating: Yes

Description of Peru

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Lodgment till derived from granite and gneiss

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
H1 - 2 to 4 inches: fine sandy loam
H2 - 4 to 18 inches: fine sandy loam
H3 - 18 to 65 inches: fine sandy loam

Properties and qualities

Slope: 0 to 15 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 18 to 39 inches to densic material
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Marlow

Percent of map unit: 6 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Tunbridge

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Wonsqueak

Percent of map unit: 2 percent
Landform: Bogs, swamps, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Lyme

Percent of map unit: 2 percent
Landform: Depressions, hillslopes
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Bucksport

Percent of map unit: 2 percent
Landform: Bogs, swamps, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Pondicherry

Percent of map unit: 2 percent
Landform: Bogs, swamps, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Searsport

Percent of map unit: 1 percent
Landform: Outwash terraces, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

828B—Skerry-Peru association, gently sloping, very stony

Map Unit Setting

National map unit symbol: 9f0v
Elevation: 820 to 2,490 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 90 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Skerry and similar soils: 55 percent
Peru and similar soils: 15 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Skerry

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Basal melt-out till derived from granite and gneiss and/or basal melt-out till derived from schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
Oe - 2 to 4 inches: moderately decomposed plant material
H1 - 4 to 8 inches: fine sandy loam
H2 - 8 to 26 inches: gravelly fine sandy loam
H3 - 26 to 31 inches: gravelly loamy sand
H4 - 31 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 0 to 15 percent
Percent of area covered with surface fragments: 1.6 percent

Depth to restrictive feature: 18 to 39 inches to densic material
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Peru

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Lodgment till derived from granite and gneiss

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
H1 - 2 to 4 inches: fine sandy loam
H2 - 4 to 18 inches: fine sandy loam
H3 - 18 to 65 inches: fine sandy loam

Properties and qualities

Slope: 0 to 15 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 18 to 39 inches to densic material
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Pillsbury

Percent of map unit: 10 percent
Landform: Depressions, hillslopes
Landform position (two-dimensional): Toeslope, footslope

Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Becket

Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Marlow

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Lyman

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Moosilauke

Percent of map unit: 2 percent
Landform: Ground moraines, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

829B—Waumbek-Hermon association, undulating, very stony

Map Unit Setting

National map unit symbol: 9f0x
Elevation: 820 to 2,490 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 90 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Waumbek and similar soils: 60 percent
Hermon and similar soils: 20 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Waumbek

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Ablation till derived from granite and gneiss

Typical profile

H1 - 0 to 9 inches: sandy loam
H2 - 9 to 24 inches: gravelly sandy loam
H3 - 24 to 65 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 15 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (2.00 to 20.00 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: No

Description of Hermon

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy-skeletal supraglacial meltout till derived from granite and gneiss

Typical profile

Oe - 0 to 3 inches: moderately decomposed plant material
H1 - 3 to 9 inches: fine sandy loam
H2 - 9 to 16 inches: very gravelly loamy sand
H3 - 16 to 65 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 15 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (1.98 to 19.98 in/hr)
Depth to water table: About 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Sunapee

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Monadnock

Percent of map unit: 4 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Skerry

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Success

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Colton

Percent of map unit: 2 percent
Landform: Terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Sheepscot

Percent of map unit: 2 percent
Landform: Terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Moosilauke

Percent of map unit: 2 percent
Landform: Ground moraines, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

895A—Bucksport muck, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2ty6y
Elevation: 390 to 1,970 feet
Mean annual precipitation: 31 to 95 inches
Mean annual air temperature: 27 to 52 degrees F
Frost-free period: 90 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Bucksport and similar soils: 78 percent
Minor components: 22 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bucksport

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Mountainbase, interfluve, base slope
Down-slope shape: Concave

Across-slope shape: Concave
Parent material: Mucky herbaceous organic material and/or mucky woody organic material

Typical profile

Oa1 - 0 to 12 inches: muck
Oa2 - 12 to 25 inches: muck
Oa3 - 25 to 45 inches: muck
Oa4 - 45 to 65 inches: muck

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water storage in profile: Very high (about 21.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Wonsqueak

Percent of map unit: 10 percent
Landform: Hills, mountains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Mountainbase, interfluve, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Rumney

Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Mountainbase, interfluve, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Peacham, very stony

Percent of map unit: 4 percent
Landform: Hills, mountains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Mountainbase, interfluve, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Searsport

Percent of map unit: 3 percent

Landform: Hills, mountains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Mountainbase, interfluve, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

919B—Tunbridge-Lyman-Marlow association, gently sloping, very stony

Map Unit Setting

National map unit symbol: 9f1r
Elevation: 820 to 6,290 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 30 to 46 degrees F
Frost-free period: 30 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Tunbridge and similar soils: 35 percent
Lyman and similar soils: 20 percent
Marlow and similar soils: 20 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tunbridge

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex

Typical profile

H1 - 0 to 2 inches: silt loam
H2 - 2 to 25 inches: silt loam
H3 - 25 to 34 inches: cobbly fine sandy loam
R - 34 to 38 inches: unweathered bedrock

Properties and qualities

Slope: 0 to 15 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to high (0.01 to 6.00 in/hr)
Depth to water table: About 72 inches
Frequency of flooding: None
Frequency of ponding: None

Available water storage in profile: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Lyman

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Ablation till derived from mica schist and/or ablation till derived from granite and gneiss

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
H1 - 1 to 4 inches: fine sandy loam
H2 - 4 to 13 inches: fine sandy loam
H3 - 13 to 16 inches: gravelly fine sandy loam
R - 16 to 20 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 15 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Low to high (0.01 to 5.95 in/hr)
Depth to water table: About 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Marlow

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Basal lodgement till derived from granite and gneiss and/or basal lodgement till derived from schist

Typical profile

Oa - 0 to 5 inches: highly decomposed plant material

H1 - 5 to 9 inches: gravelly fine sandy loam
H2 - 9 to 19 inches: fine sandy loam
H3 - 19 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 15 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 19 to 27 inches to densic material
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 24 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Peru

Percent of map unit: 8 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Berkshire

Percent of map unit: 7 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Becket

Percent of map unit: 4 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Ricker

Percent of map unit: 4 percent
Landform: Hillsides or mountainsides
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Side slope

Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Hermon

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

919D—Tunbridge-Lyman-Marlow association, moderately steep, very stony

Map Unit Setting

National map unit symbol: 9f1s
Elevation: 820 to 6,290 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 30 to 46 degrees F
Frost-free period: 30 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Tunbridge and similar soils: 35 percent
Marlow and similar soils: 20 percent
Lyman and similar soils: 20 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tunbridge

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex

Typical profile

H1 - 0 to 2 inches: silt loam
H2 - 2 to 25 inches: silt loam
H3 - 25 to 34 inches: cobbly fine sandy loam
R - 34 to 38 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 35 percent

Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to high (0.01 to 6.00 in/hr)
Depth to water table: About 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Marlow

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Basal lodgement till derived from granite and gneiss and/or basal lodgement till derived from schist

Typical profile

Oa - 0 to 5 inches: highly decomposed plant material
H1 - 5 to 9 inches: gravelly fine sandy loam
H2 - 9 to 19 inches: fine sandy loam
H3 - 19 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 19 to 27 inches to densic material
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 24 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Lyman

Setting

Landform: Hillslopes

Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Ablation till derived from mica schist and/or ablation till derived from granite and gneiss

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
H1 - 1 to 4 inches: fine sandy loam
H2 - 4 to 13 inches: fine sandy loam
H3 - 13 to 16 inches: gravelly fine sandy loam
R - 16 to 20 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Low to high (0.01 to 5.95 in/hr)
Depth to water table: About 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Berkshire

Percent of map unit: 8 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Peru

Percent of map unit: 7 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Becket

Percent of map unit: 4 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder

Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Ricker

Percent of map unit: 4 percent
Landform: Hillsides or mountainsides
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Hermon

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

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APPENDIX E

PROJECT PHOTOGRAPHS

MT. CARBERRY LANDFILL

NORTHWEST STORMWATER POND

STAGE 9

STAGE 4

STAGE 3

STAGE 8

STAGE 2

STAGE 7

STAGE 1

FUTURE PHASE III AREA

LEACHATE STORAGE POND

MAINTENANCE GARAGE

LFG PROCESSING FACILITY

LEGEND:

1 PHOTOGRAPH LOCATION AND DIRECTION

0 300' 600'

Scale: 1" = 300'

CMA ENGINEERS

CIVIL/ENVIRONMENTAL/STRUCTURAL

Portsmouth, NH • Manchester, NH • Portland, ME

603/431-6196 • 603/627-0708 • 207/541-4223

cmaengineers.com

Androscoggin Valley Regional Refuse Disposal District
Mt. Carberry Landfill
Success, New Hampshire

AVRRDD Phase IIIA Stormwater Report

Appendix E - Photograph Site Plan

P:\777 AVRRDD Phase III North\Engineering\Phase III Expansion\Stormwater Report\Appendix E – Project Photographs\777-Site Photo Plan.dwg Date Plotted: Mar 12, 2020 – 4:16pm

Photo 1: Southern Perimeter Road – Looking Northeast



Photo 2: Southern Perimeter Road – Looking Southwest



Photo 3: Landfill Toe Swale at 36” Culvert with Stone Check Dam – Looking Southwest



Photo 4: Southern Berm and Roadway Looking West



Photo 5: 36” Culvert Outlet – Looking West



Photo 6: Eastern Landfill Berm and Perimeter Road
Looking North



Photo 7: Landfill Toe Swale at 36” Culvert with Stone Check Dam – Looking Northeast



Photo 8: 36” Culvert Inlet – Looking Southeast



Photo 9: Eastern Landfill Berm and Perimeter Road Looking South



Photo 10: Northern Landfill Berm and Perimeter Road Looking West



Photo 11: Northwest Detention Pond Uplands Looking West



Photo 12: Northwest Detention Pond Looking Northwest



Photo 13: Northwest Detention Pond Outlet Pipe and Protection
Looking Northwest



Photo 14: Northern Perimeter Road and Landfill Berm
Looking Northeast



Photo 15: Interior Hauling Road to Top of Stage 10/11 Landfill Area Looking Northeast



Photo 16: Northern Exit Haul Road and Perimeter Landfill Road Looking West



Photo 17: On Top of Stage 10/11 Landfill Area Looking at Southwest Corner



Photo 18: Southern Landfill Slope At Break In Slope Looking South at Maintenance Garage



Photo 19: Eastern Area Pond and Outlet Structure Looking West



Photo 20: Future Phase III Area Looking North



Photo 21: Northern Future Phase III Area Looking West



Photo 22: Middle of Future Phase III Area Looking West



Photo 23: Eastern Area Pond Looking North (Sothern Future Phase III Area)



Photo 24: Middle Western Portion of Future Phase III Area Looking South



Photo 25: West Side of the Leachate Storage Pond Looking Northwest



Photo 26: Looking West at the Leachate Storage Pond



Photo 27: Looking West at the Leachate Storage Pond Infrastructure and Alpine Brook Road



Photo 28: Looking North Along the Western Landfill Berm



APPENDIX F

DRAINAGE ANALYSIS

EXTREME PRECIPITATION TABLES
TABLE 1 – CURVE NUMBER AND SOIL GROUP SUMMARY

F.1 PRE-DEVELOPMENT CONDITIONS
- DRAINAGE DIAGRAM & HSG PLAN
- DRAINAGE ANALYSIS AND CALCULATIONS (25–YR, 24-HOUR STORM EVENTS)

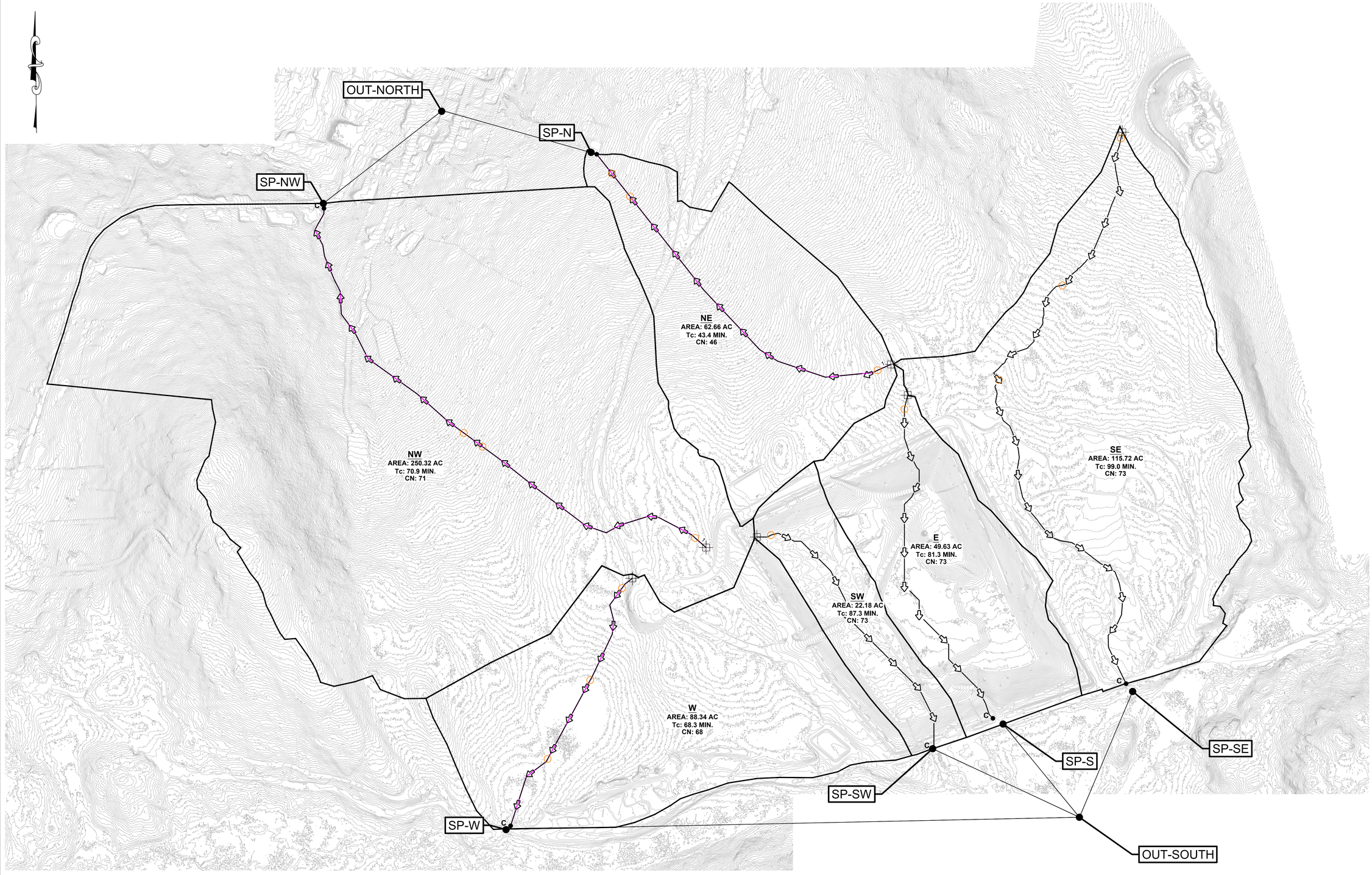
F.2 INTERMEDIATE-DEVELOPMENT CONDITIONS
- DRAINAGE DIAGRAM & HSG PLAN
- DRAINAGE ANALYSIS AND CALCULATIONS (25–YR, 24-HOUR STORM EVENTS)
- DRAINAGE ANALYSIS AND CALCULATIONS SUMMARIES (2-YEAR, 10-YEAR, 25-YEAR, AND 50-YEAR/24-HOUR STORM EVENT)

F.3 POST-DEVELOPMENT CONDITIONS
- DRAINAGE DIAGRAM & HSG PLAN
- DRAINAGE ANALYSIS AND CALCULATIONS (25–YR, 24-HOUR STORM EVENTS)
- DRAINAGE ANALYSIS AND CALCULATIONS SUMMARIES (2-YEAR, 10-YEAR, 25-YEAR, AND 50-YEAR/24-HOUR STORM EVENT)

APPENDIX F.1

PRE-DEVELOPMENT CONDITIONS

- DRAINAGE DIAGRAM & HSG PLAN
- DRAINAGE ANALYSIS AND CALCULATIONS (25–YR, 24-HOUR STORM EVENTS)



no.	revision	date	by

CMA ENGINEERS
Civil/Environmental/Structural
Portsmouth, NH • Manchester, NH • Portland, ME
603/431-6196 • 603/627-0708 • 207/541-4223
c m a e n g i n e e r s . c o m

designed by: JHK
drawn by: NJM
approved by: PDS
date: April 2020
project no: 777
file name: 777-PH 3-PRE-DEV-WSP.dwg
scale:

Androscoggin Valley Regional Refuse Disposal District
Phase IIIA Expansion
Stormwater Report

Pre-Development Drainage Diagram

drawing no.
PREDEV
sheet: 1 of 5

F:\CADD\PROJECTS\777\Engineering\Phase III-Drainage Analysis\DWG\777-PH 3-PRE-DEV-WSP.dwg Date Plotted: Apr 01, 2020 - 7:59pm Plotted By: NMESSINA

PRE-DEVELOPMENT
25-YEAR, 24 HOUR STORM EVENT
FULL REPORT

Project Description

File Name ..... 777-PH 3-PRE_DEV-MODEL.SPF

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... SCS TR-20
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Hydrodynamic
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ... YES

Analysis Options

Start Analysis On ..... May 30, 2019 00:00:00
End Analysis On ..... May 31, 2019 00:00:00
Start Reporting On ..... May 30, 2019 00:00:00
Antecedent Dry Days ..... 0 days
Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss
Reporting Time Step ..... 0 00:00:36 days hh:mm:ss
Routing Time Step ..... 1 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	6
Nodes	4
Junctions	2
Outfalls	2
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	2
Channels	0
Pipes	2
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	25-Year	Cumulative	inches	New Hampshire	Coos (North)	25	4.49	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	E	49.63	73.05	4.49	1.89	93.91	40.22	0 01:21:20
2	NE	62.66	69.39	4.49	1.62	101.69	64.50	0 00:45:55
3	NW	250.32	72.66	4.49	1.86	466.10	221.48	0 01:10:52
4	SE	115.72	73.34	4.49	1.91	221.48	81.88	0 01:39:02
5	SW	22.18	73.05	4.49	1.89	41.97	17.06	0 01:27:16
6	W	88.34	73.22	4.49	1.91	168.29	82.44	0 01:08:20

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	N	Junction	0.00	6.00	0.00	6.00	0.00	272.75	0.00	0.00	6.00	0 00:00	0.00	0.00
2	S	Junction	0.00	6.00	0.00	6.00	0.00	213.18	0.00	0.00	6.00	0 00:00	0.00	0.00
3	Out_North	Outfall	0.00					272.75	0.00					
4	Out-South	Outfall	0.00					213.18	0.00					

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	North_Direct_Link	Pipe	N	Out_North	206.24	0.00	0.00	0.0000	0.000	0.0150	272.75	0.00	0.00	0.00	0.00	0.00	0.00	
2	South_Direct_Link	Pipe	S	Out-South	240.71	0.00	0.00	0.0000	0.000	0.0150	213.18	0.00	0.00	0.00	0.00	0.00	0.00	

Subbasin Hydrology

Subbasin : E

Input Data

Area (ac) 49.63
Weighted Curve Number 73.05
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Fair	49.19	C	73.00
Woods, Fair	0.45	D	79.00
Composite Area & Weighted CN	49.64		73.05

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	3.99	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.07	0.00	0.00
Computed Flow Time (min) :	25.60	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	2408	0.00	0.00
Slope (%) :	2.10	0.00	0.00
Surface Type :	Woodland	Woodland	Unpaved
Velocity (ft/sec) :	0.72	0.00	0.00
Computed Flow Time (min) :	55.74	0.00	0.00

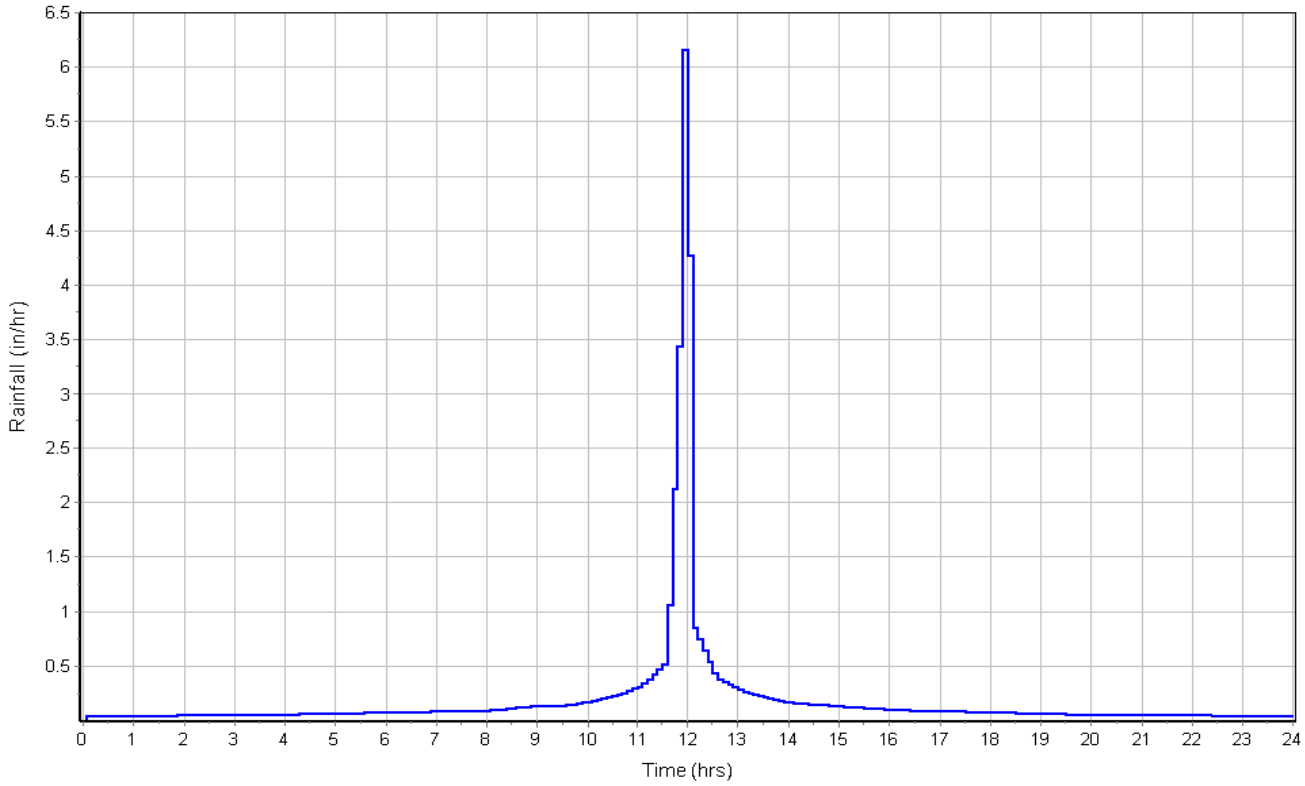
Total TOC (min) 81.34

Subbasin Runoff Results

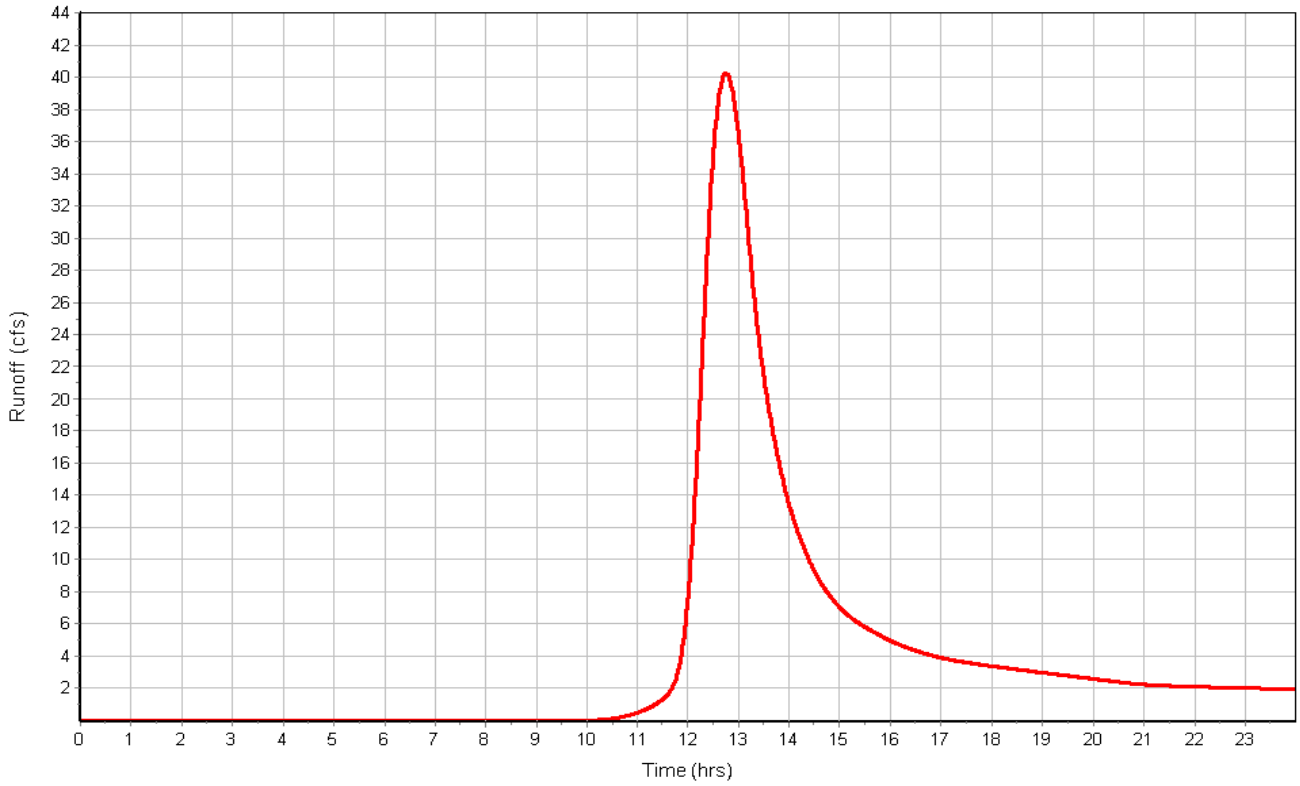
Total Rainfall (in)	4.49
Total Runoff (in)	1.89
Peak Runoff (cfs)	40.22
Weighted Curve Number	73.05
Time of Concentration (days hh:mm:ss)	0 01:21:20

Subbasin : E

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NE

Input Data

Area (ac) 62.66
Weighted Curve Number 69.39
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Fair	41.97	C	73.00
Woods, Fair	1.20	D	79.00
Meadow	1.84	C	71.00
Woods,Fair	17.65	B	60.00
Composite Area & Weighted CN	62.66		69.39

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	12.26	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.10	0.00	0.00
Computed Flow Time (min) :	16.34	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	2240.557	119.97	170.105
Slope (%) :	9.78	10.46	10.46
Surface Type :	Woodland	Grass pastur	Woodland
Velocity (ft/sec) :	1.56	2.26	1.62
Computed Flow Time (min) :	23.94	0.88	1.75

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.4	0.00	0.00
Flow Length (ft) :	308.18	0.00	0.00
Channel Slope (%) :	12.98	0.00	0.00
Cross Section Area (ft^2) :	20	0.00	0.00
Wetted Perimeter (ft) :	14	0.00	0.00
Velocity (ft/sec) :	1.70	0.00	0.00
Computed Flow Time (min) :	3.02	0.00	0.00

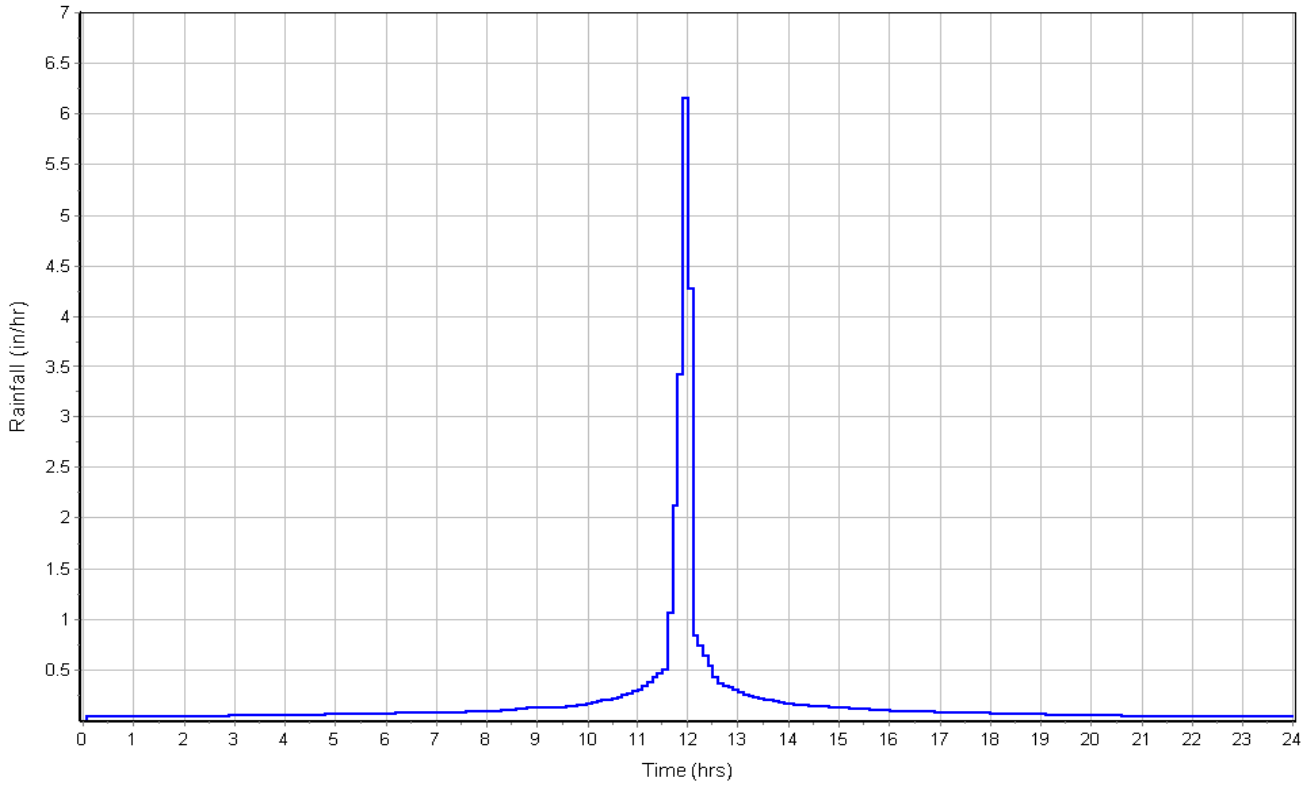
Total TOC (min) 45.93

Subbasin Runoff Results

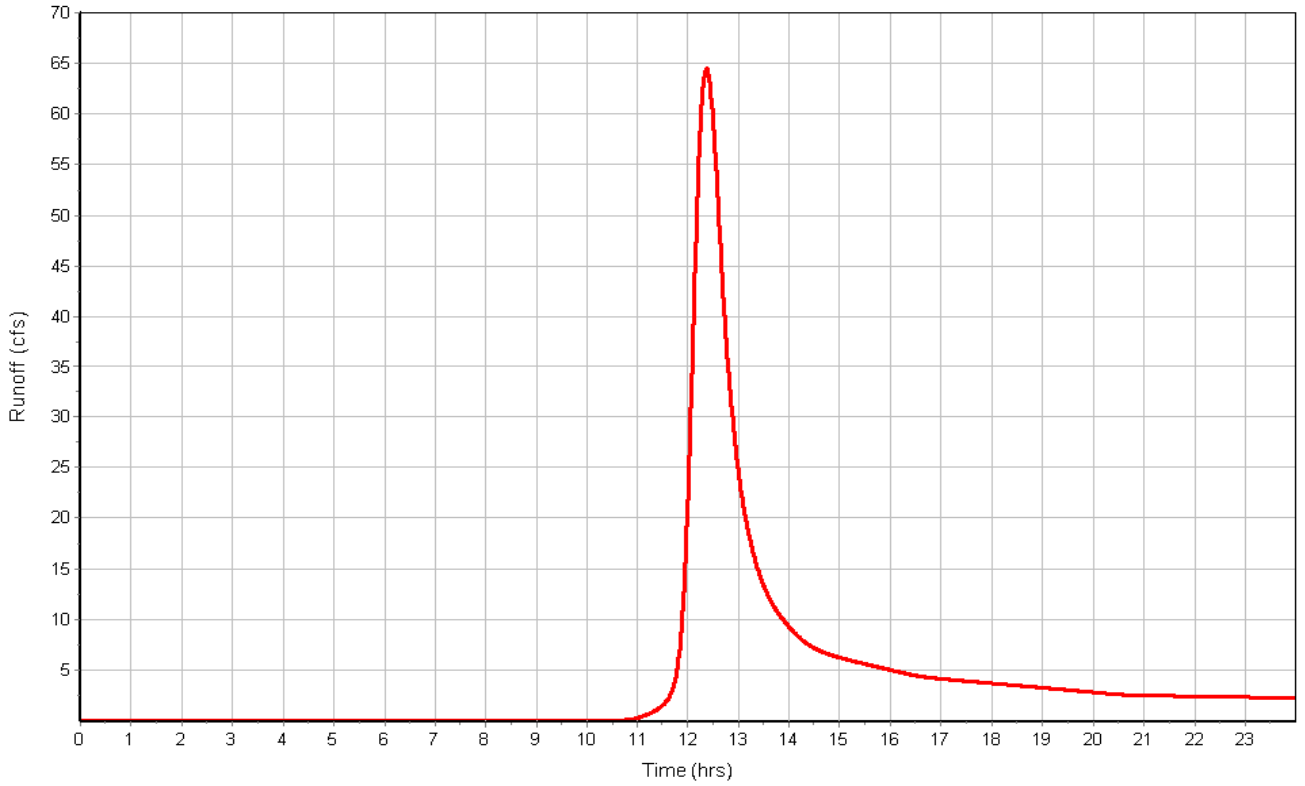
Total Rainfall (in) 4.49
Total Runoff (in) 1.62
Peak Runoff (cfs) 64.50
Weighted Curve Number 69.39
Time of Concentration (days hh:mm:ss) 0 00:45:56

Subbasin : NE

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NW

Input Data

Area (ac)	250.32
Weighted Curve Number	72.66
Rain Gage ID	NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Fair	6.03	B	60.00
Woods, Fair	7.67	D	79.00
Woods, Fair	209.90	C	73.00
Meadow	26.73	C	71.00
Composite Area & Weighted CN	250.33		72.66

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.6	0.00	0.00
Flow Length (ft) :	99.63	0.00	0.00
Slope (%) :	2.99	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.06	0.00	0.00
Computed Flow Time (min) :	28.64	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1716.846	160.166	1973.598
Slope (%) :	6.44	11.69	12.55
Surface Type :	Woodland	Grass pastur	Woodland
Velocity (ft/sec) :	1.27	2.39	1.77
Computed Flow Time (min) :	22.53	1.12	18.58

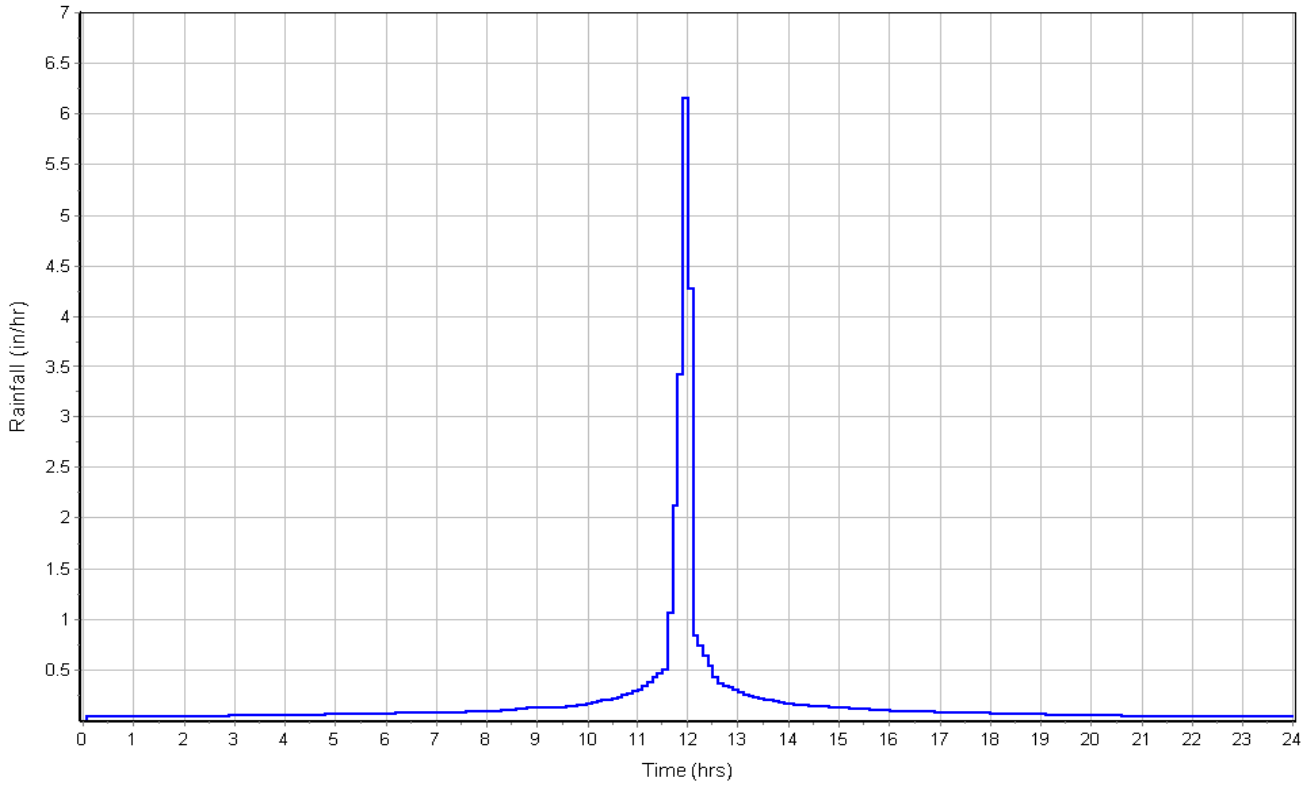
Total TOC (min) 70.87

Subbasin Runoff Results

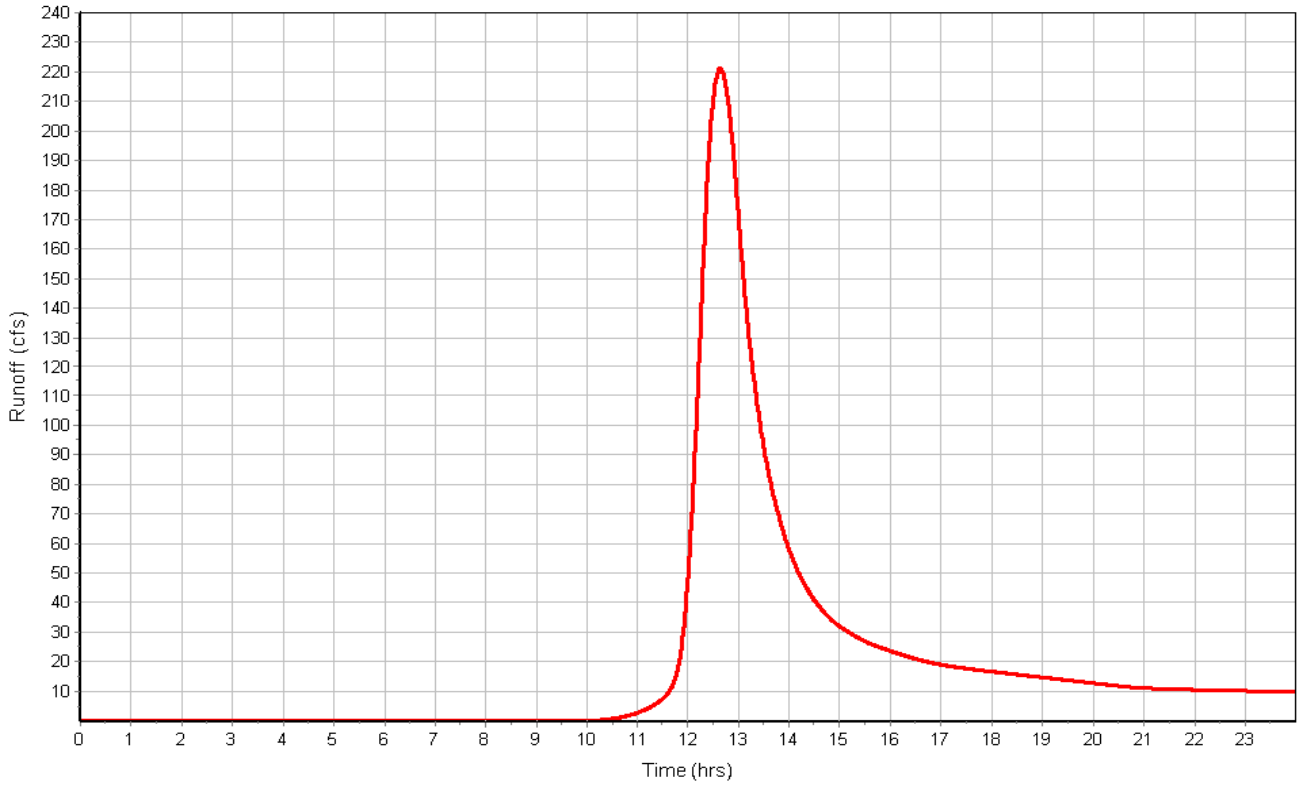
Total Rainfall (in)	4.49
Total Runoff (in)	1.86
Peak Runoff (cfs)	221.48
Weighted Curve Number	72.66
Time of Concentration (days hh:mm:ss)	0 01:10:52

Subbasin : NW

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE

Input Data

Area (ac) 115.72
Weighted Curve Number 73.34
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Fair	4.18	B	60.00
Woods, Fair	95.89	C	73.00
Woods, Fair	15.65	D	79.00
Composite Area & Weighted CN	115.72		73.34

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	41.5	0.00	0.00
Slope (%) :	6.80	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.07	0.00	0.00
Computed Flow Time (min) :	10.23	0.00	0.00

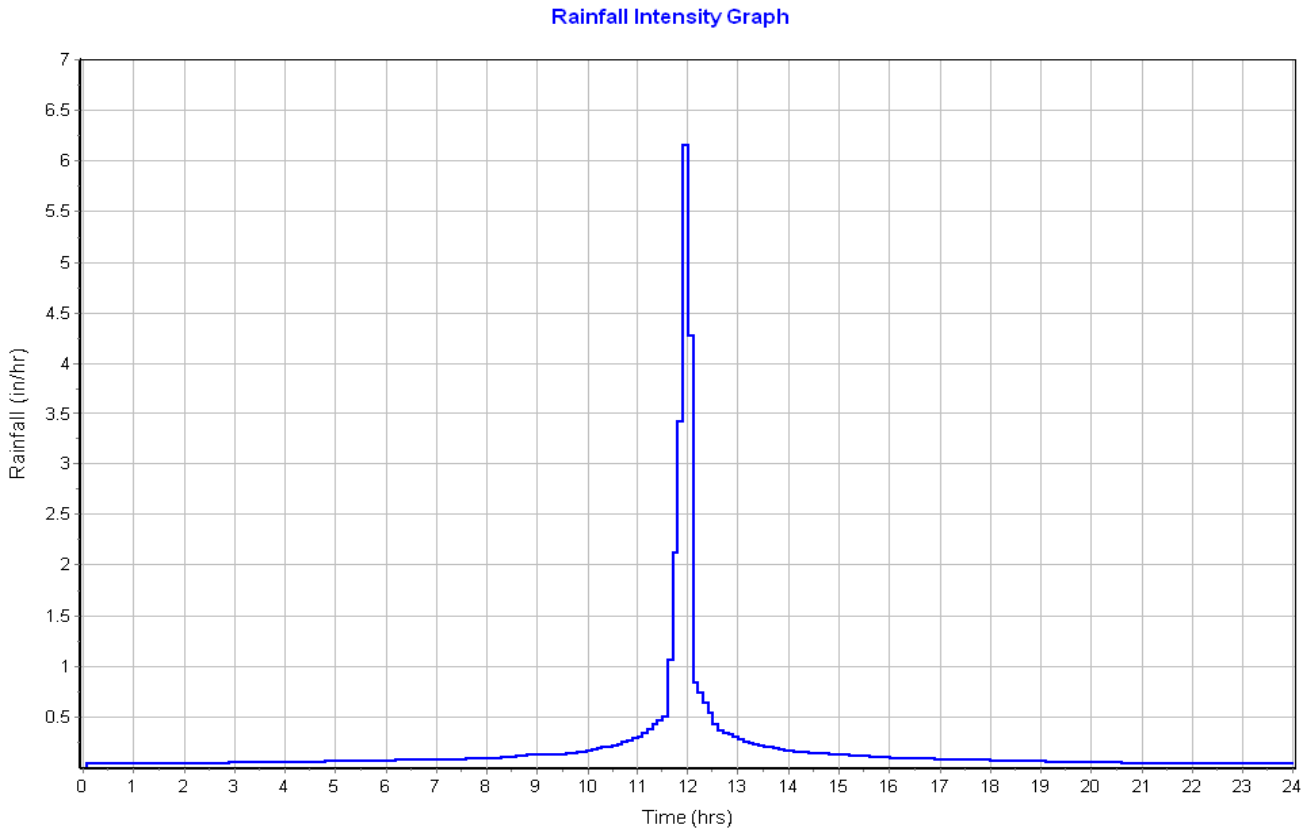
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1146	890	2545
Slope (%) :	7.47	3.44	2.09
Surface Type :	Woodland	Woodland	Woodland
Velocity (ft/sec) :	1.37	0.93	0.72
Computed Flow Time (min) :	13.94	15.95	58.91

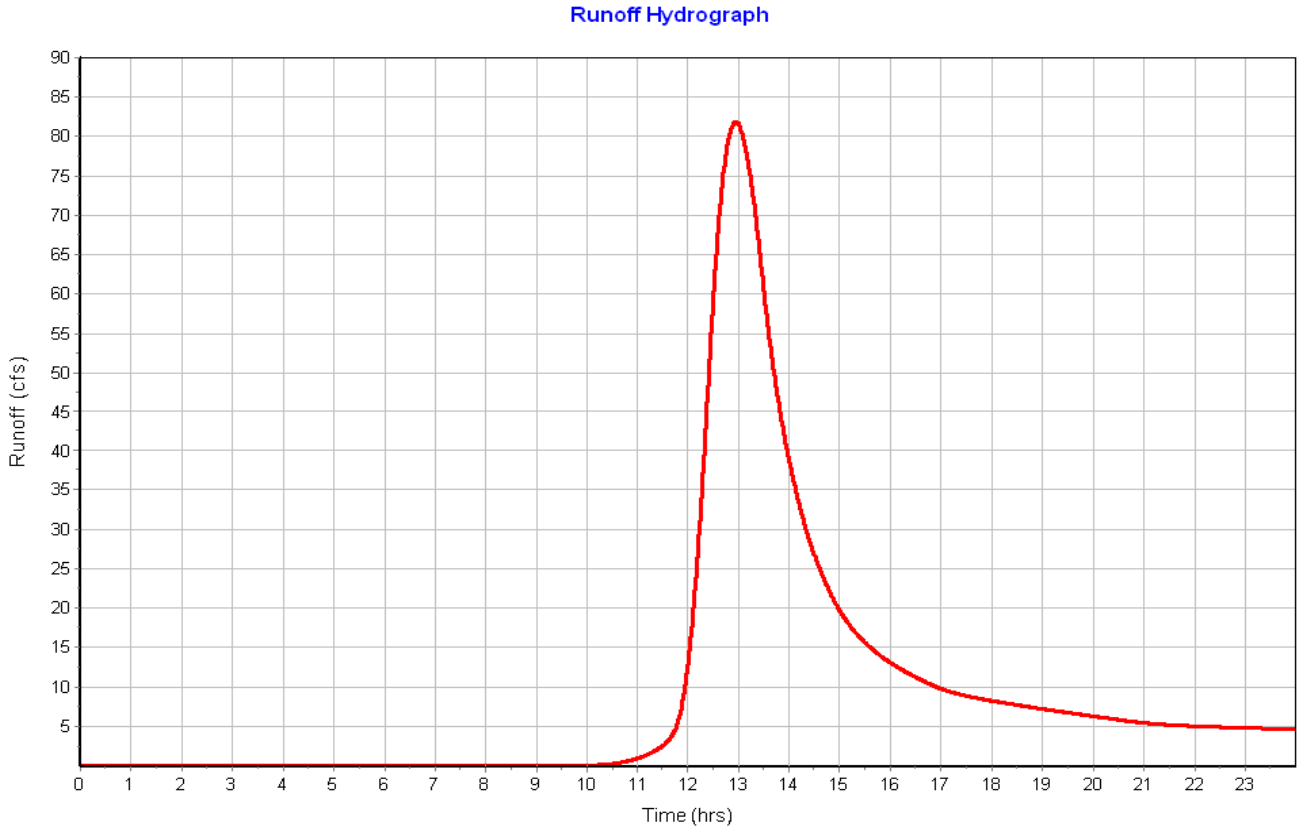
Total TOC (min) 99.04

Subbasin Runoff Results

Total Rainfall (in) 4.49
Total Runoff (in) 1.91
Peak Runoff (cfs) 81.88
Weighted Curve Number 73.34
Time of Concentration (days hh:mm:ss) 0 01:39:02

Subbasin : SE


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : SW

Input Data

Area (ac) 22.18
Weighted Curve Number 73.05
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Fair	0.19	D	79.00
Woods, Fair	21.99	C	73.00
Composite Area & Weighted CN	22.18		73.05

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1.33	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.04	0.00	0.00
Computed Flow Time (min) :	39.72	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1997	0.00	0.00
Slope (%) :	1.95	0.00	0.00
Surface Type :	Woodland	Woodland	Unpaved
Velocity (ft/sec) :	0.70	0.00	0.00
Computed Flow Time (min) :	47.55	0.00	0.00

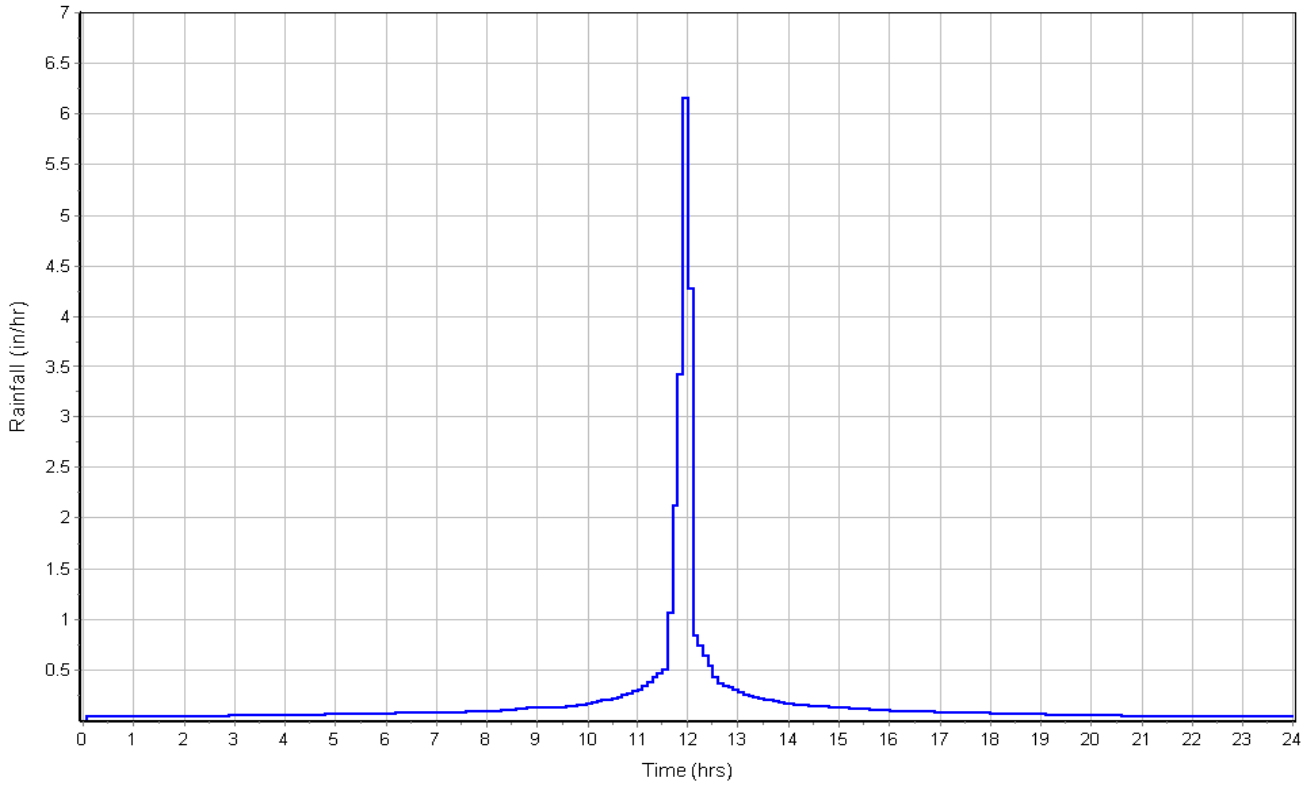
Total TOC (min) 87.27

Subbasin Runoff Results

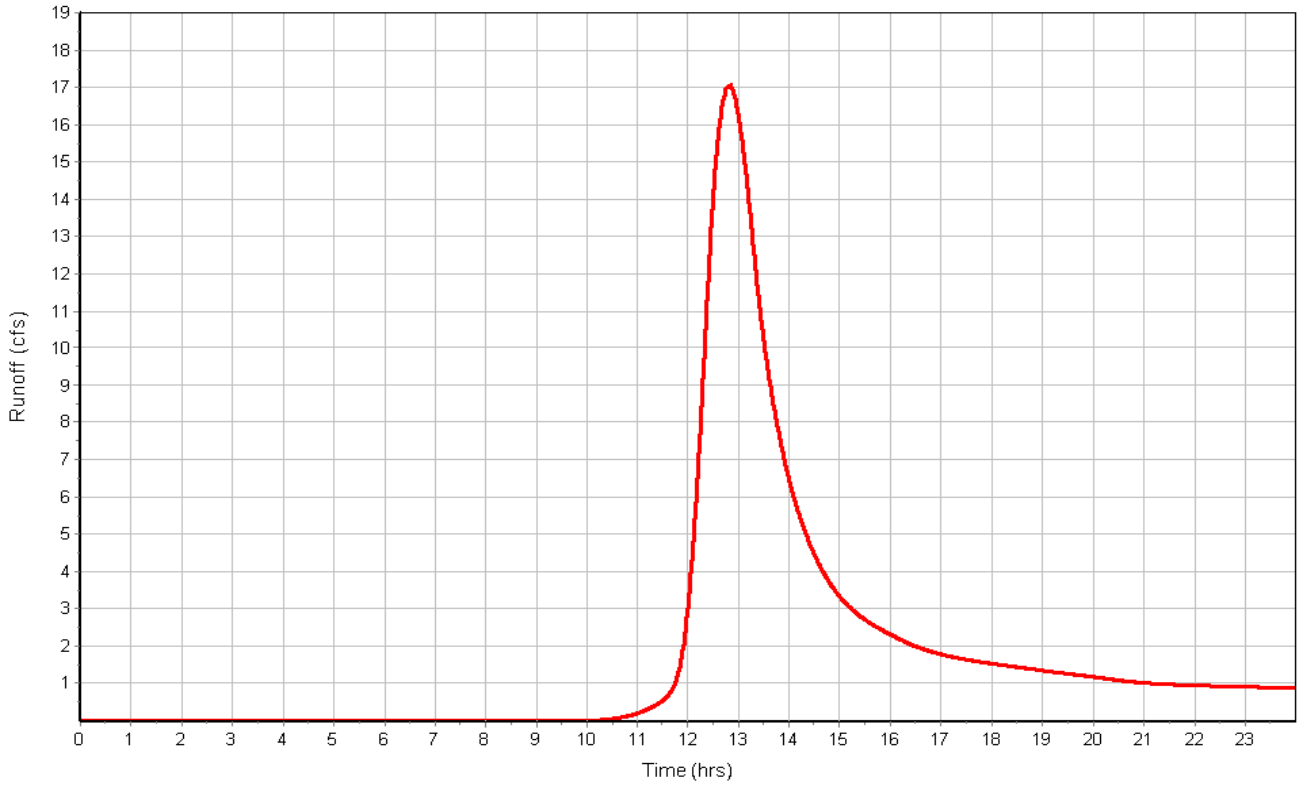
Total Rainfall (in) 4.49
Total Runoff (in) 1.89
Peak Runoff (cfs) 17.06
Weighted Curve Number 73.05
Time of Concentration (days hh:mm:ss) 0 01:27:16

Subbasin : SW

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : W

Input Data

Area (ac) 88.34
Weighted Curve Number 73.22
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Fair	6.92	D	79.00
Woods, Fair	70.51	C	73.00
Meadow	10.91	C	71.00
Composite Area & Weighted CN	88.34		73.22

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	7.22	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.08	0.00	0.00
Computed Flow Time (min) :	20.19	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	698	617	548
Slope (%) :	3.86	.6	1.12
Surface Type :	Woodland	Grass pastur	Woodland
Velocity (ft/sec) :	0.98	0.54	0.53
Computed Flow Time (min) :	11.87	19.04	17.23

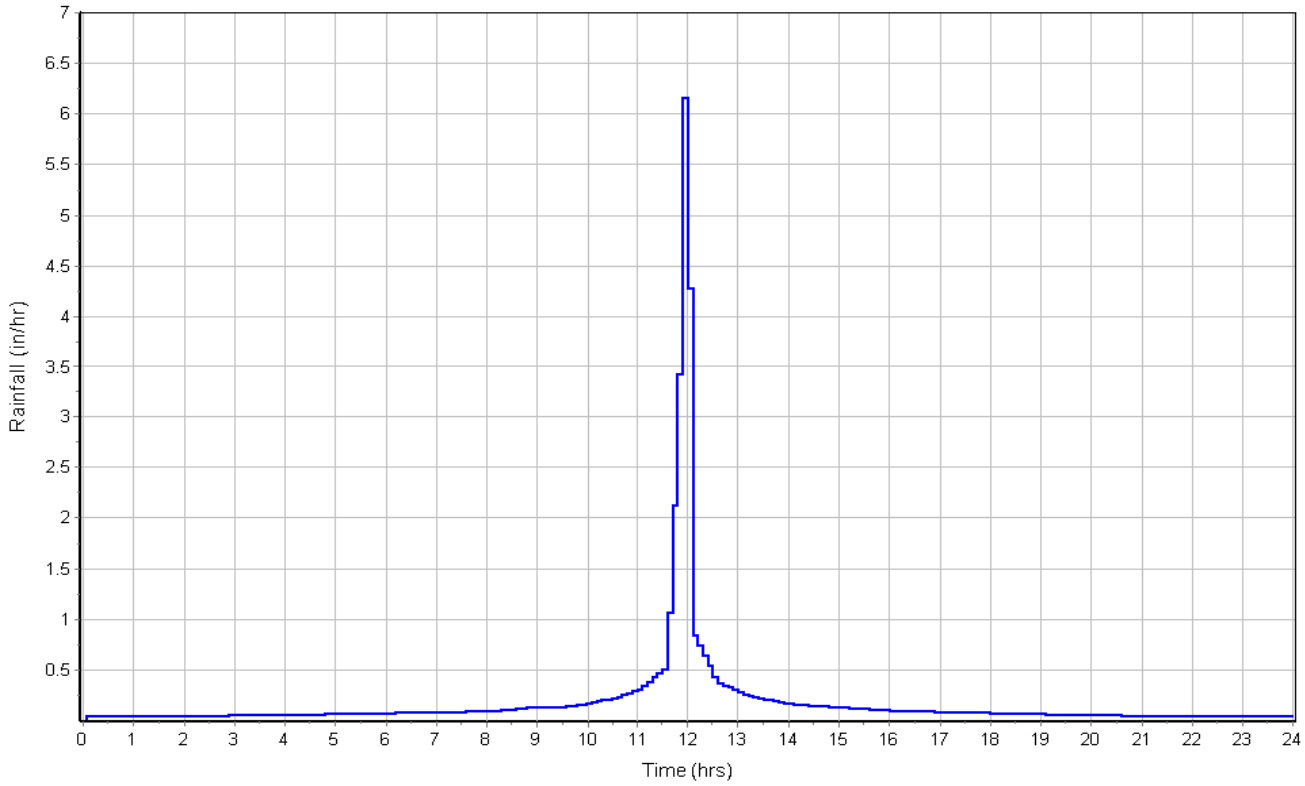
Total TOC (min) 68.34

Subbasin Runoff Results

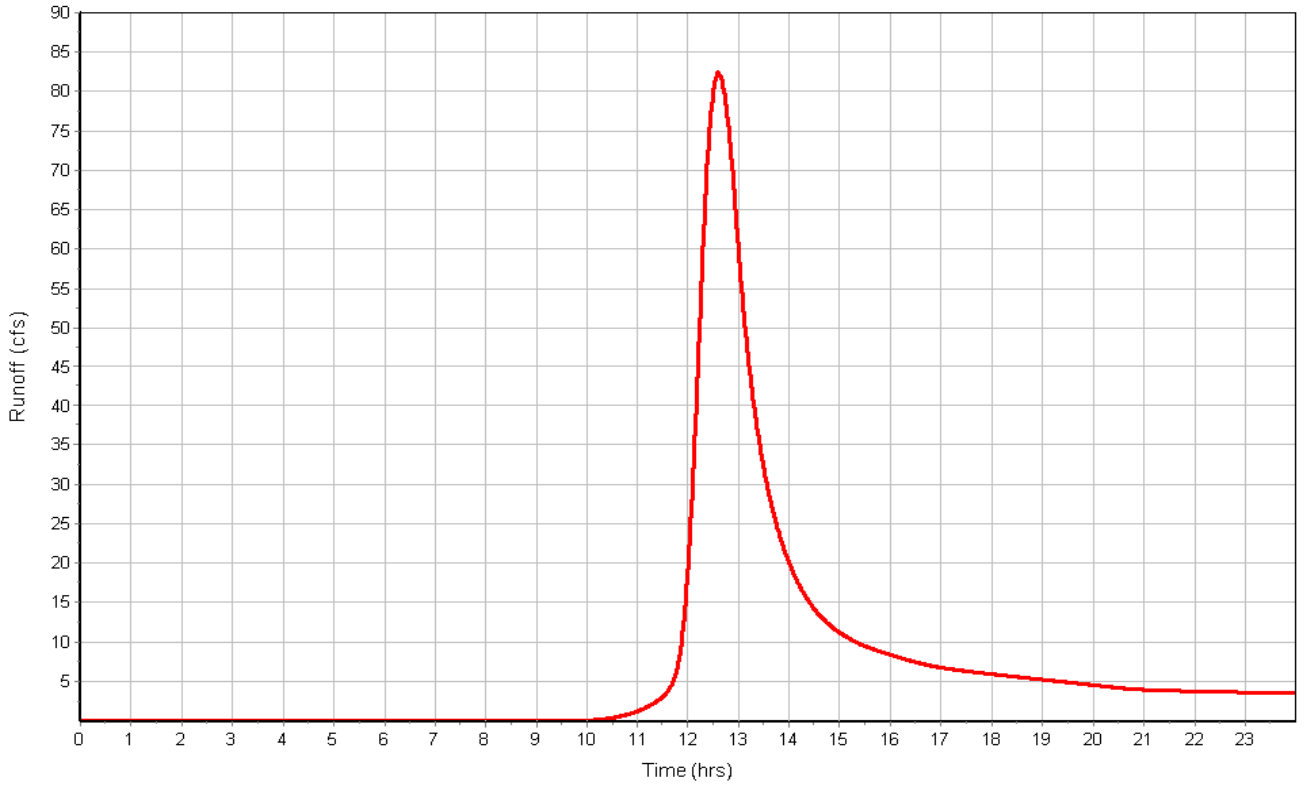
Total Rainfall (in) 4.49
Total Runoff (in) 1.91
Peak Runoff (cfs) 82.44
Weighted Curve Number 73.22
Time of Concentration (days hh:mm:ss) 0 01:08:20

Subbasin : W

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (in)
1	N	0.00	6.00	6.00	0.00	0.00	6.00	0.00	0.00	72.00
2	S	0.00	6.00	6.00	0.00	0.00	6.00	0.00	0.00	72.00

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	N	272.75	272.75	0.00	0.00	0.00	6.00	0.00	0.00	0 00:00	0 00:00	0.00	0.00
2	S	213.18	213.18	0.00	0.00	0.00	6.00	0.00	0.00	0 00:00	0 00:00	0.00	0.00

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	North_Direct_Link	206.24	0.00	0.00	0.00	0.00	0.00	0.0000	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
2	South_Direct_Link	240.71	0.00	0.00	0.00	0.00	0.00	0.0000	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	North_Direct_Link	272.75	0 12:33	0.00	0.00	0.00		0.00	0.00	0.00		
2	South_Direct_Link	213.18	0 12:45	0.00	0.00	0.00		0.00	0.00	0.00		

APPENDIX F.2

INTERMEDIATE-DEVELOPMENT CONDITIONS

- DRAINAGE DIAGRAM & HSG PLAN
- DRAINAGE ANALYSIS AND CALCULATIONS (25–YR, 24-HOUR STORM EVENTS)
- DRAINAGE ANALYSIS AND CALCULATIONS SUMMARIES (2-YEAR, 10-YEAR, 25-YEAR, AND 50-YEAR/24-HOUR STORM EVENT)

POND-NW-5

Tc: 17.2 MIN.

NW-2
AREA: 6.62 AC
Tc: 18.5 MIN.

NW-5-OCS-1

SP-2

SE-5
AREA: 7.32 AC
Tc: 6.0 MIN.

SE-15
AREA: 10.09 AC
Tc: 22.1 MIN.

NW-4
AREA: 10,99 AC
Tc: 6.0 MIN.

NW-3
AREA: 8.26 AC
Tc: 6.0 MIN.

SW-5
AREA: 6.36 AC
Tc: 6.0 MIN.

SE-7
AREA: 7,69 AC
Tc: 6,0 MIN.

SE-2-OCS-1

SW-6
AREA: 11.72 AC
Tc: 6.0 MIN.

SE-8
AREA: 14.13 AC
Tc: 6.0 MIN.

SE-1-OCS-1

S-2
AREA: 9.03 AC
Tc: 6.0 MIN.

SE-1-OCS-2

SW-2
AREA: 1.16 AC
Tc: 6.0 MIN.

SE-10
AREA: 3.42 AC
Tc: 6.0 MIN.

SE-11
AREA: 3.48 AC
Tc: 6.0 MIN.

S-3
AREA: 7.51 AC
Tc: 6.0 MIN.

S-1
AREA: 2.83 AC
Tc: 6.0 MIN.

SW-4
AREA: 17.27 AC
Tc: 53.2 MIN.

SP-SE

SP-S

300 150 0 300 600
1 IN. = 300 FT.

no.	revision	date	by

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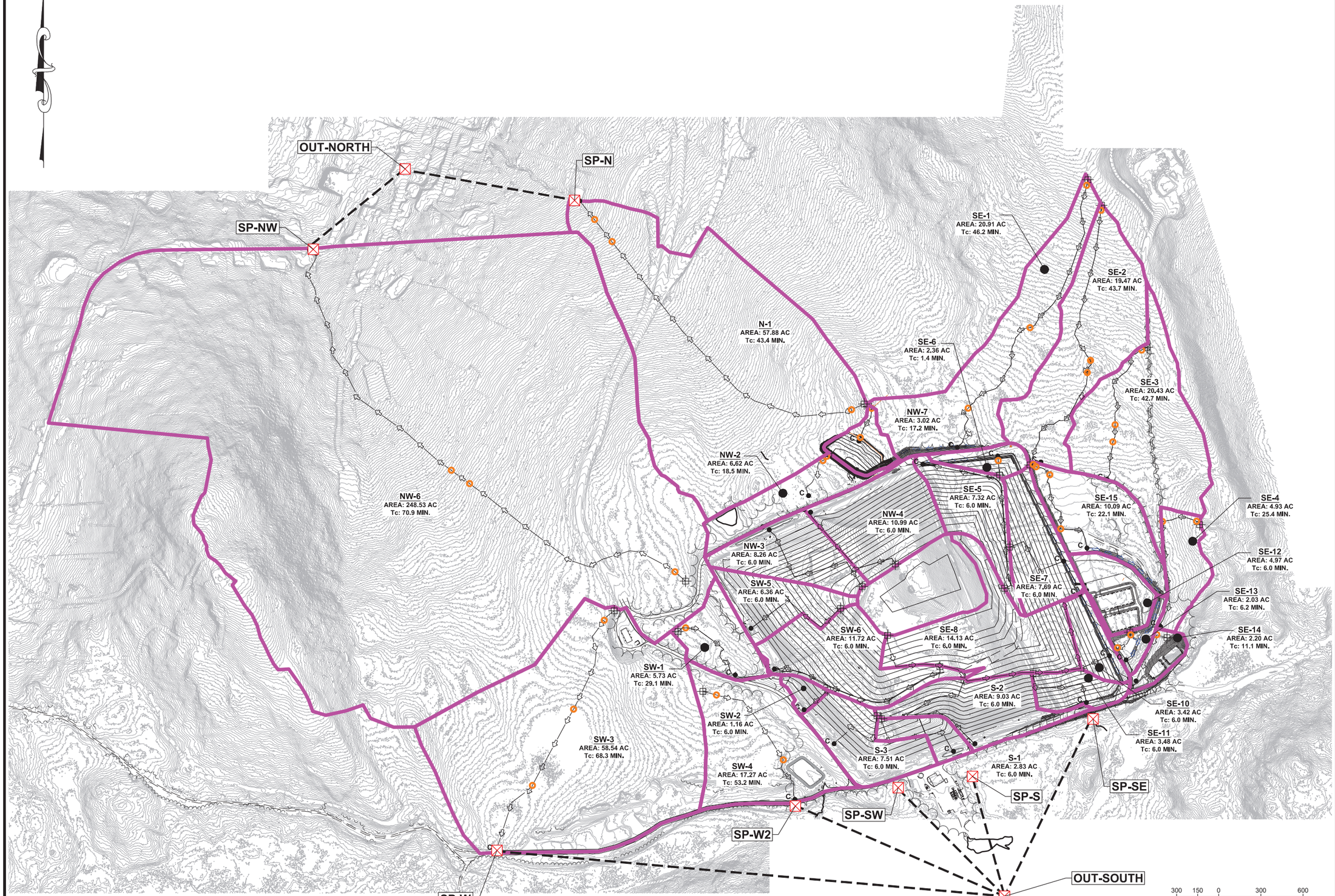
designed by: JHK
drawn by: NJM
approved by: PDS
date: April 2020
project no: 777
file name: 777-PH 3-INTR-DEV-WSP.dwg
scale:

Androscoggin Valley Regional Refuse Disposal District
Phase IIIA Expansion
Stormwater Report
Intermediate Watershed Diagram

drawing no.
INTER-DEV-1

sheet: 1 of 2

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CIVIL/ENVIRONMENTAL/STRUCTURAL
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c m a e n g i n e e r s . c o m

designed by: JHK
drawn by: NJM
approved by: PDS
date: April 2020
project no: 777
file name: 777-PH 3-INTR-DEV-WSP.dwg
scale:

Androscoggin Valley Regional Refuse Disposal District
Phase IIIA Expansion
Stormwater Report
Intermediate Watershed Diagram

drawing no. INTER-DEV-2

sheet: 2 of 2

F:\CADD\PROJECTS\777\Engineering\Phase III-Drainage Analysis\DWG\777-PH 3-INTR-DEV-WSP.dwg Date Plotted: Apr 01, 2020 - 10:42pm Plotted By: JKIEFFNER

INTERMEDIATE-DEVELOPMENT
25-YEAR, 24 HOUR STORM EVENT
FULL REPORT

Project Description

File Name 777-PH 3-INTR-MODEL.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-20
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Mar 03, 2020	00:00:00
End Analysis On	Mar 04, 2020	00:00:00
Start Reporting On	Mar 03, 2020	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:00:36	days hh:mm:ss
Routing Time Step	1	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	29
Nodes	73
Junctions	52
Outfalls	3
Flow Diversions	0
Inlets	0
Storage Nodes	18
Links	83
Channels	29
Pipes	38
Pumps	0
Orifices	10
Weirs	6
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	25-Year	Cumulative	inches	New Hampshire	Coos (North)	25	4.49	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	N-1	57.90	70.55	4.49	1.71	98.78	65.62	0 00:43:26
2	NW2	6.62	74.12	4.49	1.97	13.07	14.85	0 00:18:24
3	NW3	8.26	93.58	4.49	3.76	31.05	44.77	0 00:06:00
4	NW4	10.99	95.33	4.49	3.95	43.41	61.18	0 00:06:00
5	NW5	248.50	70.66	4.49	1.71	425.93	199.20	0 01:10:54
6	NW7	3.02	73.97	4.49	1.96	5.92	7.51	0 00:13:54
7	S1	2.83	94.18	4.49	3.83	10.82	15.48	0 00:06:00
8	S2	9.03	95.54	4.49	3.98	35.89	50.39	0 00:06:00
9	S3	7.51	91.22	4.49	3.51	26.37	38.90	0 00:06:00
10	SE-1	20.91	70.94	4.49	1.74	36.28	23.21	0 00:46:09
11	SE-10	3.42	97.27	4.49	4.17	14.25	19.44	0 00:06:00
12	SE-11	3.48	97.55	4.49	4.20	14.60	19.83	0 00:06:00
13	SE-12	4.97	81.82	4.49	2.61	12.96	19.97	0 00:06:00
14	SE-13	2.03	73.24	4.49	1.91	3.86	5.89	0 00:06:09
15	SE-14	2.20	77.76	4.49	2.27	4.99	6.77	0 00:11:03
16	SE-15	10.09	73.22	4.49	1.91	19.22	19.92	0 00:22:03
17	SE-2	19.47	70.16	4.49	1.68	32.68	21.57	0 00:43:40
18	SE-3	26.27	70.87	4.49	1.73	45.44	41.72	0 00:26:39
19	SE-4	4.93	61.99	4.49	1.13	5.59	4.81	0 00:25:22
20	SE-5	7.32	97.78	4.49	4.23	30.96	41.82	0 00:06:00
21	SE-6	2.36	96.94	4.49	4.13	9.76	13.39	0 00:06:00
22	SE-7	7.69	97.83	4.49	4.23	32.54	43.96	0 00:06:00
23	SE-8	14.13	98.00	4.49	4.25	60.12	80.86	0 00:06:00
24	SW1	5.70	74.19	4.49	1.98	11.28	9.99	0 00:29:07
25	SW2	1.16	88.03	4.49	3.19	3.69	5.57	0 00:06:00
26	SW3	58.50	63.03	4.49	1.20	70.08	30.63	0 01:08:20
27	SW4	17.30	71.04	4.49	1.74	30.14	17.42	0 00:53:12
28	SW5	6.36	74.27	4.49	1.99	12.64	19.38	0 00:06:00
29	SW6	11.72	97.78	4.49	4.23	49.56	66.93	0 00:06:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Culv-SE-11-IN	Junction	1635.50	1639.75	1634.50	0.00	0.00	17.57	1637.93	0.00	1.82	0 00:00	0.00	0.00
2	Culv-SE4-Out	Junction	1642.00	1646.00	1641.00	0.00	0.00	24.04	1642.83	0.00	3.17	0 00:00	0.00	0.00
3	Culv-SE5-Out	Junction	1678.00	1680.00	0.00	0.00	0.00	41.77	1679.29	0.00	2.71	0 00:00	0.00	0.00
4	Culv-SW4_Out	Junction	1633.28	1639.28	1633.28	1639.28	10.00	5.33	1633.64	0.00	5.64	0 00:00	0.00	0.00
5	Culv-SW5_Out	Junction	1645.73	1651.73	1645.73	1651.73	10.00	19.40	1645.91	0.00	5.82	0 00:00	0.00	0.00
6	Culv-SW6_Out	Junction	1648.73	1654.73	1648.73	1654.73	1000.00	65.39	1649.52	0.00	5.21	0 00:00	0.00	0.00
7	HW-14	Junction	1643.32	1650.00	1642.00	0.00	0.00	24.04	1646.50	0.00	3.91	0 00:00	0.00	0.00
8	HW-15	Junction	1642.97	1650.00	1642.00	0.00	0.00	19.40	1644.26	0.00	5.74	0 00:00	0.00	0.00
9	HW-SE-1	Junction	1622.54	1626.75	1622.00	0.00	0.00	18.51	1626.75	0.00	0.00	0 12:15	0.46	17.00
10	Intr-7	Junction	1668.00	1672.00	0.00	0.00	0.00	53.54	1669.20	0.00	2.80	0 00:00	0.00	0.00
11	Intr-SE6	Junction	1674.07	1678.07	0.00	0.00	0.00	54.85	1676.00	0.00	2.07	0 00:00	0.00	0.00
12	Intr-SE8	Junction	1654.00	1658.00	0.00	0.00	0.00	94.04	1655.61	0.00	2.39	0 00:00	0.00	0.00
13	Int-SE1	Junction	1668.33	1676.00	0.00	0.00	0.00	23.21	1669.51	0.00	6.49	0 00:00	0.00	0.00
14	Int-SE15	Junction	1646.44	1648.50	0.00	0.00	0.00	19.92	1647.69	0.00	0.81	0 00:00	0.00	0.00
15	Int-SE2	Junction	1664.17	1665.06	0.00	0.00	10.00	21.57	1683.35	18.08	0.00	0 12:22	5.45	118.00
16	Int-SE3	Junction	1658.26	1660.25	1658.00	0.00	0.00	51.43	1660.25	0.00	0.00	0 12:10	39.51	199.00
17	Jun-150	Junction	1662.00	1666.00	0.00	0.00	0.00	94.30	1663.51	0.00	2.49	0 00:00	0.00	0.00
18	Jun-177	Junction	1654.80	1656.80	1654.00	0.00	0.00	4.47	1655.47	0.00	2.33	0 00:00	0.00	0.00
19	Jun-180	Junction	1635.50	1639.75	1635.70	0.00	10.00	19.80	1637.95	0.00	1.80	0 00:00	0.00	0.00
20	Jun-185	Junction	1622.06	1626.75	1620.70	0.00	10.00	18.44	1626.49	0.00	0.26	0 00:00	0.00	0.00
21	Jun-189	Junction	1657.30	1659.00	0.00	0.00	0.00	0.82	1657.55	0.00	2.45	0 00:00	0.00	0.00
22	Jun-190	Junction	1665.25	1670.00	0.00	0.00	0.00	23.20	1667.33	0.00	4.42	0 00:00	0.00	0.00
23	Jun-191	Junction	1649.25	1654.00	0.00	0.00	10.00	93.83	1652.68	0.00	1.32	0 00:00	0.00	0.00
24	Jun-194	Junction	1640.00	1646.00	1640.00	1646.00	0.00	29.86	1641.04	0.00	8.16	0 00:00	0.00	0.00
25	Jun-250	Junction	1672.00	1676.00	0.00	0.00	0.00	53.78	1673.14	0.00	2.86	0 00:00	0.00	0.00
26	Jun-251	Junction	1647.50	1652.00	0.00	0.00	10.00	80.81	1650.09	0.00	1.91	0 00:00	0.00	0.00
27	Jun-NW3	Junction	1649.13	1654.00	0.00	1654.00	1000.00	53.71	1650.14	0.00	3.86	0 00:00	0.00	0.00
28	Jun-SW4A	Junction	1628.38	1634.38	1628.38	1634.38	10.00	36.57	1631.86	0.00	2.52	0 00:00	0.00	0.00
29	Jun-SW4B	Junction	1612.00	1618.00	1612.00	1618.00	1000.00	52.70	1616.12	0.00	1.88	0 00:00	0.00	0.00
30	NW-1	Junction	1260.00	1270.00	1260.00	1270.00	10.00	199.07	1260.00	0.00	10.00	0 00:00	0.00	0.00
31	NW-2	Junction	1220.00	1226.00	1220.00	1226.00	10.00	79.69	1220.14	0.00	186.86	0 00:00	0.00	0.00
32	Out-N	Junction	1100.00	1120.00	1100.00	1120.00	100000.00	262.20	1106.58	0.00	13.42	0 00:00	0.00	0.00
33	Out-S	Junction	1500.00	1650.00	1500.00	1650.00	1000.00	143.63	1502.33	0.00	147.67	0 00:00	0.00	0.00
34	Out-SE	Junction	1618.14	1628.00	1617.00	0.00	0.00	44.40	1618.17	0.00	9.83	0 00:00	0.00	0.00
35	PDMH-1	Junction	1619.16	1640.00	1618.00	0.00	0.00	44.40	1620.93	0.00	19.07	0 00:00	0.00	0.00
36	PDMH-2	Junction	1620.64	1640.00	1619.50	0.00	0.00	44.40	1625.90	0.00	14.10	0 00:00	0.00	0.00
37	PDMH-3	Junction	1621.47	1626.75	1621.00	0.00	0.00	18.35	1626.23	0.00	0.52	0 00:00	0.00	0.00
38	PDMH-4	Junction	1630.32	1642.00	1630.00	0.00	0.00	29.80	1631.44	0.00	10.56	0 00:00	0.00	0.00
39	Pond_NW2-Out	Junction	1642.00	1650.00	1642.00	1650.00	1000.00	14.95	1643.43	0.00	6.57	0 00:00	0.00	0.00
40	Pond_NW-5-OCS	Junction	1660.50	1670.00	1662.50	1671.00	10.00	0.82	1662.72	0.00	7.28	0 00:00	0.00	0.00
41	Pond_SE1-Out	Junction	1658.30	1660.30	0.00	0.00	10.00	0.82	1658.53	0.00	7.60	0 00:00	0.00	0.00
42	Pond_SE-1-Out	Junction	1625.65	1631.10	1625.00	0.00	0.00	18.51	1628.50	0.00	2.60	0 00:00	0.00	0.00
43	Pond_SE-2-Out	Junction	1641.50	1648.00	0.00	0.00	0.00	12.40	1641.99	0.00	6.01	0 00:00	0.00	0.00
44	Pond_SE-4_OCS	Junction	1642.59	1646.00	1642.00	0.00	0.00	4.80	1643.58	0.00	2.42	0 00:00	0.00	0.00
45	Pond-SE13	Junction	1638.00	1644.00	1638.00	1645.00	9000.00	30.36	1641.03	0.00	2.97	0 00:00	0.00	0.00
46	SE-1-OCS-1	Junction	1625.25	1633.50	1625.00	0.00	10.00	18.50	1629.41	0.00	4.09	0 00:00	0.00	0.00
47	SE-1-OCS-2	Junction	1622.75	1633.50	1625.00	0.00	36.00	0.51	1626.49	0.00	7.01	0 00:00	0.00	0.00
48	SE-2-OCS-1	Junction	1641.80	1651.00	0.00	1651.00	4.00	12.40	1643.71	0.00	7.29	0 00:00	0.00	0.00
49	South-1	Junction	1613.00	1620.00	1613.00	1620.00	1000.00	62.11	1613.95	0.00	7.85	0 00:00	0.00	0.00
50	South-3	Junction	1613.00	1620.00	1613.00	1620.00	1000.00	37.92	1613.59	0.00	6.41	0 00:00	0.00	0.00
51	Southwest	Junction	1570.00	1610.00	1570.00	1610.00	10.00	80.63	1571.40	0.00	38.60	0 00:00	0.00	0.00
52	Swale-NW4	Junction	1650.04	1656.04	1650.04	0.00	10.00	60.94	1652.65	0.00	3.39	0 00:00	0.00	0.00
53	Out-North	Outfall	1000.00					262.20	1000.00					
54	Out-South	Outfall	1400.00					142.80	1400.00					
55	Pond_SE-1-OFW	Outfall	1632.00					0.00	1632.00					
56	Culv-SE-10-IN	Storage Node	1638.78	1642.00	1638.78		3500.00	19.41	1641.36				0.00	0.00
57	Pond_NW2	Storage Node	1642.00	1650.00	1642.00		54786.20	99.12	1648.24				0.00	0.00
58	Pond_NW-5	Storage Node	1662.50	1670.00	1663.00		65300.00	24.63	1667.33				0.00	0.00
59	Pond_S1	Storage Node	1616.46	1622.46	1616.46		10.00	15.46	1618.36				0.00	0.00
60	Pond_S2	Storage Node	1619.20	1624.00	1619.20		10.00	50.28	1622.75				0.00	0.00
61	Pond_S3	Storage Node	1615.31	1621.31	1615.31		10.00	38.85	1618.71				0.00	0.00
62	Pond_SE-1	Storage Node	1628.00	1633.50	1628.40		26200.00	40.38	1631.55				0.00	0.00
63	Pond_SE-1-FB	Storage Node	1632.50	1636.00	1632.50		5410.00	40.79	1635.39				0.00	0.00
64	Pond_SE-2	Storage Node	1642.80	1651.00	1644.20		75400.00	76.76	1648.18				0.00	0.00
65	Pond_SE-2-FB	Storage Node	1645.30	1651.00	0.00		116600.00	271.67	1648.89				0.00	0.00
66	Pond_SW1	Storage Node	1629.16	1636.00	1629.16		10.00	86.90	1634.93				0.00	0.00
67	Pond_SW2	Storage Node	1634.25	1640.25	1634.25		10.00	5.57	1635.43				0.00	0.00
68	Pond_SW3	Storage Node	1578.00	1583.00	1578.00		10.00	30.63	1580.96				0.00	0.00
69	Pond_SW4	Storage Node	1602.72	1608.72	1602.72		10.00	51.87	1607.12				0.00	0.00
70	Pond_SW5	Storage Node	1647.36	1653.36	1647.36		10.00	19.34	1649.62				0.00	0.00
71	Pond_SW6	Storage Node	1650.36	1656.36	1650.36		10.00	66.85	1657.89				0.03	3.00
72	Pond-NW3	Storage Node	1647.91	1653.91	1647.91		10.00	60.27	1650.23				0.00	0.00
73	Pond-NW4	Storage Node	1651.04	1654.00	1651.04		10.00	61.06	1653.35				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1	1625.75	Pipe	SE-1-OCS-2	Jun-185	58.20	1625.75	1622.56	5.4800	12.000	0.0120	0.51	9.04	0.06	1.04	0.87	0.87	0.00
2	1662.50	Pipe	Pond_NW-5-OCS	Pond_SE1-Out	58.10	1662.50	1660.50	3.4400	18.000	0.0120	0.82	21.11	0.04	5.49	0.21	0.14	0.00
3	Cul-SW4	Pipe	Pond_SW4	Southwest	41.14	1602.72	1601.68	2.5300	30.000	0.0110	51.79	77.07	0.67	12.30	2.00	0.80	0.00
4	Culv_SE-11	Pipe	Culv-SE-11-IN	Pond_SE-1-FB	150.33	1634.75	1633.60	0.7600	24.000	0.0120	16.42	27.55	0.60	5.33	1.90	0.95	0.00
5	Culvert-SW4	Pipe	Pond_SW2	Culv-SW4_Out	82.60	1634.25	1633.28	1.1700	24.000	0.0100	5.33	31.87	0.17	4.82	0.77	0.38	0.00
6	Culv-NW3A	Pipe	Pond-NW3	Pond_NW2	63.30	1647.91	1646.75	1.8300	36.000	0.0110	23.80	106.71	0.22	6.02	1.64	0.55	0.00
7	Culv-NW3B	Pipe	Pond-NW3	Pond_NW2	63.30	1647.91	1647.43	0.7600	36.000	0.0110	23.80	68.64	0.35	5.49	1.77	0.59	0.00
8	Culv-NW4A	Pipe	Pond-NW4	Swale-NW4	40.02	1651.04	1651.57	-1.3200	36.000	0.0110	16.41	90.71	0.18	3.99	1.69	0.56	0.00
9	Culv-NW4B	Pipe	Pond-NW4	Jun-NW3	81.71	1651.14	1650.16	1.2000	36.000	0.0110	43.62	172.65	0.25	5.61	1.62	0.54	0.00
10	Culv-S1	Pipe	Pond_S1	South-1	62.08	1616.46	1616.45	0.0200	30.000	0.0110	14.62	6.15	2.38	4.43	1.59	0.64	0.00
11	Culv-S2	Pipe	Pond_S2	South-1	90.97	1619.20	1618.80	0.4400	36.000	0.0110	47.49	52.27	0.91	7.25	2.62	0.87	0.00
12	Culv-S3	Pipe	Pond_S3	South-3	61.14	1615.31	1614.18	1.8500	30.000	0.0110	37.92	65.90	0.58	9.32	1.93	0.77	0.00
13	Culv-SE10	Pipe	Culv-SE-10-IN	Pond_SE-1-FB	73.94	1638.78	1636.26	3.4100	24.000	0.0120	17.94	45.24	0.40	7.42	1.44	0.72	0.00
14	Culv-SE3	Pipe	HW-14	HW-15	64.30	1643.32	1642.97	0.5400	24.000	0.0120	19.40	18.08	1.07	7.01	1.65	0.82	0.00
15	Culv-SE4	Pipe	Pond_SE-4_OCS	Culv-SE4-Out	61.60	1642.59	1642.00	0.9600	24.000	0.0120	4.97	23.98	0.21	3.74	0.91	0.45	0.00
16	Culv-SE8	Pipe	Jun-191	Pond_SE-2-FB	71.80	1649.50	1646.00	4.8700	30.000	0.0120	179.25	294.32	0.61	12.17	2.50	1.00	3.00
17	Culv-SE9	Pipe	Jun-251	Pond_SE-2-FB	63.20	1647.50	1645.30	3.4800	30.000	0.0120	86.25	248.71	0.35	5.86	2.50	1.00	3.00
18	Culv-SW3	Pipe	Pond_SW3	Southwest	59.15	1578.00	1576.00	3.3800	30.000	0.0110	30.53	89.14	0.34	8.30	1.75	0.70	0.00
19	Culv-SW4	Pipe	Pond_SW1	Jun-SW4A	52.00	1629.16	1628.38	1.5000	24.000	0.0110	36.57	32.74	1.12	11.64	2.00	1.00	543.00
20	Culv-SW5	Pipe	Pond_SW5	Culv-SW5_Out	59.57	1647.36	1645.73	2.7400	36.000	0.0240	19.40	59.76	0.32	7.50	1.21	0.40	0.00
21	Culv-SW6	Pipe	Pond_SW6	Culv-SW6_Out	71.39	1650.36	1648.73	2.2800	30.000	0.0110	65.39	73.25	0.89	19.11	1.65	0.66	0.00
22	EPIPE-SE1	Pipe	PDMH-1	Out-SE	50.94	1619.16	1618.14	2.0000	30.000	0.0120	44.40	62.88	0.71	27.93	0.90	0.36	0.00
23	Link-384	Pipe	Jun-185	PDMH-3	97.70	1622.06	1621.57	0.5000	30.000	0.0120	18.35	31.47	0.58	4.33	2.50	1.00	33.00
24	NW_Direct_Rout-1	Pipe	NW-1	Out-N	1.00	1260.00	1100.00	16000.0000	0.000	0.0300	199.07	0.00	0.62	0.00	3.67	0.92	0.00
25	NW_Direct_Rout-2	Pipe	NW-2	Out-N	1.00	1220.00	1100.00	12000.0000	0.000	0.0300	79.69	0.00	0.62	0.00	3.67	0.92	0.00
26	PIPE-1	Pipe	PDMH-2	PDMH-1	275.30	1620.64	1619.26	0.5000	30.000	0.0120	44.40	31.46	1.41	9.26	2.36	0.94	0.00
27	Pipe-10	Pipe	Pond_SE-1-Out	HW-SE-1	202.70	1625.65	1622.64	1.4800	24.000	0.0120	18.51	29.86	0.62	6.63	2.00	1.00	20.00
28	PIPE-14	Pipe	Pond-SE13	PDMH-4	73.90	1638.00	1630.42	10.2600	30.000	0.0120	29.80	142.31	0.21	8.07	1.76	0.70	0.00
29	PIPE-15	Pipe	PDMH-4	PDMH-2	201.30	1630.32	1620.74	4.7600	30.000	0.0120	29.81	96.94	0.31	8.92	1.81	0.72	0.00
30	PIPE-2	Pipe	PDMH-3	PDMH-2	145.60	1621.47	1620.74	0.5000	30.000	0.0120	18.35	31.46	0.58	3.74	2.50	1.00	37.00
31	PIPE-3	Pipe	HW-SE-1	Jun-185	75.50	1622.54	1622.16	0.5000	30.000	0.0120	18.44	31.52	0.59	4.40	2.50	1.00	30.00
32	Pipe-6	Pipe	SE-1-OCS-1	Pond_SE-1-Out	37.50	1625.75	1625.37	1.0100	24.000	0.0120	18.51	12.66	1.46	6.33	2.00	1.00	20.00
33	Pond_NW2-Prime	Pipe	Pond_NW2	Pond_NW2-Out	42.84	1643.88	1643.04	1.9600	15.000	0.0110	14.95	10.69	1.40	12.19	1.25	1.00	217.00
34	Pond_SE-2-Primary	Pipe	SE-2-OCS-1	Pond_SE-2-Out	57.10	1641.80	1641.50	0.5300	24.000	0.0120	12.40	17.76	0.70	6.32	1.20	0.60	0.00
35	S_Direct_Rout-2	Pipe	South-1	Out-S	575.23	1613.00	1500.00	19.6400	0.000	0.0150	62.11	0.00	0.70	0.00	1.20	0.60	0.00
36	S_Direct_Rout-3	Pipe	South-3	Out-S	115.53	1613.00	1500.00	97.8100	0.000	0.0150	37.92	0.00	0.70	0.00	1.20	0.60	0.00
37	SE_Direct_Rout-1	Pipe	Out-SE	Out-S	1422.07	1618.10	1500.00	8.3000	0.000	0.0320	44.40	0.00	0.02	0.00	1.65	0.41	0.00
38	SW_Rout-1	Pipe	Southwest	Out-S	1606.22	1570.00	1500.00	4.3600	60.000	0.0150	80.61	471.21	0.17	12.68	1.82	0.36	0.00
39	Link-388	Channel	Jun-190	Pond_NW-5	211.00	1665.25	1663.60	0.7800	78.000	0.0300	23.10	1508.76	0.02	1.73	2.90	0.45	0.00
40	N_Routing	Channel	Out-N	Out-North	0.10	1100.00	1099.99	10.0000	48.000	0.0300	262.20	421.70	0.62	15.54	3.67	0.92	0.00
41	NW2-Swale	Channel	Pond_NW2-Out	NW-2	2560.00	1643.00	1406.00	9.2600	12.000	0.0500	14.88	91.61	0.16	3.93	0.43	0.43	0.00
42	S_Rout	Channel	Out-S	Out-South	0.10	1500.00	1499.90	100.0000	48.000	0.0300	142.80	6208.64	0.02	10.50	1.65	0.41	0.00
43	Swale-NW2	Channel	Jun-NW3	Pond_NW2	651.44	1649.13	1643.88	0.8100	24.000	0.0300	52.76	196.25	0.27	2.19	1.50	0.75	0.00
44	Swale-NW3	Channel	Swale-NW4	Pond-NW3	449.31	1651.57	1647.91	0.8100	24.000	0.0300	60.27	197.45	0.31	2.43	1.54	0.77	0.00
45	Swale-NW6	Channel	Jun-189	Jun-NW3	366.70	1657.30	1649.13	2.2300	15.000	0.0300	0.82	33.50	0.02	2.71	0.57	0.46	0.00
46	Swale-NW7	Channel	Pond_SE1-Out	Jun-189	32.50	1658.30	1658.00	0.9200	24.000	0.0300	0.82	80.76	0.01	1.63	0.19	0.10	0.00
47	Swale-SE11	Channel	Jun-180	Culv-SE-11-IN	200.00	1635.50	1635.50	0.0000	48.000	0.0300	17.57	9.95	1.77	0.88	2.44	0.61	0.00
48	Swale-SE15	Channel	Int-SE15	HW-14	664.00	1646.44	1643.32	0.4700	24.000	0.0300	19.57	57.62	0.34	1.76	1.62	0.81	0.00
49	Swale-SE1-A	Channel	Int-SE1	Jun-190	612.50	1668.33	1665.25	0.5000	60.000	0.0300	23.20	641.71	0.04	2.96	1.14	0.23	0.00
50	Swale-SE2	Channel	Int-SE2	Int-SE3	465.30	1664.17	1658.26	1.2700	13.200	0.0300	9.75	9.75	1.00	3.62	1.10	1.00	118.00
51	Swale-SE20	Channel	Pond_SE-2-Out	Jun-194	58.20	1641.50	1640.00	2.5800	24.000	0.0270	12.40	199.69	0.06	3.50	0.71	0.35	0.00
52	Swale-SE21	Channel	Jun-194	Pond-SE13	197.10	1640.00	1638.00	1.0100	36.000	0.0300	29.48	332.48	0.09	1.38	2.02	0.67	0.00
53	Swale-SE3	Channel	Int-SE3	Jun-177	701.00	1658.26	1653.62	0.6600	13.200	0.0300	4.47	5.91	0.76	2.70	0.88	0.80	0.00
54	SWALE-SE3b	Channel	Jun-177	HW-14	219.80	1654.80	1647.41	3.3600	36.000	0.0300	4.47	210.27	0.02	4.25	0.67	0.22	0.00
55	Swale-SE3c	Channel	HW-15	Culv-SE4-Out	193.00	1642.97	1642.00	0.5000	48.000	0.0300	19.40	317.49	0.06	3.55	1.06	0.27	0.00
56	Swale-SE4	Channel	Culv-SE4-Out	Jun-194	124.60	1642.00	1640.00	1.6100	48.000	0.0300	23.67	676.18	0.04	4.27	0.92	0.23	0.00
57	Swale-SE5	Channel	Culv-SE5-Out	Intr-SE6	385.20	1678.00	1674.07	1.0200	48.000	0.0330	41.52	408.74	0.10	3.18	1.60	0.40	0.00
58	Swale-SE6A	Channel	Intr-SE6	Jun-250	398.10	1674.07	1672.00	0.5200	48.000	0.0330	53.78	291.80	0.18	4.35	1.53	0.38	0.00

Reported Condition
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Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
59	Swale-SE6B	Channel	Jun-250	Intr-7	150.50	1672.00	1668.00	2.6600	48.000	0.0330	53.54	659.72	0.08	6.24	1.17	0.29	0.00
60	Swale-SE7	Channel	Intr-7	Jun-150	274.50	1668.00	1662.00	2.1900	48.000	0.0330	53.39	598.28	0.09	5.12	1.36	0.34	0.00
61	Swale-SE8	Channel	Jun-150	Intr-SE8	283.30	1662.00	1654.00	2.8200	48.000	0.0330	94.04	680.02	0.14	7.42	1.56	0.39	0.00
62	Swale-SE9	Channel	Intr-SE8	Jun-191	180.74	1654.00	1650.00	2.2100	48.000	0.0330	93.83	602.01	0.16	6.09	2.14	0.54	0.00
63	Swale-SW4A-Routing	Channel	Jun-SW4A	Jun-SW4B	775.76	1631.00	1614.00	2.1900	24.000	0.1000	36.29	163.89	0.22	1.04	1.43	0.71	0.00
64	Swale-SW4B-Routing	Channel	Culv-SW4_Out	Jun-SW4B	414.00	1633.43	1612.00	5.1800	24.000	0.1000	5.03	251.89	0.02	0.19	1.10	0.55	0.00
65	Swale-SW4C	Channel	Jun-SW4B	Pond_SW4	254.98	1614.00	1602.72	4.4200	48.000	0.0300	51.87	280.48	0.18	4.79	3.06	0.77	0.00
66	Swale-SW5-Routing	Channel	Culv-SW5_Out	Pond_SW1	390.00	1645.00	1634.00	2.8200	12.000	0.0300	19.07	332.62	0.06	2.63	0.52	0.52	0.00
67	Swale-SW6-Routing	Channel	Culv-SW6_Out	Pond_SW1	170.69	1639.00	1634.00	2.9300	48.000	0.0300	64.94	2449.26	0.03	9.34	0.78	0.20	0.00
68	2_Year	Orifice	Pond_SE-1	SE-1-OCS-1		1628.00	1625.25		21.000		18.02						
69	POCS-2-50-Year	Orifice	Pond_SE-1	SE-1-OCS-2		1628.00	1622.75		48.000		0.00						
70	Pond_NW-5-Dev 1	Orifice	Pond_NW-5	Pond_NW-5-OCS		1662.50	1660.50		4.000		0.82						
71	Pond_NW-5-Dev 2	Orifice	Pond_NW-5	Pond_NW-5-OCS		1662.50	1660.50		48.000		0.00						
72	Pond_SE-1-Drawdown	Orifice	Pond_SE-1	SE-1-OCS-1		1628.00	1625.25		3.500		0.57						
73	Pond_SE-1-FB-Drawdown	Orifice	Pond_SE-1-FB	Pond_SE-1		1632.50	1628.00		8.000		2.75						
74	Pond_SE-2-2_YR-B	Orifice	Pond_SE-2	SE-2-OCS-1		1642.80	1641.80		6.000		6.42						
75	Pond_SE-2-25_YR-A	Orifice	Pond_SE-2	SE-2-OCS-1		1642.80	1641.80		48.000		3.01						
76	Pond_SE-2-Drawdown	Orifice	Pond_SE-2	SE-2-OCS-1		1642.80	1641.80		7.600		2.97						
77	Pond_SE-2-FB-Drawdown	Orifice	Pond_SE-2-FB	Pond_SE-2		1645.30	1642.80		12.000		6.41						
78	Pond_NW2-Over	Weir	Pond_NW2	Pond_NW2-Out		1642.00	1642.00				0.00						
79	Pond_NW-5-OF	Weir	Pond_NW-5	Pond_SE1-Out		1662.50	1658.30				0.00						
80	Pond_SE-1-FB-WQV	Weir	Pond_SE-1-FB	Pond_SE-1		1632.50	1628.00				37.62						
81	Pond_SE-2-FB-HFW	Weir	Pond_SE-2-FB	Pond_SE-2		1645.30	1642.80				70.68						
82	SE-1-OFW	Weir	Pond_SE-1	Pond_SE-1-OFW		1628.00	1632.00				0.00						
83	SE-2-OFW	Weir	Pond_SE-2	Jun-194		1642.80	1640.00				0.00						

Reported
Condition

Subbasin Hydrology

Subbasin : N-1

Input Data

Area (ac) 57.90
Weighted Curve Number 70.55
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	54.52	C	70.00
Gravel roads	0.17	C	89.00
Meadow, non-grazed	2.27	C	71.00
Paved parking & roofs	0.94	C	98.00
Composite Area & Weighted CN	57.90		70.55

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.60	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	12.25	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.10	0.00	0.00
Computed Flow Time (min) :	16.34	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	2236	199	168
Slope (%) :	9.76	10.42	10.42
Surface Type :	Woodland	Grass pasture	Woodland
Velocity (ft/sec) :	1.56	2.26	1.61
Computed Flow Time (min) :	23.89	1.47	1.74

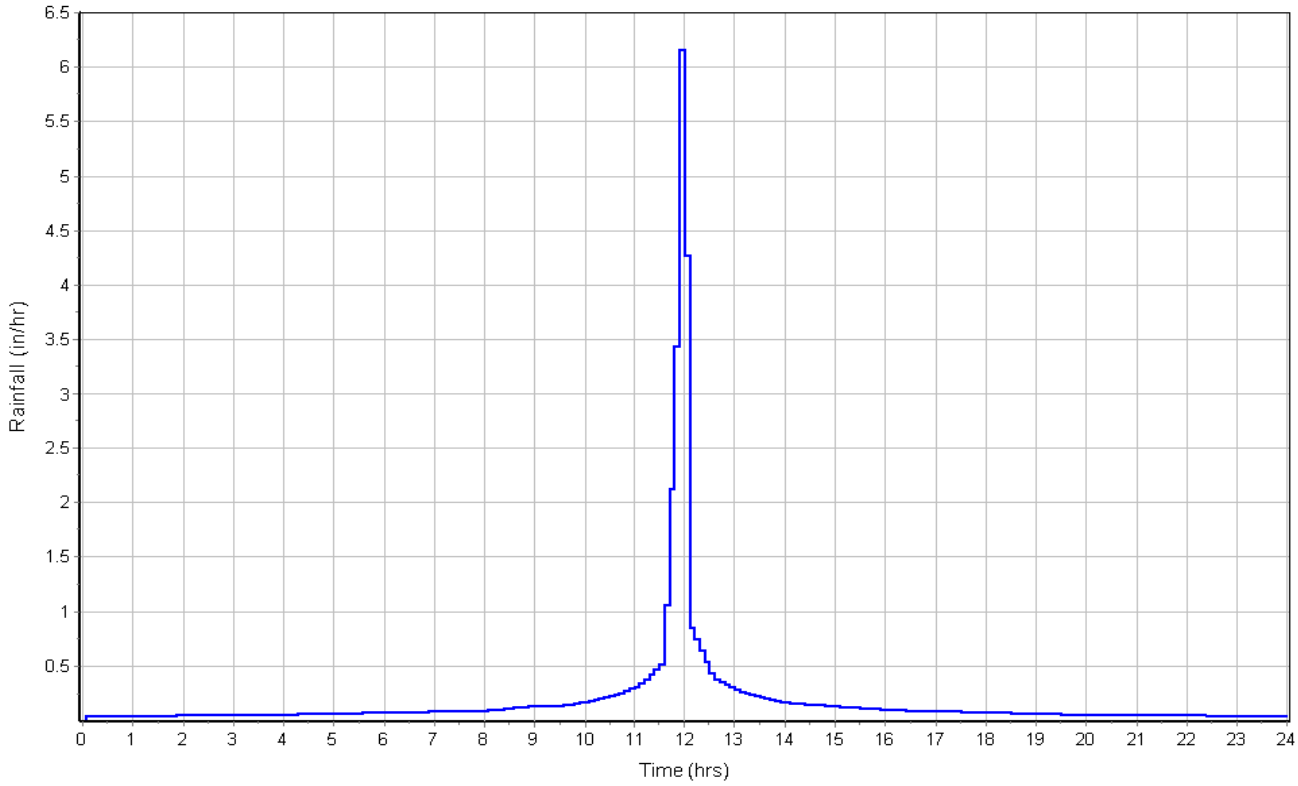
Total TOC (min) 43.44

Subbasin Runoff Results

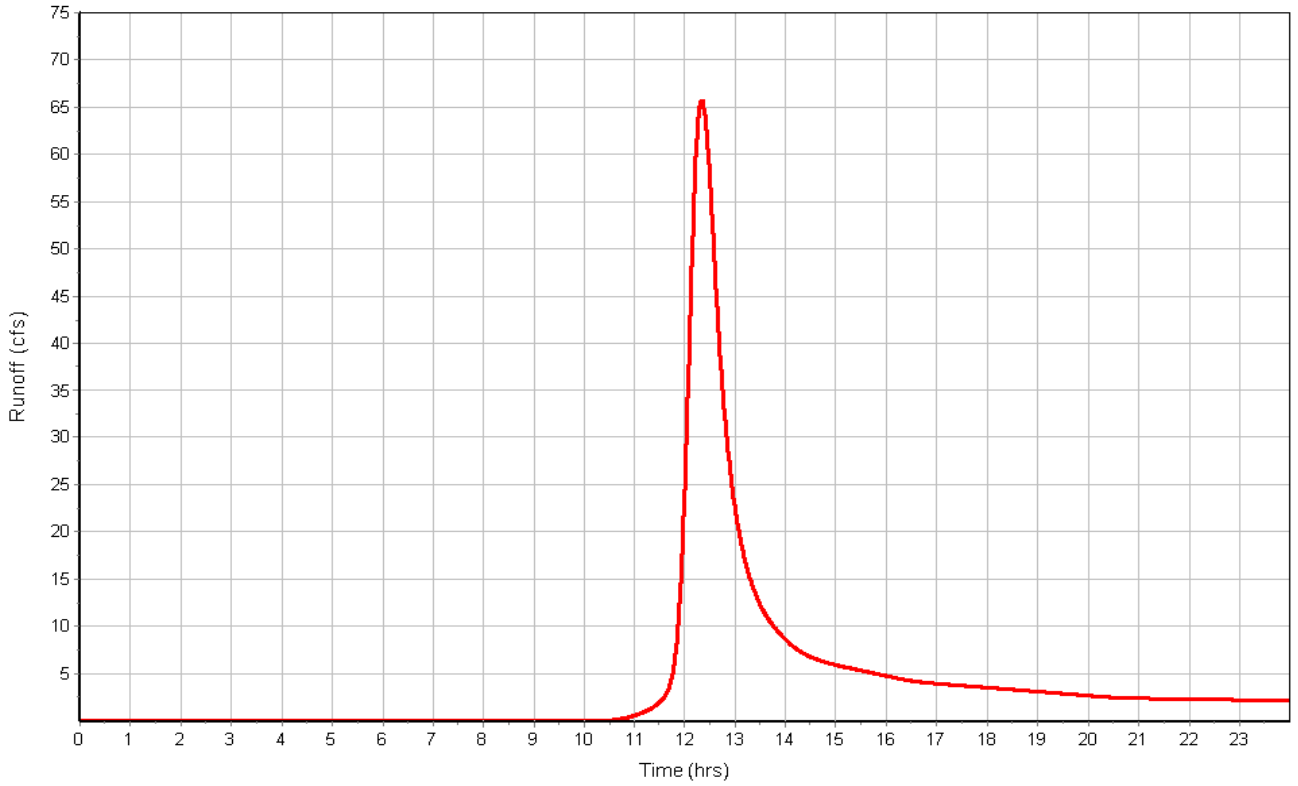
Total Rainfall (in)	4.49
Total Runoff (in)	1.71
Peak Runoff (cfs)	65.62
Weighted Curve Number	70.55
Time of Concentration (days hh:mm:ss)	0 00:43:26

Subbasin : N-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NW2

Input Data

Area (ac) 6.62
Weighted Curve Number 74.12
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved roads	0.40	C	98.00
Woods, Good	1.91	C	70.00
Meadow, non-grazed	2.47	C	71.00
Meadow, non-grazed	0.79	D	78.00
Woods, Good	1.06	D	77.00
Composite Area & Weighted CN	6.63		74.12

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.24	.24	0.00
Flow Length (ft) :	26.22	41.145	0.00
Slope (%) :	33.33	4.19	0.00
2 yr, 24 hr Rainfall (in) :	2.48	2.48	0.00
Velocity (ft/sec) :	0.24	0.12	0.00
Computed Flow Time (min) :	1.80	5.93	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	301.114	0.00	0.00
Slope (%) :	3.46	0.00	0.00
Surface Type :	Forest	Unpaved	Unpaved
Velocity (ft/sec) :	0.47	0.00	0.00
Computed Flow Time (min) :	10.68	0.00	0.00

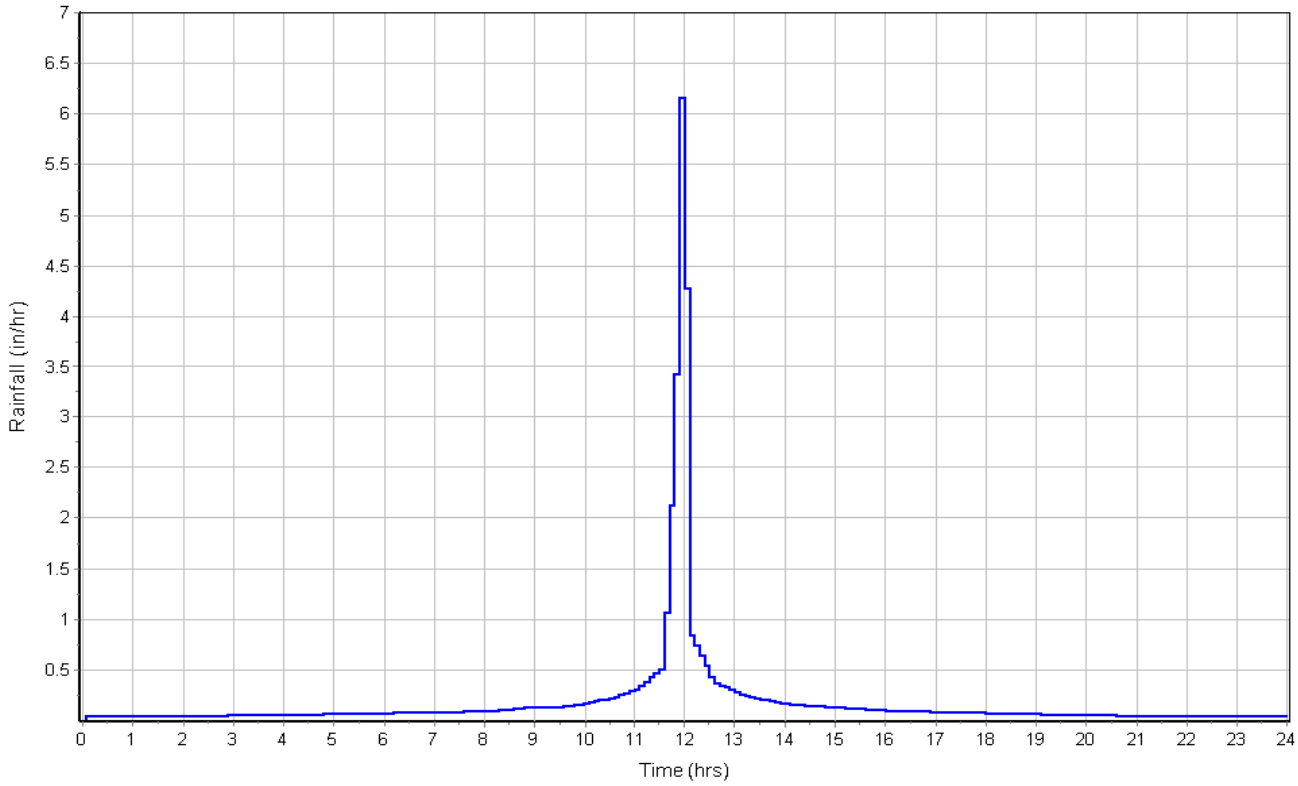
Total TOC (min) 18.41

Subbasin Runoff Results

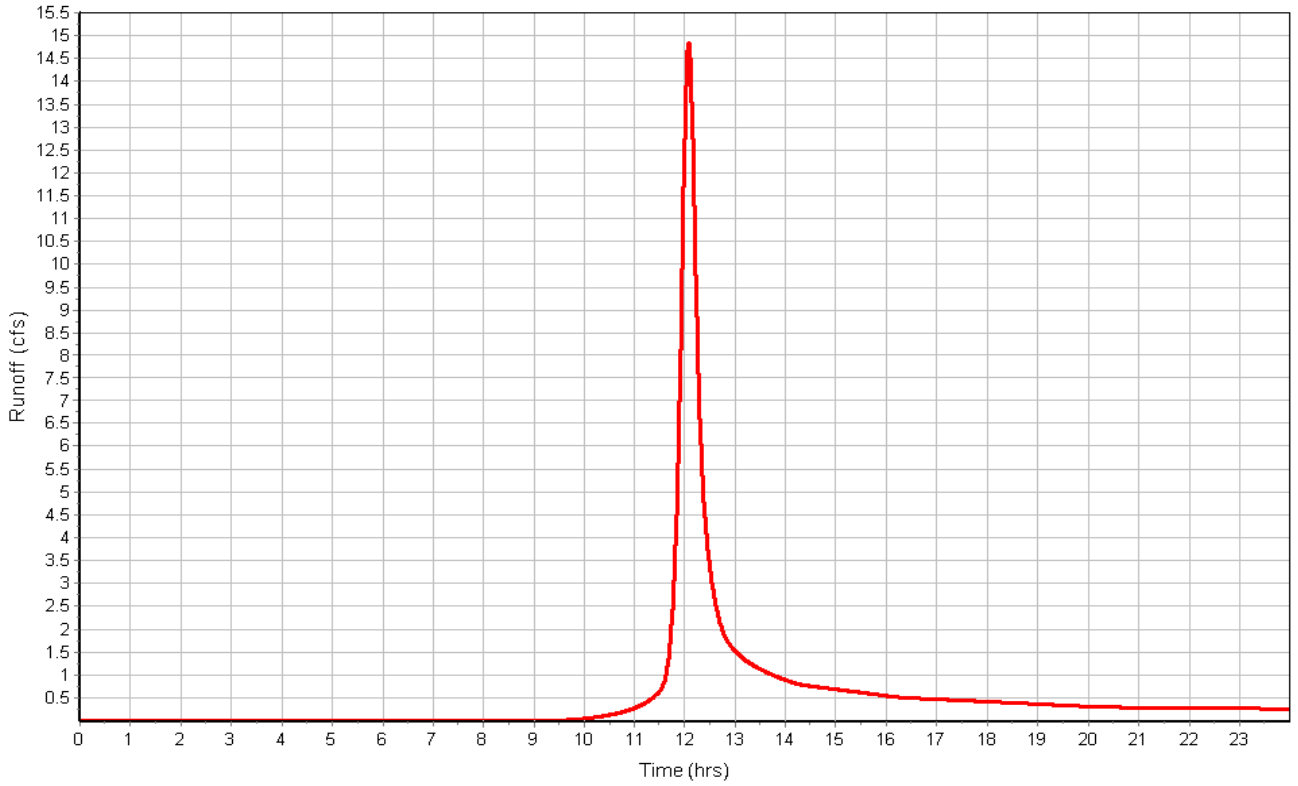
Total Rainfall (in) 4.49
Total Runoff (in) 1.97
Peak Runoff (cfs) 14.85
Weighted Curve Number 74.12
Time of Concentration (days hh:mm:ss) 0 00:18:25

Subbasin : NW2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NW3

Input Data

Area (ac) 8.26
Weighted Curve Number 93.58
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved roads	0.16	C	98.00
Landfill cap, interim, 100% imp	6.75	C	98.00
Meadow, non-grazed	1.35	C	71.00
Composite Area & Weighted CN	8.26		93.58

Time of Concentration

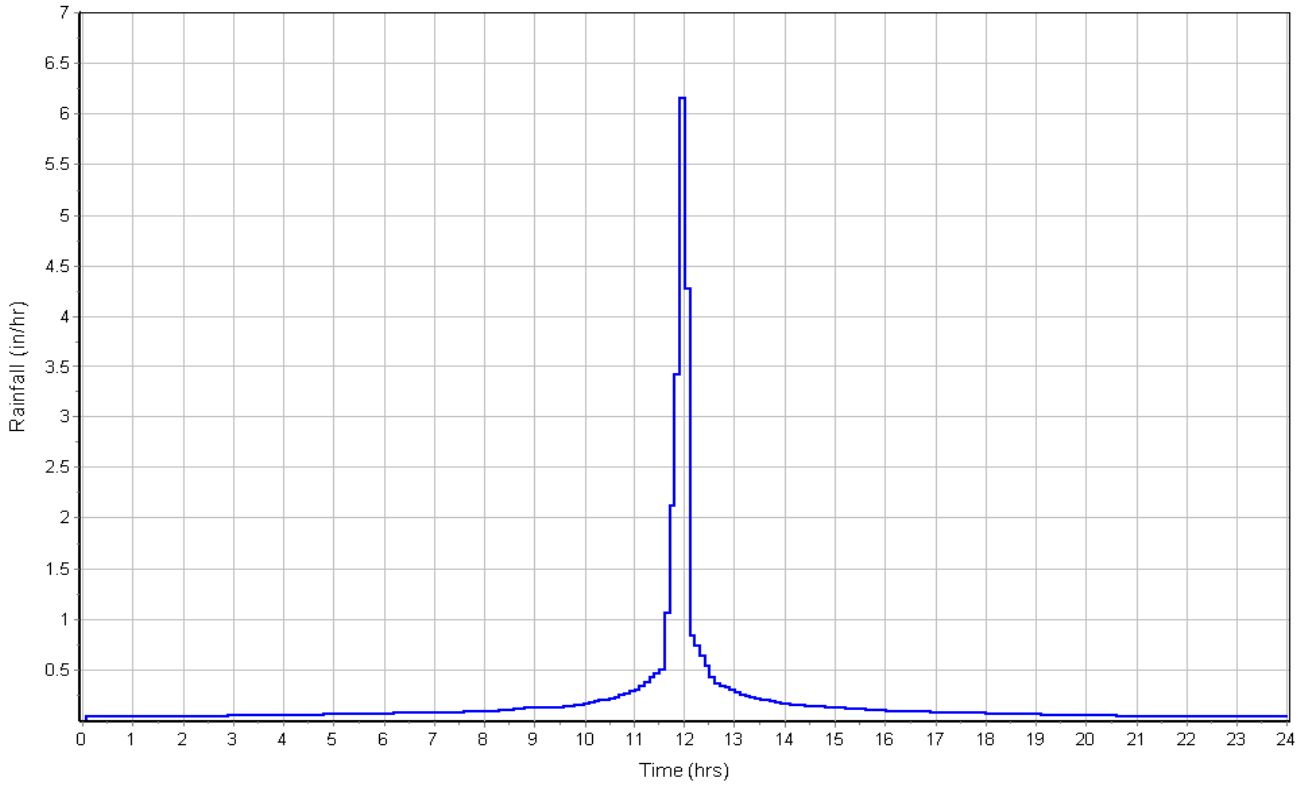
User-Defined TOC override (minutes): 6

Subbasin Runoff Results

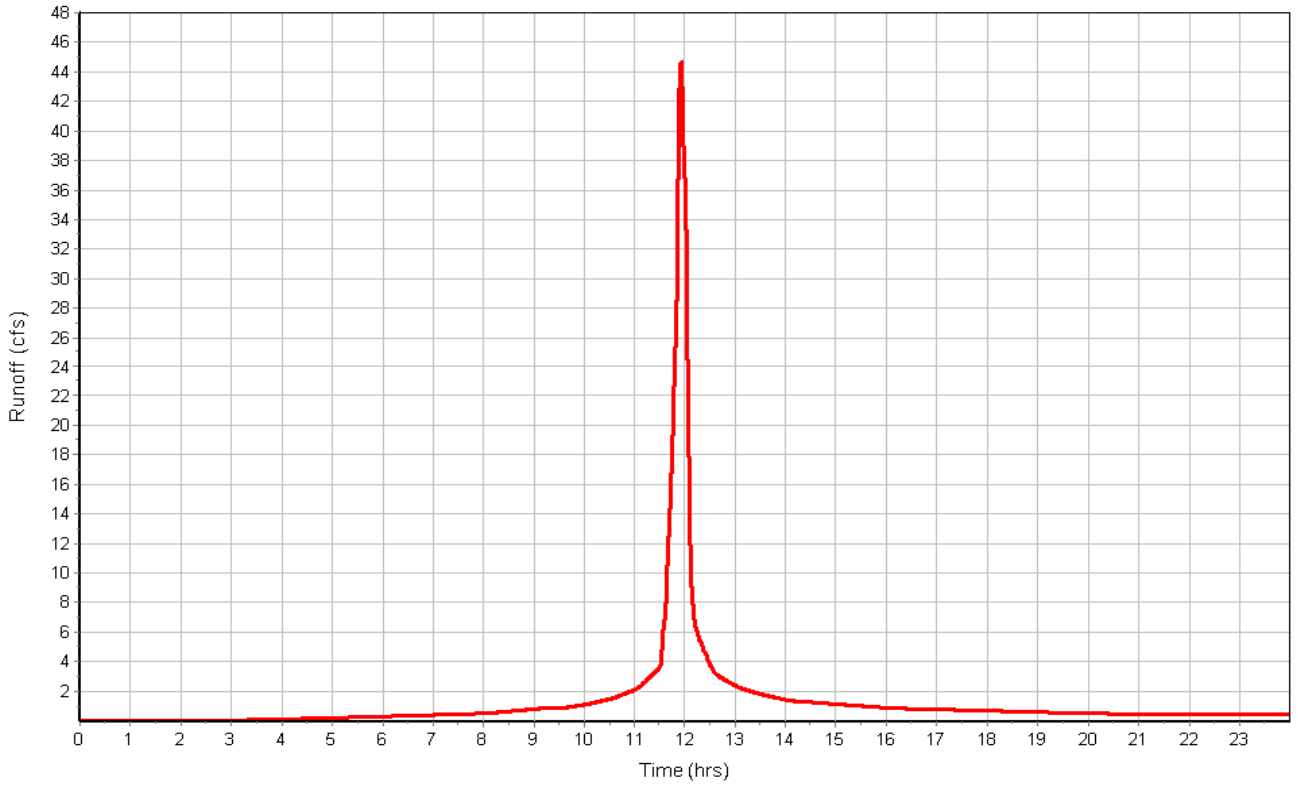
Total Rainfall (in) 4.49
Total Runoff (in) 3.76
Peak Runoff (cfs) 44.77
Weighted Curve Number 93.58
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : NW3

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NW4

Input Data

Area (ac) 10.99
Weighted Curve Number 95.33
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved roads	0.32	C	98.00
Landfill cap, interim, 100% imp	9.58	C	98.00
Meadow, non-grazed	1.09	C	71.00
Composite Area & Weighted CN	10.99		95.33

Time of Concentration

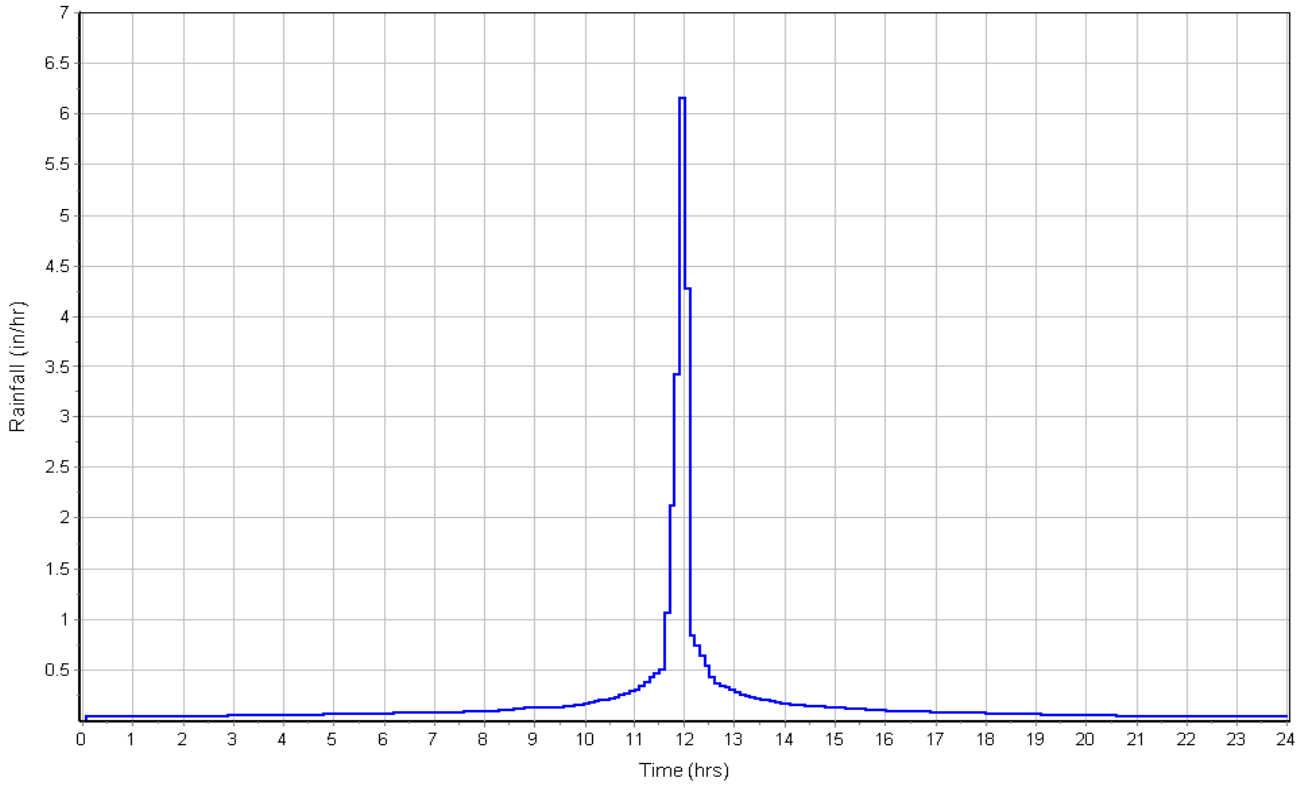
User-Defined TOC override (minutes): 6

Subbasin Runoff Results

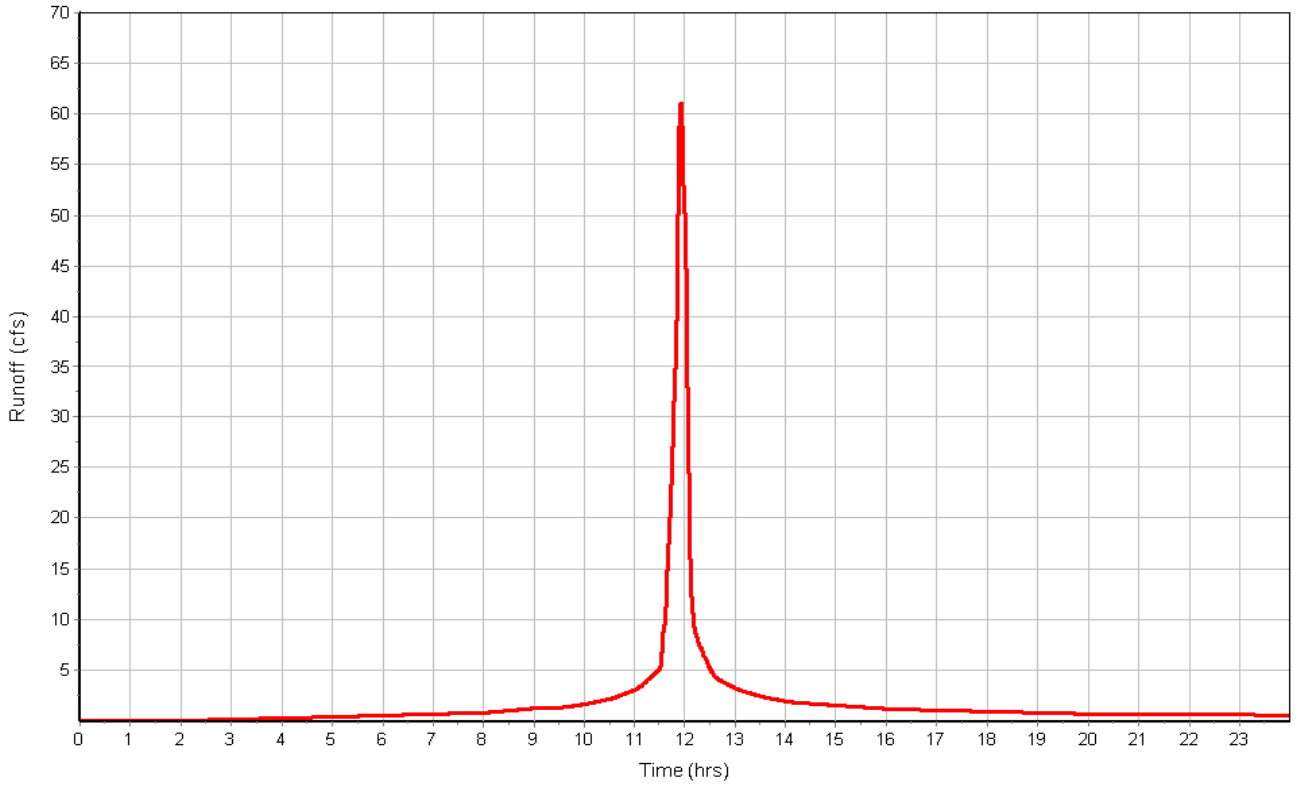
Total Rainfall (in) 4.49
Total Runoff (in) 3.95
Peak Runoff (cfs) 61.18
Weighted Curve Number 95.33
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : NW4

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NW5

Input Data

Area (ac) 248.50
Weighted Curve Number 70.66
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.22	B	55.00
Woods, Good	218.61	C	70.00
Woods, Good	8.92	D	77.00
Gravel roads	0.62	C	89.00
Meadow, non-grazed	12.17	C	71.00
Paved parking & roofs	2.73	C	98.00
Composite Area & Weighted CN	243.27		70.66

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.60	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	3.00	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.06	0.00	0.00
Computed Flow Time (min) :	28.69	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1716.085	160.816	1973.584
Slope (%) :	6.44	11.69	12.55
Surface Type :	Woodland	Grass pasture	Woodland
Velocity (ft/sec) :	1.27	2.39	1.77
Computed Flow Time (min) :	22.52	1.12	18.58

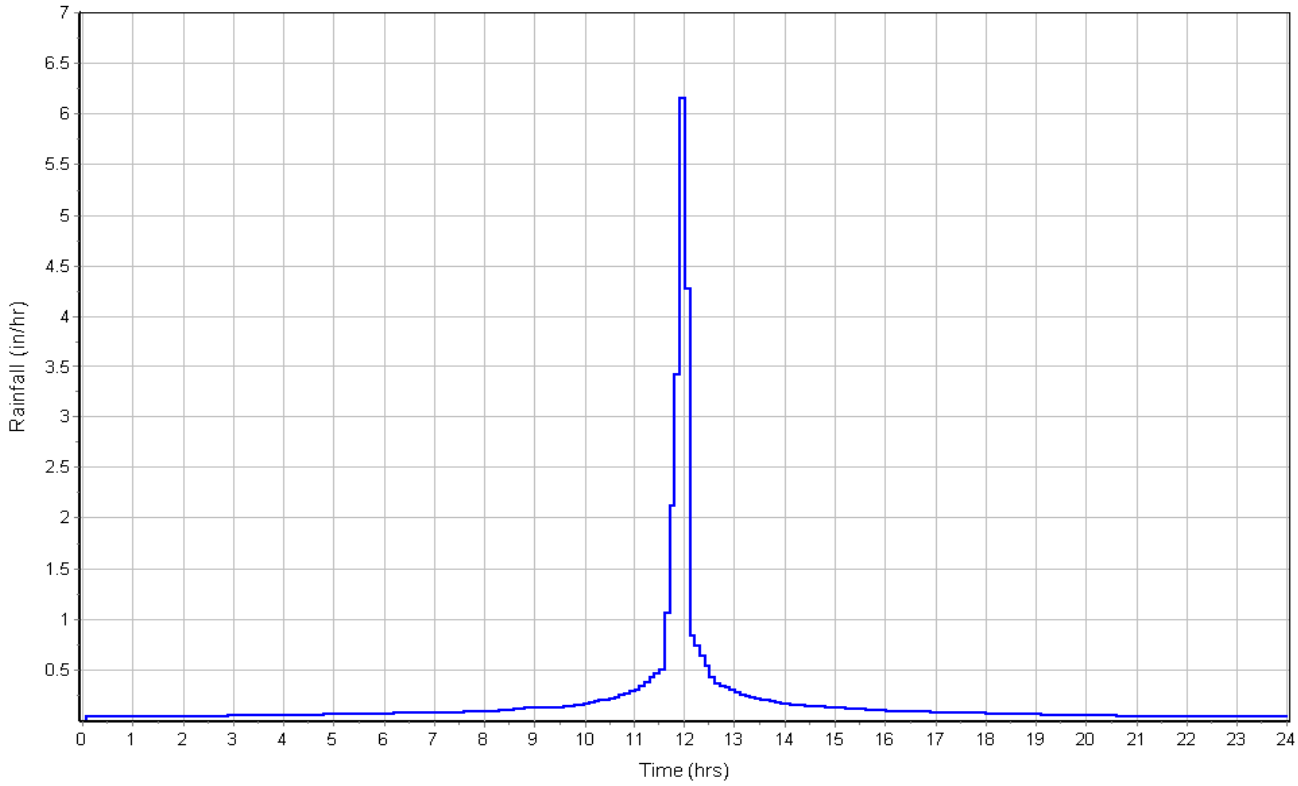
Total TOC (min) 70.91

Subbasin Runoff Results

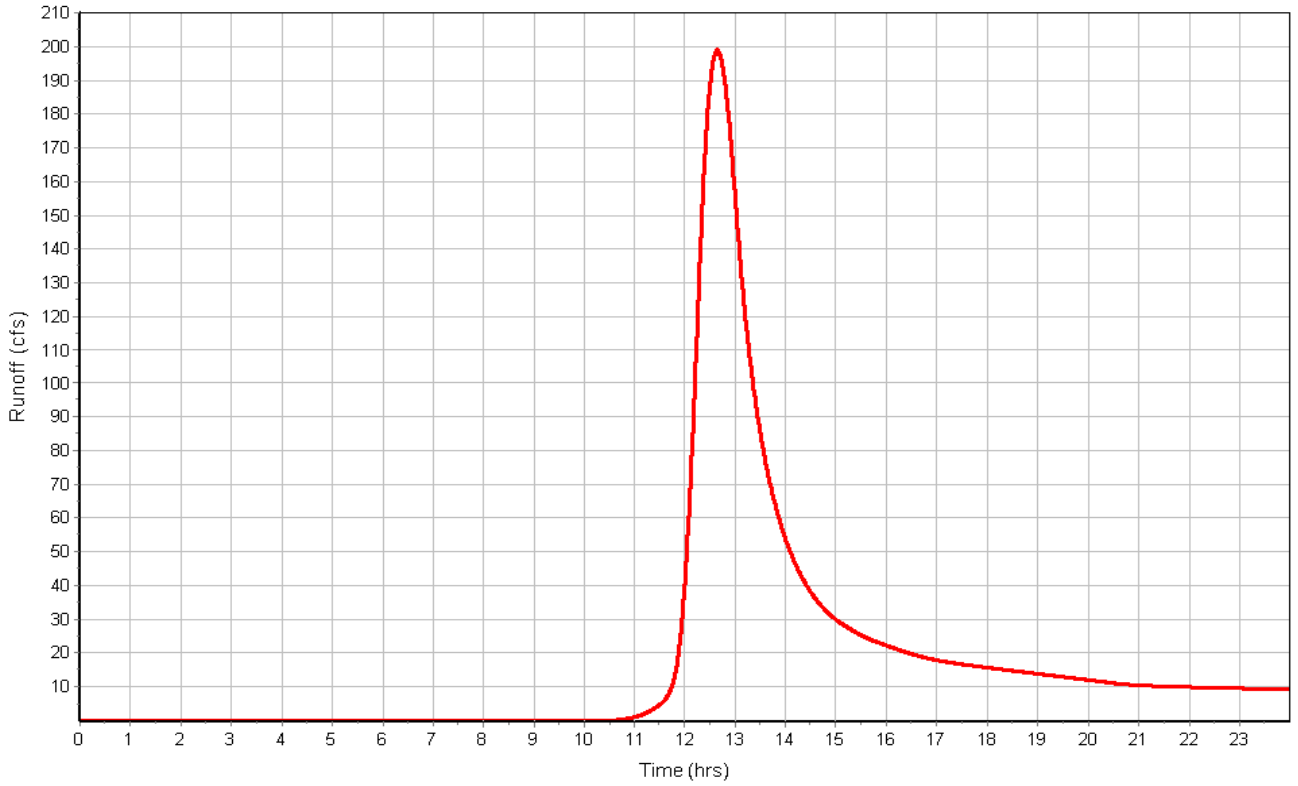
Total Rainfall (in) 4.49
Total Runoff (in) 1.71
Peak Runoff (cfs) 199.20
Weighted Curve Number 70.66
Time of Concentration (days hh:mm:ss) 0 01:10:55

Subbasin : NW5

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NW7

Input Data

Area (ac) 3.02
Weighted Curve Number 73.97
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.92	C	70.00
Meadow, non-grazed	0.68	C	71.00
Meadow, non-grazed	1.41	D	78.00
Composite Area & Weighted CN	3.01		73.97

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	24.91	0.00	0.00
Slope (%) :	2.34	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.04	0.00	0.00
Computed Flow Time (min) :	10.42	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	230.79	26.23	0.00
Slope (%) :	5.60	7.45	0.00
Surface Type :	Woodland	Grass pasture	Unpaved
Velocity (ft/sec) :	1.18	1.91	0.00
Computed Flow Time (min) :	3.26	0.23	0.00

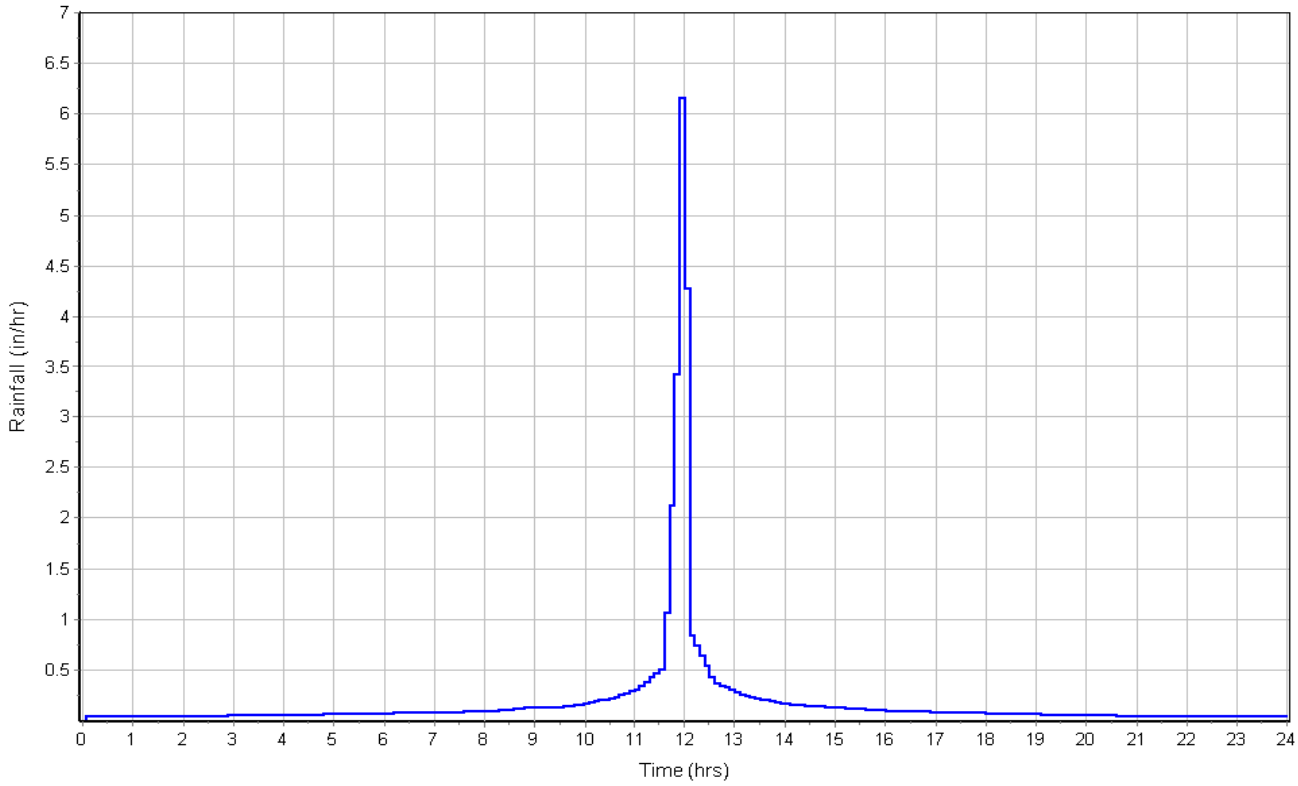
Total TOC (min) 13.91

Subbasin Runoff Results

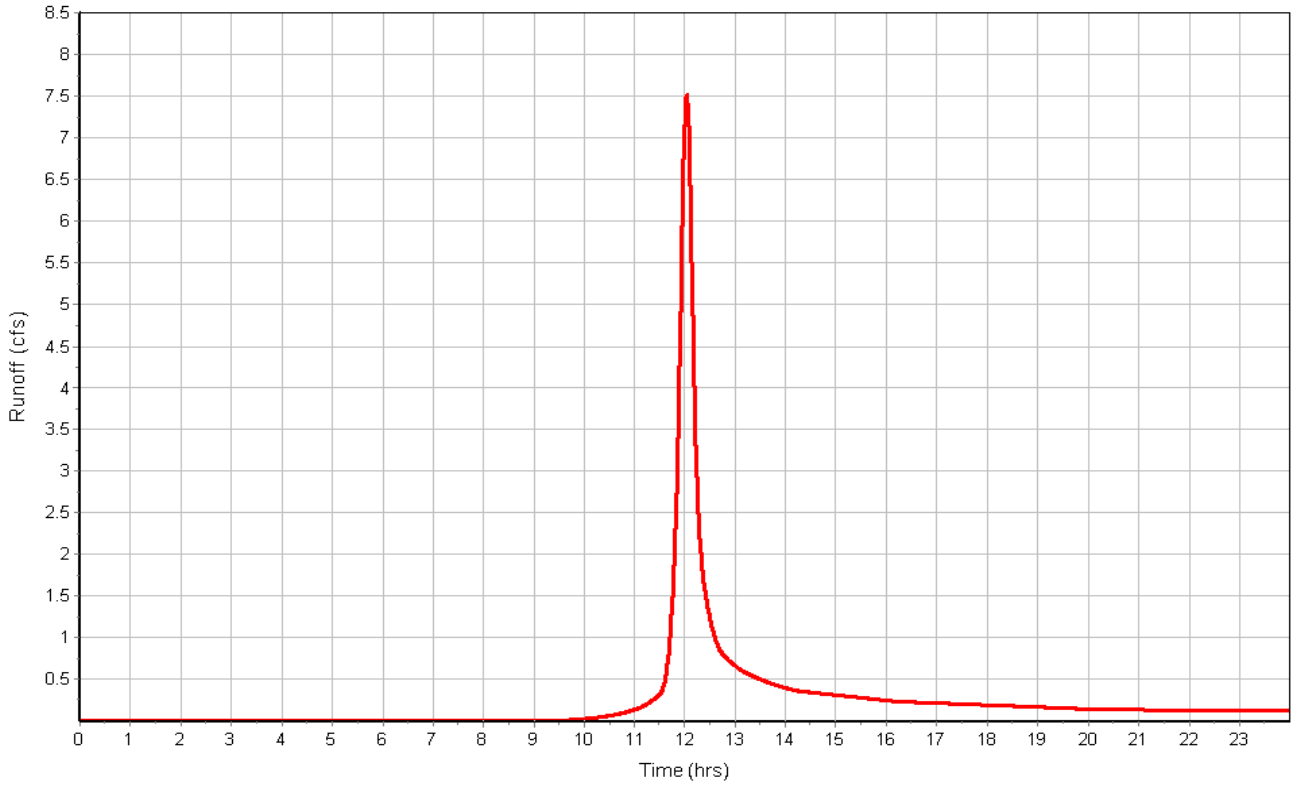
Total Rainfall (in) 4.49
Total Runoff (in) 1.96
Peak Runoff (cfs) 7.51
Weighted Curve Number 73.97
Time of Concentration (days hh:mm:ss) 0 00:13:55

Subbasin : NW7

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : S1

Input Data

Area (ac) 2.83
Weighted Curve Number 94.18
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved roads	0.07	C	98.00
Landfill cap, interim, 100% imp	2.36	C	98.00
Meadow, non-grazed	0.40	C	71.00
Composite Area & Weighted CN	2.83		94.18

Time of Concentration

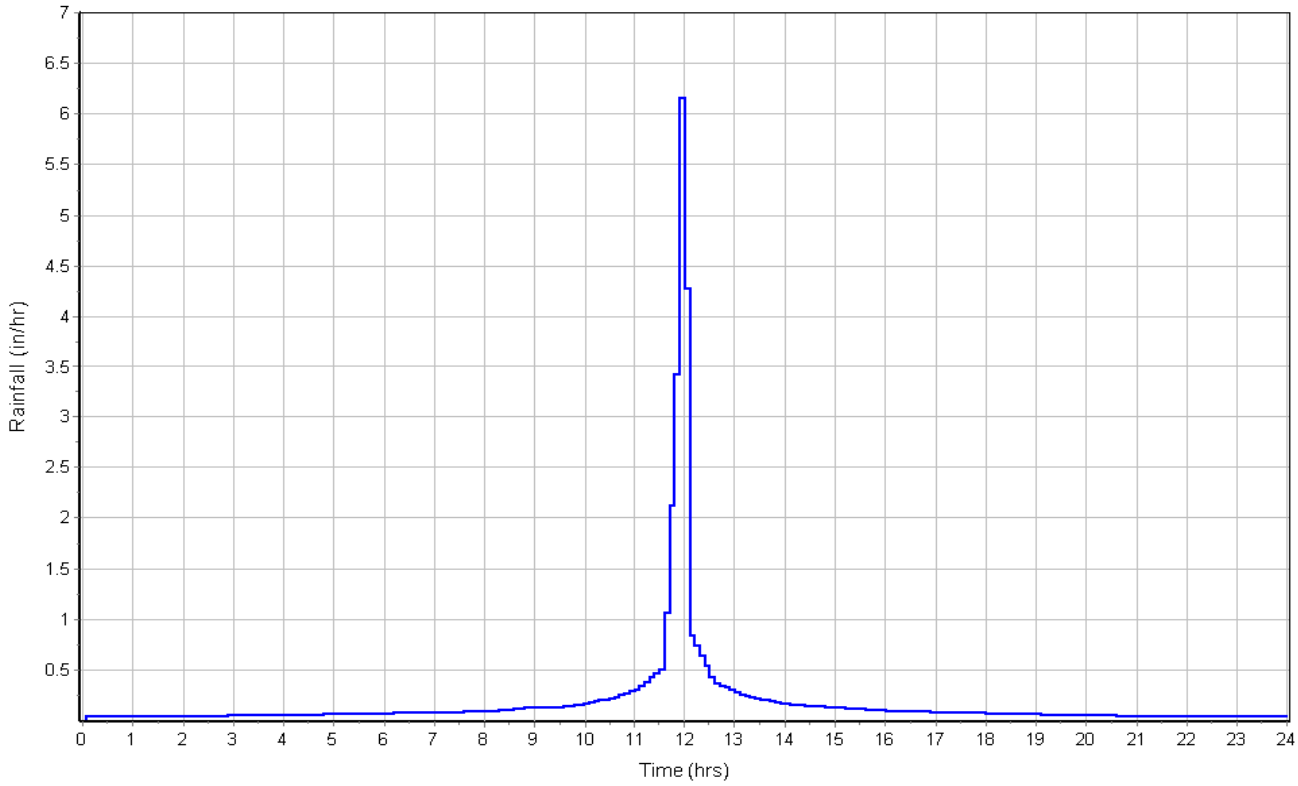
User-Defined TOC override (minutes): 6

Subbasin Runoff Results

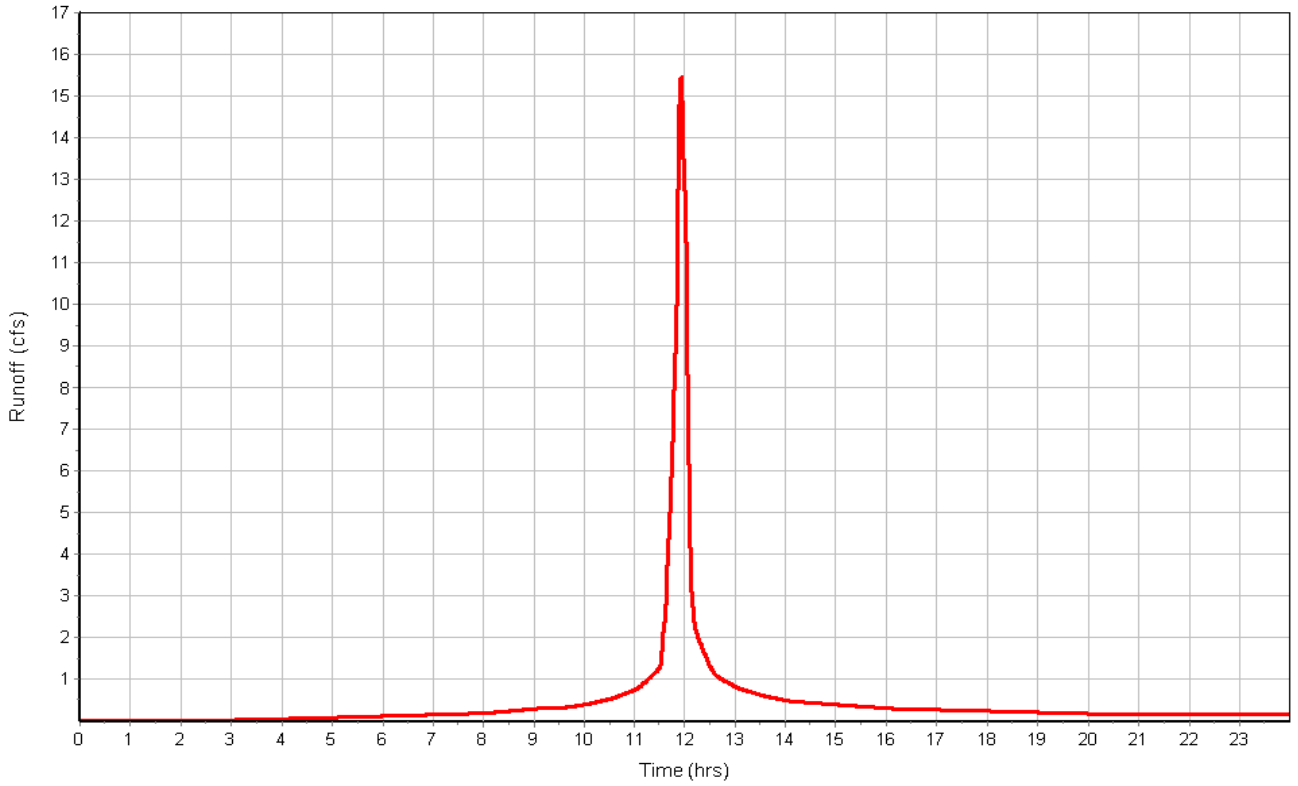
Total Rainfall (in) 4.49
Total Runoff (in) 3.83
Peak Runoff (cfs) 15.48
Weighted Curve Number 94.18
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : S1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : S2

Input Data

Area (ac) 9.03
Weighted Curve Number 95.54
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved roads	0.99	C	98.00
Meadow, non-grazed	0.82	C	71.00
Landfill cap, interim, 100% imp	7.22	C	98.00
Composite Area & Weighted CN	9.03		95.54

Time of Concentration

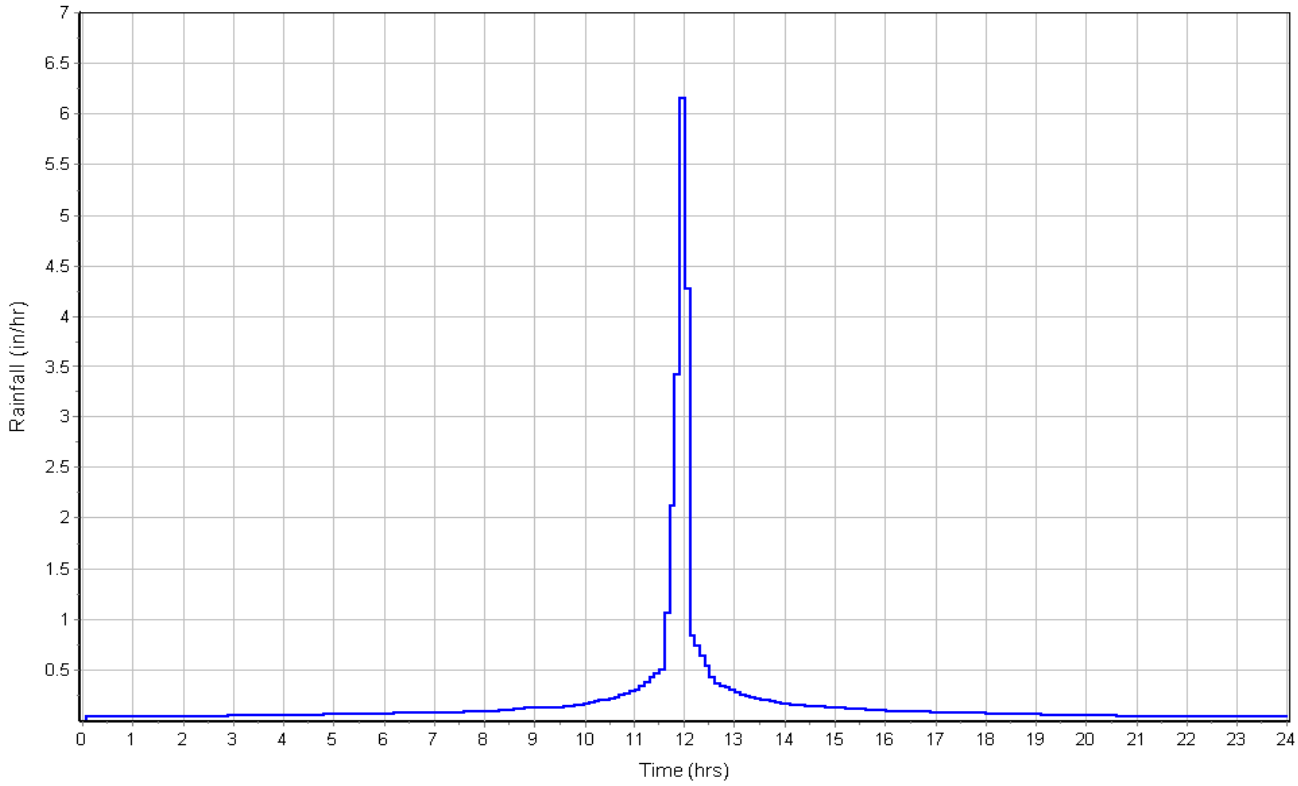
User-Defined TOC override (minutes): 6

Subbasin Runoff Results

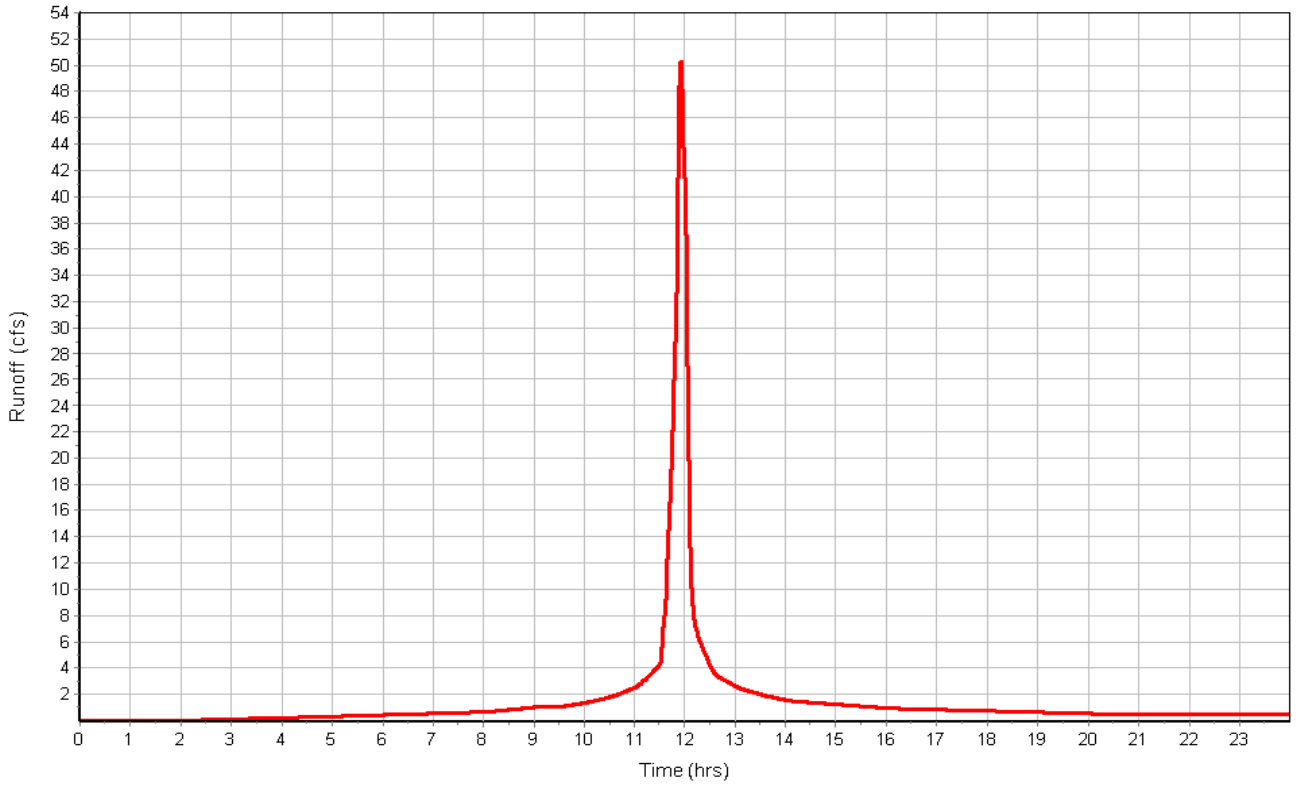
Total Rainfall (in) 4.49
Total Runoff (in) 3.98
Peak Runoff (cfs) 50.39
Weighted Curve Number 95.54
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : S2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : S3

Input Data

Area (ac) 7.51
Weighted Curve Number 91.22
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved roads	0.31	C	98.00
Landfill cap, interim, 100% imp	5.31	C	98.00
Meadow, non-grazed	1.89	C	71.00
Composite Area & Weighted CN	7.51		91.22

Time of Concentration

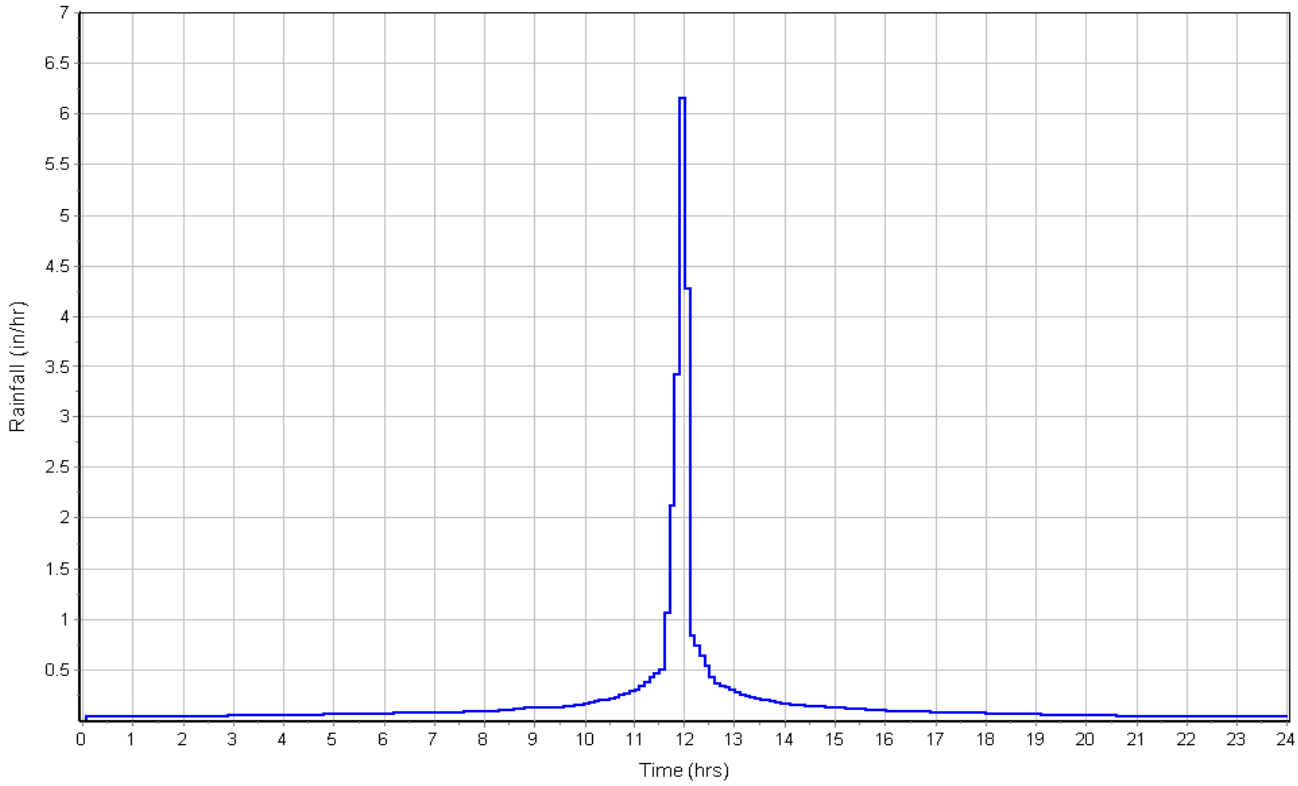
User-Defined TOC override (minutes): 6

Subbasin Runoff Results

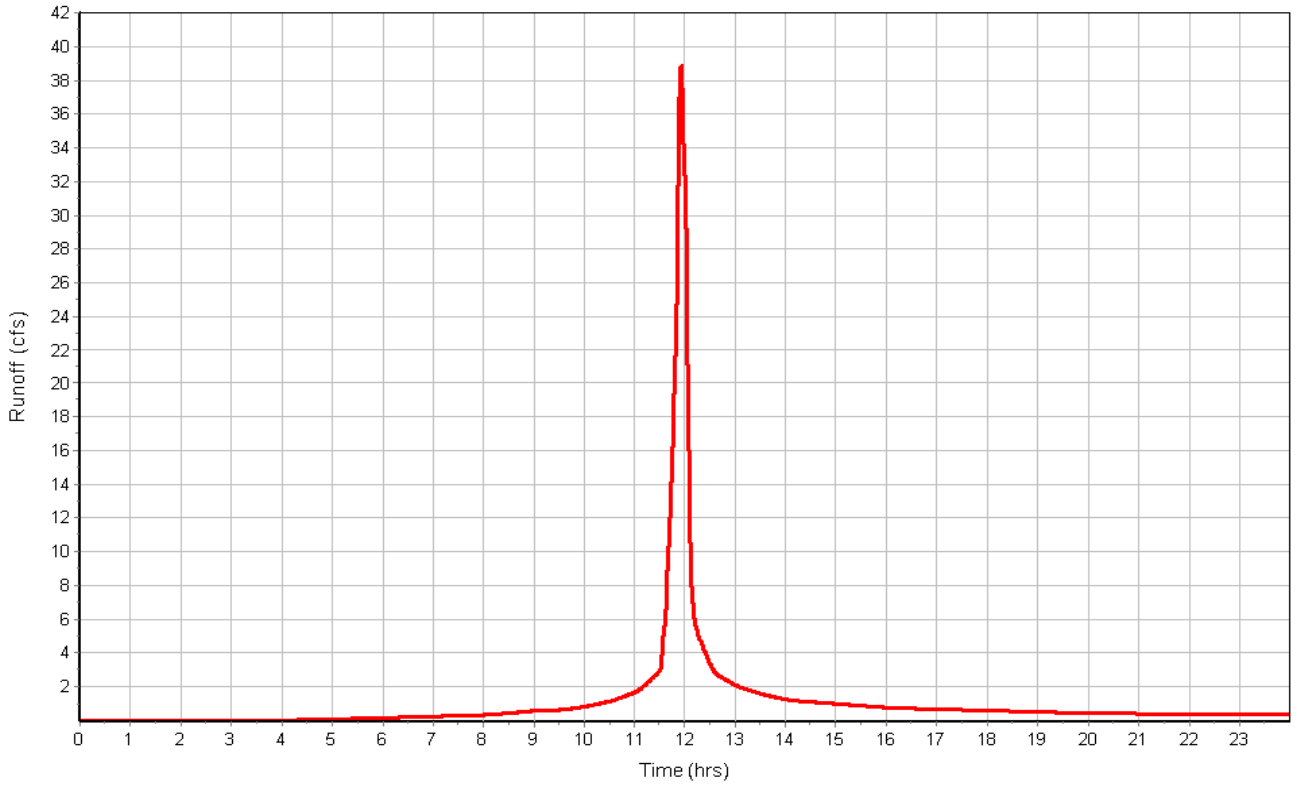
Total Rainfall (in) 4.49
Total Runoff (in) 3.51
Peak Runoff (cfs) 38.90
Weighted Curve Number 91.22
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : S3

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-1

Input Data

Area (ac) 20.91
Weighted Curve Number 70.94
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	17.74	C	70.00
Woods, Good	1.98	D	77.00
Meadow, non-grazed	0.63	C	71.00
Meadow, non-grazed	0.54	D	78.00
Gravel roads	0.03	D	96.00
Composite Area & Weighted CN	20.92		70.94

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.6	0.00	0.00
Flow Length (ft) :	41.87	0.00	0.00
Slope (%) :	6.80	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.07	0.00	0.00
Computed Flow Time (min) :	10.31	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1147	788	346
Slope (%) :	7.47	3.74	1.91
Surface Type :	Woodland	Woodland	Woodland
Velocity (ft/sec) :	1.37	0.97	0.69
Computed Flow Time (min) :	13.95	13.54	8.36

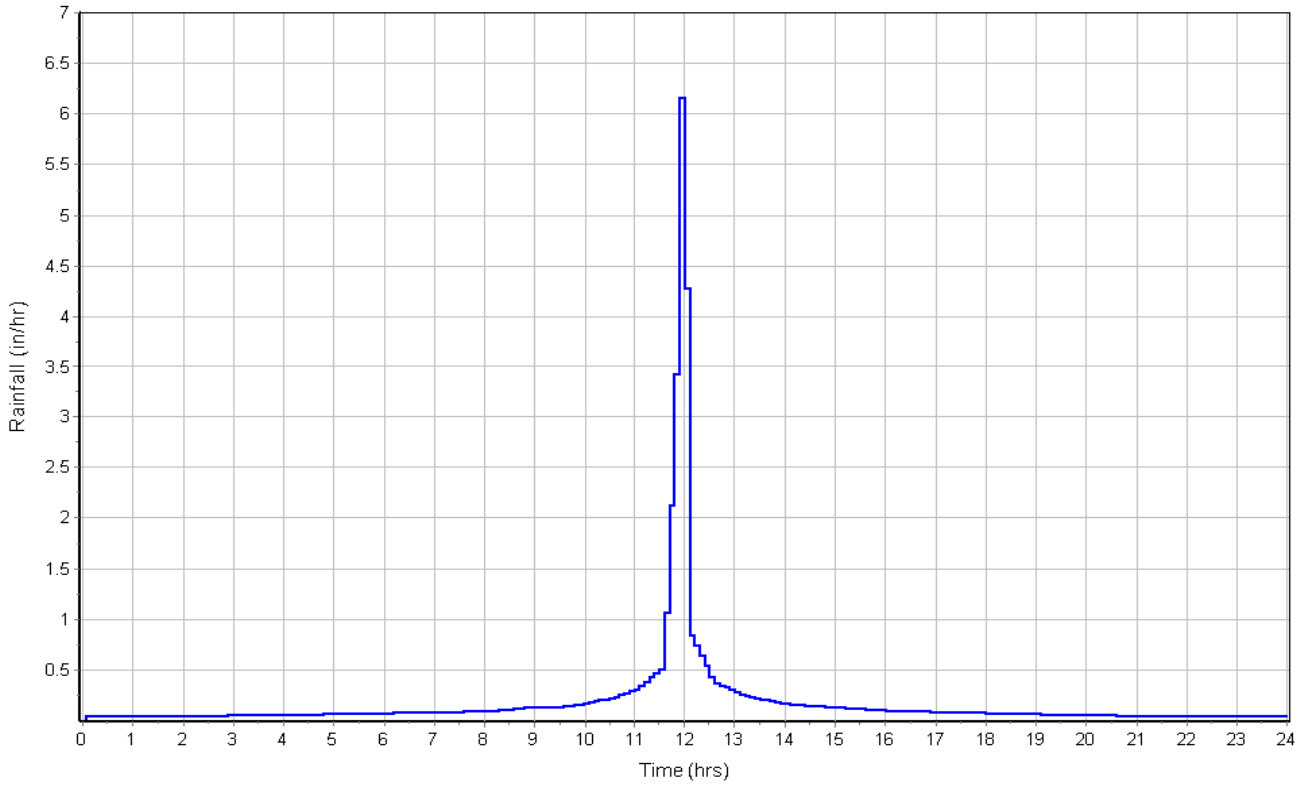
Total TOC (min) 46.16

Subbasin Runoff Results

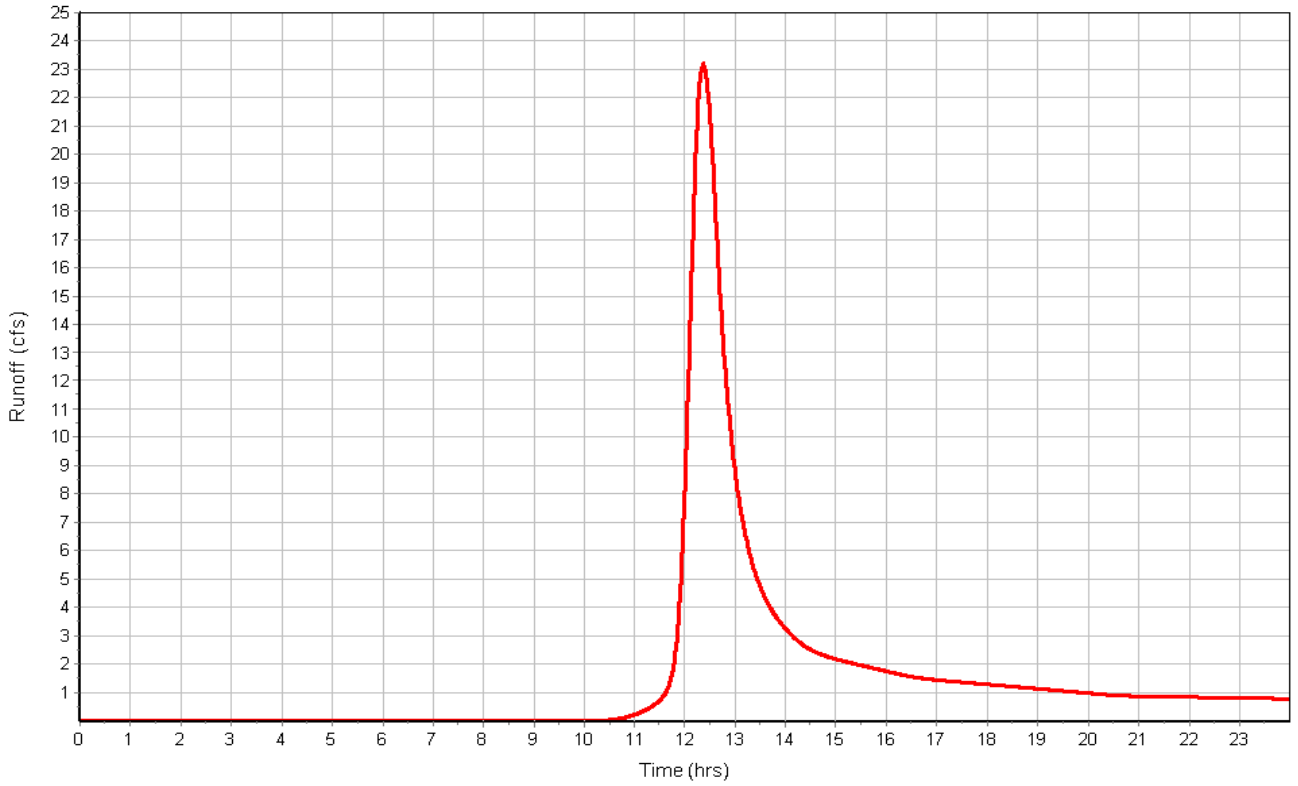
Total Rainfall (in) 4.49
Total Runoff (in) 1.74
Peak Runoff (cfs) 23.21
Weighted Curve Number 70.94
Time of Concentration (days hh:mm:ss) 0 00:46:10

Subbasin : SE-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-10

Input Data

Area (ac) 3.42
Weighted Curve Number 97.27
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Landfill cap, interim, 100% imp	2.26	C	98.00
Swale, riprap over soils	0.50	C	93.00
Paved roads	0.66	C	98.00
Composite Area & Weighted CN	3.42		97.27

Time of Concentration

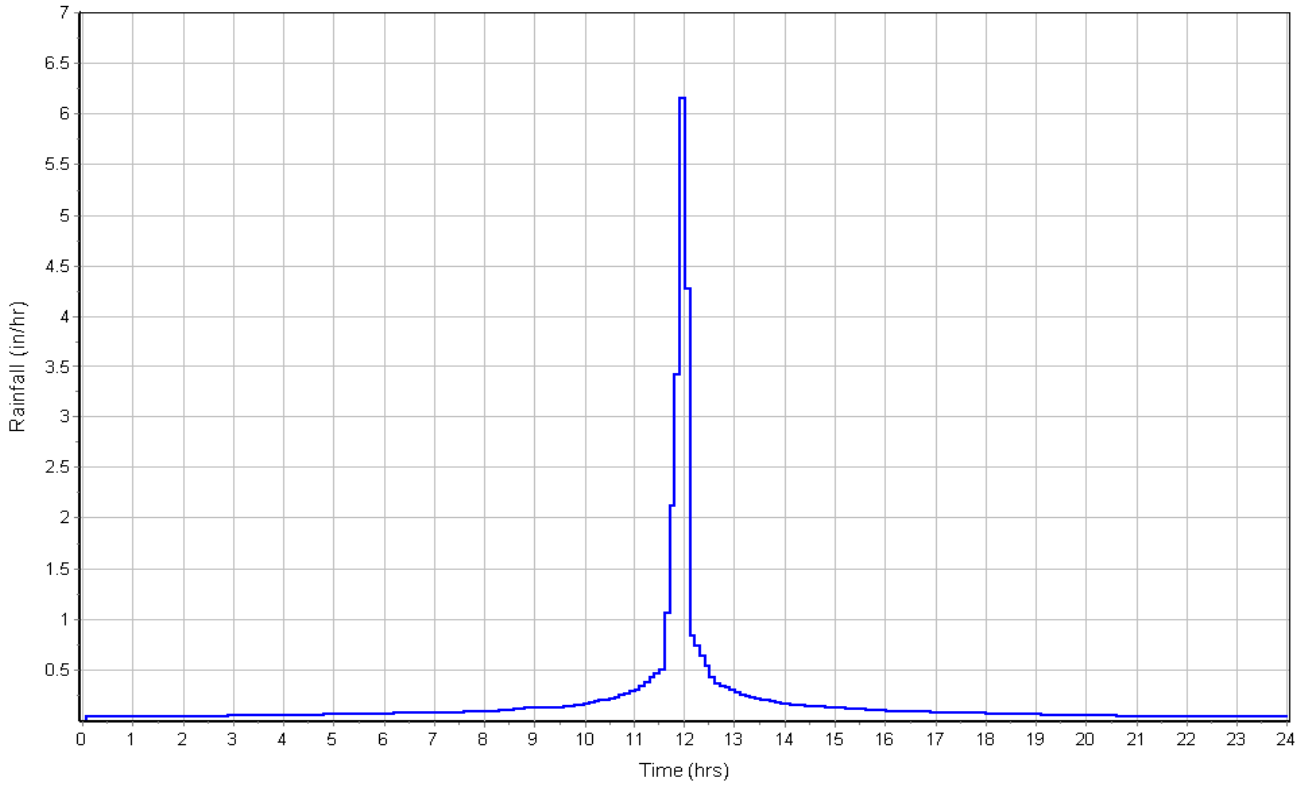
User-Defined TOC override (minutes): 6

Subbasin Runoff Results

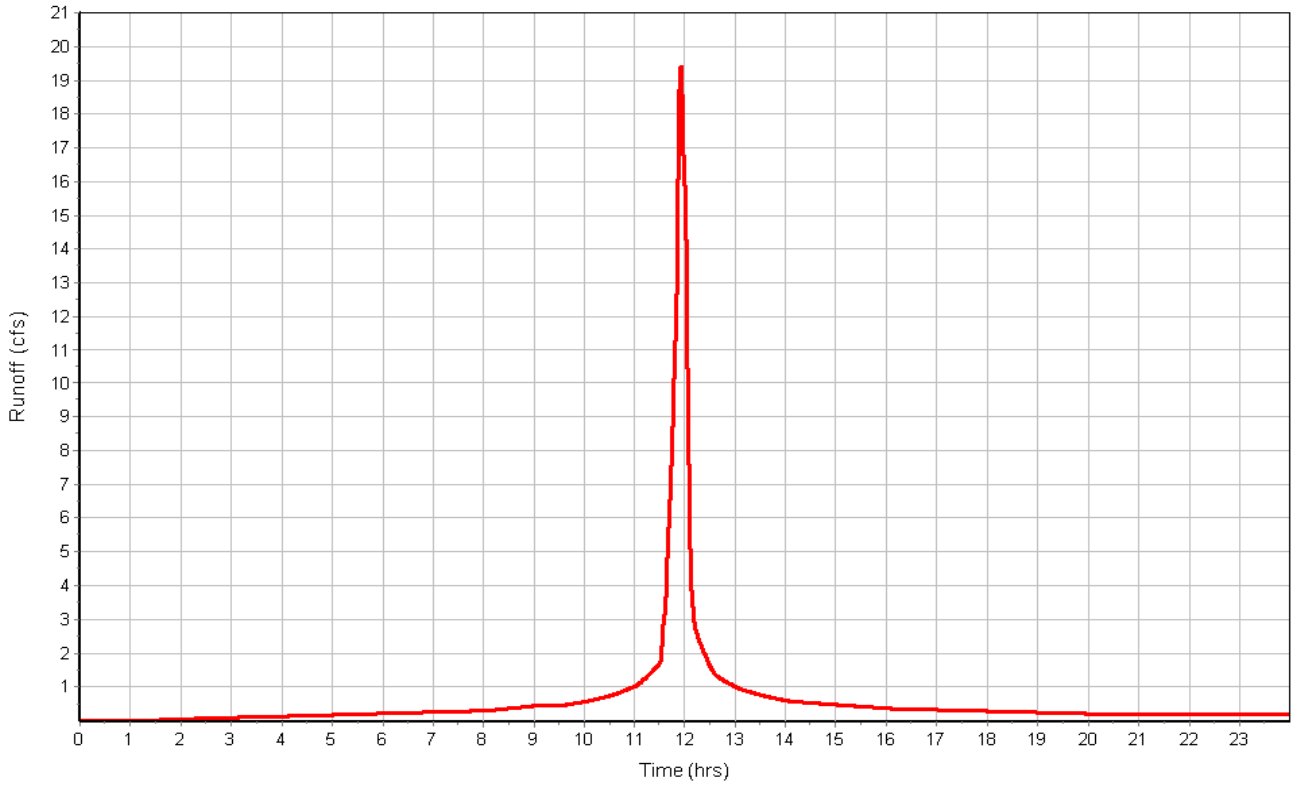
Total Rainfall (in) 4.49
Total Runoff (in) 4.17
Peak Runoff (cfs) 19.44
Weighted Curve Number 97.27
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : SE-10

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-11

Input Data

Area (ac) 3.48
Weighted Curve Number 97.55
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Landfill cap, interim, 100% imp	2.82	C	98.00
Swale, riprap over soils	0.31	C	93.00
Paved roads	0.35	C	98.00
Composite Area & Weighted CN	3.48		97.55

Time of Concentration

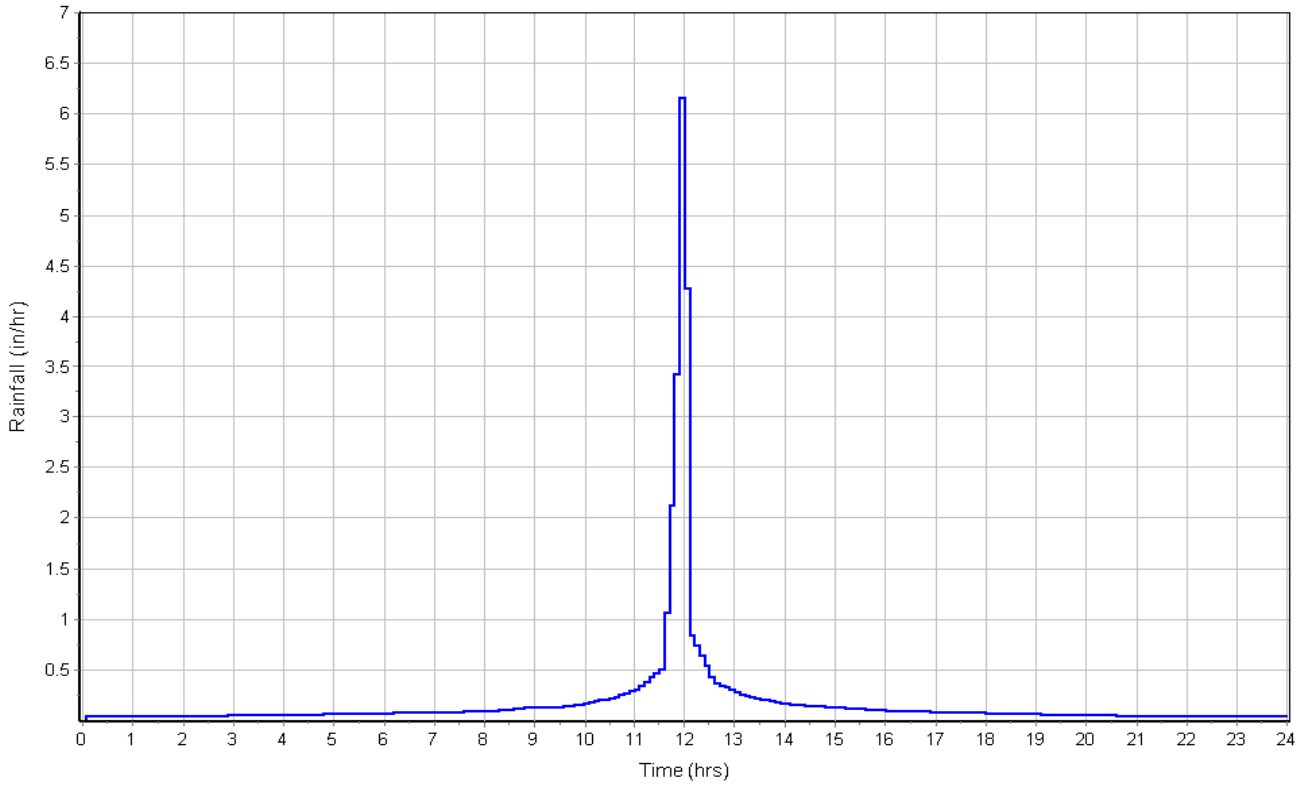
User-Defined TOC override (minutes): 6

Subbasin Runoff Results

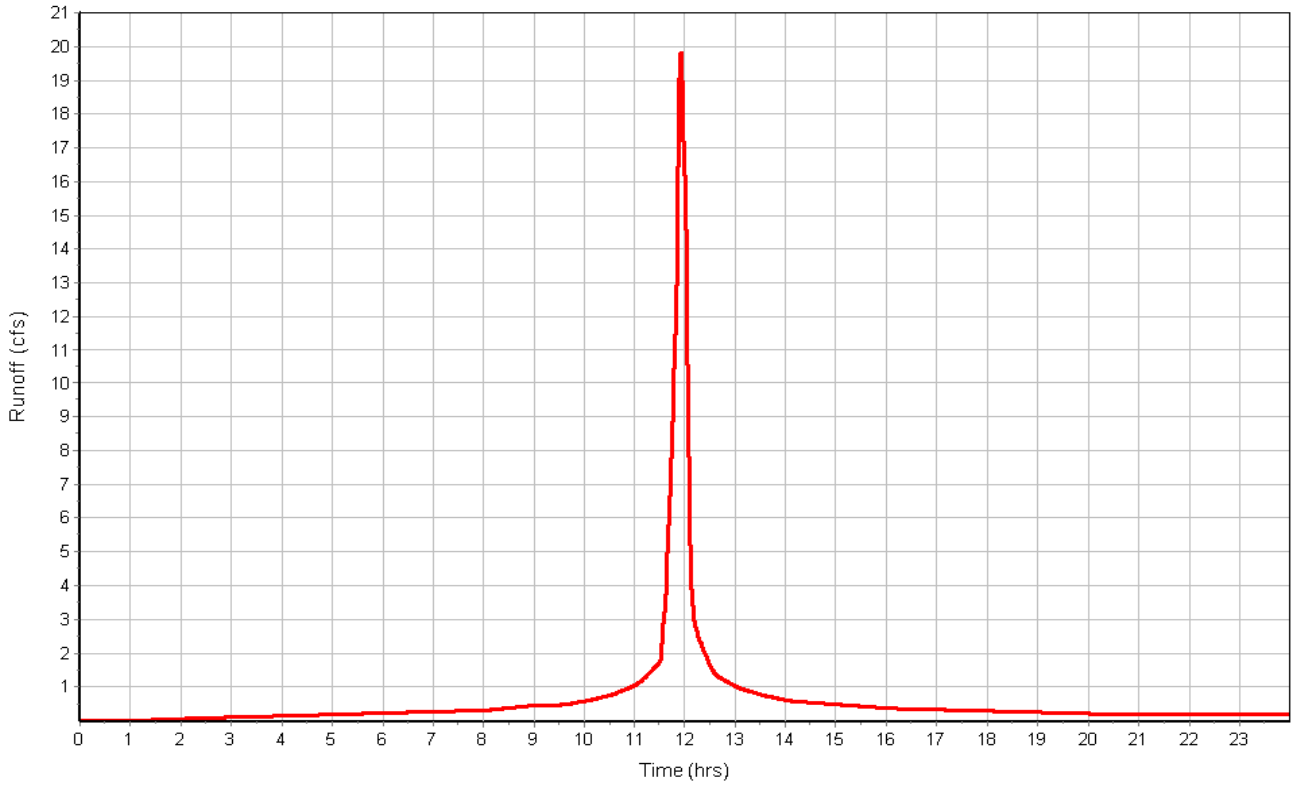
Total Rainfall (in) 4.49
Total Runoff (in) 4.20
Peak Runoff (cfs) 19.83
Weighted Curve Number 97.55
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : SE-11

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-12

Input Data

Area (ac) 4.97
Weighted Curve Number 81.82
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Meadow, non-grazed	2.06	C	71.00
Pond, 100% imp	1.67	D	98.00
Meadow, non-grazed	1.24	D	78.00
Composite Area & Weighted CN	4.97		81.82

Time of Concentration

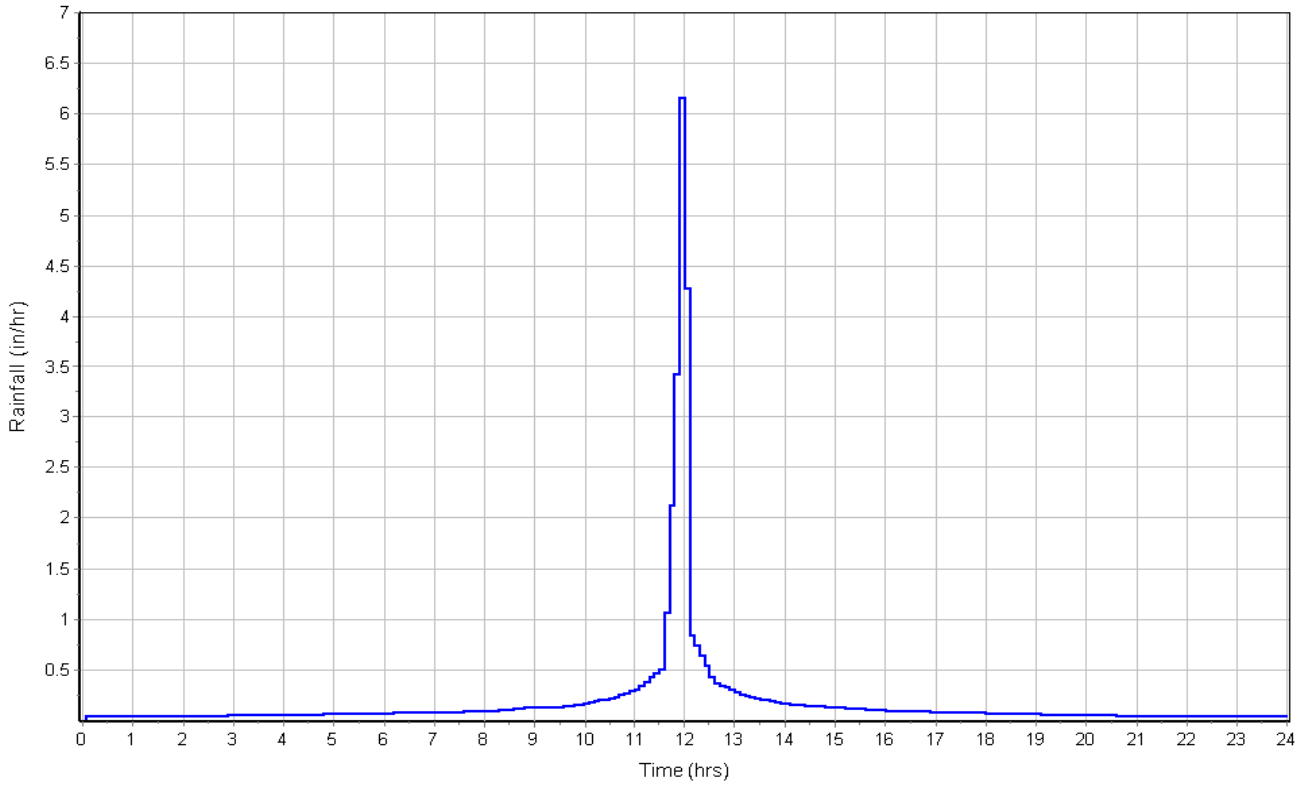
User-Defined TOC override (minutes): 6

Subbasin Runoff Results

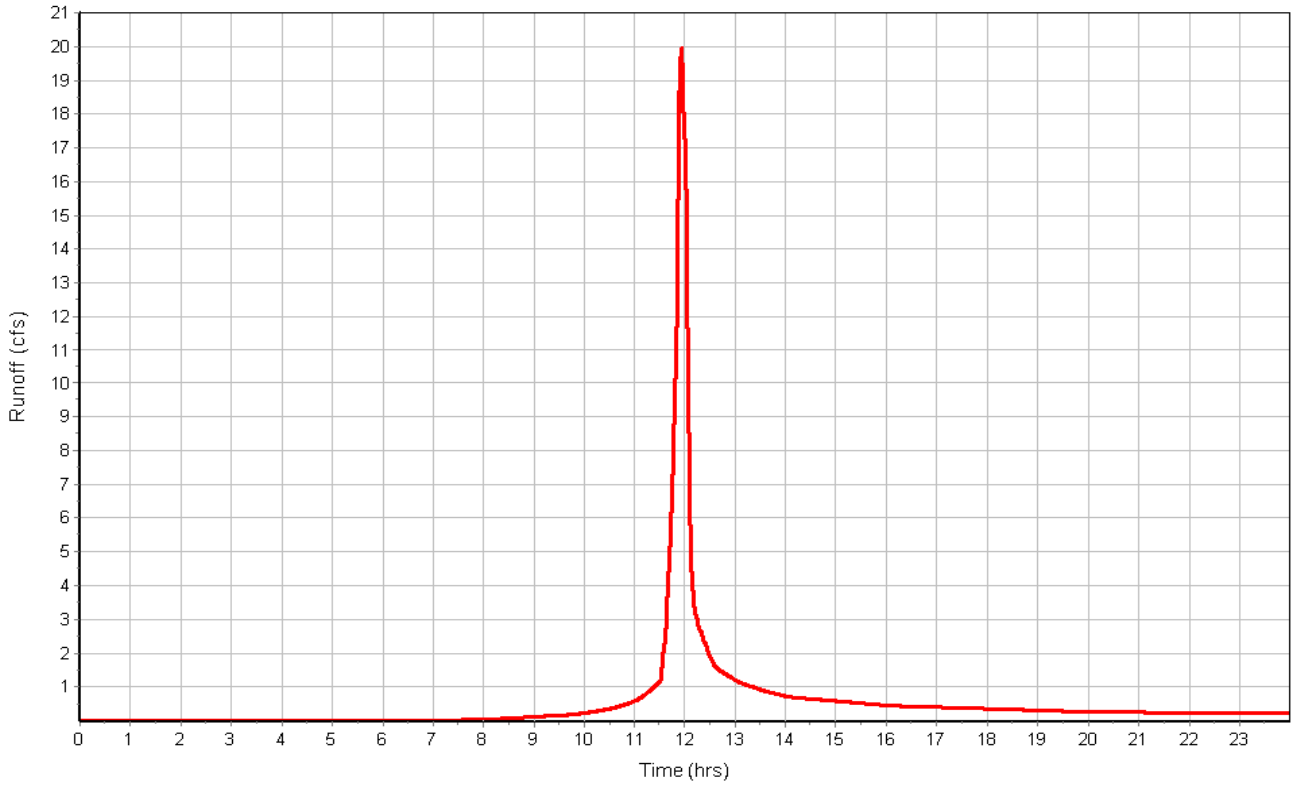
Total Rainfall (in) 4.49
Total Runoff (in) 2.61
Peak Runoff (cfs) 19.97
Weighted Curve Number 81.82
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : SE-12

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-13

Input Data

Area (ac) 2.03
Weighted Curve Number 73.24
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Meadow, non-grazed	1.84	C	71.00
Gravel roads	0.18	D	96.00
Composite Area & Weighted CN	2.02		73.24

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.24	0.00	0.00
Flow Length (ft) :	20	0.00	0.00
Slope (%) :	33.33	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.23	0.00	0.00
Computed Flow Time (min) :	1.45	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	144	102.67	0.00
Slope (%) :	2.64	0.43	0.00
Surface Type :	Woodland	Grassed waterwa	Unpaved
Velocity (ft/sec) :	0.81	0.98	0.00
Computed Flow Time (min) :	2.96	1.75	0.00

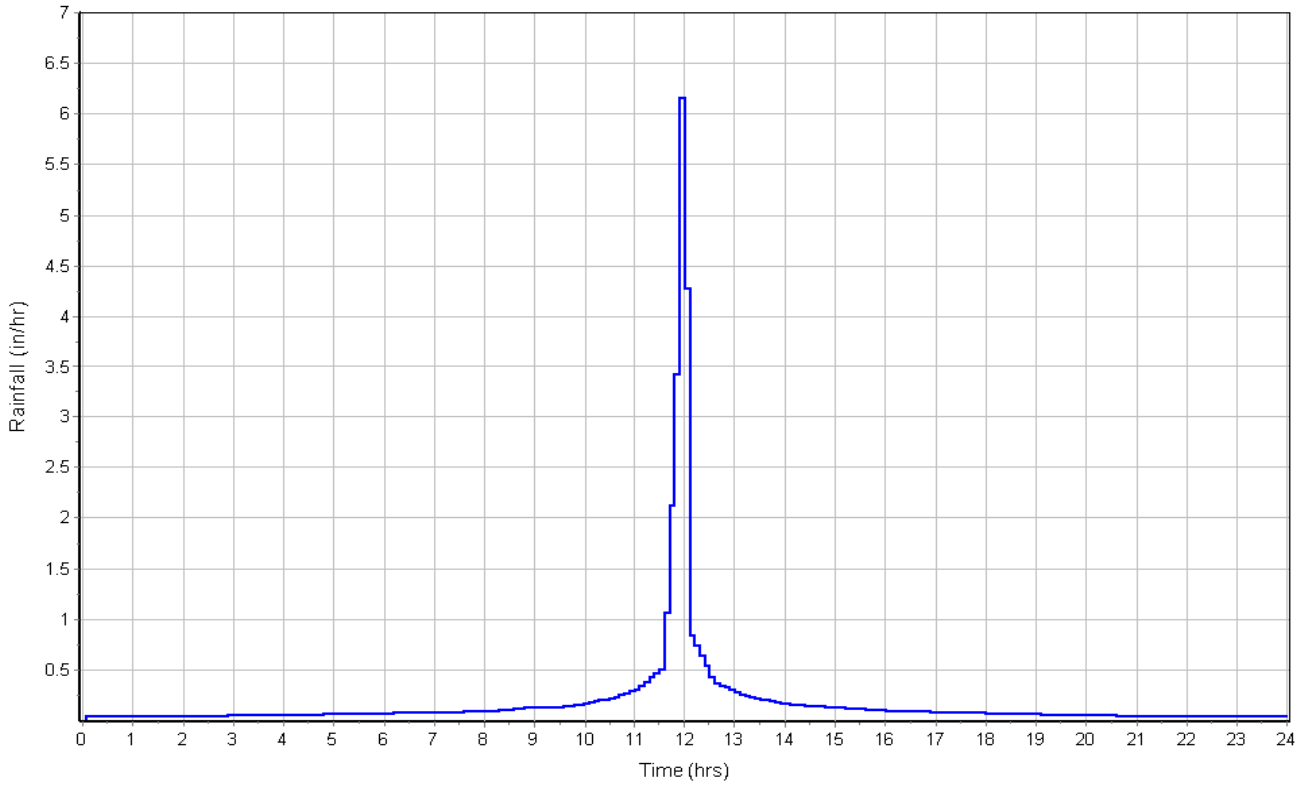
Total TOC (min) 6.16

Subbasin Runoff Results

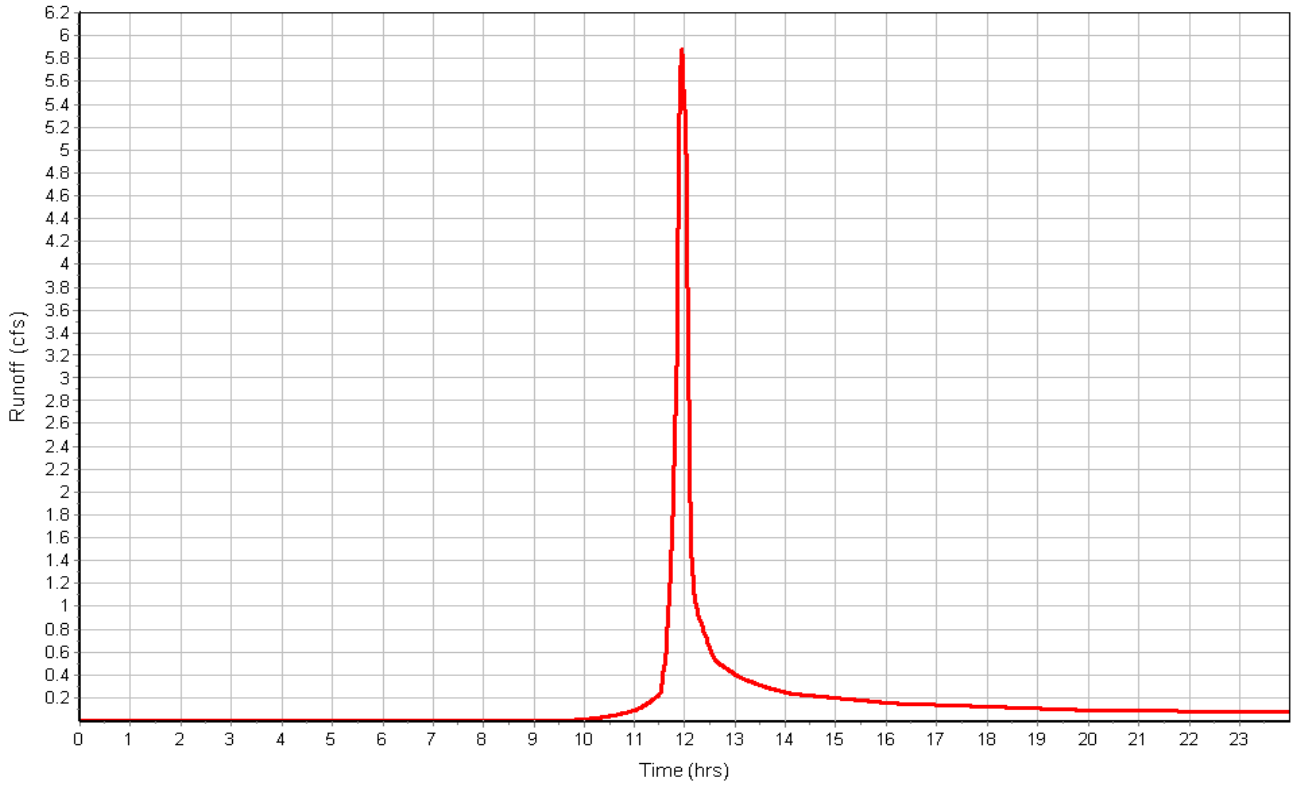
Total Rainfall (in) 4.49
Total Runoff (in) 1.91
Peak Runoff (cfs) 5.89
Weighted Curve Number 73.24
Time of Concentration (days hh:mm:ss) 0 00:06:10

Subbasin : SE-13

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-14

Input Data

Area (ac) 2.20
Weighted Curve Number 77.76
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Meadow, non-grazed	1.64	C	71.00
Gravel roads	0.15	C	96.00
Pond, 100% imp	0.41	D	98.00
Composite Area & Weighted CN	2.20		77.76

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.24	0.00	0.00
Flow Length (ft) :	75.869	0.00	0.00
Slope (%) :	14	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.21	0.00	0.00
Computed Flow Time (min) :	5.97	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	362.727	0.00	0.00
Slope (%) :	2.88	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.19	0.00	0.00
Computed Flow Time (min) :	5.08	0.00	0.00

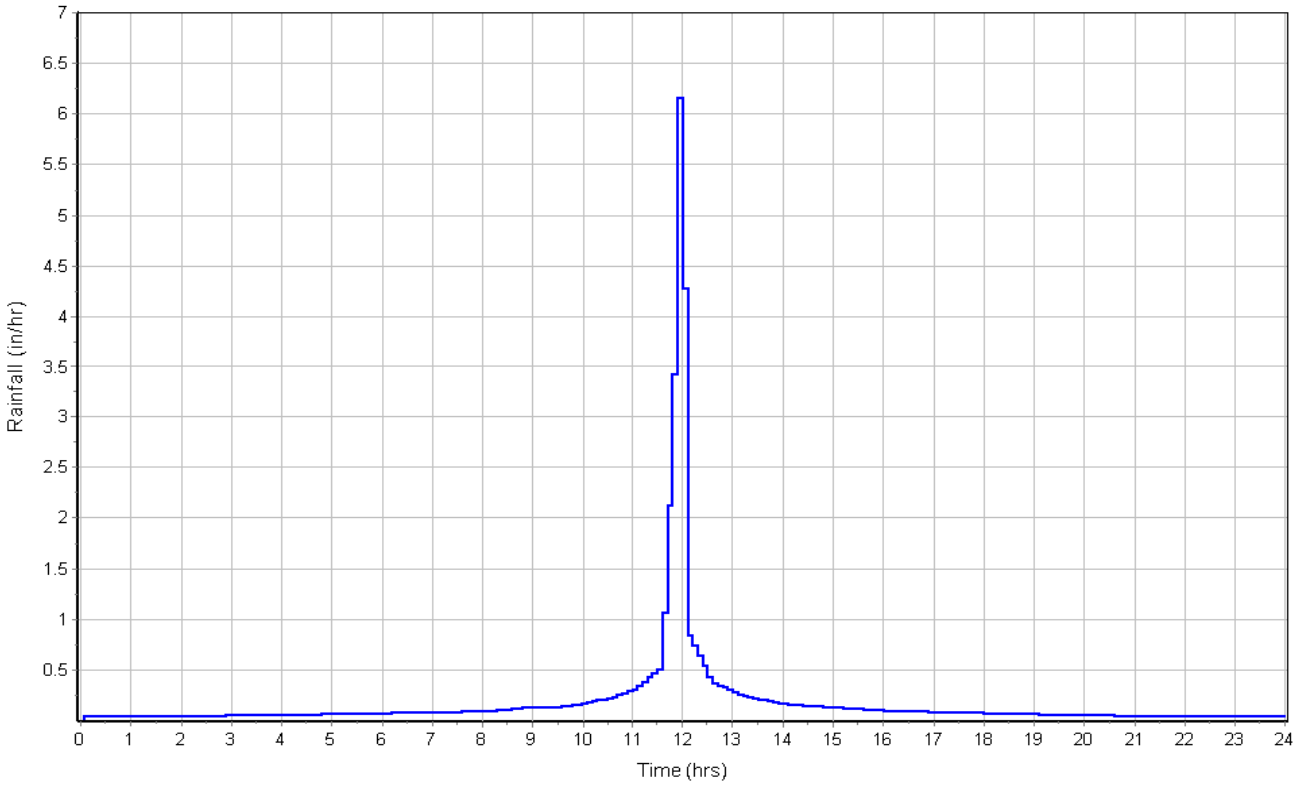
Total TOC (min) 11.05

Subbasin Runoff Results

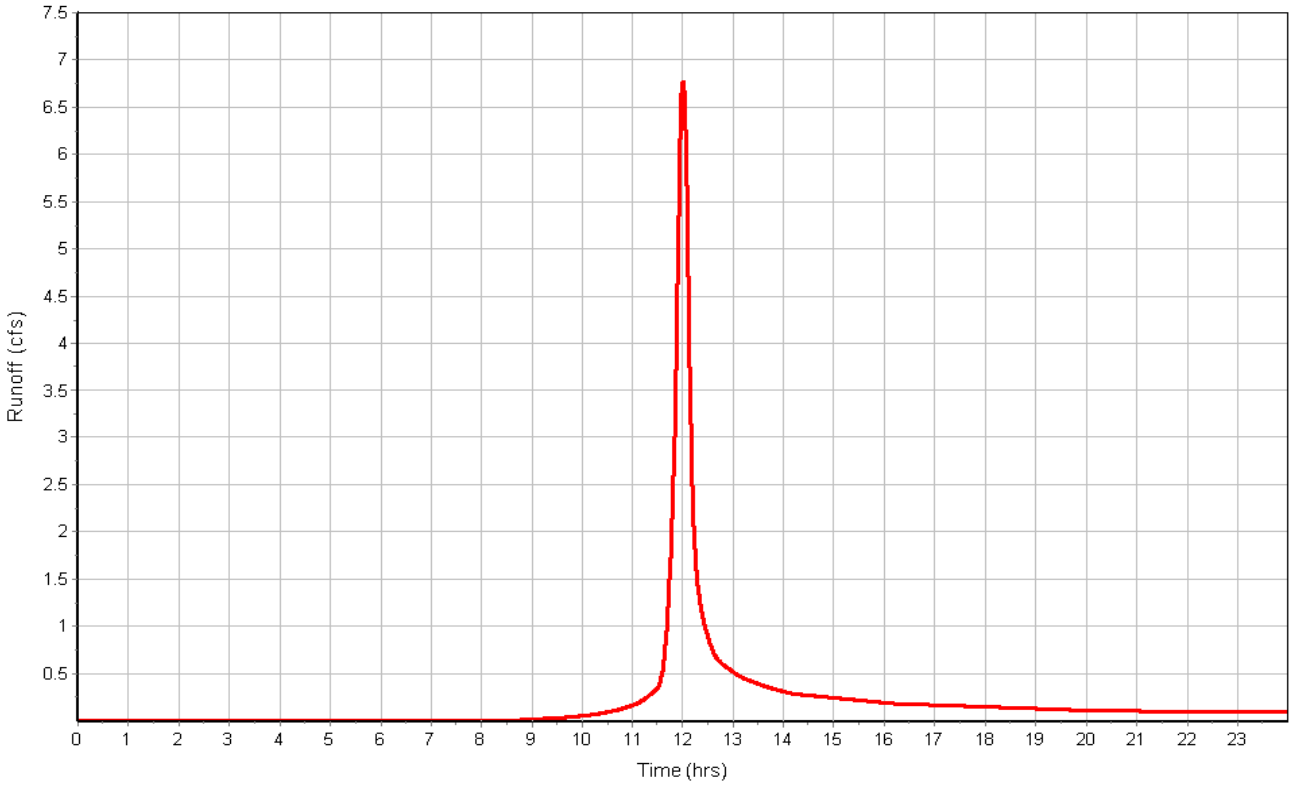
Total Rainfall (in) 4.49
Total Runoff (in) 2.27
Peak Runoff (cfs) 6.77
Weighted Curve Number 77.76
Time of Concentration (days hh:mm:ss) 0 00:11:03

Subbasin : SE-14

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-15

Input Data

Area (ac) 10.09
Weighted Curve Number 73.22
Rain Gage ID ..... *

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel pavements, 100% imp	0.00	C	96.00
Meadow, non-grazed	3.19	C	71.00
Meadow, non-grazed	3.13	D	78.00
Woods, Good	2.44	C	70.00
Composite Area & Weighted CN	8.76		73.22

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.24	.6	0.00
Flow Length (ft) :	25	24.733	0.00
Slope (%) :	40	6.73	0.00
2 yr, 24 hr Rainfall (in) :	2.48	2.48	0.00
Velocity (ft/sec) :	0.26	0.06	0.00
Computed Flow Time (min) :	1.61	6.79	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	120.942	429.581	283.342
Slope (%) :	3.27	2.55	1.64
Surface Type :	Woodland	Woodland	ıssed waterway
Velocity (ft/sec) :	0.90	0.80	1.92
Computed Flow Time (min) :	2.24	8.95	2.46

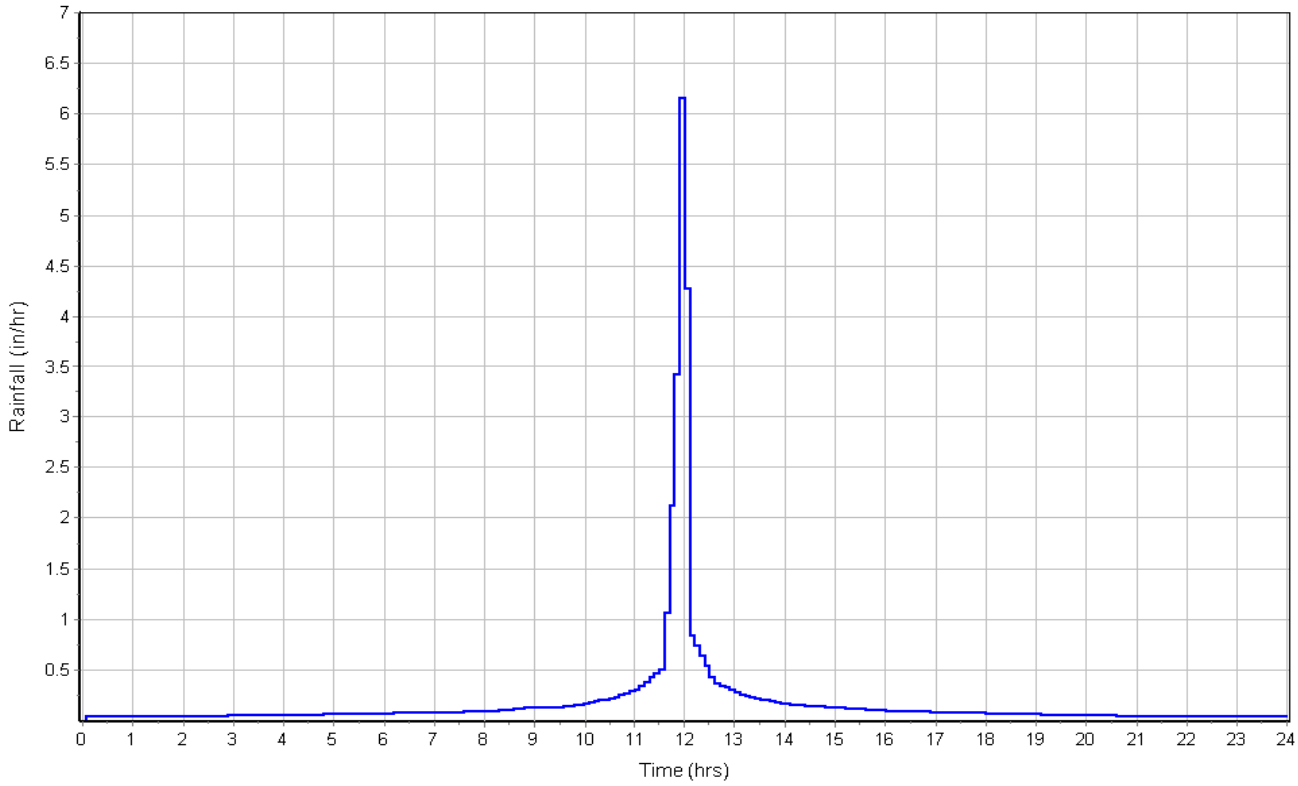
Total TOC (min) 22.05

Subbasin Runoff Results

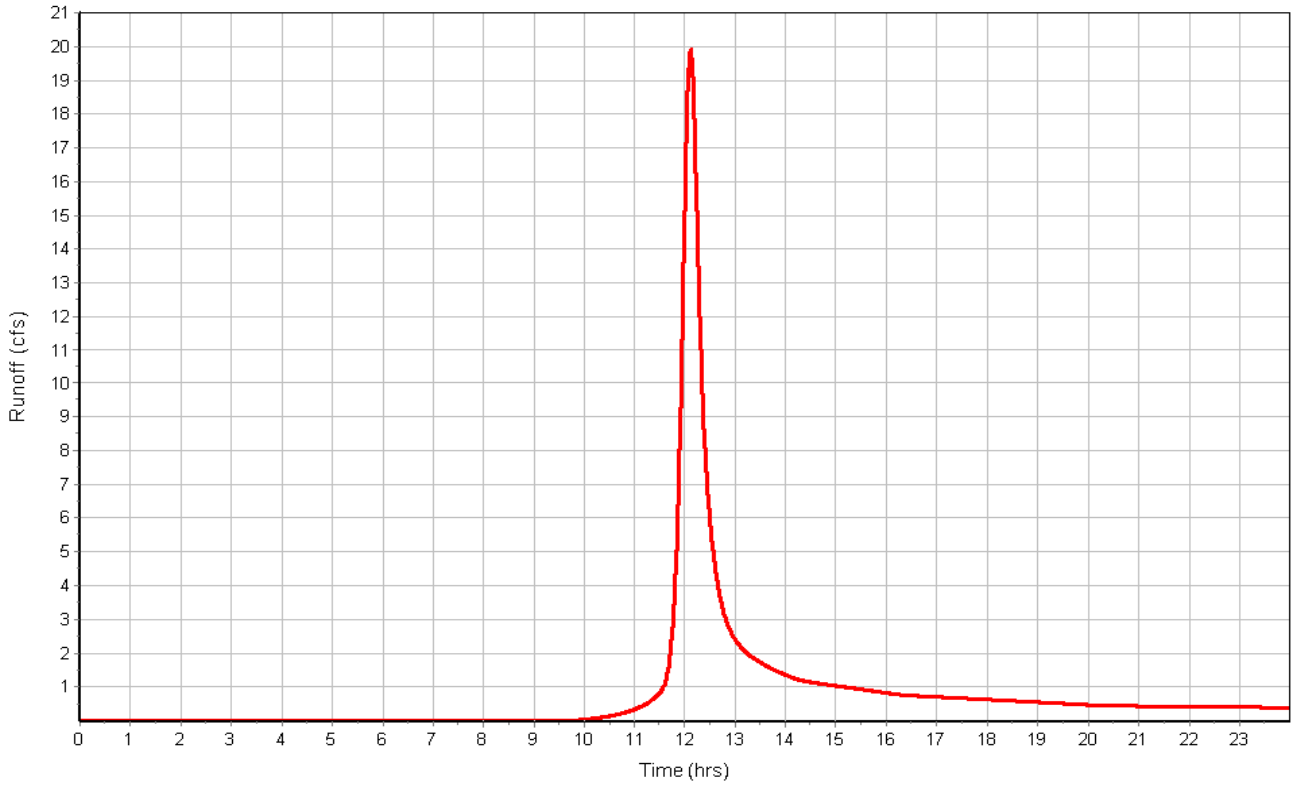
Total Rainfall (in) 4.49
Total Runoff (in) 1.91
Peak Runoff (cfs) 19.92
Weighted Curve Number 73.22
Time of Concentration (days hh:mm:ss) 0 00:22:03

Subbasin : SE-15

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-2

Input Data

Area (ac) 19.47
Weighted Curve Number 70.16
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	0.07	C	96.00
Woods, Good	18.86	C	70.00
Woods, Good	0.14	D	77.00
Meadow, non-grazed	0.41	C	71.00
Composite Area & Weighted CN	19.48		70.16

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.6	0.00	0.00
Flow Length (ft) :	36.92	0.00	0.00
Slope (%) :	5.87	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.06	0.00	0.00
Computed Flow Time (min) :	9.88	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1130	99	855
Slope (%) :	7.41	0.70	3.18
Surface Type :	Woodland	Woodland	Woodland
Velocity (ft/sec) :	1.36	0.42	0.89
Computed Flow Time (min) :	13.85	3.93	16.01

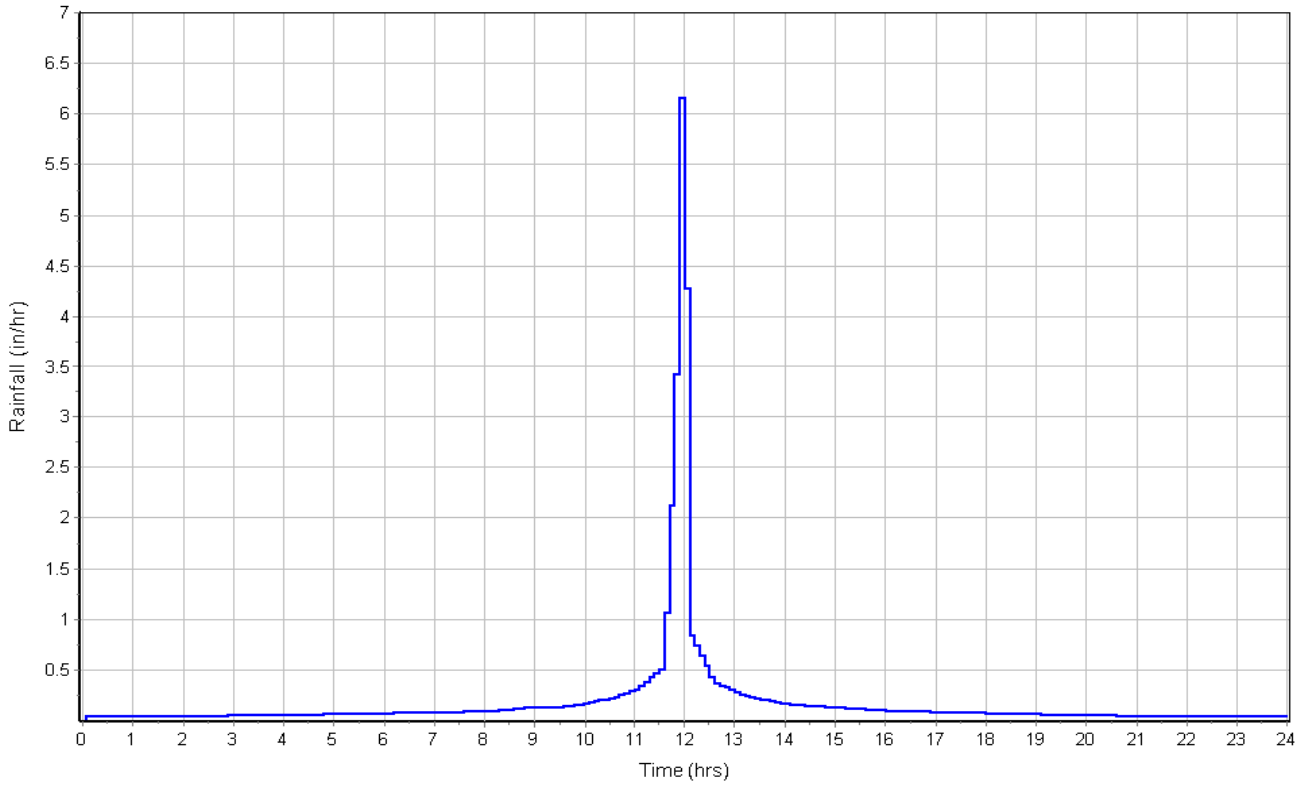
Total TOC (min) 43.67

Subbasin Runoff Results

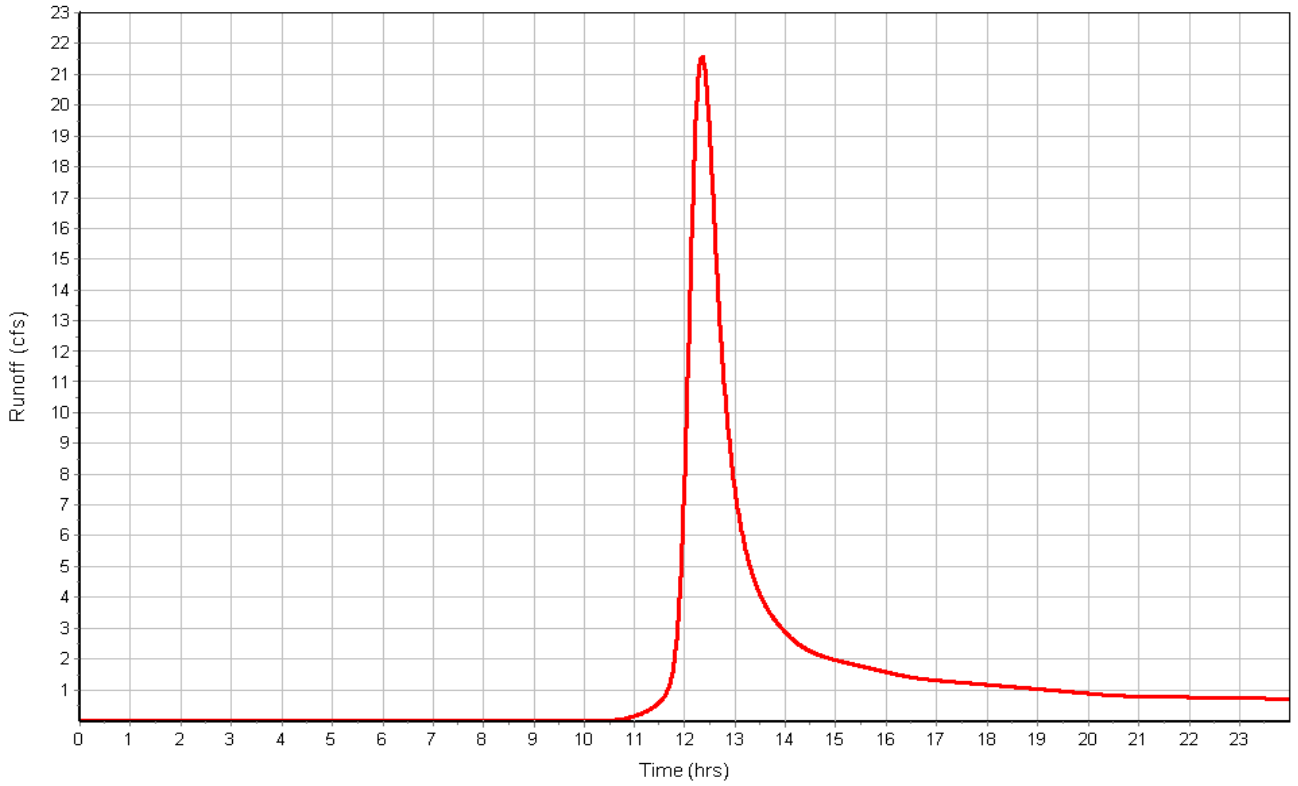
Total Rainfall (in) 4.49
Total Runoff (in) 1.68
Peak Runoff (cfs) 21.57
Weighted Curve Number 70.16
Time of Concentration (days hh:mm:ss) 0 00:43:40

Subbasin : SE-2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-3

Input Data

Area (ac) 26.27
Weighted Curve Number 70.87
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	1.00	C	96.00
Meadow, non-grazed	4.24	C	71.00
Woods, Good	18.38	C	70.00
Woods, Good	0.24	D	77.00
Woods, Good	1.23	B	55.00
Fill, sand	1.18	D	78.00
Composite Area & Weighted CN	26.27		70.87

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.60	0.00	0.00
Flow Length (ft) :	45.53	0.00	0.00
Slope (%) :	7.40	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.07	0.00	0.00
Computed Flow Time (min) :	10.65	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	645.06	125.19	276.34
Slope (%) :	4.89	2.40	6.58
Surface Type :	Woodland	Woodland	Woodland
Velocity (ft/sec) :	1.11	0.77	1.28
Computed Flow Time (min) :	9.69	2.71	3.60

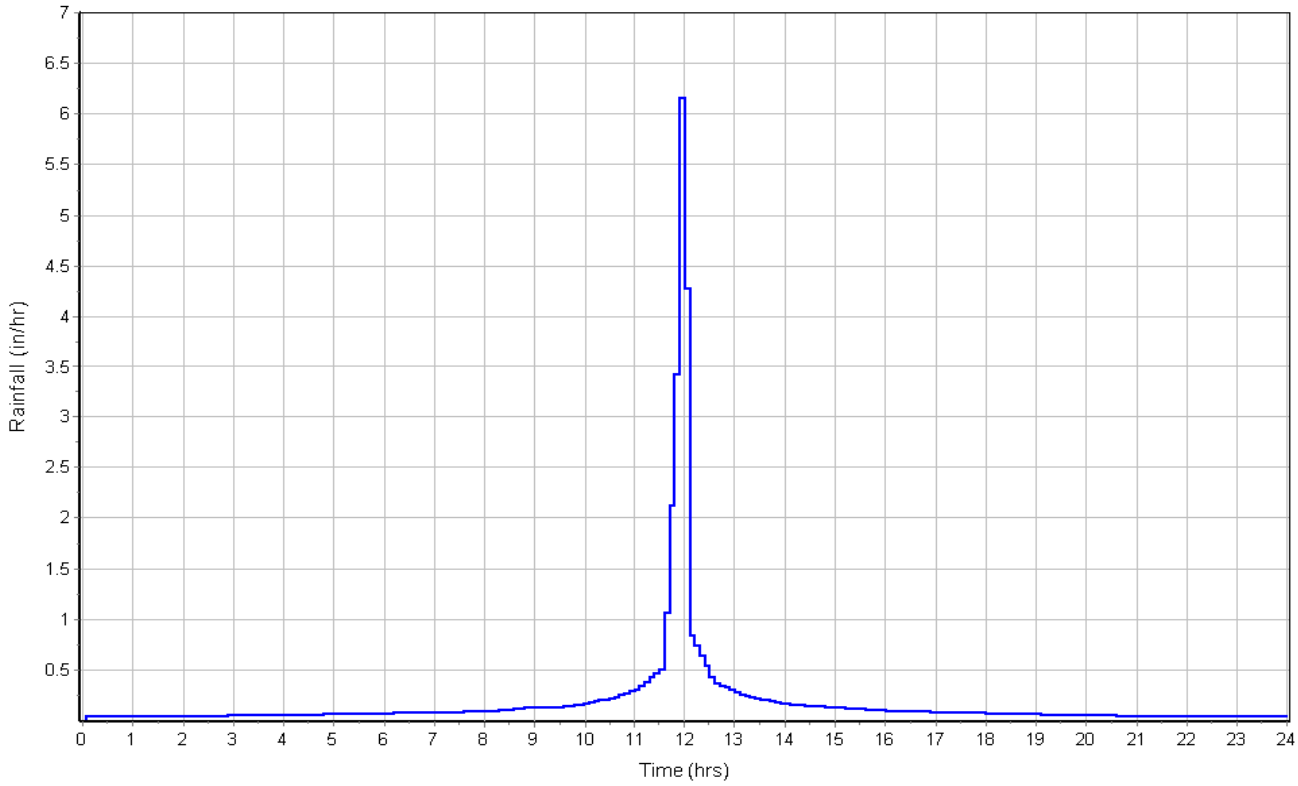
Total TOC (min) 26.65

Subbasin Runoff Results

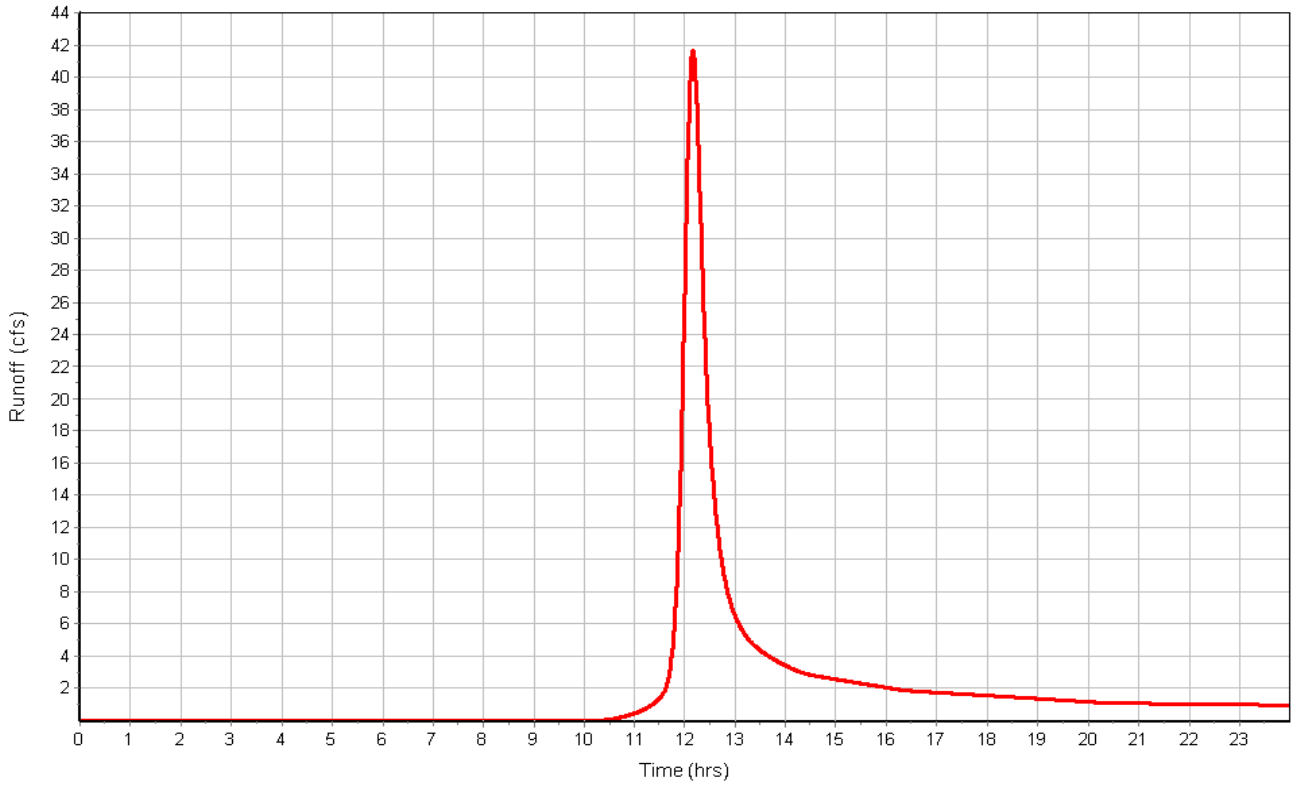
Total Rainfall (in) 4.49
Total Runoff (in) 1.73
Peak Runoff (cfs) 41.72
Weighted Curve Number 70.87
Time of Concentration (days hh:mm:ss) 0 00:26:39

Subbasin : SE-3

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-4

Input Data

Area (ac) 4.93
Weighted Curve Number 61.99
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.79	C	70.00
Gravel roads	0.11	C	96.00
Woods, Good	2.65	B	55.00
Meadow, non-grazed	0.30	B	58.00
Meadow, non-grazed	1.08	C	71.00
Composite Area & Weighted CN	4.93		61.99

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.60	0.00	0.00
Flow Length (ft) :	37.14	0.00	0.00
Slope (%) :	4.75	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.06	0.00	0.00
Computed Flow Time (min) :	10.81	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	252.7	760.9	0.00
Slope (%) :	8.92	2.37	0.00
Surface Type :	Woodland	Grass pasture	Unpaved
Velocity (ft/sec) :	1.49	1.08	0.00
Computed Flow Time (min) :	2.83	11.74	0.00

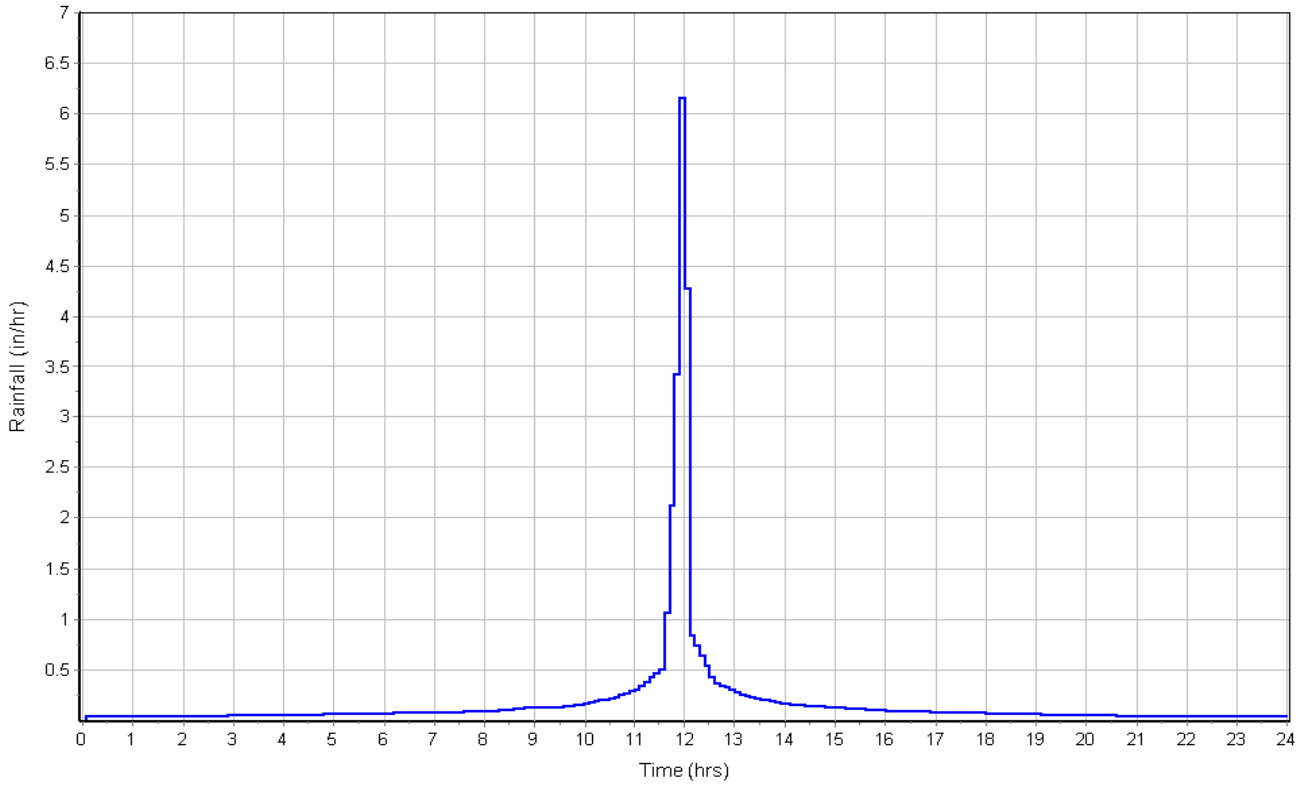
Total TOC (min) 25.38

Subbasin Runoff Results

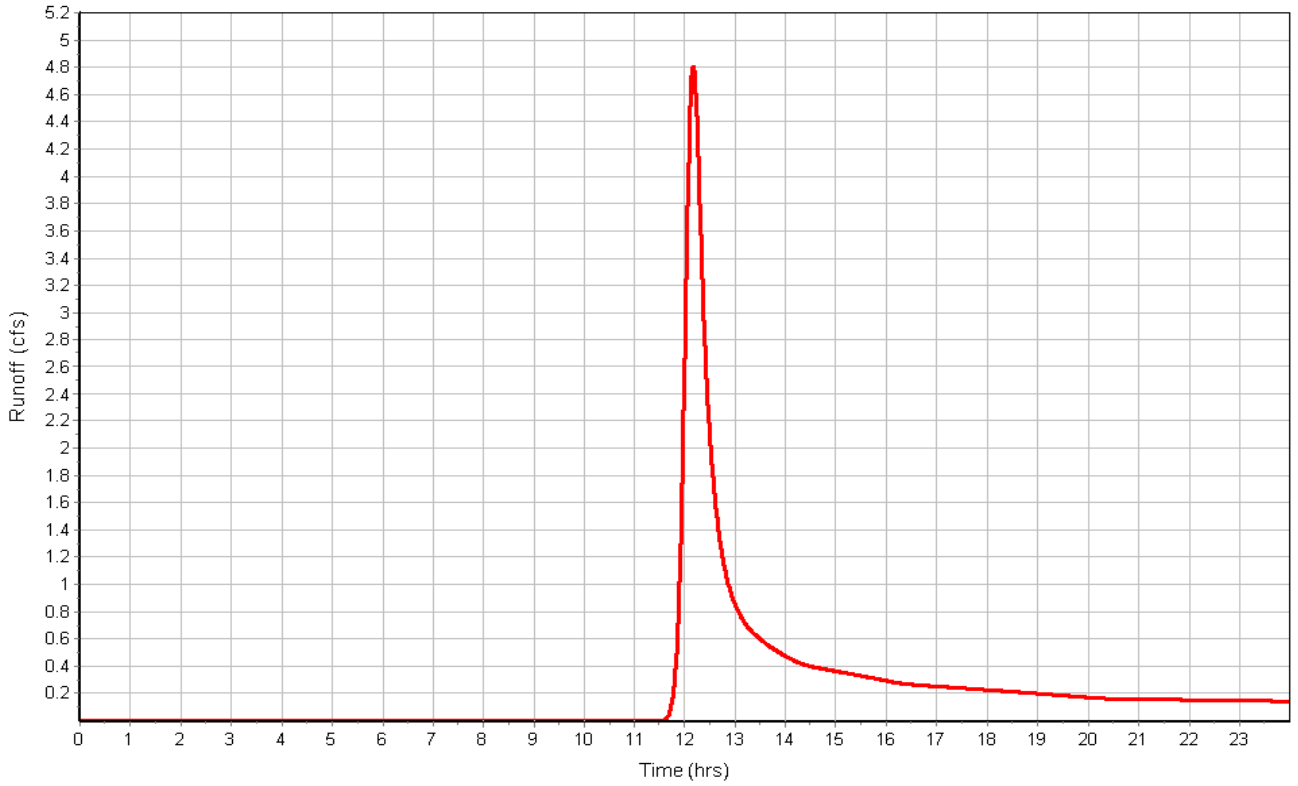
Total Rainfall (in) 4.49
Total Runoff (in) 1.13
Peak Runoff (cfs) 4.81
Weighted Curve Number 61.99
Time of Concentration (days hh:mm:ss) 0 00:25:23

Subbasin : SE-4

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-5

Input Data

Area (ac) 7.32
Weighted Curve Number 97.78
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Landfill cap, interim, 100% imp	6.89	C	98.00
Swale, riprap over soils	0.32	C	93.00
Paved roads	0.12	C	98.00
Composite Area & Weighted CN	7.33		97.78

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.010	0.00	0.00
Flow Length (ft) :	49.186	0.00	0.00
Slope (%) :	33.33	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	3.49	0.00	0.00
Computed Flow Time (min) :	0.23	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.033	0.033	0.033
Flow Length (ft) :	721.731	523.324	58.702
Channel Slope (%) :	8.87	6.65	5.45
Cross Section Area (ft^2) :	9.63	9.63	9.63
Wetted Perimeter (ft) :	9.62	9.62	9.62
Velocity (ft/sec) :	13.46	11.65	10.55
Computed Flow Time (min) :	0.89	0.75	0.09

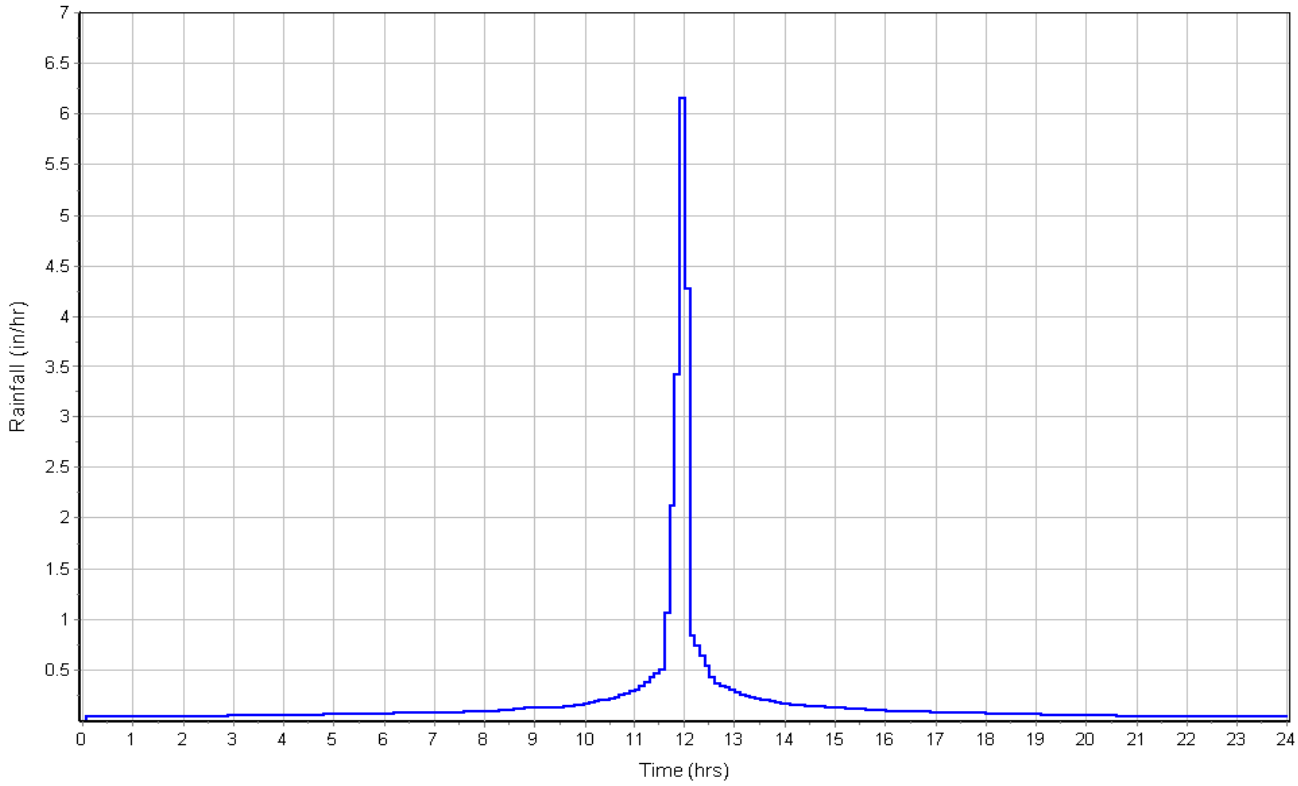
Total TOC (min) 1.97

Subbasin Runoff Results

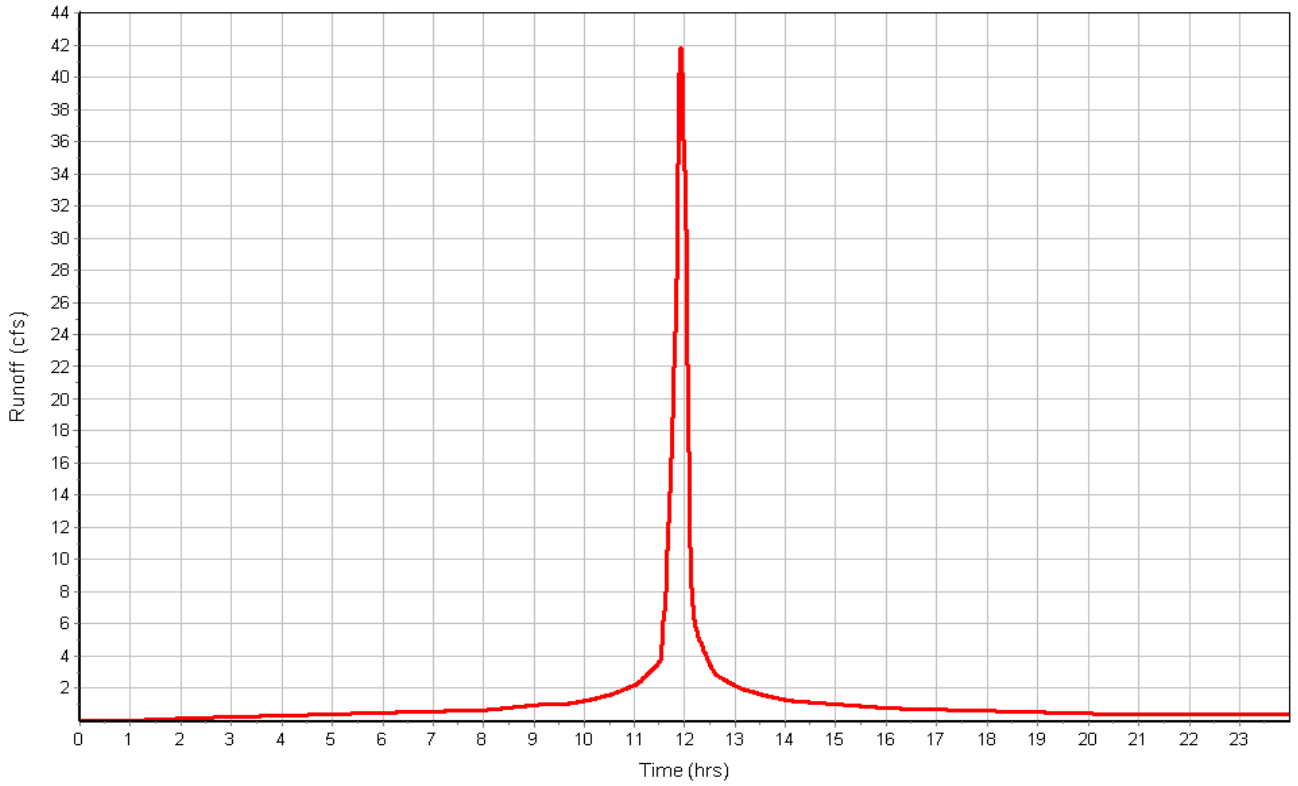
Total Rainfall (in) 4.49
Total Runoff (in) 4.23
Peak Runoff (cfs) 41.82
Weighted Curve Number 97.78
Time of Concentration (days hh:mm:ss) 0 00:01:58

Subbasin : SE-5

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-6

Input Data

Area (ac) 2.36
Weighted Curve Number 96.94
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Landfill cap, interim, 100% imp	1.32	C	98.00
Swale, riprap over soils	0.50	C	93.00
Paved roads	0.54	C	98.00
Composite Area & Weighted CN	2.36		96.94

Time of Concentration

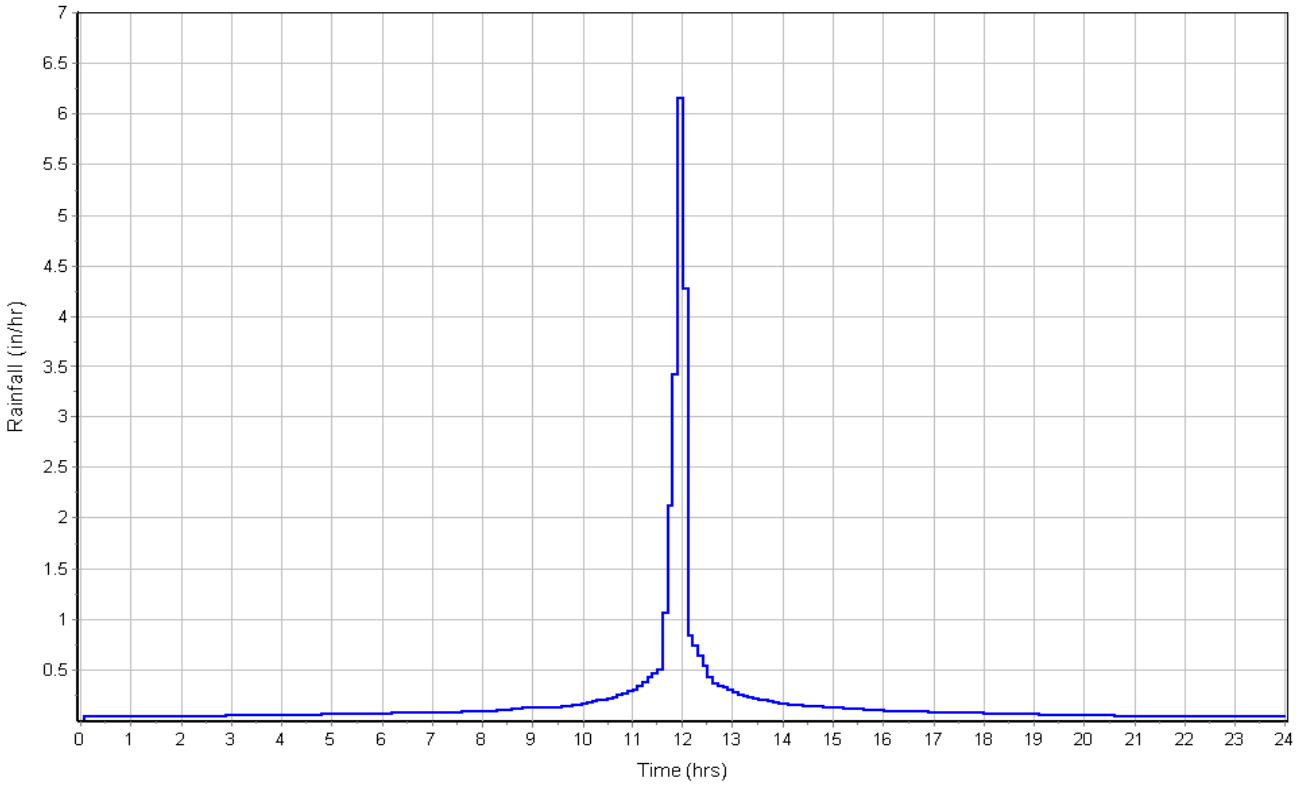
User-Defined TOC override (minutes): 6

Subbasin Runoff Results

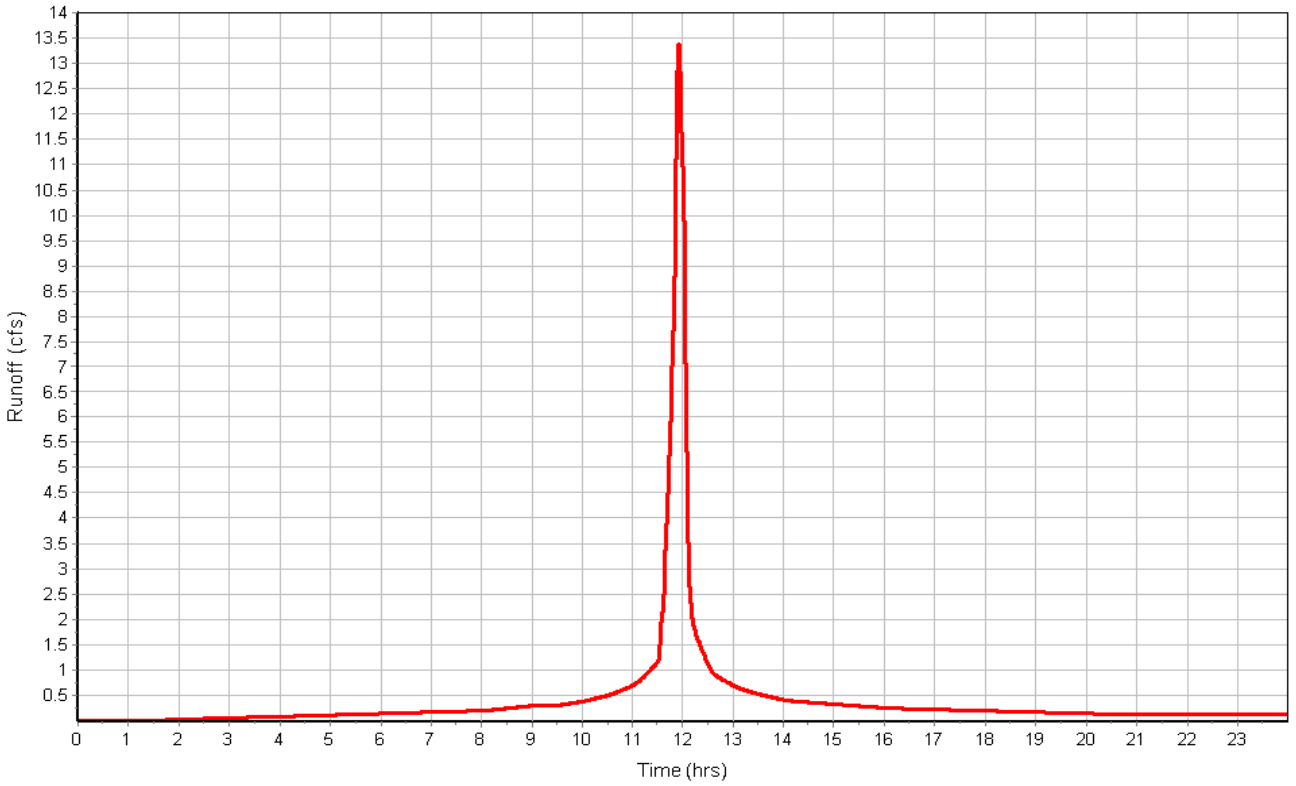
Total Rainfall (in) 4.49
Total Runoff (in) 4.13
Peak Runoff (cfs) 13.39
Weighted Curve Number 96.94
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : SE-6

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-7

Input Data

Area (ac) 7.69
Weighted Curve Number 97.83
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Landfill cap, interim, 100% imp	6.99	C	98.00
Swale, riprap over soils	0.26	C	93.00
Paved roads	0.44	C	98.00
Composite Area & Weighted CN	7.69		97.83

Time of Concentration

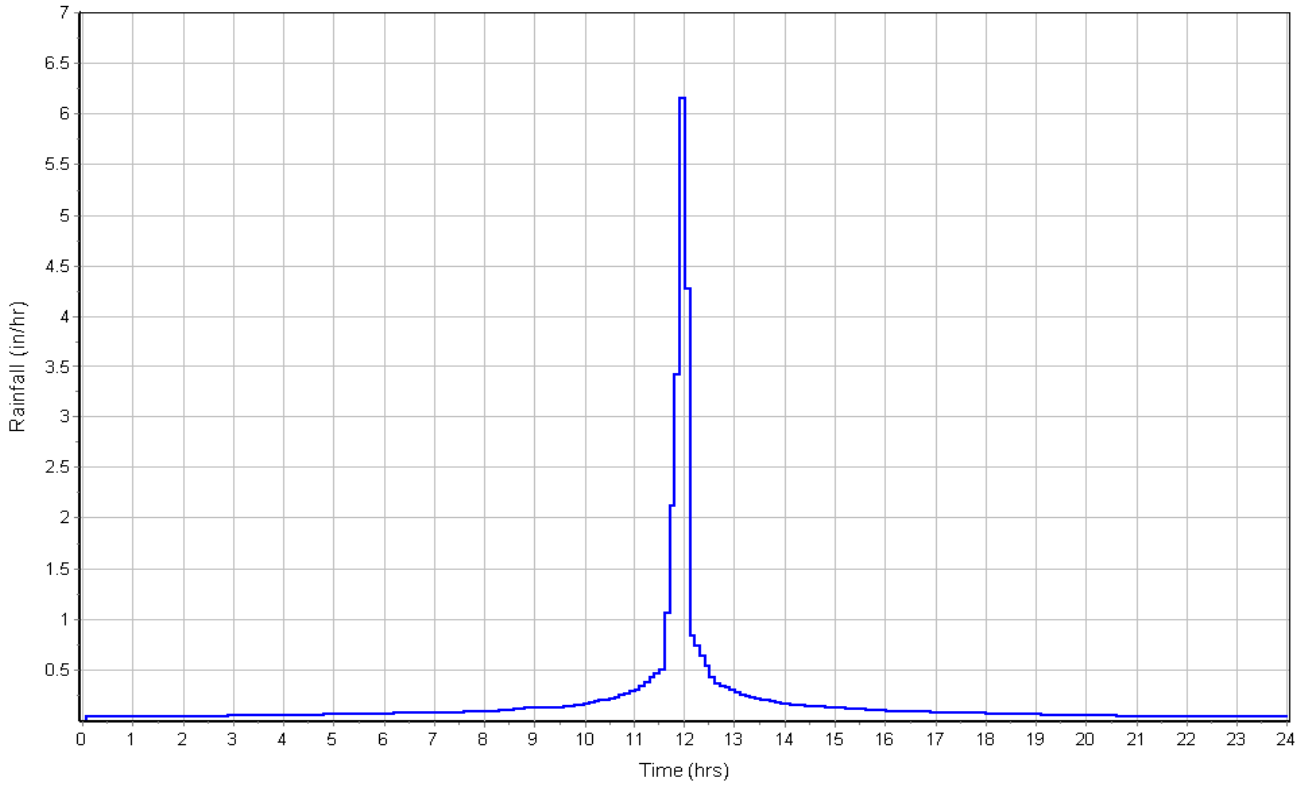
User-Defined TOC override (minutes): 6

Subbasin Runoff Results

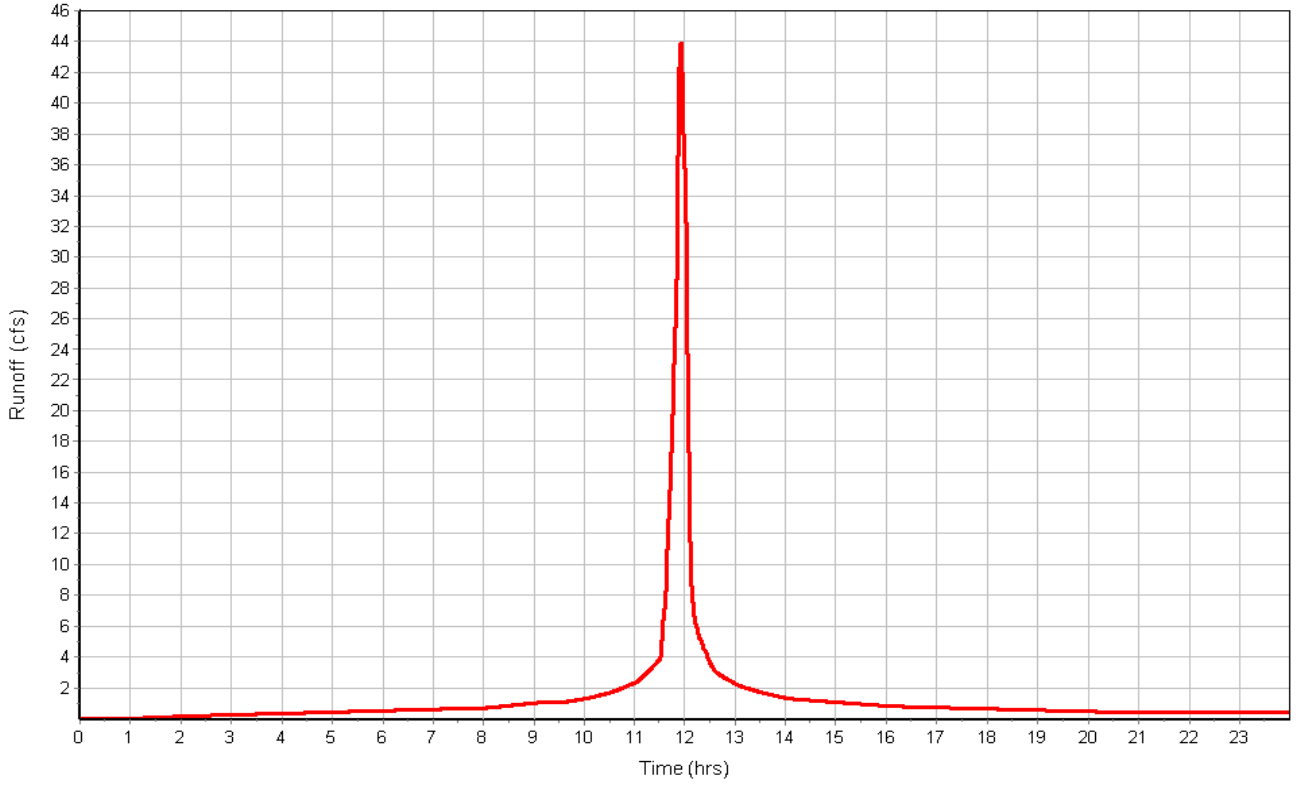
Total Rainfall (in) 4.49
Total Runoff (in) 4.23
Peak Runoff (cfs) 43.96
Weighted Curve Number 97.83
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : SE-7

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-8

Input Data

Area (ac) 14.13
Weighted Curve Number 98.00
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Landfill cap, interim, 100% imp	14.11	C	98.00
Swale, riprap over soils	0.01	C	93.00
Paved roads	0.01	C	98.00
Composite Area & Weighted CN	14.13		98.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.010	.010	0.00
Flow Length (ft) :	57.957	177.043	0.00
Slope (%) :	5	23.81	0.00
2 yr, 24 hr Rainfall (in) :	2.48	2.48	0.00
Velocity (ft/sec) :	1.69	3.95	0.00
Computed Flow Time (min) :	0.57	0.75	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	446.109	0.00	0.00
Slope (%) :	5.00	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	4.55	0.00	0.00
Computed Flow Time (min) :	1.63	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.012	0.013	0.013
Flow Length (ft) :	105.406	1309.891	126.945
Channel Slope (%) :	1	5	33.33
Cross Section Area (ft^2) :	6.28	4.5	8.48
Wetted Perimeter (ft) :	12.58	6.71	10.9
Velocity (ft/sec) :	7.81	19.64	55.97
Computed Flow Time (min) :	0.22	1.11	0.04

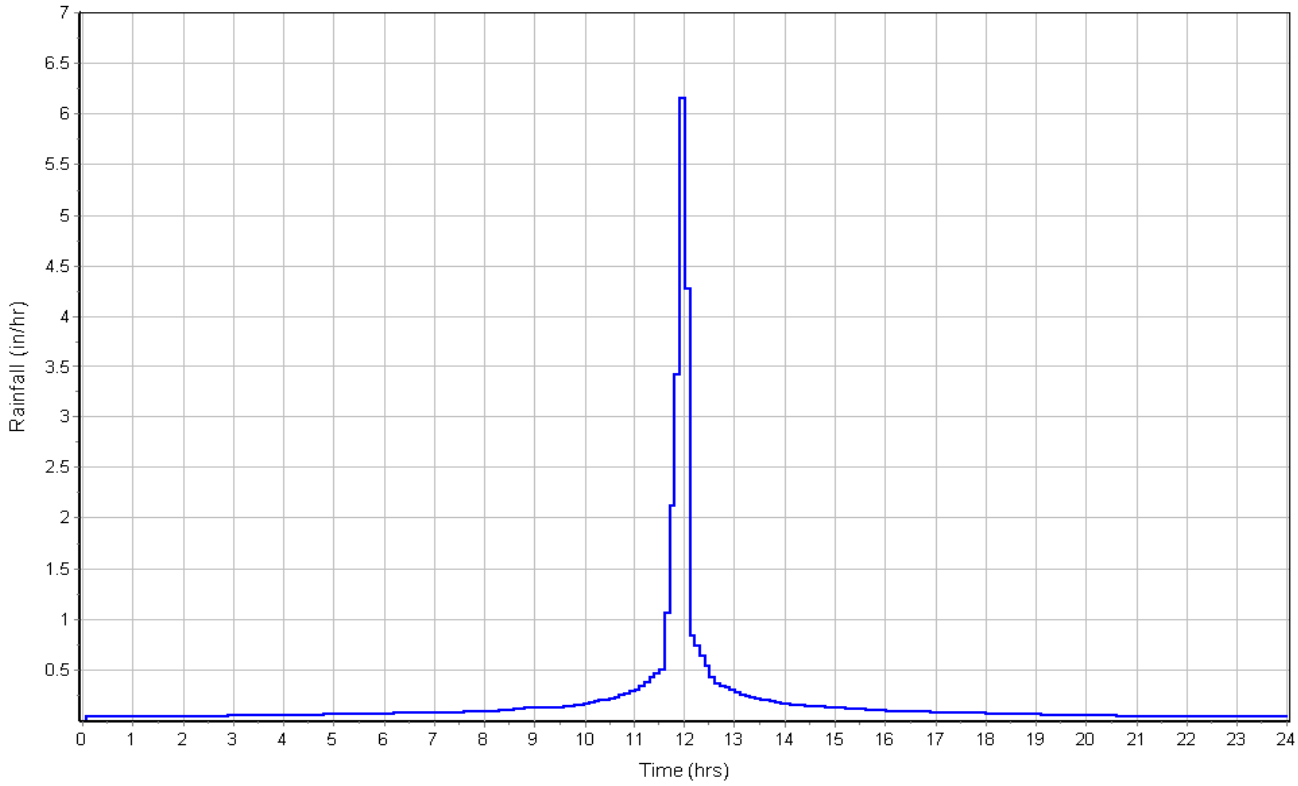
Total TOC (min) 4.33

Subbasin Runoff Results

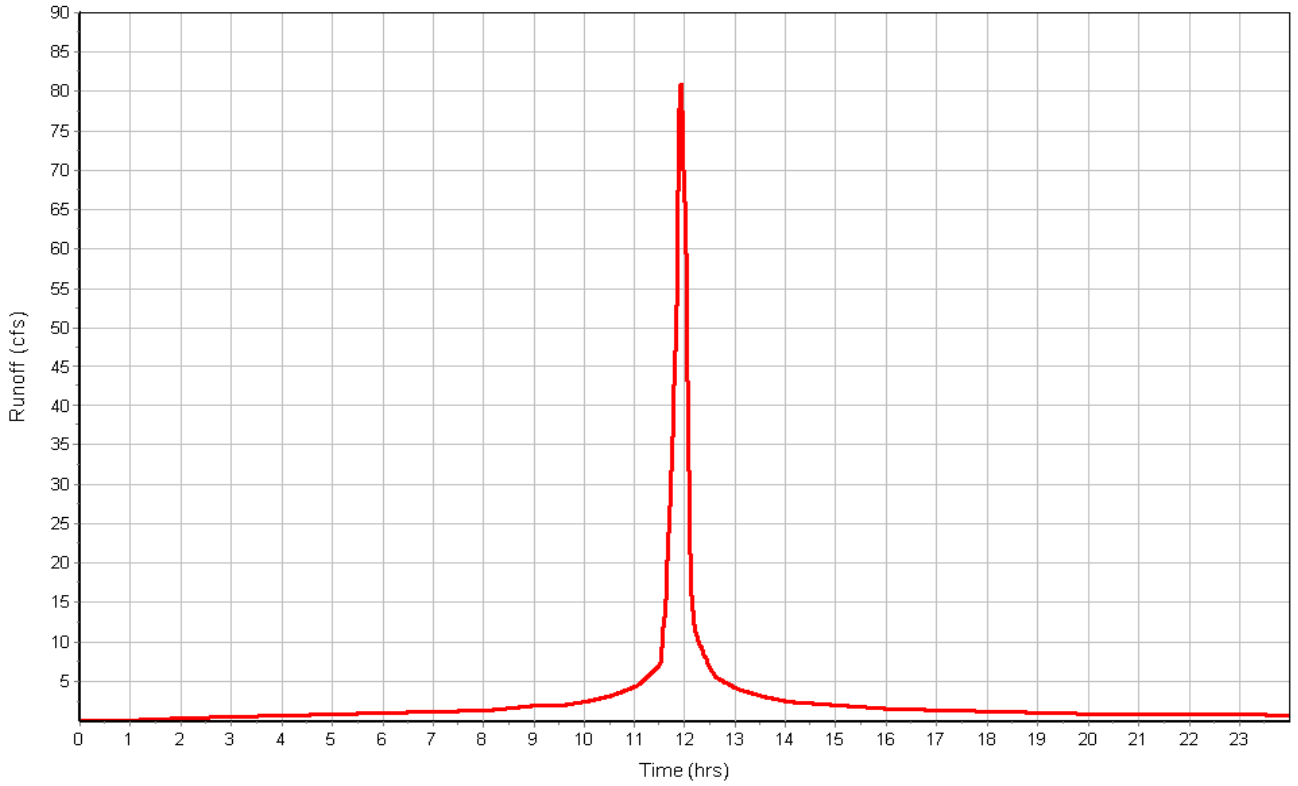
Total Rainfall (in) 4.49
Total Runoff (in) 4.25
Peak Runoff (cfs) 80.86
Weighted Curve Number 98.00
Time of Concentration (days hh:mm:ss) 0 00:04:20

Subbasin : SE-8

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SW1

Input Data

Area (ac) 5.70
Weighted Curve Number 74.19
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	0.86	C	89.00
Paved parking & roofs	0.28	C	98.00
Woods, Good	4.64	C	70.00
Composite Area & Weighted CN	5.78		74.19

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.60	0.00	0.00
Flow Length (ft) :	64.9	0.00	0.00
Slope (%) :	8.10	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.08	0.00	0.00
Computed Flow Time (min) :	13.64	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	576	0.00	0.00
Slope (%) :	1.55	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	0.62	0.00	0.00
Computed Flow Time (min) :	15.48	0.00	0.00

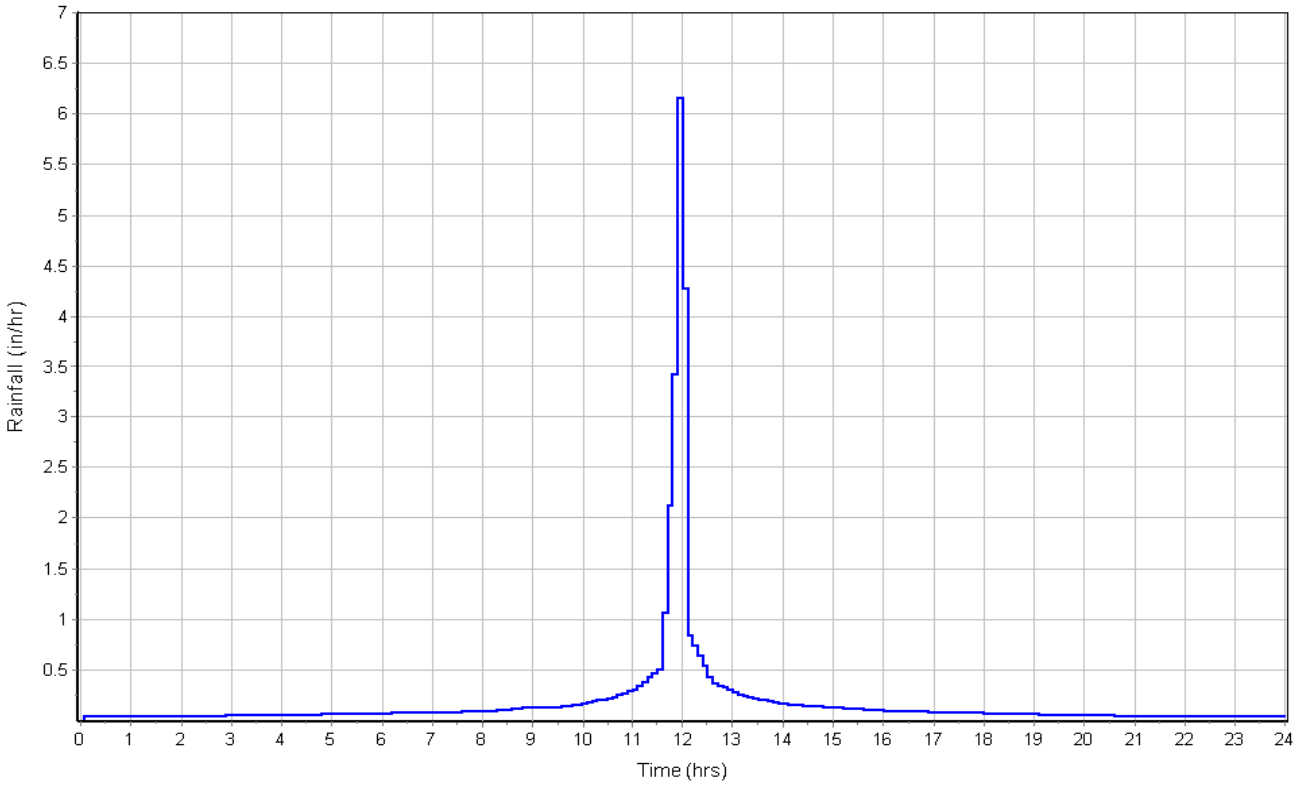
Total TOC (min) 29.13

Subbasin Runoff Results

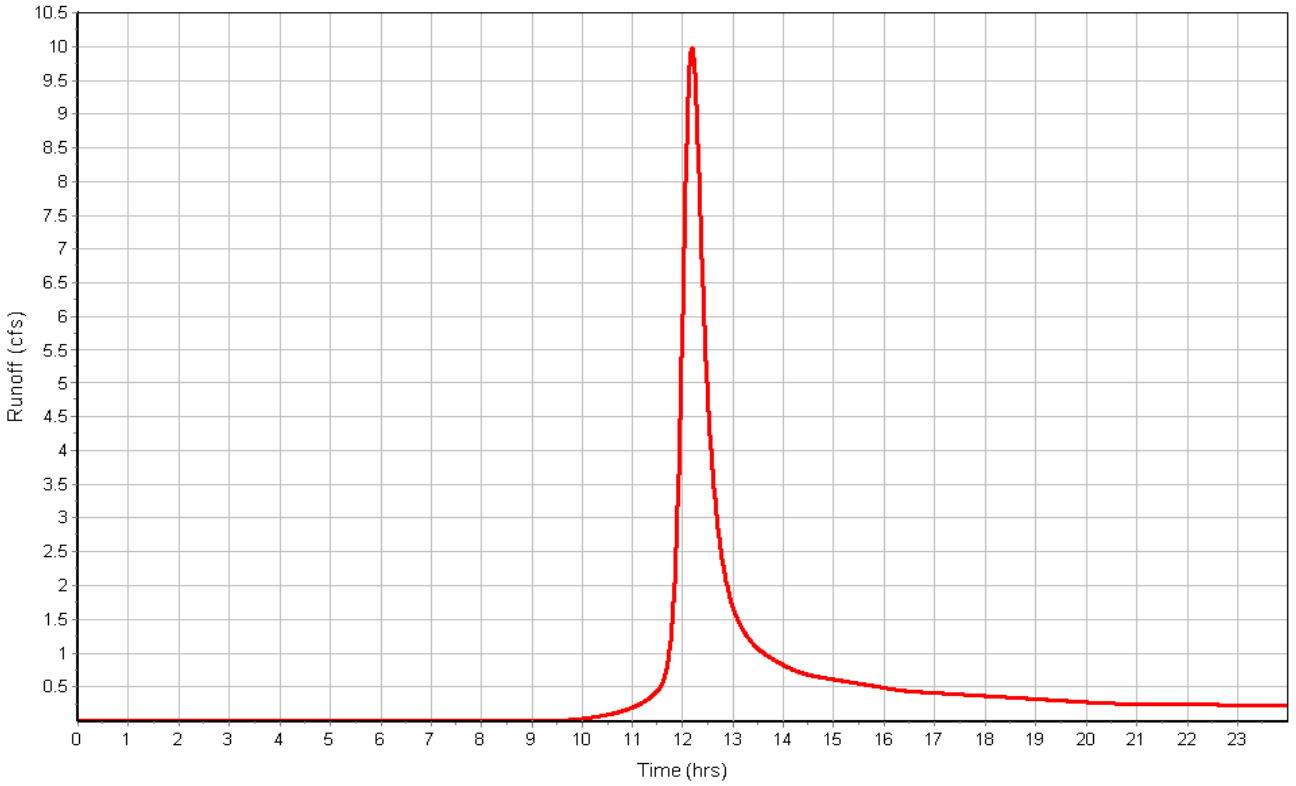
Total Rainfall (in) 4.49
Total Runoff (in) 1.98
Peak Runoff (cfs) 9.99
Weighted Curve Number 74.19
Time of Concentration (days hh:mm:ss) 0 00:29:08

Subbasin : SW1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SW2

Input Data

Area (ac) 1.16
Weighted Curve Number 88.03
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Landfill cap, interim, 100% imp	0.73	C	98.00
Meadow, non-grazed	0.43	C	71.00
Composite Area & Weighted CN	1.16		88.03

Time of Concentration

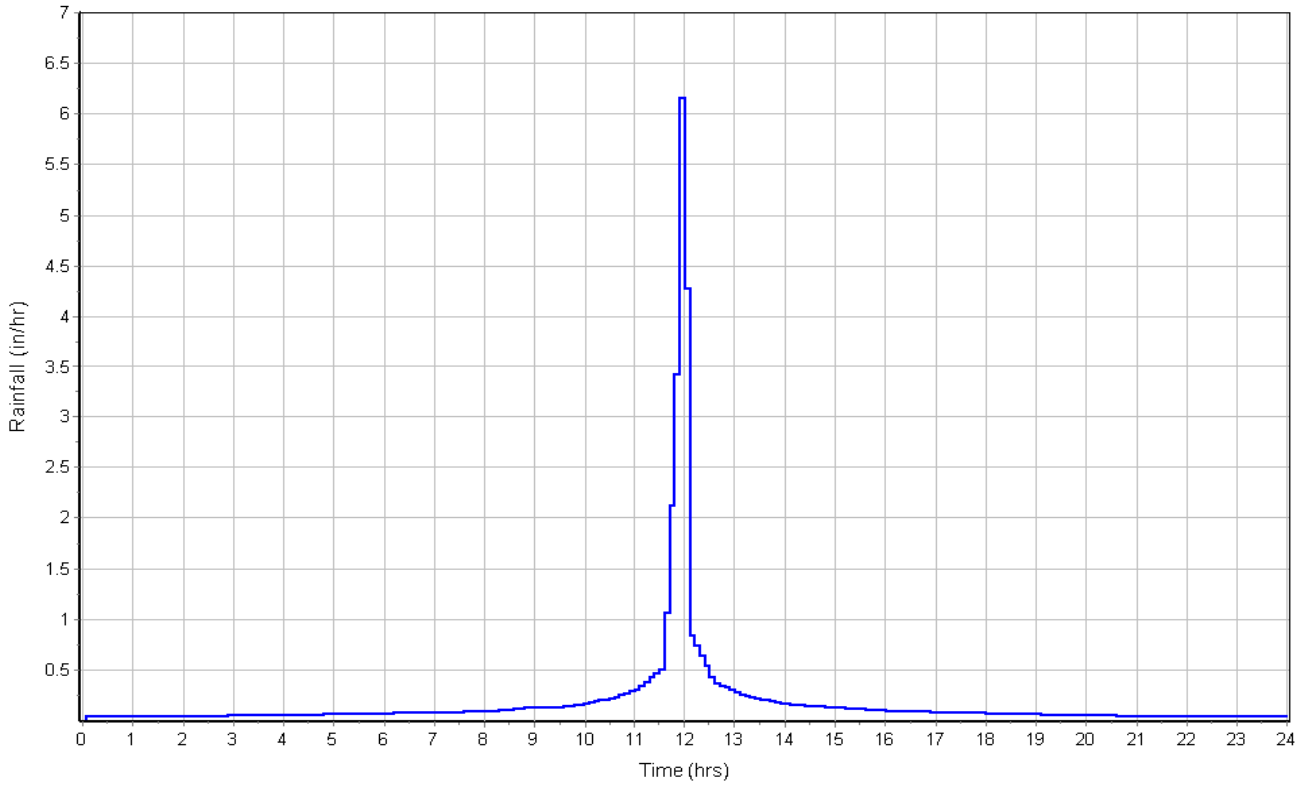
User-Defined TOC override (minutes): 6

Subbasin Runoff Results

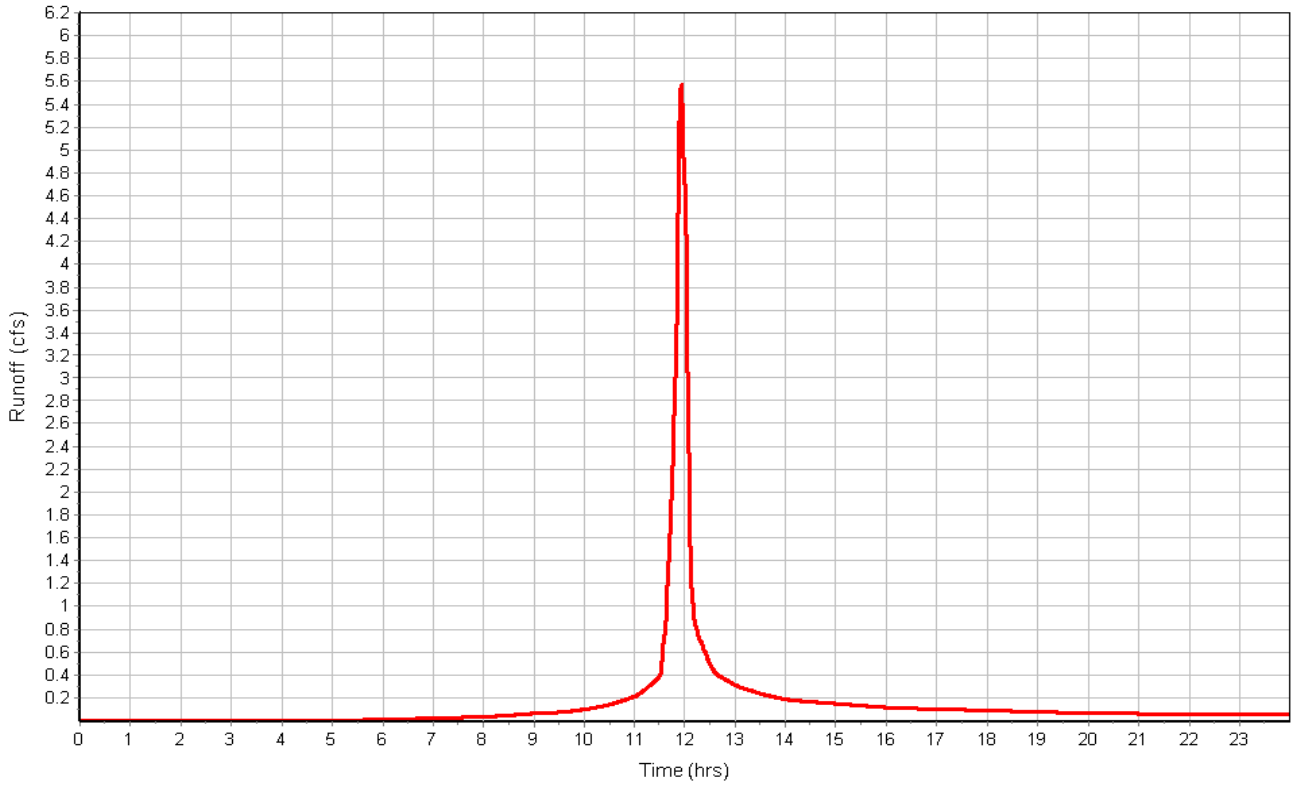
Total Rainfall (in) 4.49
Total Runoff (in) 3.19
Peak Runoff (cfs) 5.57
Weighted Curve Number 88.03
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : SW2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SW3

Input Data

Area (ac) 58.50
Weighted Curve Number 63.03
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.51	C	98.00
Meadow, non-grazed	7.09	B	58.00
Woods, Good	21.04	B	55.00
Woods, Good	5.67	D	77.00
Woods, Good	15.42	C	70.00
Composite Area & Weighted CN	49.73		63.03

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	7.22	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.08	0.00	0.00
Computed Flow Time (min) :	20.19	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	698	617	548
Slope (%) :	3.87	0.60	1.12
Surface Type :	Woodland	Grass pasture	Woodland
Velocity (ft/sec) :	0.98	0.54	0.53
Computed Flow Time (min) :	11.87	19.04	17.23

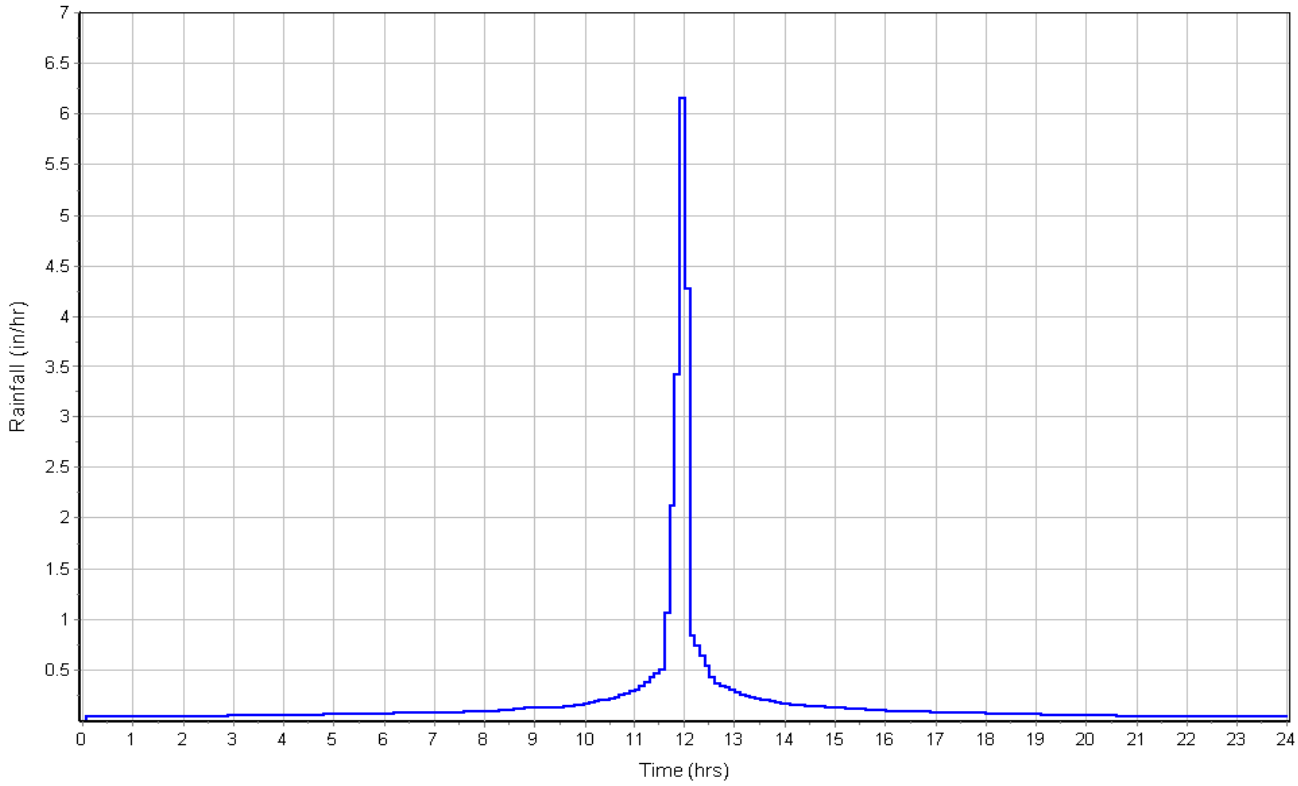
Total TOC (min) 68.34

Subbasin Runoff Results

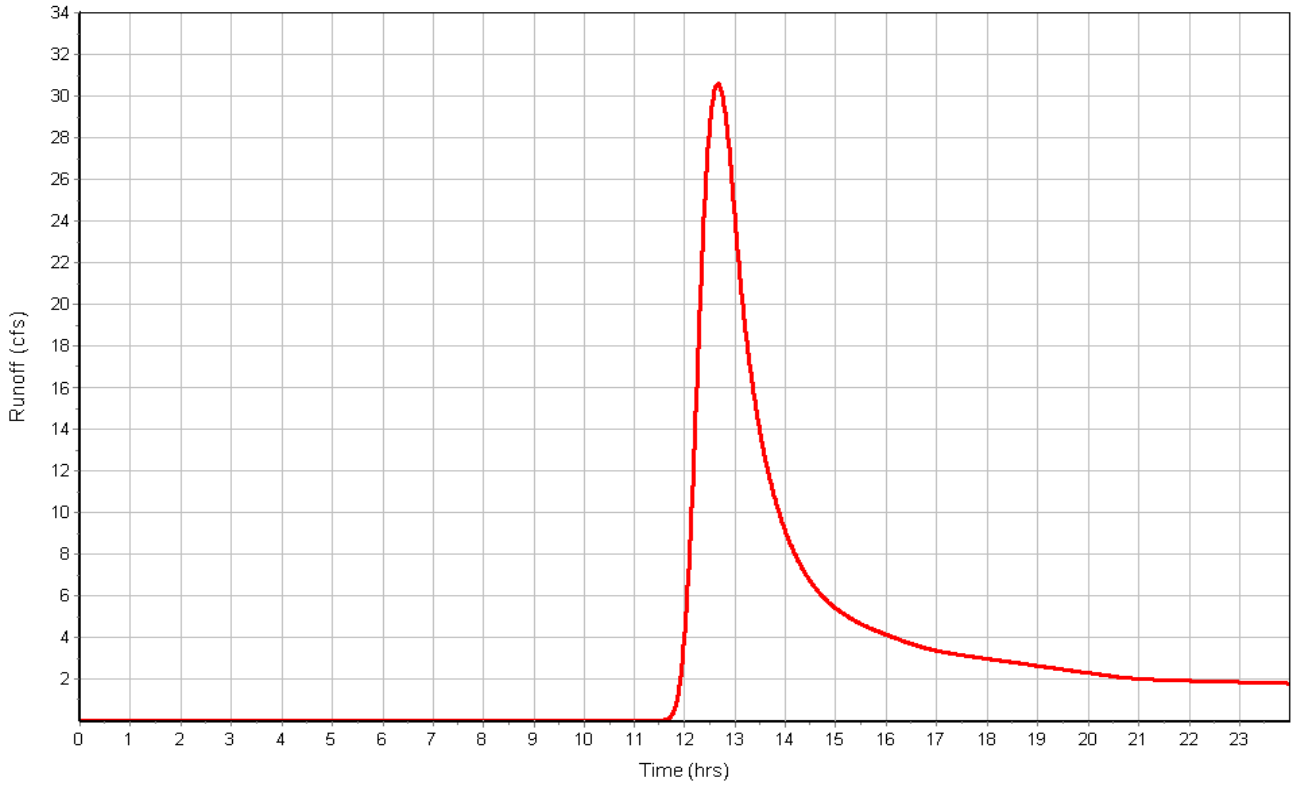
Total Rainfall (in) 4.49
Total Runoff (in) 1.20
Peak Runoff (cfs) 30.63
Weighted Curve Number 63.03
Time of Concentration (days hh:mm:ss) 0 01:08:20

Subbasin : SW3

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SW4

Input Data

Area (ac) 17.30
Weighted Curve Number 71.04
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	0.31	C	89.00
Paved parking & roofs	1.17	C	98.00
Woods, Good	10.46	C	70.00
Meadow, non-grazed	2.00	B	58.00
Meadow, non-grazed	2.74	C	71.00
Composite Area & Weighted CN	16.68		71.04

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.60	0.00	0.00
Flow Length (ft) :	99.5	0.00	0.00
Slope (%) :	1.45	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.04	0.00	0.00
Computed Flow Time (min) :	38.22	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	703	0.00	0.00
Slope (%) :	2.64	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	0.81	0.00	0.00
Computed Flow Time (min) :	14.47	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.033	0.00	0.00
Flow Length (ft) :	316	0.00	0.00
Channel Slope (%) :	3.48	0.00	0.00
Cross Section Area (ft^2) :	14	0.00	0.00
Wetted Perimeter (ft) :	11	0.00	0.00
Velocity (ft/sec) :	9.89	0.00	0.00
Computed Flow Time (min) :	0.53	0.00	0.00

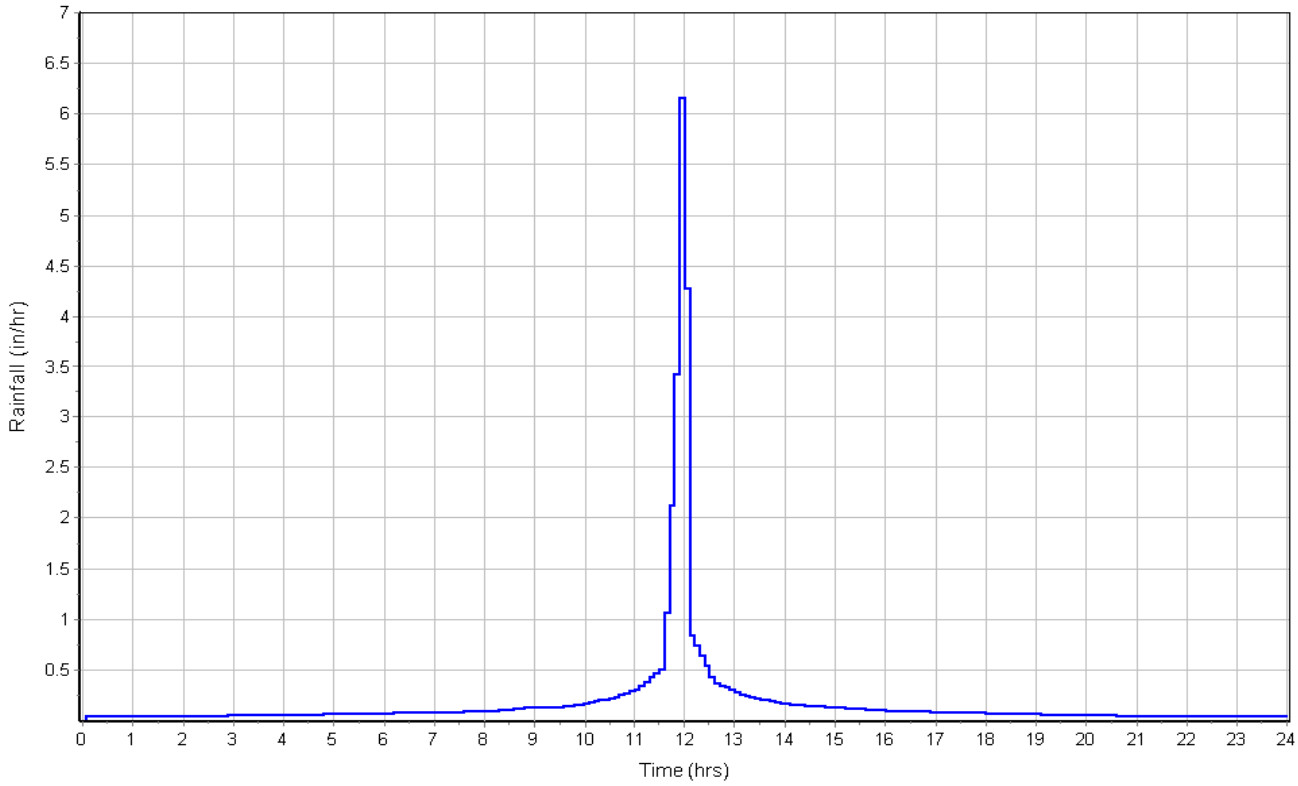
Total TOC (min) 53.21

Subbasin Runoff Results

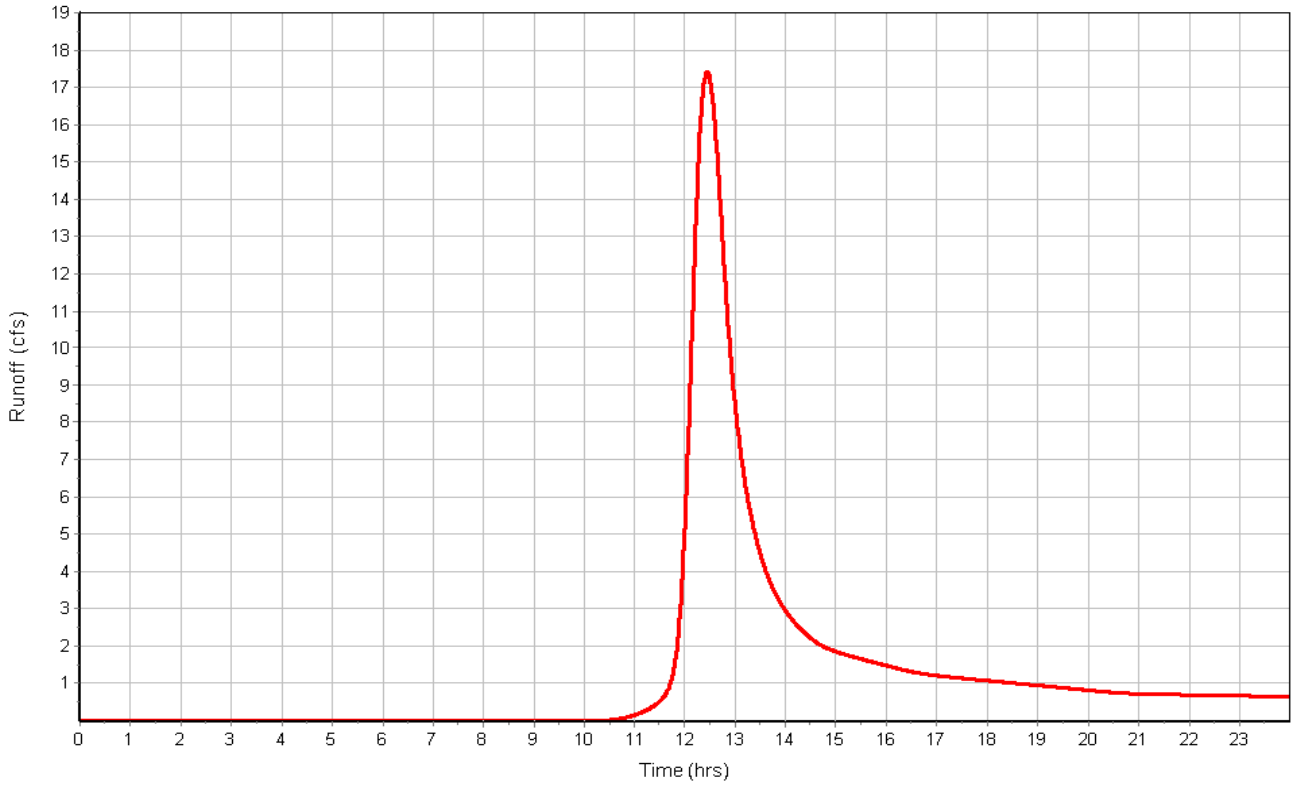
Total Rainfall (in) 4.49
Total Runoff (in) 1.74
Peak Runoff (cfs) 17.42
Weighted Curve Number 71.04
Time of Concentration (days hh:mm:ss) 0 00:53:13

Subbasin : SW4

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SW5

Input Data

Area (ac) 6.36
Weighted Curve Number 74.27
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	0.38	C	89.00
Grassed Landfill Cap	14.50	C	74.00
Meadow, non-grazed	0.50	C	71.00
Composite Area & Weighted CN	15.38		74.27

Time of Concentration

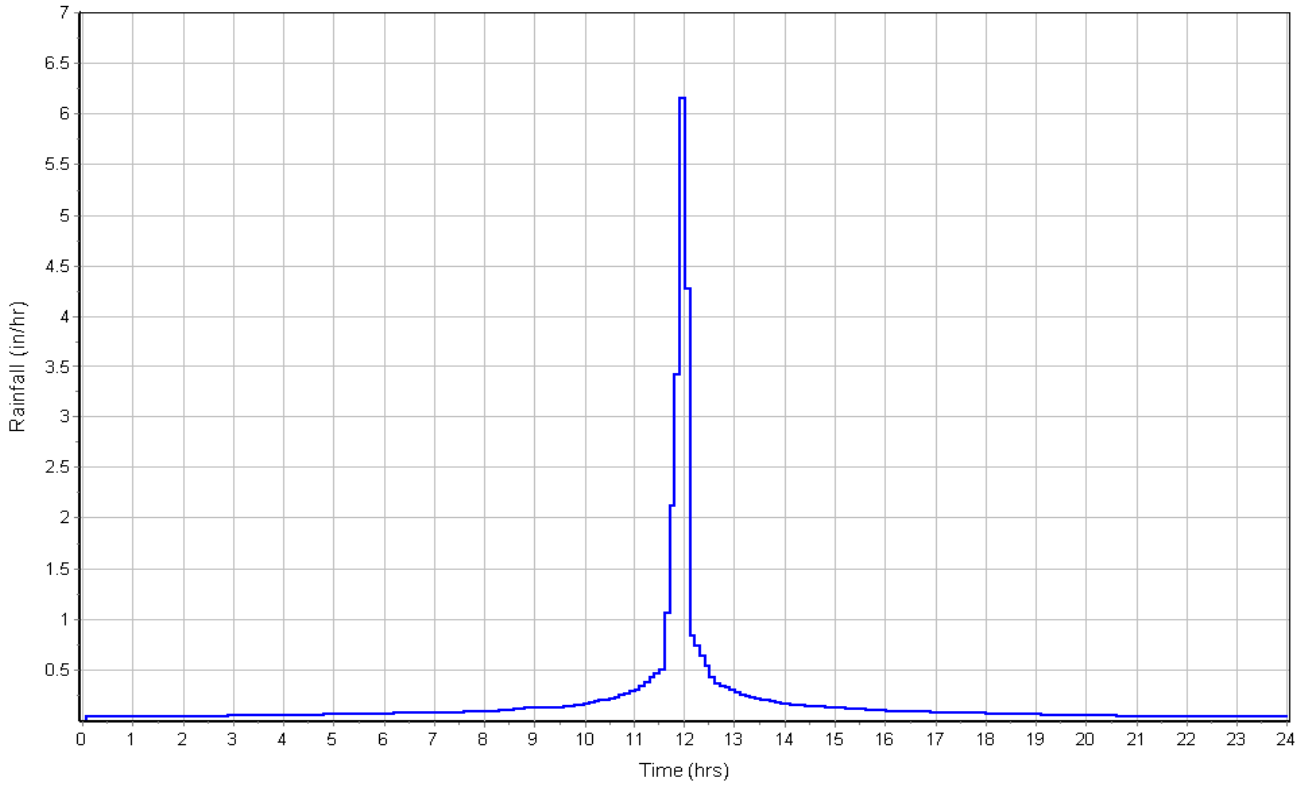
User-Defined TOC override (minutes): 6

Subbasin Runoff Results

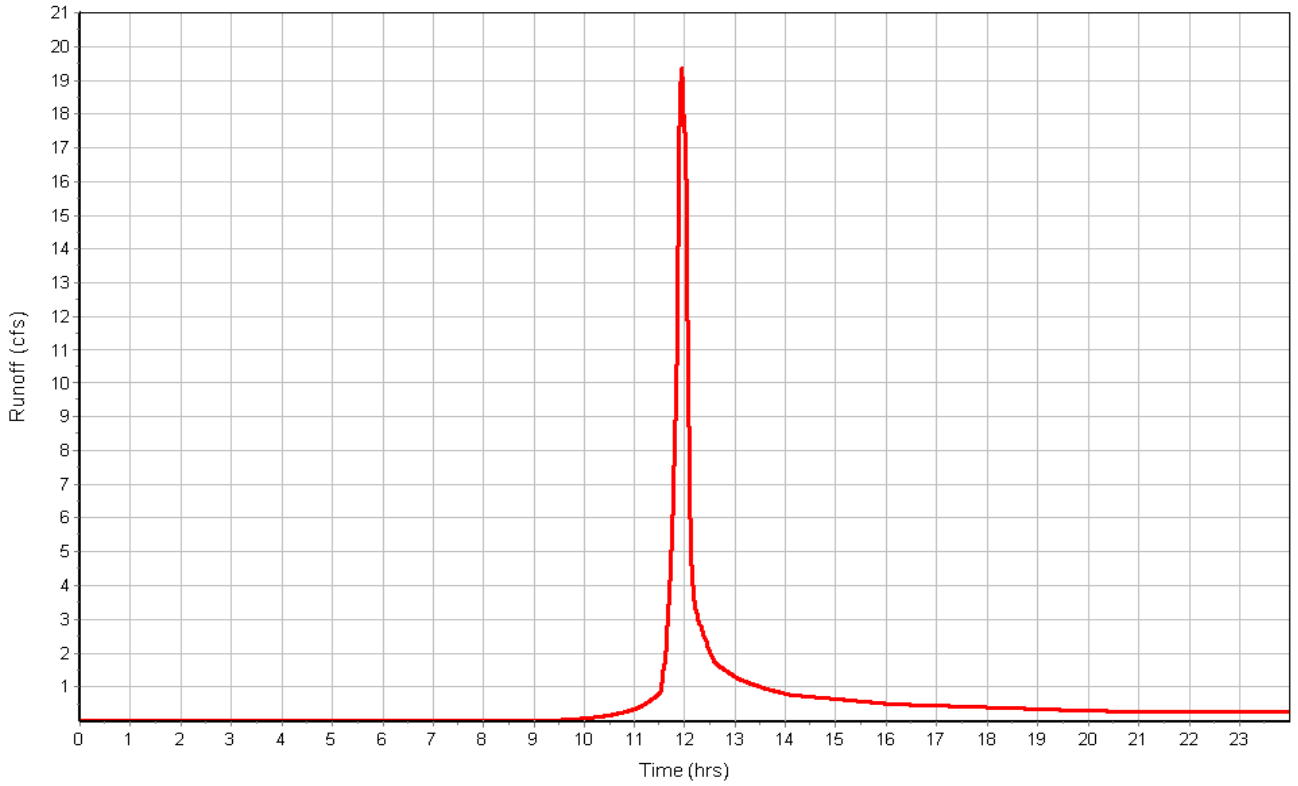
Total Rainfall (in) 4.49
Total Runoff (in) 1.99
Peak Runoff (cfs) 19.38
Weighted Curve Number 74.27
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : SW5

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SW6

Input Data

Area (ac) 11.72
Weighted Curve Number 97.78
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved roads	1.57	C	98.00
Landfill cap, interim, 100% imp	10.05	C	98.00
Meadow, non-grazed	0.10	C	71.00
Composite Area & Weighted CN	11.72		97.78

Time of Concentration

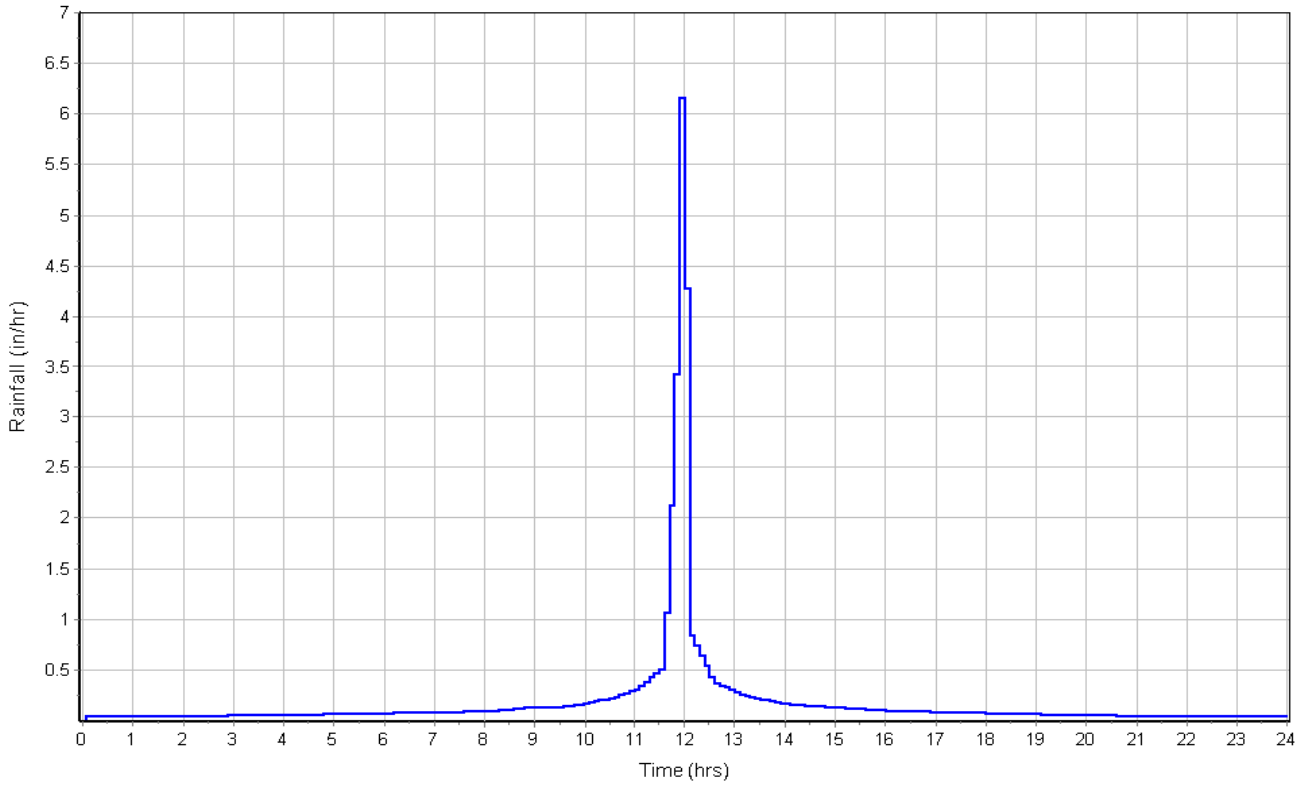
User-Defined TOC override (minutes): 6

Subbasin Runoff Results

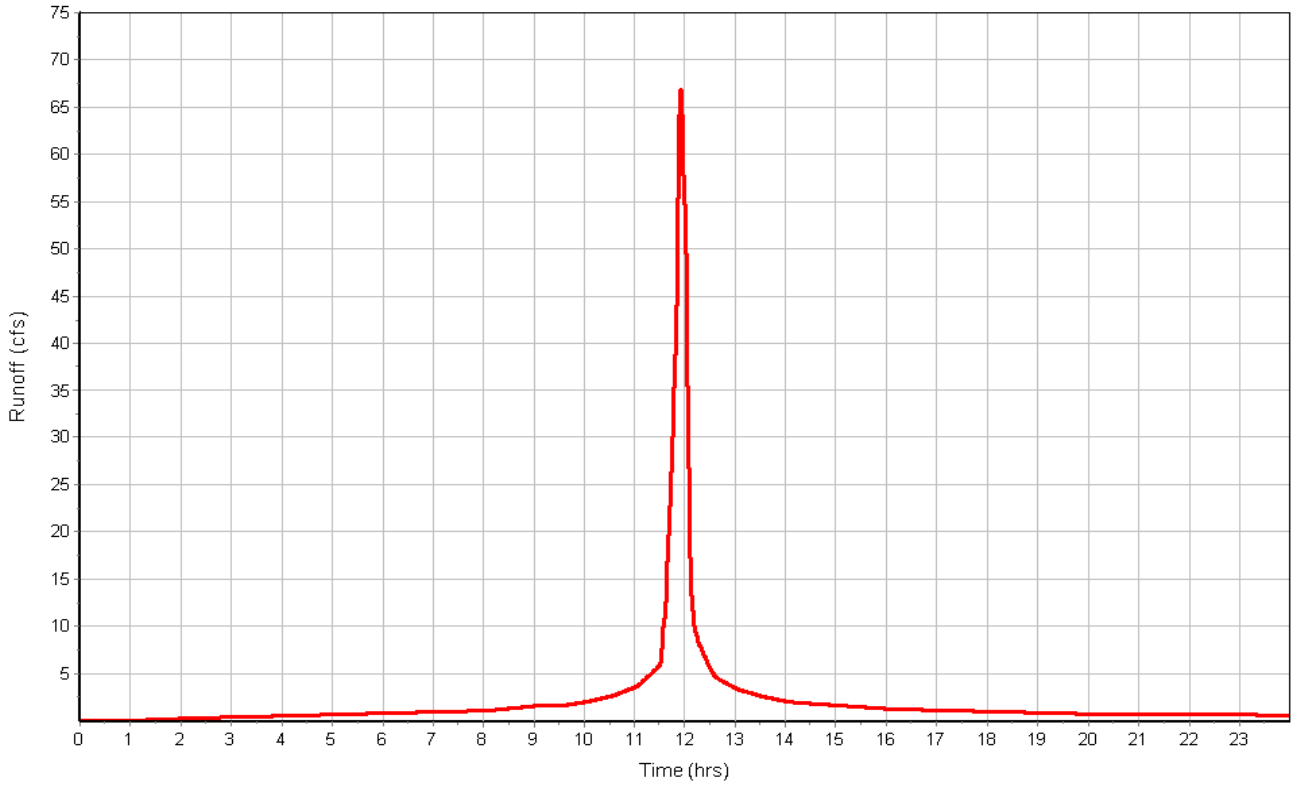
Total Rainfall (in) 4.49
Total Runoff (in) 4.23
Peak Runoff (cfs) 66.93
Weighted Curve Number 97.78
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : SW6

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1	Culv-SE-11-IN	1635.50	1639.75	4.25	1634.50	-1.00	0.00	-1639.75	0.00	3.00
2	Culv-SE4-Out	1642.00	1646.00	4.00	1641.00	-1.00	0.00	-1646.00	0.00	0.00
3	Culv-SE5-Out	1678.00	1680.00	2.00	0.00	-1678.00	0.00	-1680.00	0.00	0.00
4	Culv-SW4_Out	1633.28	1639.28	6.00	1633.28	0.00	1639.28	0.00	10.00	46.20
5	Culv-SW5_Out	1645.73	1651.73	6.00	1645.73	0.00	1651.73	0.00	10.00	36.00
6	Culv-SW6_Out	1648.73	1654.73	6.00	1648.73	0.00	1654.73	0.00	1000.00	42.00
7	HW-14	1643.32	1650.00	6.68	1642.00	-1.32	0.00	-1650.00	0.00	0.00
8	HW-15	1642.97	1650.00	7.03	1642.00	-0.97	0.00	-1650.00	0.00	36.36
9	HW-SE-1	1622.54	1626.75	4.21	1622.00	-0.54	0.00	-1626.75	0.00	20.52
10	Intr-7	1668.00	1672.00	4.00	0.00	-1668.00	0.00	-1672.00	0.00	0.00
11	Intr-SE6	1674.07	1678.07	4.00	0.00	-1674.07	0.00	-1678.07	0.00	0.00
12	Intr-SE8	1654.00	1658.00	4.00	0.00	-1654.00	0.00	-1658.00	0.00	0.00
13	Int-SE1	1668.33	1676.00	7.67	0.00	-1668.33	0.00	-1676.00	0.00	32.04
14	Int-SE15	1646.44	1648.50	2.06	0.00	-1646.44	0.00	-1648.50	0.00	0.72
15	Int-SE2	1664.17	1665.06	0.89	0.00	-1664.17	0.00	-1665.06	10.00	0.00
16	Int-SE3	1658.26	1660.25	1.99	1658.00	-0.26	0.00	-1660.25	0.00	10.68
17	Jun-150	1662.00	1666.00	4.00	0.00	-1662.00	0.00	-1666.00	0.00	0.00
18	Jun-177	1654.80	1656.80	2.00	1654.00	-0.80	0.00	-1656.80	0.00	0.00
19	Jun-180	1635.50	1639.75	4.25	1635.70	0.20	0.00	-1639.75	10.00	3.00
20	Jun-185	1622.06	1626.75	4.69	1620.70	-1.36	0.00	-1626.75	10.00	25.08
21	Jun-189	1657.30	1659.00	1.70	0.00	-1657.30	0.00	-1659.00	0.00	0.00
22	Jun-190	1665.25	1670.00	4.75	0.00	-1665.25	0.00	-1670.00	0.00	0.00
23	Jun-191	1649.25	1654.00	4.75	0.00	-1649.25	0.00	-1654.00	10.00	0.00
24	Jun-194	1640.00	1646.00	6.00	1640.00	0.00	1646.00	0.00	0.00	0.00
25	Jun-250	1672.00	1676.00	4.00	0.00	-1672.00	0.00	-1676.00	0.00	0.00
26	Jun-251	1647.50	1652.00	4.50	0.00	-1647.50	0.00	-1652.00	10.00	24.00
27	Jun-NW3	1649.13	1654.00	4.87	0.00	-1649.13	1654.00	0.00	1000.00	10.08
28	Jun-SW4A	1628.38	1634.38	6.00	1628.38	0.00	1634.38	0.00	10.00	16.56
29	Jun-SW4B	1612.00	1618.00	6.00	1612.00	0.00	1618.00	0.00	1000.00	0.00
30	NW-1	1260.00	1270.00	10.00	1260.00	0.00	1270.00	0.00	10.00	120.00
31	NW-2	1220.00	1226.00	6.00	1220.00	0.00	1226.00	0.00	10.00	0.00
32	Out-N	1100.00	1120.00	20.00	1100.00	0.00	1120.00	0.00	100000.00	192.00
33	Out-S	1500.00	1650.00	150.00	1500.00	0.00	1650.00	0.00	1000.00	1740.00
34	Out-SE	1618.14	1628.00	9.86	1617.00	-1.14	0.00	-1628.00	0.00	88.32
35	PDMH-1	1619.16	1640.00	20.84	1618.00	-1.16	0.00	-1640.00	0.00	218.88
36	PDMH-2	1620.64	1640.00	19.36	1619.50	-1.14	0.00	-1640.00	0.00	201.12
37	PDMH-3	1621.47	1626.75	5.28	1621.00	-0.47	0.00	-1626.75	0.00	32.16
38	PDMH-4	1630.32	1642.00	11.68	1630.00	-0.32	0.00	-1642.00	0.00	108.96
39	Pond_NW2-Out	1642.00	1650.00	8.00	1642.00	0.00	1650.00	0.00	1000.00	0.00
40	Pond_NW-5-OCS	1660.50	1670.00	9.50	1662.50	2.00	1671.00	1.00	10.00	0.00
41	Pond_SE1-Out	1658.30	1660.30	2.00	0.00	-1658.30	0.00	-1660.30	10.00	0.00
42	Pond_SE-1-Out	1625.65	1631.10	5.45	1625.00	-0.65	0.00	-1631.10	0.00	41.40
43	Pond_SE-2-Out	1641.50	1648.00	6.50	0.00	-1641.50	0.00	-1648.00	0.00	54.00
44	Pond_SE-4_OCS	1642.59	1646.00	3.41	1642.00	-0.59	0.00	-1646.00	0.00	16.92
45	Pond-SE13	1638.00	1644.00	6.00	1638.00	0.00	1645.00	1.00	9000.00	36.00
46	SE-1-OCS-1	1625.25	1633.50	8.25	1625.00	-0.25	0.00	-1633.50	10.00	0.00
47	SE-1-OCS-2	1622.75	1633.50	10.75	1625.00	2.25	0.00	-1633.50	36.00	0.00
48	SE-2-OCS-1	1641.80	1651.00	9.20	0.00	-1641.80	1651.00	0.00	4.00	0.00
49	South-1	1613.00	1620.00	7.00	1613.00	0.00	1620.00	0.00	1000.00	0.00
50	South-3	1613.00	1620.00	7.00	1613.00	0.00	1620.00	0.00	1000.00	39.84
51	Southwest	1570.00	1610.00	40.00	1570.00	0.00	1610.00	0.00	10.00	69.84
52	Swale-NW4	1650.04	1656.04	6.00	1650.04	0.00	0.00	-1656.04	10.00	17.64

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Culv-SE-11-IN	17.57	0.00	1637.93	2.43	0.00	1.82	1635.82	0.32	0 12:00	0 00:00	0.00	0.00
2	Culv-SE4-Out	24.04	0.00	1642.83	0.83	0.00	3.17	1642.18	0.18	0 12:15	0 00:00	0.00	0.00
3	Culv-SE5-Out	41.77	41.77	1679.29	1.29	0.00	2.71	1678.14	0.14	0 11:56	0 00:00	0.00	0.00
4	Culv-SW4_Out	5.33	0.00	1633.64	0.36	0.00	5.64	1633.41	0.13	0 12:00	0 00:00	0.00	0.00
5	Culv-SW5_Out	19.40	0.00	1645.91	0.18	0.00	5.82	1645.74	0.01	0 11:59	0 00:00	0.00	0.00
6	Culv-SW6_Out	65.39	0.00	1649.52	0.79	0.00	5.21	1648.82	0.09	0 11:57	0 00:00	0.00	0.00
7	HW-14	24.04	0.00	1646.50	3.18	0.00	3.91	1643.89	0.57	0 12:17	0 00:00	0.00	0.00
8	HW-15	19.40	0.00	1644.26	1.29	0.00	5.74	1643.34	0.37	0 12:17	0 00:00	0.00	0.00
9	HW-SE-1	18.51	0.00	1626.75	4.21	0.00	0.00	1622.88	0.34	0 12:09	0 12:15	0.46	17.00
10	Intr-7	53.54	0.00	1669.20	1.20	0.00	2.80	1668.13	0.13	0 11:58	0 00:00	0.00	0.00
11	Intr-SE6	54.85	13.37	1676.00	1.93	0.00	2.07	1674.33	0.26	0 11:57	0 00:00	0.00	0.00
12	Intr-SE8	94.04	0.00	1655.61	1.61	0.00	2.39	1654.18	0.18	0 11:58	0 00:00	0.00	0.00
13	Int-SE1	23.21	23.21	1669.51	1.18	0.00	6.49	1668.50	0.17	0 12:23	0 00:00	0.00	0.00
14	Int-SE15	19.92	19.92	1647.69	1.25	0.00	0.81	1646.60	0.16	0 12:09	0 00:00	0.00	0.00
15	Int-SE2	21.57	21.57	1683.35	19.18	18.08	0.00	1665.35	1.18	0 12:51	0 12:22	5.45	118.00
16	Int-SE3	51.43	41.68	1660.25	1.99	0.00	0.00	1658.95	0.69	0 11:44	0 12:10	39.51	199.00
17	Jun-150	94.30	43.88	1663.51	1.51	0.00	2.49	1662.17	0.17	0 11:57	0 00:00	0.00	0.00
18	Jun-177	4.47	0.00	1655.47	0.67	0.00	2.33	1655.10	0.30	0 12:46	0 00:00	0.00	0.00
19	Jun-180	19.80	19.80	1637.95	2.45	0.00	1.80	1635.84	0.34	0 12:00	0 00:00	0.00	0.00
20	Jun-185	18.44	0.00	1626.49	4.43	0.00	0.26	1622.40	0.34	0 12:23	0 00:00	0.00	0.00
21	Jun-189	0.82	0.00	1657.55	0.25	0.00	2.45	1657.42	0.12	1 00:00	0 00:00	0.00	0.00
22	Jun-190	23.20	0.00	1667.33	2.08	0.00	4.42	1666.21	0.96	0 21:51	0 00:00	0.00	0.00
23	Jun-191	93.83	0.00	1652.68	3.43	0.00	1.32	1649.83	0.58	0 11:58	0 00:00	0.00	0.00
24	Jun-194	29.86	0.00	1641.04	1.04	0.00	8.16	1640.34	0.34	0 12:23	0 00:00	0.00	0.00
25	Jun-250	53.78	0.00	1673.14	1.14	0.00	2.86	1672.12	0.12	0 11:58	0 00:00	0.00	0.00
26	Jun-251	80.81	80.81	1650.09	2.59	0.00	1.91	1647.86	0.36	0 11:54	0 00:00	0.00	0.00
27	Jun-NW3	53.71	14.84	1650.14	1.01	0.00	3.86	1649.28	0.15	0 11:59	0 00:00	0.00	0.00
28	Jun-SW4A	36.57	0.00	1631.86	3.48	0.00	2.52	1630.86	2.48	0 12:11	0 00:00	0.00	0.00
29	Jun-SW4B	52.70	17.41	1616.12	4.12	0.00	1.88	1613.87	1.87	0 12:27	0 00:00	0.00	0.00
30	NW-1	199.07	199.07	1260.00	0.00	0.00	10.00	1260.00	0.00	0 00:00	0 00:00	0.00	0.00
31	NW-2	79.69	65.62	1220.14	0.14	0.00	186.86	1220.04	0.04	0 12:45	0 00:00	0.00	0.00
32	Out-N	262.20	0.00	1106.58	6.58	0.00	13.42	1101.32	1.32	0 12:34	0 00:00	0.00	0.00
33	Out-S	143.63	0.00	1502.33	2.33	0.00	147.67	1500.78	0.78	0 12:02	0 00:00	0.00	0.00
34	Out-SE	44.40	0.00	1618.17	0.03	0.00	9.83	1618.15	0.01	0 12:23	0 00:00	0.00	0.00
35	PDMH-1	44.40	0.00	1620.93	1.77	0.00	19.07	1619.77	0.61	0 12:23	0 00:00	0.00	0.00
36	PDMH-2	44.40	0.00	1625.90	5.26	0.00	14.10	1621.55	0.91	0 12:23	0 00:00	0.00	0.00
37	PDMH-3	18.35	0.00	1626.23	4.76	0.00	0.52	1621.90	0.43	0 12:23	0 00:00	0.00	0.00
38	PDMH-4	29.80	0.00	1631.44	1.12	0.00	10.56	1630.71	0.39	0 12:23	0 00:00	0.00	0.00
39	Pond_NW2-Out	14.95	0.00	1643.43	1.43	0.00	6.57	1642.83	0.83	0 12:45	0 00:00	0.00	0.00
40	Pond_NW-5-OCS	0.82	0.00	1662.72	2.22	0.00	7.28	1662.61	2.11	0 21:53	0 00:00	0.00	0.00
41	Pond_SE1-Out	0.82	0.00	1658.53	0.23	0.00	7.60	1658.42	0.12	0 21:53	0 00:00	0.00	0.00
42	Pond_SE-1-Out	18.51	0.00	1628.50	2.85	0.00	2.60	1625.89	0.24	0 12:10	0 00:00	0.00	0.00
43	Pond_SE-2-Out	12.40	0.00	1641.99	0.49	0.00	6.01	1641.73	0.23	0 13:08	0 00:00	0.00	0.00
44	Pond_SE-4_OCS	4.80	4.80	1643.58	0.99	0.00	2.42	1642.75	0.16	0 12:10	0 00:00	0.00	0.00
45	Pond-SE13	30.36	5.88	1641.03	3.03	0.00	2.97	1638.96	0.96	0 12:23	0 00:00	0.00	0.00
46	SE-1-OCS-1	18.50	0.00	1629.41	4.16	0.00	4.09	1626.11	0.86	0 12:10	0 00:00	0.00	0.00
47	SE-1-OCS-2	0.51	0.00	1626.49	3.74	0.00	7.01	1625.38	2.63	0 12:22	0 00:00	0.00	0.00
48	SE-2-OCS-1	12.40	0.00	1643.71	1.91	0.00	7.29	1642.71	0.91	0 13:08	0 00:00	0.00	0.00
49	South-1	62.11	0.00	1613.95	0.95	0.00	7.85	1613.05	0.05	0 11:57	0 00:00	0.00	0.00
50	South-3	37.92	0.00	1613.59	0.59	0.00	6.41	1613.03	0.03	0 11:57	0 00:00	0.00	0.00
51	Southwest	80.63	0.00	1571.40	1.40	0.00	38.60	1570.28	0.28	0 12:35	0 00:00	0.00	0.00
52	Swale-NW4	60.94	44.70	1652.65	2.61	0.00	3.39	1651.47	1.43	0 11:57	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Shape	Height (ft)	Width (ft)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
1	Link-388	211.00	1665.25	0.00	1663.60	1.10	1.65	0.7800	Trapezoidal	6.500	43.000	0.0300	0.0000	0.0000	0.0000	0.00	No
2	N_Routing	0.10	1100.00	0.00	1099.99	99.99	0.01	10.0000	Triangular	4.000	10.000	0.0300	0.5000	0.5000	0.0000	0.00	No
3	NW2-Swale	2560.00	1643.00	1.00	1406.00	186.00	237.00	9.2600	Parabolic	1.000	20.000	0.0500	0.5000	0.5000	0.0000	0.00	No
4	S_Rout	0.10	1500.00	0.00	1499.90	99.90	0.10	100.0000	Triangular	4.000	40.000	0.0300	0.5000	0.5000	0.0000	0.00	No
5	Swale-NW2	651.44	1649.13	0.00	1643.88	1.88	5.25	0.8100	Trapezoidal	2.000	26.000	0.0300	0.5000	0.5000	0.0000	0.00	No
6	Swale-NW3	449.31	1651.57	1.53	1647.91	0.00	3.66	0.8100	Trapezoidal	2.000	26.000	0.0300	0.5000	0.5000	0.0000	0.00	No
7	Swale-NW6	366.70	1657.30	0.00	1649.13	0.00	8.17	2.2300	Trapezoidal	1.250	8.500	0.0300	0.0000	0.0000	0.0000	0.00	No
8	Swale-NW7	32.50	1658.30	0.00	1658.00	0.70	0.30	0.9200	Trapezoidal	2.000	14.000	0.0300	0.0000	0.0000	0.0000	0.00	No
9	Swale-SE11	200.00	1635.50	0.00	1635.50	0.00	0.00	0.0000	Trapezoidal	4.000	21.000	0.0300	0.0000	0.0000	0.0000	0.00	No
10	Swale-SE15	664.00	1646.44	0.00	1643.32	0.00	3.12	0.4700	Trapezoidal	2.000	14.000	0.0300	0.0000	0.0000	0.0000	0.00	No
11	Swale-SE1-A	612.50	1668.33	0.00	1665.25	0.00	3.08	0.5000	Trapezoidal	5.000	34.000	0.0300	0.0000	0.0000	0.0000	0.00	No
12	Swale-SE2	465.30	1664.17	0.00	1658.26	0.00	5.91	1.2700	Trapezoidal	1.100	4.650	0.0300	0.0000	0.0000	0.0000	0.00	No
13	Swale-SE20	58.20	1641.50	0.00	1640.00	0.00	1.50	2.5800	Trapezoidal	2.000	16.000	0.0270	0.0000	0.0000	0.0000	0.00	No
14	Swale-SE21	197.10	1640.00	0.00	1638.00	0.00	2.00	1.0100	Trapezoidal	3.000	24.000	0.0300	0.0000	0.0000	0.0000	0.00	No
15	Swale-SE3	701.00	1658.26	0.00	1653.62	-1.18	4.64	0.6600	Trapezoidal	1.100	4.600	0.0300	0.0000	0.0000	0.0000	0.00	No
16	SWALE-SE3b	219.80	1654.80	0.00	1647.41	4.09	7.39	3.3600	Trapezoidal	3.000	12.250	0.0300	0.5000	0.5000	0.0000	0.00	No
17	Swale-SE3c	193.00	1642.97	0.00	1642.00	0.00	0.97	0.5000	Trapezoidal	4.000	26.000	0.0300	0.0000	0.0000	0.0000	0.00	No
18	Swale-SE4	124.60	1642.00	0.00	1640.00	0.00	2.00	1.6100	Trapezoidal	4.000	28.000	0.0300	0.0000	0.0000	0.0000	0.00	No
19	Swale-SE5	385.20	1678.00	0.00	1674.07	0.00	3.93	1.0200	Trapezoidal	4.000	21.000	0.0330	0.0000	0.0000	0.0000	0.00	No
20	Swale-SE6A	398.10	1674.07	0.00	1672.00	0.00	2.07	0.5200	Trapezoidal	4.000	21.000	0.0330	0.0000	0.0000	0.0000	0.00	No
21	Swale-SE6B	150.50	1672.00	0.00	1668.00	0.00	4.00	2.6600	Trapezoidal	4.000	21.000	0.0330	0.0000	0.0000	0.0000	0.00	No
22	Swale-SE7	274.50	1668.00	0.00	1662.00	0.00	6.00	2.1900	Trapezoidal	4.000	21.000	0.0330	0.0000	0.0000	0.0000	0.00	No
23	Swale-SE8	283.30	1662.00	0.00	1654.00	0.00	8.00	2.8200	Trapezoidal	4.000	21.000	0.0330	0.0000	0.0000	0.0000	0.00	No
24	Swale-SE9	180.74	1654.00	0.00	1650.00	0.75	4.00	2.2100	Trapezoidal	4.000	21.000	0.0330	0.0000	0.0000	0.0000	0.00	No
25	Swale-SW4A-Routing	775.76	1631.00	2.62	1614.00	2.00	17.00	2.1900	Trapezoidal	2.000	36.000	0.1000	0.5000	0.5000	0.0000	0.00	No
26	Swale-SW4B-Routing	414.00	1633.43	0.15	1612.00	0.00	21.43	5.1800	Trapezoidal	2.000	36.000	0.1000	0.5000	0.5000	0.0000	0.00	No
27	Swale-SW4C	254.98	1614.00	2.00	1602.72	0.00	11.28	4.4200	Triangular	4.000	10.000	0.0300	0.5000	0.5000	0.0000	0.00	No
28	Swale-SW5-Routing	390.00	1645.00	-0.73	1634.00	4.84	11.00	2.8200	Rectangular	1.000	40.000	0.0300	0.5000	0.5000	0.0000	0.00	No
29	Swale-SW6-Routing	170.69	1639.00	-9.73	1634.00	4.84	5.00	2.9300	Trapezoidal	4.000	45.000	0.0300	0.5000	0.5000	0.0000	0.00	No

Channel Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	Link-388	23.10	0 12:25	1508.76	0.02	1.73	2.03	2.90	0.45	0.00		
2	N_Routing	262.20	0 12:34	421.70	0.62	15.54	0.00	3.67	0.92	0.00		
3	NW2-Swale	14.88	0 12:45	91.61	0.16	3.93	10.86	0.43	0.43	0.00		
4	S_Rout	142.80	0 12:03	6208.64	0.02	10.50	0.00	1.65	0.41	0.00		
5	Swale-NW2	52.76	0 11:59	196.25	0.27	2.19	4.96	1.50	0.75	0.00		
6	Swale-NW3	60.27	0 11:57	197.45	0.31	2.43	3.08	1.54	0.77	0.00		
7	Swale-NW6	0.82	0 21:45	33.50	0.02	2.71	2.26	0.57	0.46	0.00		
8	Swale-NW7	0.82	0 21:53	80.76	0.01	1.63	0.33	0.19	0.10	0.00		
9	Swale-SE11	17.57	0 11:56	9.95	1.77	0.88	3.79	2.44	0.61	0.00		
10	Swale-SE15	19.57	0 12:09	57.62	0.34	1.76	6.29	1.62	0.81	0.00		
11	Swale-SE1-A	23.20	0 12:23	641.71	0.04	2.96	3.45	1.14	0.23	0.00		
12	Swale-SE2	9.75	0 12:08	9.75	1.00	3.62	2.14	1.10	1.00	118.00		
13	Swale-SE20	12.40	0 13:08	199.69	0.06	3.50	0.28	0.71	0.35	0.00		
14	Swale-SE21	29.48	0 12:18	332.48	0.09	1.38	2.38	2.02	0.67	0.00		
15	Swale-SE3	4.47	0 12:46	5.91	0.76	2.70	4.33	0.88	0.80	0.00		
16	SWALE-SE3b	4.47	0 12:46	210.27	0.02	4.25	0.86	0.67	0.22	0.00		
17	Swale-SE3c	19.40	0 12:17	317.49	0.06	3.55	0.91	1.06	0.27	0.00		
18	Swale-SE4	23.67	0 12:15	676.18	0.04	4.27	0.49	0.92	0.23	0.00		
19	Swale-SE5	41.52	0 11:56	408.74	0.10	3.18	2.02	1.60	0.40	0.00		
20	Swale-SE6A	53.78	0 11:57	291.80	0.18	4.35	1.53	1.53	0.38	0.00		
21	Swale-SE6B	53.54	0 11:58	659.72	0.08	6.24	0.40	1.17	0.29	0.00		
22	Swale-SE7	53.39	0 11:58	598.28	0.09	5.12	0.89	1.36	0.34	0.00		
23	Swale-SE8	94.04	0 11:57	680.02	0.14	7.42	0.64	1.56	0.39	0.00		
24	Swale-SE9	93.83	0 11:58	602.01	0.16	6.09	0.49	2.14	0.54	0.00		
25	Swale-SW4A-Routing	36.29	0 12:11	163.89	0.22	1.04	12.43	1.43	0.71	0.00		
26	Swale-SW4B-Routing	5.03	0 12:00	251.89	0.02	0.19	36.32	1.10	0.55	0.00		
27	Swale-SW4C	51.87	0 12:27	280.48	0.18	4.79	0.89	3.06	0.77	0.00		
28	Swale-SW5-Routing	19.07	0 11:59	332.62	0.06	2.63	2.47	0.52	0.52	0.00		
29	Swale-SW6-Routing	64.94	0 11:57	2449.26	0.03	9.34	0.30	0.78	0.20	0.00		

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)
1	1625.75	58.20	1625.75	3.00	1622.56	0.50	3.19	5.4800	CIRCULAR	12.000	12.000	0.0120	0.5000	0.8000	0.0000	0.00
2	1662.50	58.10	1662.50	2.00	1660.50	2.20	2.00	3.4400	CIRCULAR	18.000	18.000	0.0120	0.5000	0.5000	0.0000	0.00
3	Cul-SW4	41.14	1602.72	0.00	1601.68	31.68	1.04	2.5300	CIRCULAR	30.000	30.000	0.0110	0.5000	0.5000	0.0000	0.00
4	Culv_SE-11	150.33	1634.75	-0.75	1633.60	1.10	1.15	0.7600	CIRCULAR	24.000	24.000	0.0120	0.0000	0.0000	0.0000	0.00
5	Culvert-SW4	82.60	1634.25	0.00	1633.28	0.00	0.97	1.1700	CIRCULAR	24.000	24.000	0.0100	0.5000	0.5000	0.0000	0.00
6	Culv-NW3A	63.30	1647.91	0.00	1646.75	4.75	1.16	1.8300	CIRCULAR	36.000	36.000	0.0110	0.5000	0.5000	0.0000	0.00
7	Culv-NW3B	63.30	1647.91	0.00	1647.43	5.43	0.48	0.7600	CIRCULAR	36.000	36.000	0.0110	0.5000	0.5000	0.0000	0.00
8	Culv-NW4A	40.02	1651.04	0.00	1651.57	1.53	-0.53	-1.3200	CIRCULAR	36.000	36.000	0.0110	0.5000	0.5000	0.0000	0.00
9	Culv-NW4B	81.71	1651.14	0.10	1650.16	1.03	0.98	1.2000	CIRCULAR	36.000	36.000	0.0110	0.5000	0.5000	0.0000	0.00
10	Culv-S1	62.08	1616.46	0.00	1616.45	3.45	0.01	0.0200	CIRCULAR	30.000	30.000	0.0110	0.5000	0.5000	0.0000	0.00
11	Culv-S2	90.97	1619.20	0.00	1618.80	5.80	0.40	0.4400	CIRCULAR	36.000	36.000	0.0110	0.5000	0.5000	0.0000	0.00
12	Culv-S3	61.14	1615.31	0.00	1614.18	1.18	1.13	1.8500	CIRCULAR	30.000	30.000	0.0110	0.5000	0.5000	0.0000	0.00
13	Culv-SE10	73.94	1638.78	0.00	1636.26	3.76	2.52	3.4100	CIRCULAR	24.000	24.000	0.0120	0.0000	0.0000	0.0000	0.00
14	Culv-SE3	64.30	1643.32	0.00	1642.97	0.00	0.35	0.5400	CIRCULAR	24.000	24.000	0.0120	0.9000	0.3000	0.0000	0.00
15	Culv-SE4	61.60	1642.59	0.00	1642.00	0.00	0.59	0.9600	CIRCULAR	24.000	24.000	0.0120	0.0000	0.0000	0.0000	0.00
16	Culv-SE8	71.80	1649.50	0.25	1646.00	0.70	3.50	4.8700	CIRCULAR	30.000	30.000	0.0120	0.5000	0.5000	0.0000	0.00
17	Culv-SE9	63.20	1647.50	0.00	1645.30	0.00	2.20	3.4800	CIRCULAR	30.000	30.000	0.0120	0.5000	0.5000	0.0000	0.00
18	Culv-SW3	59.15	1578.00	0.00	1576.00	6.00	2.00	3.3800	CIRCULAR	30.000	30.000	0.0110	0.5000	0.5000	0.0000	0.00
19	Culv-SW4	52.00	1629.16	0.00	1628.38	0.00	0.78	1.5000	CIRCULAR	24.000	24.000	0.0110	0.5000	0.5000	0.0000	0.00
20	Culv-SW5	59.57	1647.36	0.00	1645.73	0.00	1.63	2.7400	CIRCULAR	36.000	36.000	0.0240	0.5000	0.5000	0.0000	0.00
21	Culv-SW6	71.39	1650.36	0.00	1648.73	0.00	1.63	2.2800	CIRCULAR	30.000	30.000	0.0110	0.5000	0.5000	0.0000	0.00
22	EPIPE-SE1	50.94	1619.16	0.00	1618.14	0.00	1.02	2.0000	CIRCULAR	30.000	30.000	0.0120	0.5000	0.0000	0.0000	0.00
23	Link-384	97.70	1622.06	0.00	1621.57	0.10	0.49	0.5000	CIRCULAR	30.000	30.000	0.0120	0.5000	0.6000	0.0000	0.00
24	NW_Direct_Rout-1	1.00	1260.00	0.00	1100.00	0.00	160.00	16000.0000	Dummy	0.000	0.000	0.0300	0.5000	0.5000	0.0000	0.00
25	NW_Direct_Rout-2	1.00	1220.00	0.00	1100.00	0.00	120.00	12000.0000	Dummy	0.000	0.000	0.0300	0.5000	0.5000	0.0000	0.00
26	PIPE-1	275.30	1620.64	0.00	1619.26	0.10	1.38	0.5000	CIRCULAR	30.000	30.000	0.0120	0.5000	0.8000	0.0000	0.00
27	Pipe-10	202.70	1625.65	0.00	1622.64	0.10	3.01	1.4800	CIRCULAR	24.000	24.000	0.0120	0.5000	0.6000	0.0000	0.00
28	PIPE-14	73.90	1638.00	0.00	1630.42	0.10	7.58	10.2600	CIRCULAR	30.000	30.000	0.0120	0.0000	0.0000	0.0000	0.00
29	PIPE-15	201.30	1630.32	0.00	1620.74	0.10	9.58	4.7600	CIRCULAR	30.000	30.000	0.0120	0.5000	0.8000	0.0000	0.00
30	PIPE-2	145.60	1621.47	0.00	1620.74	0.10	0.73	0.5000	CIRCULAR	30.000	30.000	0.0120	0.5000	0.8000	0.0000	0.00
31	PIPE-3	75.50	1622.54	0.00	1622.16	0.10	0.38	0.5000	CIRCULAR	30.000	30.000	0.0120	0.5000	0.8000	0.0000	0.00
32	Pipe-6	37.50	1625.75	0.50	1625.37	-0.28	0.38	1.0100	CIRCULAR	24.000	24.000	0.0120	0.5000	0.8000	0.0000	0.00
33	Pond_NW2-Prime	42.84	1643.88	1.88	1643.04	1.04	0.84	1.9600	CIRCULAR	15.000	15.000	0.0110	0.5000	0.5000	0.0000	0.00
34	Pond_SE-2-Primary	57.10	1641.80	0.00	1641.50	0.00	0.30	0.5300	CIRCULAR	24.000	24.000	0.0120	0.0000	0.0000	0.0000	0.00
35	S_Direct_Rout-2	575.23	1613.00	0.00	1500.00	0.00	113.00	19.6400	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00
36	S_Direct_Rout-3	115.53	1613.00	0.00	1500.00	0.00	113.00	97.8100	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00
37	SE_Direct_Rout-1	1422.07	1618.10	-0.04	1500.00	0.00	118.10	8.3000	Dummy	0.000	0.000	0.0320	0.5000	0.5000	0.0000	0.00
38	SW_Rout-1	1606.22	1570.00	0.00	1500.00	0.00	70.00	4.3600	CIRCULAR	60.000	60.000	0.0150	0.5000	0.5000	0.0000	0.00

Flap Gate	No. of Barrels
No	1
No	1
No	1
No	1
No	1
No	1
No	1
No	1
No	2
No	1
No	1
No	1
No	1
No	1
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No	3
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No	1

Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	1625.75	0.51	0 12:08	9.04	0.06	1.04	0.93	0.87	0.87	0.00		Calculated
2	1662.50	0.82	0 21:53	21.11	0.04	5.49	0.18	0.21	0.14	0.00		Calculated
3	Cul-SW4	51.79	0 12:29	77.07	0.67	12.30	0.06	2.00	0.80	0.00		Calculated
4	Culv_SE-11	16.42	0 12:00	27.55	0.60	5.33	0.47	1.90	0.95	0.00		Calculated
5	Culvert-SW4	5.33	0 11:57	31.87	0.17	4.82	0.29	0.77	0.38	0.00		Calculated
6	Culv-NW3A	23.80	0 12:02	106.71	0.22	6.02	0.18	1.64	0.55	0.00		Calculated
7	Culv-NW3B	23.80	0 12:02	68.64	0.35	5.49	0.19	1.77	0.59	0.00		Calculated
8	Culv-NW4A	16.41	0 11:57	90.71	0.18	3.99	0.17	1.69	0.56	0.00		Calculated
9	Culv-NW4B	43.62	0 11:57	172.65	0.25	5.61	0.24	1.62	0.54	0.00		Calculated
10	Culv-S1	14.62	0 11:57	6.15	2.38	4.43	0.23	1.59	0.64	0.00		> CAPACITY
11	Culv-S2	47.49	0 11:57	52.27	0.91	7.25	0.21	2.62	0.87	0.00		Calculated
12	Culv-S3	37.92	0 11:57	65.90	0.58	9.32	0.11	1.93	0.77	0.00		Calculated
13	Culv-SE10	17.94	0 11:58	45.24	0.40	7.42	0.17	1.44	0.72	0.00		Calculated
14	Culv-SE3	19.40	0 12:17	18.08	1.07	7.01	0.15	1.65	0.82	0.00		> CAPACITY
15	Culv-SE4	4.97	0 12:10	23.98	0.21	3.74	0.27	0.91	0.45	0.00		Calculated
16	Culv-SE8	179.25	0 11:59	294.32	0.61	12.17	0.10	2.50	1.00	3.00		SURCHARGED
17	Culv-SE9	86.25	0 11:55	248.71	0.35	5.86	0.18	2.50	1.00	3.00		SURCHARGED
18	Culv-SW3	30.53	0 12:41	89.14	0.34	8.30	0.12	1.75	0.70	0.00		Calculated
19	Culv-SW4	36.57	0 12:07	32.74	1.12	11.64	0.07	2.00	1.00	543.00		SURCHARGED
20	Culv-SW5	19.40	0 11:58	59.76	0.32	7.50	0.13	1.21	0.40	0.00		Calculated
21	Culv-SW6	65.39	0 11:57	73.25	0.89	19.11	0.06	1.65	0.66	0.00		Calculated
22	EPIPE-SE1	44.40	0 12:24	62.88	0.71	27.93	0.03	0.90	0.36	0.00		Calculated
23	Link-384	18.35	0 12:09	31.47	0.58	4.33	0.38	2.50	1.00	33.00		SURCHARGED
24	NW_Direct_Rout-1	199.07	0 12:39	0.00	0.62	0.00		3.67	0.92	0.00		Calculated
25	NW_Direct_Rout-2	79.69	0 12:22	0.00	0.62	0.00		3.67	0.92	0.00		Calculated
26	PIPE-1	44.40	0 12:23	31.46	1.41	9.26	0.50	2.36	0.94	0.00		> CAPACITY
27	Pipe-10	18.51	0 12:10	29.86	0.62	6.63	0.51	2.00	1.00	20.00		SURCHARGED
28	PIPE-14	29.80	0 12:23	142.31	0.21	8.07	0.15	1.76	0.70	0.00		Calculated
29	PIPE-15	29.81	0 12:24	96.94	0.31	8.92	0.38	1.81	0.72	0.00		Calculated
30	PIPE-2	18.35	0 12:09	31.46	0.58	3.74	0.65	2.50	1.00	37.00		SURCHARGED
31	PIPE-3	18.44	0 12:09	31.52	0.59	4.40	0.29	2.50	1.00	30.00		SURCHARGED
32	Pipe-6	18.51	0 12:10	12.66	1.46	6.33	0.10	2.00	1.00	20.00		SURCHARGED
33	Pond_NW2-Prime	14.95	0 12:33	10.69	1.40	12.19	0.06	1.25	1.00	217.00		SURCHARGED
34	Pond_SE-2-Primary	12.40	0 13:08	17.76	0.70	6.32	0.15	1.20	0.60	0.00		Calculated
35	S_Direct_Rout-2	62.11	0 11:57	0.00	0.70	0.00		1.20	0.60	0.00		Calculated
36	S_Direct_Rout-3	37.92	0 11:57	0.00	0.70	0.00		1.20	0.60	0.00		Calculated
37	SE_Direct_Rout-1	44.40	0 12:24	0.00	0.02	0.00		1.65	0.41	0.00		Calculated
38	SW_Rout-1	80.61	0 12:35	471.21	0.17	12.68	2.11	1.82	0.36	0.00		Calculated

Storage Nodes

Storage Node : Culv-SE-10-IN

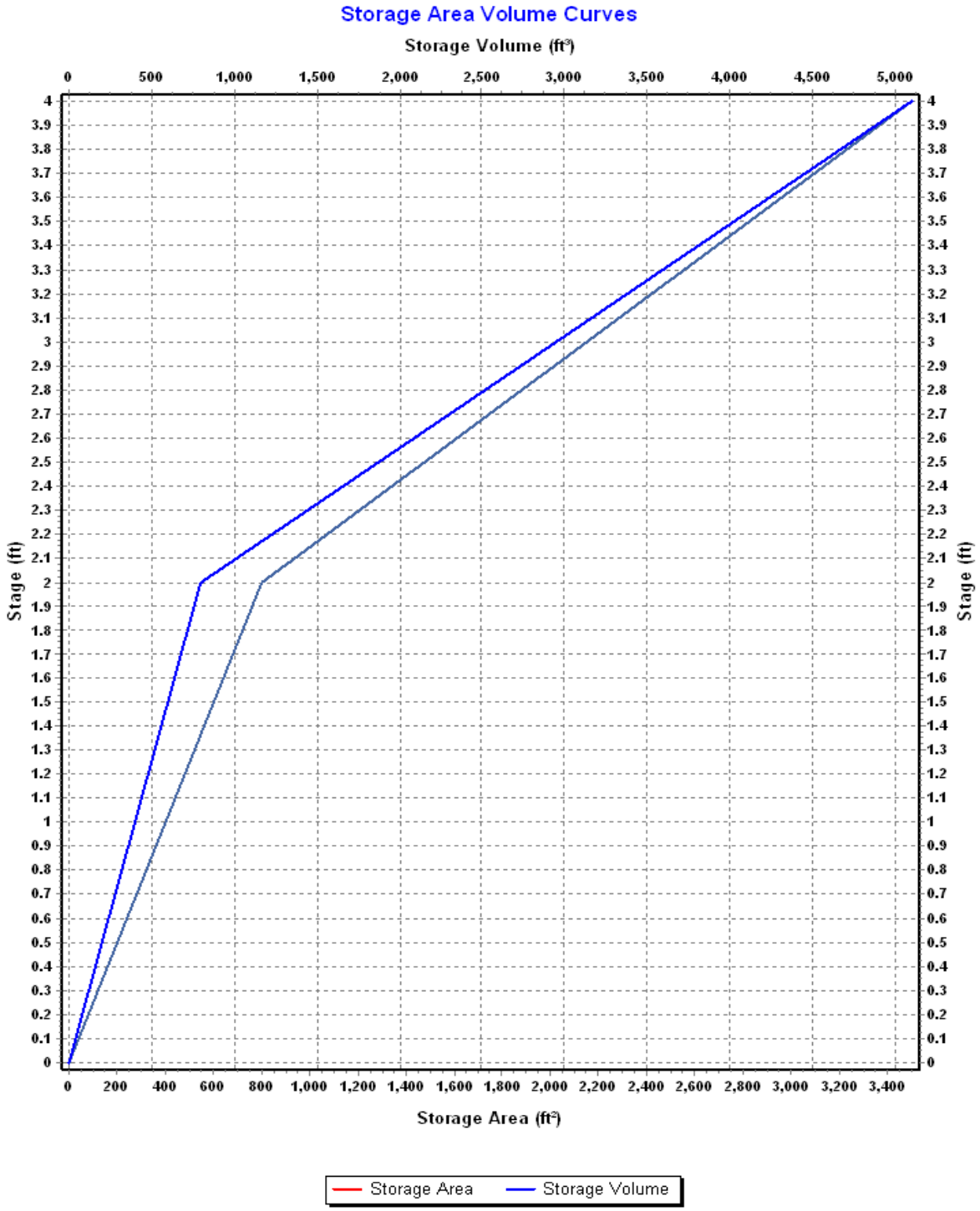
Input Data

Invert Elevation (ft)	1638.78
Max (Rim) Elevation (ft)	1642.00
Max (Rim) Offset (ft)	3.22
Initial Water Elevation (ft)	1638.78
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	3500.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Swale-SE-10

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	0	0.000
2	800	800.00
4	3500	5100.00


Storage Area Volume Curves
Storage Volume (ft³)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
Stage (ft)
Stage (ft)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3
3.1
3.2
3.3
3.4
3.5
3.6
3.7
3.8
3.9
4
0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200
2,400
2,600
2,800
3,000
3,200
3,400
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Culv-SE-10-IN (continued)

Output Summary Results

Peak Inflow (cfs)	19.41
Peak Lateral Inflow (cfs)	19.41
Peak Outflow (cfs)	17.94
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	1641.36
Max HGL Depth Attained (ft)	2.58
Average HGL Elevation Attained (ft)	1639.07
Average HGL Depth Attained (ft)	0.29
Time of Max HGL Occurrence (days hh:mm)	0 11:58
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_NW2

Input Data

Invert Elevation (ft)	1642.00
Max (Rim) Elevation (ft)	1650.00
Max (Rim) Offset (ft)	8.00
Initial Water Elevation (ft)	1642.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	54786.20
Evaporation Loss	0.00

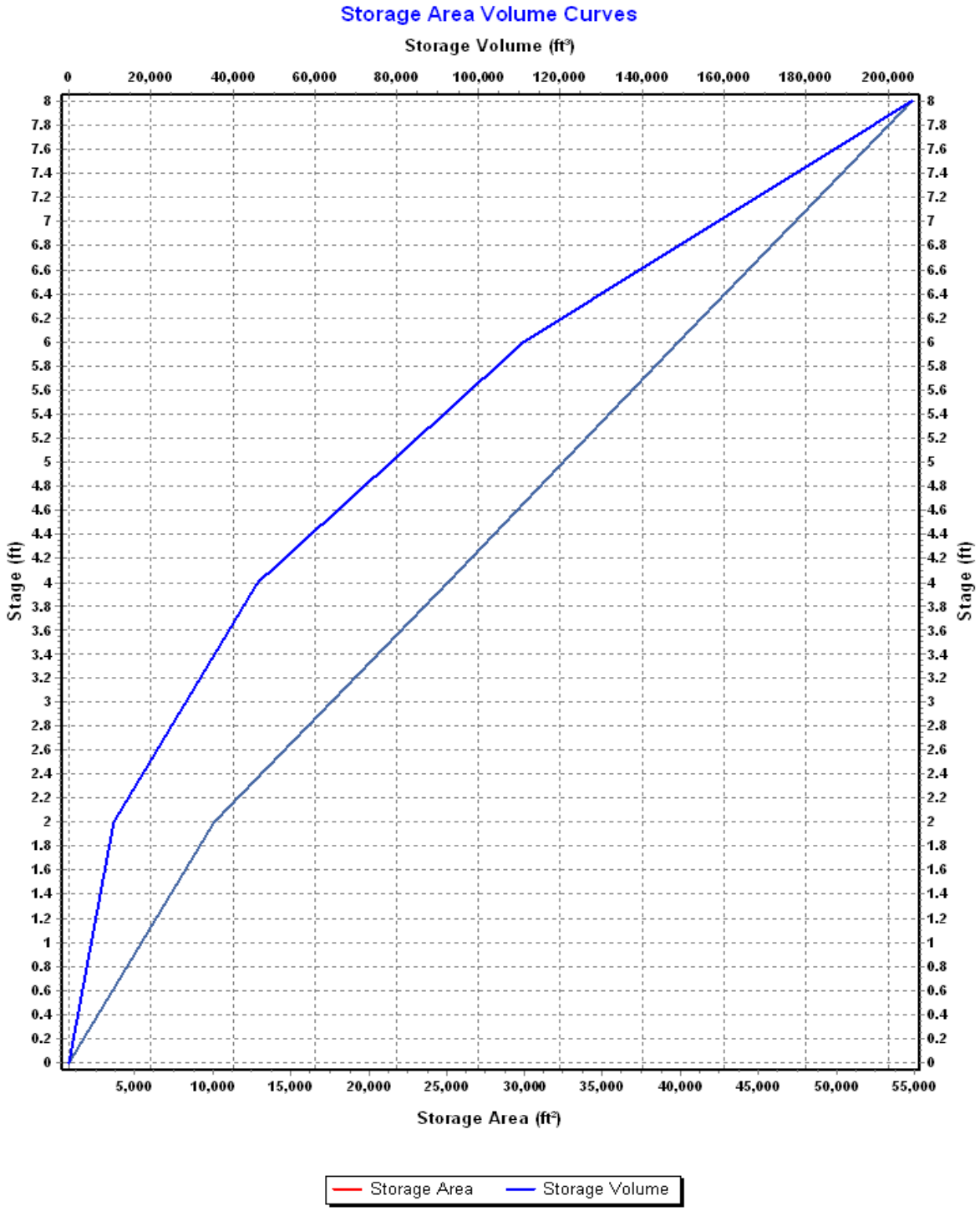
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.1000

Storage Area Volume Curves

Storage Curve : Storage-NW2

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	821.5183	0.000
2	10109.1334	10930.65
4	25079.2635	46119.05
6	39870.9340	111069.25
8	54786.20	205726.38


Storage Area Volume Curves
Storage Volume (ft³)
0
20,000
40,000
60,000
80,000
100,000
120,000
140,000
160,000
180,000
200,000
Stage (ft)
Stage (ft)
8
7.8
7.6
7.4
7.2
7
6.8
6.6
6.4
6.2
6
5.8
5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
45,000
50,000
55,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Pond_NW2 (continued)

Outflow Weirs

SN	Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1	Pond_NW2-Over	Trapezoidal	No	1649.00	7.00	10.00	1.00	3.33

Output Summary Results

Peak Inflow (cfs)	99.12
Peak Lateral Inflow (cfs)	0.00
Peak Outflow (cfs)	14.95
Peak Exfiltration Flow Rate (cfm)	5.79
Max HGL Elevation Attained (ft)	1648.24
Max HGL Depth Attained (ft)	6.24
Average HGL Elevation Attained (ft)	1644.53
Average HGL Depth Attained (ft)	2.53
Time of Max HGL Occurrence (days hh:mm)	0 12:33
Total Exfiltration Volume (1000-ft³)	3.056
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_NW-5

Input Data

Invert Elevation (ft)	1662.50
Max (Rim) Elevation (ft)	1670.00
Max (Rim) Offset (ft)	7.50
Initial Water Elevation (ft)	1663.00
Initial Water Depth (ft)	0.50
Ponded Area (ft²)	65300.00
Evaporation Loss	0.00

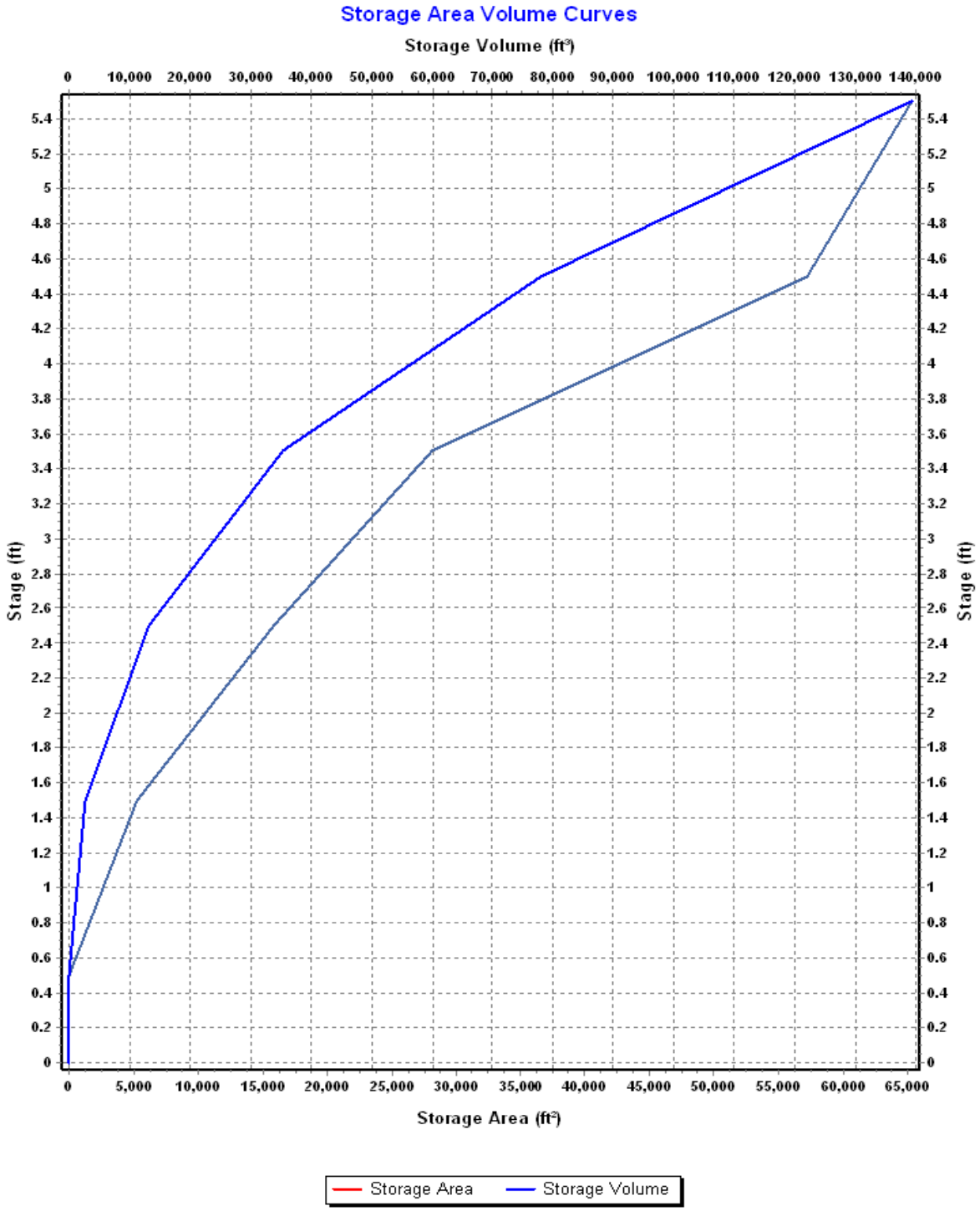
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.1000

Storage Area Volume Curves

Storage Curve : Pond_NW5

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	0	0.000
.5	45	11.25
1.5	5300	2683.75
2.5	15900	13283.75
3.5	28200	35333.75
4.5	57200	78033.75
5.5	65300	139283.75


Storage Area Volume Curves
Storage Volume (ft³)
0
10,000
20,000
30,000
40,000
50,000
60,000
70,000
80,000
90,000
100,000
110,000
120,000
130,000
140,000
Stage (ft)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
4.4
4.6
4.8
5
5.2
5.4
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
45,000
50,000
55,000
60,000
65,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Pond_NW-5 (continued)

Outflow Weirs

SN	Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1	Pond_NW-5-OF	Trapezoidal	No	1669.33	6.83	10.00	1.00	2.67

Outflow Orifices

SN	Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1	Pond_NW-5-Dev 1	Side	CIRCULAR	No	4.00			1663.50	0.61
2	Pond_NW-5-Dev 2	Bottom	Rectangular	No		48.00	48.00	1668.50	0.62

Output Summary Results

Peak Inflow (cfs)	24.63
Peak Lateral Inflow (cfs)	7.51
Peak Outflow (cfs)	0.82
Peak Exfiltration Flow Rate (cfm)	8.31
Max HGL Elevation Attained (ft)	1667.33
Max HGL Depth Attained (ft)	4.83
Average HGL Elevation Attained (ft)	1665.09
Average HGL Depth Attained (ft)	2.59
Time of Max HGL Occurrence (days hh:mm)	0 21:53
Total Exfiltration Volume (1000-ft³)	5.713
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_S1

Input Data

Invert Elevation (ft)	1616.46
Max (Rim) Elevation (ft)	1622.46
Max (Rim) Offset (ft)	6.00
Initial Water Elevation (ft)	1616.46
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	10.00
Evaporation Loss	0.00

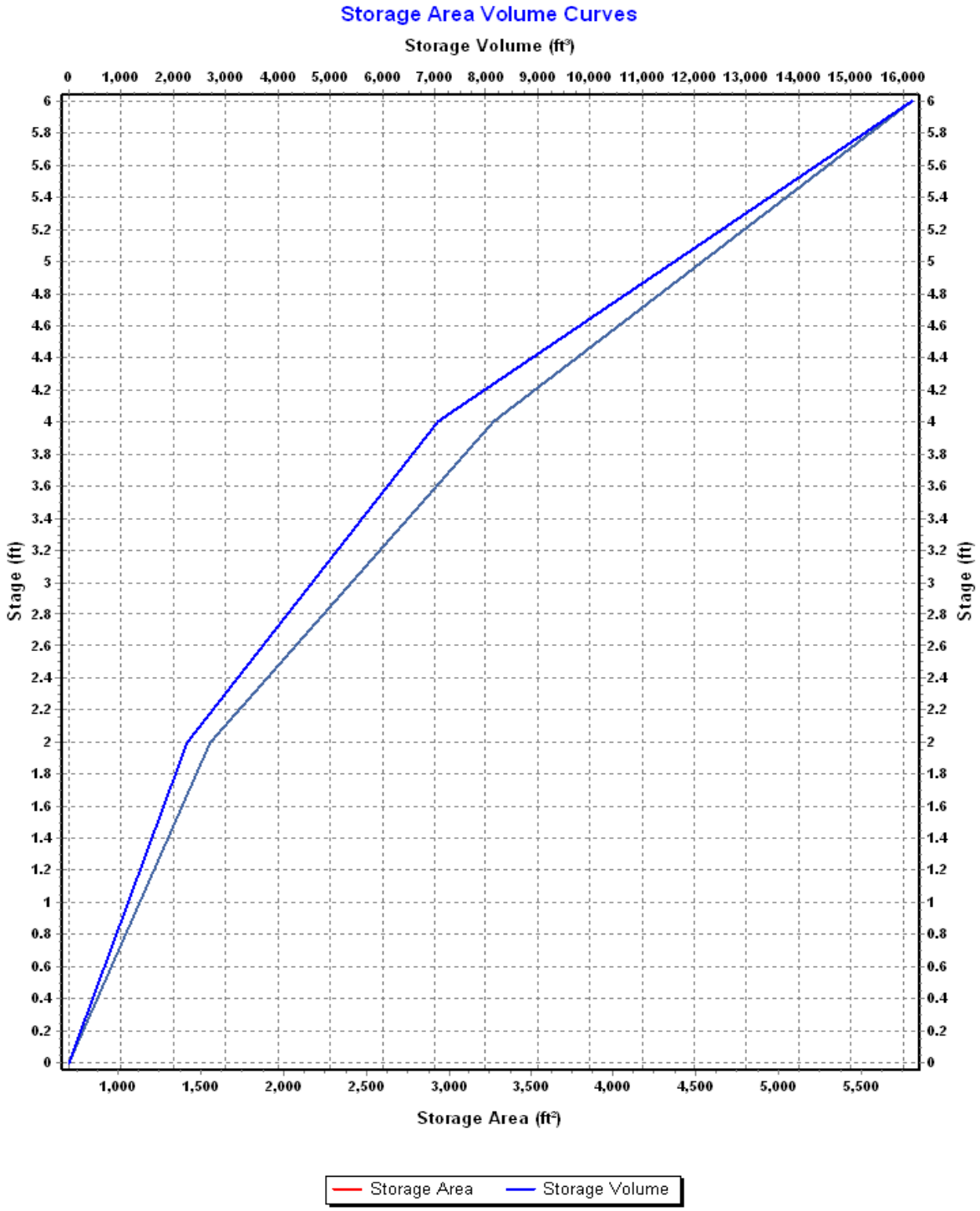
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.0850

Storage Area Volume Curves

Storage Curve : Pond-S1

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	700	0.000
2	1556	2256.00
4	3273	7085.00
6	5806	16164.00


Storage Area Volume Curves
Storage Volume (ft³)
0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000 11,000 12,000 13,000 14,000 15,000 16,000
Stage (ft)
0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4 2.6 2.8 3 3.2 3.4 3.6 3.8 4 4.2 4.4 4.6 4.8 5 5.2 5.4 5.6 5.8 6
1,000 1,500 2,000 2,500 3,000 3,500 4,000 4,500 5,000 5,500
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Pond_S1 (continued)

Output Summary Results

Peak Inflow (cfs)	15.46
Peak Lateral Inflow (cfs)	15.46
Peak Outflow (cfs)	14.62
Peak Exfiltration Flow Rate (cfm)	0.18
Max HGL Elevation Attained (ft)	1618.36
Max HGL Depth Attained (ft)	1.9
Average HGL Elevation Attained (ft)	1616.72
Average HGL Depth Attained (ft)	0.26
Time of Max HGL Occurrence (days hh:mm)	0 11:57
Total Exfiltration Volume (1000-ft³)	0.125
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_S2

Input Data

Invert Elevation (ft)	1619.20
Max (Rim) Elevation (ft)	1624.00
Max (Rim) Offset (ft)	4.80
Initial Water Elevation (ft)	1619.20
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	10.00
Evaporation Loss	0.00

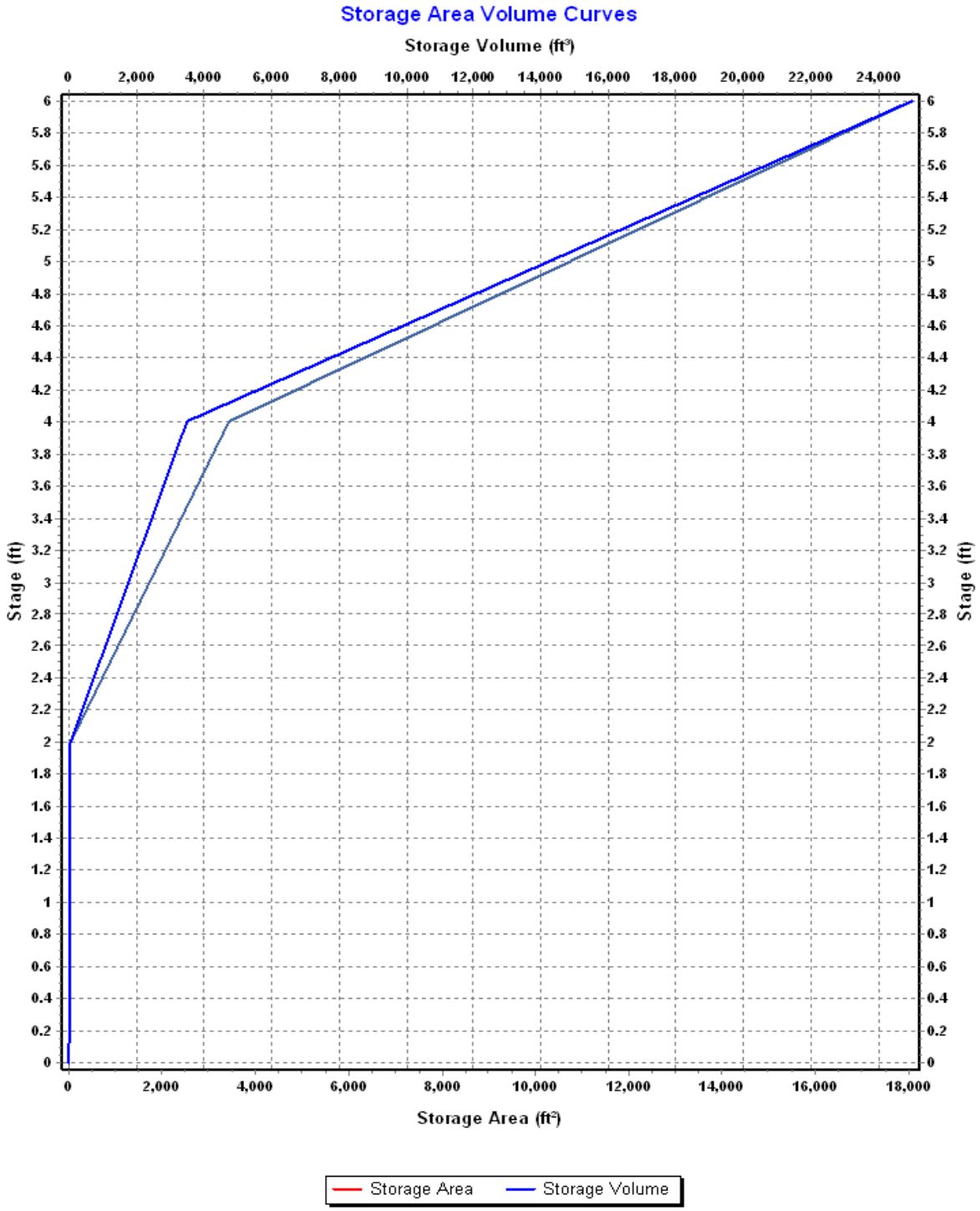
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.0850

Storage Area Volume Curves

Storage Curve : Pond-S2

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	10	0.000
2	27.9476	37.95
4	3428.8452	3494.74
6	18058.8080	24982.39


Storage Area Volume Curves
Storage Volume (ft³)
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
22,000
24,000
Stage (ft)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
4.4
4.6
4.8
5
5.2
5.4
5.6
5.8
6
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Pond_S2 (continued)

Output Summary Results

Peak Inflow (cfs)	50.28
Peak Lateral Inflow (cfs)	50.28
Peak Outflow (cfs)	47.49
Peak Exfiltration Flow Rate (cfm)	0.32
Max HGL Elevation Attained (ft)	1622.75
Max HGL Depth Attained (ft)	3.55
Average HGL Elevation Attained (ft)	1619.58
Average HGL Depth Attained (ft)	0.38
Time of Max HGL Occurrence (days hh:mm)	0 11:57
Total Exfiltration Volume (1000-ft³)	0.006
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_S3

Input Data

Invert Elevation (ft)	1615.31
Max (Rim) Elevation (ft)	1621.31
Max (Rim) Offset (ft)	6.00
Initial Water Elevation (ft)	1615.31
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	10.00
Evaporation Loss	0.00

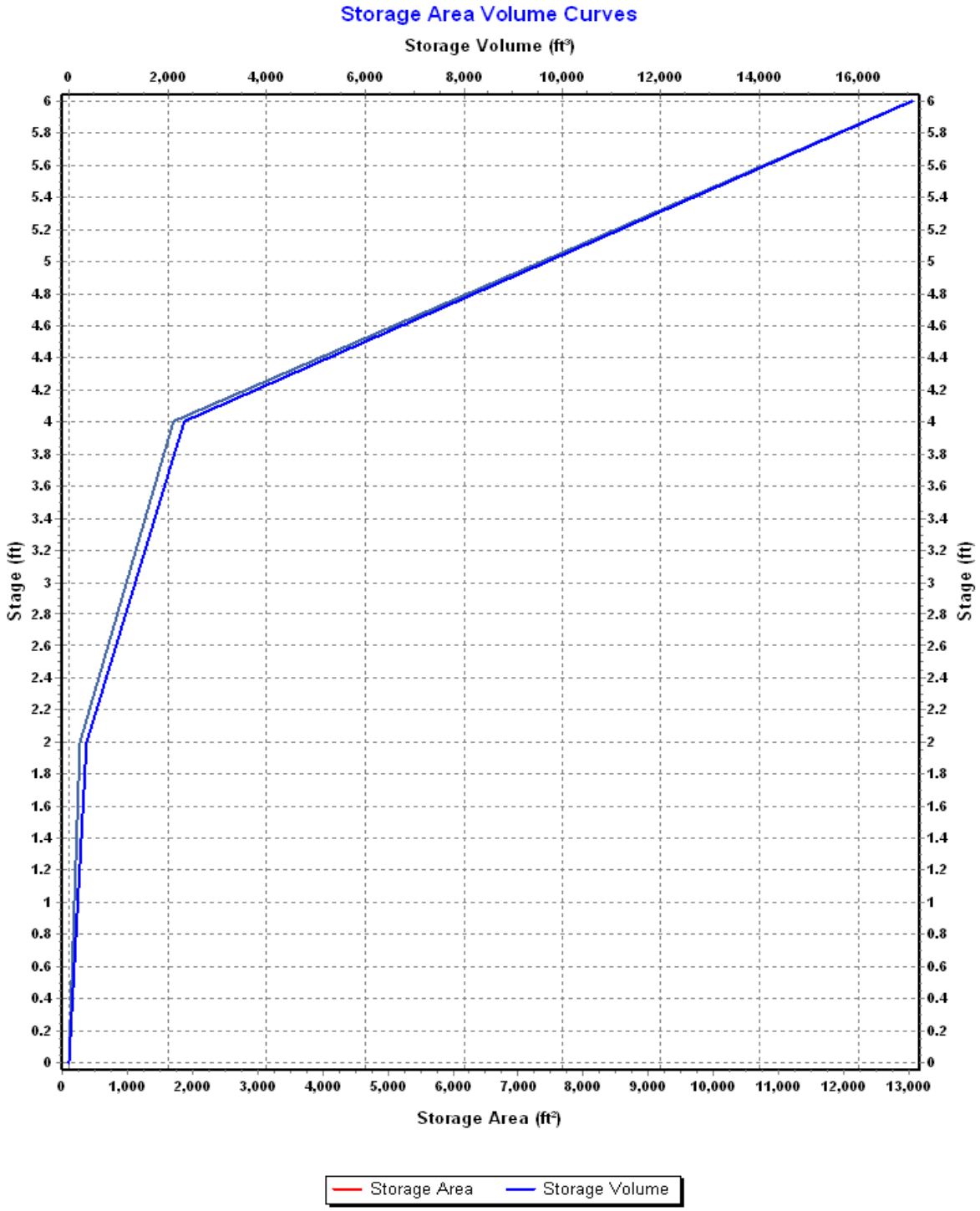
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.0850

Storage Area Volume Curves

Storage Curve : Pond-S3

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	100	0.000
2	267	367.00
4	1701	2335.00
6	13043	17079.00


Storage Area Volume Curves
Storage Volume (ft³)
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
Stage (ft)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
4.4
4.6
4.8
5
5.2
5.4
5.6
5.8
6
Storage Area (ft²)
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
11,000
12,000
13,000
Storage Area
Storage Volume

Storage Node : Pond_S3 (continued)

Output Summary Results

Peak Inflow (cfs)	38.85
Peak Lateral Inflow (cfs)	38.85
Peak Outflow (cfs)	37.92
Peak Exfiltration Flow Rate (cfm)	0.15
Max HGL Elevation Attained (ft)	1618.71
Max HGL Depth Attained (ft)	3.4
Average HGL Elevation Attained (ft)	1615.64
Average HGL Depth Attained (ft)	0.33
Time of Max HGL Occurrence (days hh:mm)	0 11:57
Total Exfiltration Volume (1000-ft³)	0.020
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_SE-1

Input Data

Invert Elevation (ft)	1628.00
Max (Rim) Elevation (ft)	1633.50
Max (Rim) Offset (ft)	5.50
Initial Water Elevation (ft)	1628.40
Initial Water Depth (ft)	0.40
Ponded Area (ft²)	26200.00
Evaporation Loss	0.00

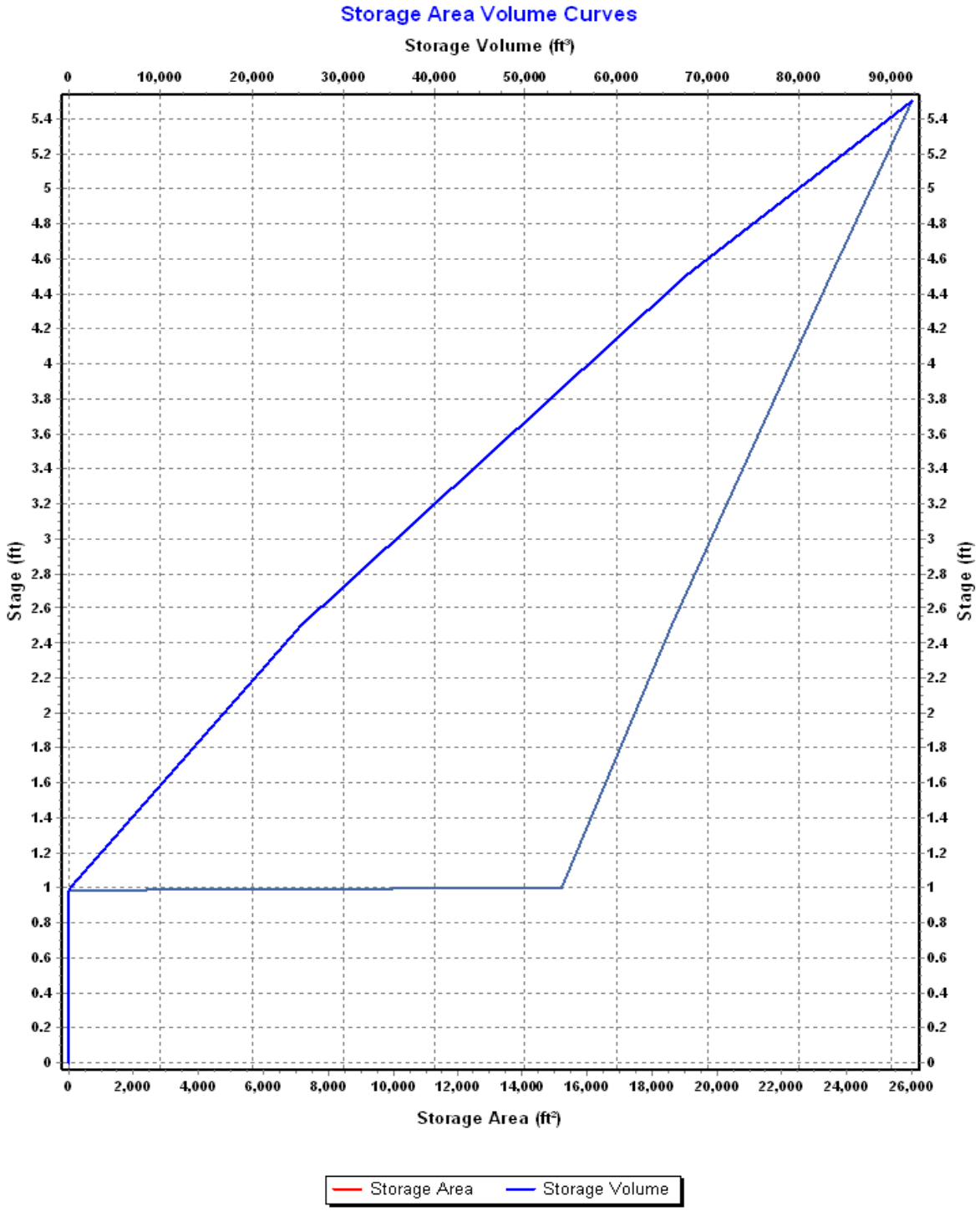
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.0000

Storage Area Volume Curves

Storage Curve : Pond_SE-1

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	16	0.000
0.99	16	15.84
1	15200	91.92
2.5	18600	25441.92
4.5	23500	67541.92
5.5	26000	92291.92


Storage Area Volume Curves
Storage Volume (ft³)
0
10,000
20,000
30,000
40,000
50,000
60,000
70,000
80,000
90,000
Stage (ft)
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Storage Area (ft²)
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
22,000
24,000
26,000
Storage Area
Storage Volume

Storage Node : Pond_SE-1 (continued)

Outflow Weirs

SN	Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1	SE-1-OFW	Trapezoidal	No	1633.00	5.00	10.00	0.50	2.67

Outflow Orifices

SN	Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1	2_Year	Bottom	Rectangular	No		21.00	24.00	1630.50	0.63
2	POCS-2-50-Year	Bottom	Rectangular	No		48.00	48.00	1632.00	0.63
3	Pond_SE-1-Drawdown	Side	CIRCULAR	No	3.50			1628.40	0.61

Output Summary Results

Peak Inflow (cfs)	40.38
Peak Lateral Inflow (cfs)	0.00
Peak Outflow (cfs)	18.50
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	1631.55
Max HGL Depth Attained (ft)	3.55
Average HGL Elevation Attained (ft)	1629.84
Average HGL Depth Attained (ft)	1.84
Time of Max HGL Occurrence (days hh:mm)	0 12:10
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_SE-1-FB

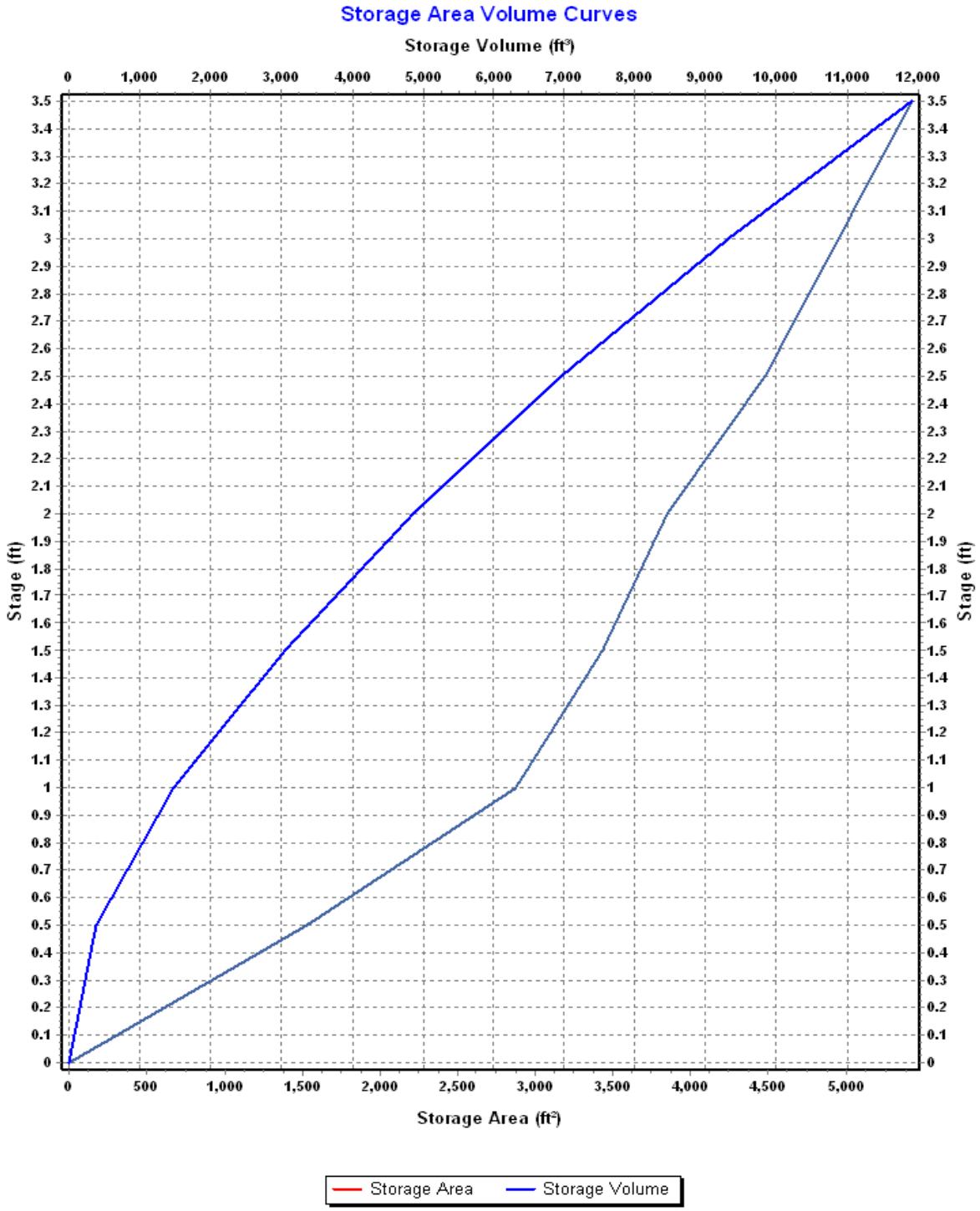
Input Data

Invert Elevation (ft)	1632.50
Max (Rim) Elevation (ft)	1636.00
Max (Rim) Offset (ft)	3.50
Initial Water Elevation (ft)	1632.50
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	5410.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Pond_SE1-FB

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	0	0.000
.5	1528.34	382.09
1	2870.16	1481.72
1.5	3431.80	3057.21
2	3850.25	4877.72
2.5	4477.89	6959.76
3	4946.93	9315.97
3.5	5421.68	11908.12


Storage Area Volume Curves
Storage Volume (ft³)
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
11,000
12,000
Stage (ft)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3
3.1
3.2
3.3
3.4
3.5
Storage Area (ft²)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
Storage Area
Storage Volume

Storage Node : Pond_SE-1-FB (continued)

Outflow Weirs

SN	Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1	Pond_SE-1-FB-WQV	Trapezoidal	No	1634.50	2.00	15.00	1.50	2.67

Outflow Orifices

SN	Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1	Pond_SE-1-FB-Drawdown	Side	CIRCULAR	No	8.00			1632.50	0.61

Output Summary Results

Peak Inflow (cfs)	40.79
Peak Lateral Inflow (cfs)	6.76
Peak Outflow (cfs)	40.38
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	1635.39
Max HGL Depth Attained (ft)	2.89
Average HGL Elevation Attained (ft)	1633.19
Average HGL Depth Attained (ft)	0.69
Time of Max HGL Occurrence (days hh:mm)	0 12:00
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_SE-2

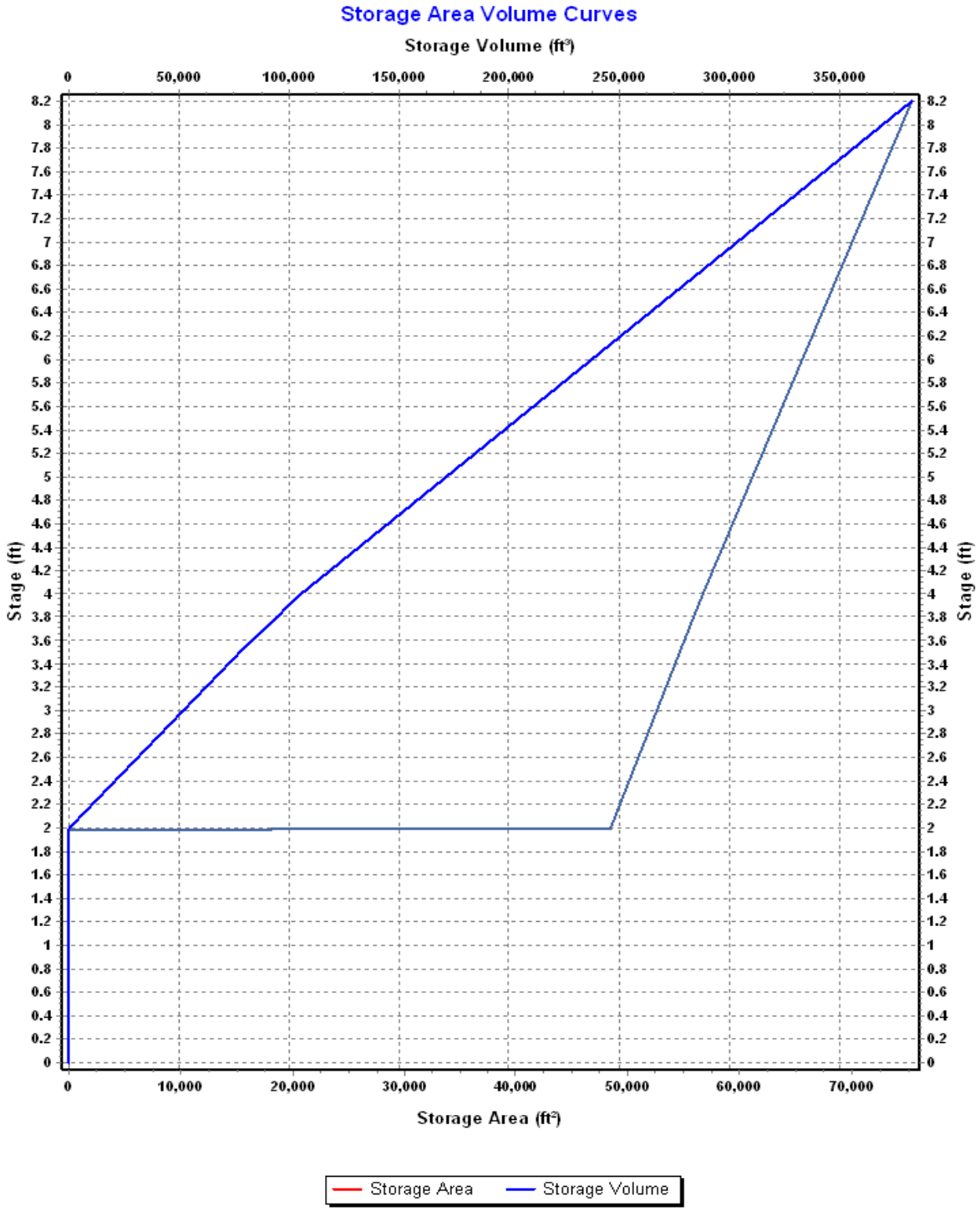
Input Data

Invert Elevation (ft)	1642.80
Max (Rim) Elevation (ft)	1651.00
Max (Rim) Offset (ft)	8.20
Initial Water Elevation (ft)	1644.20
Initial Water Depth (ft)	1.40
Ponded Area (ft²)	75400.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Pond_SE-2

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	18	0.000
1.99	18	35.82
2	48500	278.41
3.5	54600	77603.41
4	56700	105428.41
8.2	75400	382838.41


Storage Area Volume Curves
Storage Volume (ft³)
0
50,000
100,000
150,000
200,000
250,000
300,000
350,000
Stage (ft)
8.2
8
7.8
7.6
7.4
7.2
7
6.8
6.6
6.4
6.2
6
5.8
5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
10,000
20,000
30,000
40,000
50,000
60,000
70,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Pond_SE-2 (continued)

Outflow Weirs

SN	Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1	SE-2-OFW	Trapezoidal	No	1650.00	7.20	10.00	2.00	2.67

Outflow Orifices

SN	Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1	Pond_SE-2-2_YR-B	Side	Rectangular	No		6.00	24.00	1646.30	0.63
2	Pond_SE-2-25_YR-A	Bottom	Rectangular	No		48.00	21.00	1648.00	0.63
3	Pond_SE-2-Drawdown	Side	CIRCULAR	No	7.60			1644.20	0.61

Output Summary Results

Peak Inflow (cfs)	76.76
Peak Lateral Inflow (cfs)	0.00
Peak Outflow (cfs)	12.40
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	1648.18
Max HGL Depth Attained (ft)	5.38
Average HGL Elevation Attained (ft)	1646.18
Average HGL Depth Attained (ft)	3.38
Time of Max HGL Occurrence (days hh:mm)	0 13:07
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_SE-2-FB

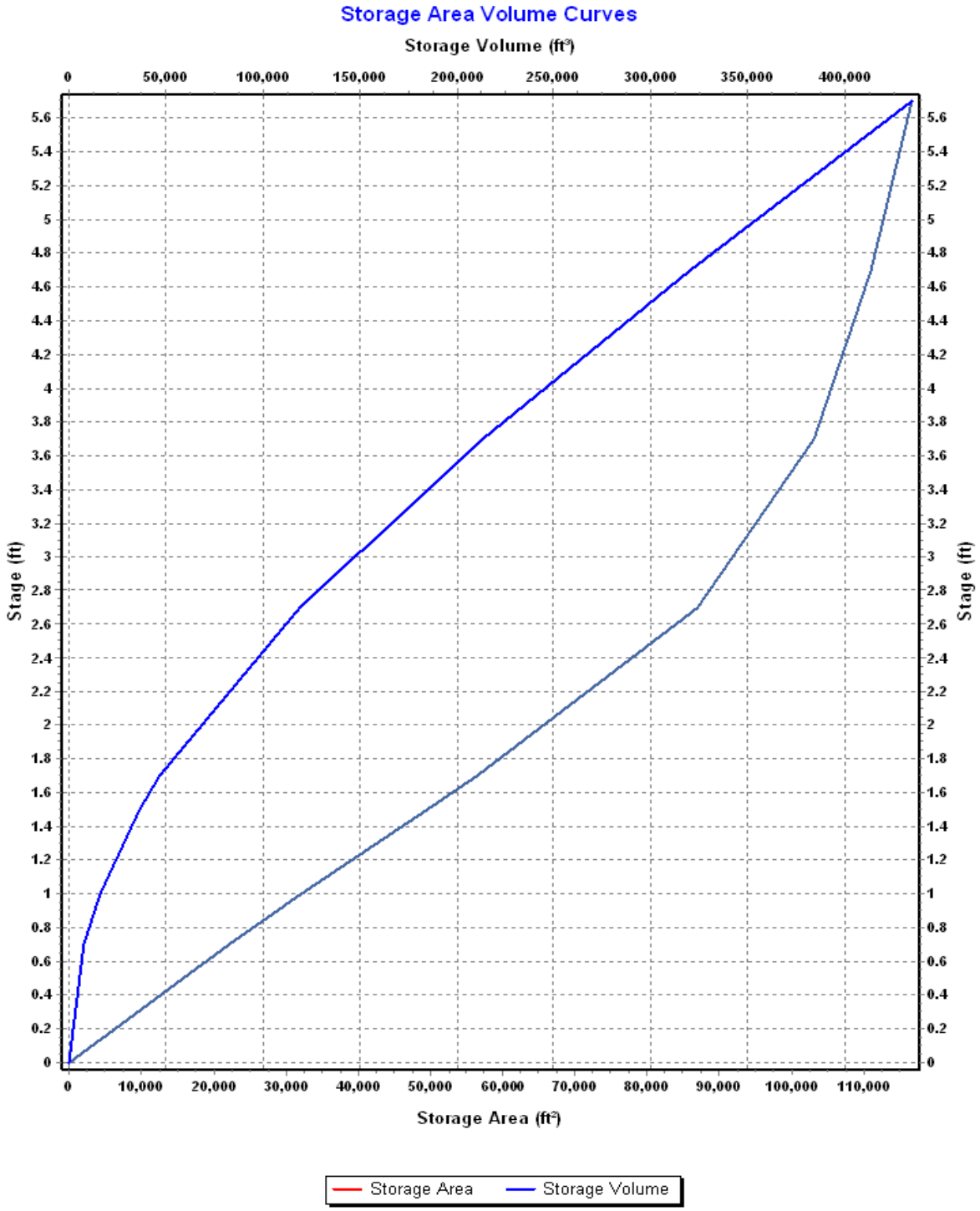
Input Data

Invert Elevation (ft)	1645.30
Max (Rim) Elevation (ft)	1651.00
Max (Rim) Offset (ft)	5.70
Initial Water Elevation (ft)	0.00
Initial Water Depth (ft)	-1645.30
Ponded Area (ft²)	116600.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Pond_SE-2-FB

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	0	0.000
.7	22100	7735.00
1	32100	15865.00
1.5	49600	36290.00
1.7	56600	46910.00
2.7	86900	118660.00
3.7	103000	213610.00
4.7	110900	320560.00
5.7	116600	434310.00


Storage Area Volume Curves
Storage Volume (ft³)
0
50,000
100,000
150,000
200,000
250,000
300,000
350,000
400,000
Stage (ft)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
4.4
4.6
4.8
5
5.2
5.4
5.6
Storage Area (ft²)
0
10,000
20,000
30,000
40,000
50,000
60,000
70,000
80,000
90,000
100,000
110,000
Storage Area
Storage Volume

Storage Node : Pond_SE-2-FB (continued)

Outflow Weirs

SN	Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1	Pond_SE-2-FB-HFW	Trapezoidal	No	1647.30	2.00	10.00	3.70	2.67

Outflow Orifices

SN	Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1	Pond_SE-2-FB-Drawdown	Side	CIRCULAR	No	12.00			1645.30	0.61

Output Summary Results

Peak Inflow (cfs)	271.67
Peak Lateral Inflow (cfs)	19.95
Peak Outflow (cfs)	76.76
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	1648.89
Max HGL Depth Attained (ft)	3.59
Average HGL Elevation Attained (ft)	1646.89
Average HGL Depth Attained (ft)	1.59
Time of Max HGL Occurrence (days hh:mm)	0 12:07
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_SW1

Input Data

Invert Elevation (ft)	1629.16
Max (Rim) Elevation (ft)	1636.00
Max (Rim) Offset (ft)	6.84
Initial Water Elevation (ft)	1629.16
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	10.00
Evaporation Loss	0.00

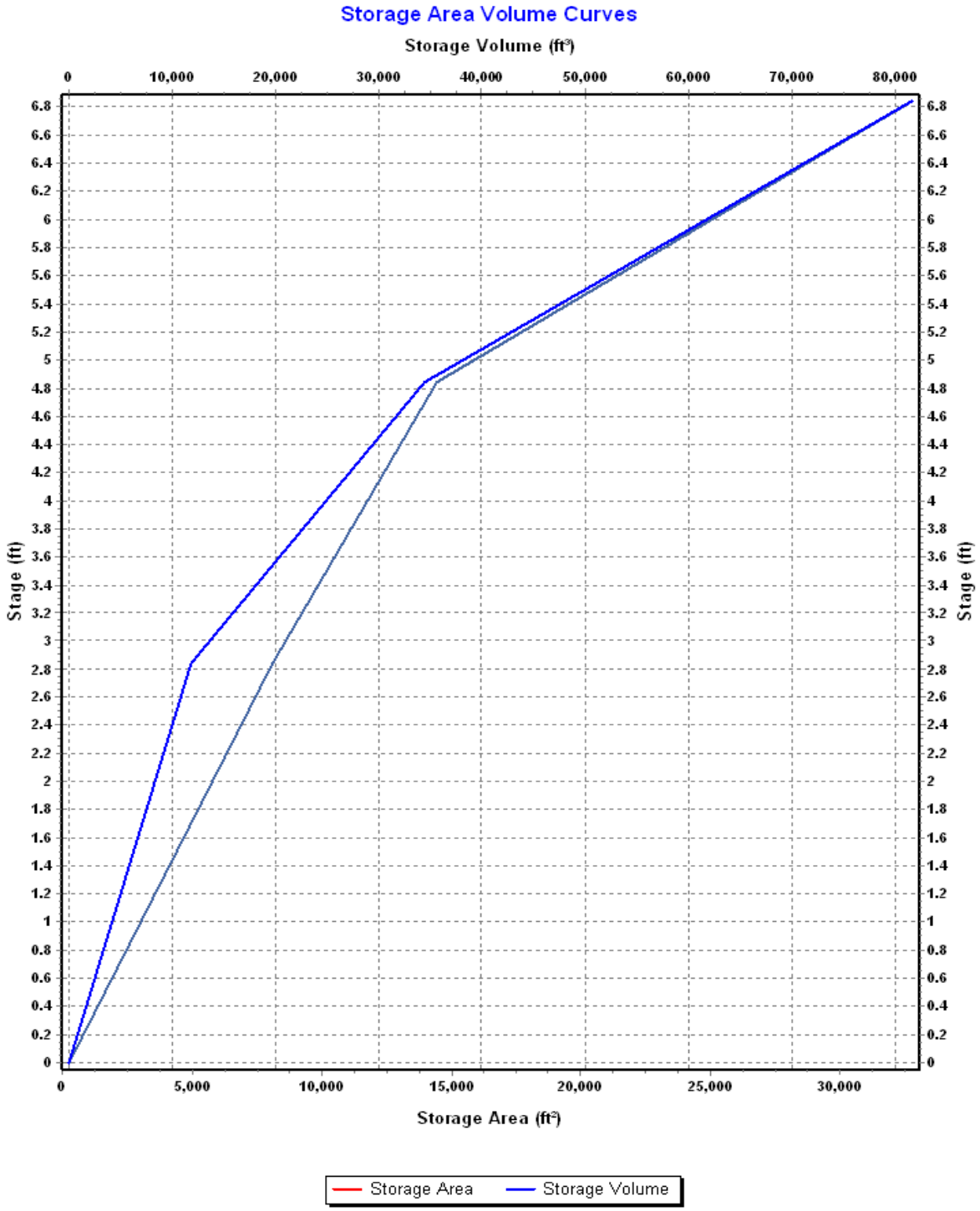
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.0850

Storage Area Volume Curves

Storage Curve : Pond-SW1

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	239	0.000
2.84	8089.7325	11826.80
4.84	14453.7561	34370.29
6.84	32772	81596.05


Storage Area Volume Curves
Storage Volume (ft³)
0
10,000
20,000
30,000
40,000
50,000
60,000
70,000
80,000
Stage (ft)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
4.4
4.6
4.8
5
5.2
5.4
5.6
5.8
6
6.2
6.4
6.6
6.8
0
5,000
10,000
15,000
20,000
25,000
30,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Pond_SW1 (continued)

Output Summary Results

Peak Inflow (cfs)	86.90
Peak Lateral Inflow (cfs)	9.99
Peak Outflow (cfs)	36.57
Peak Exfiltration Flow Rate (cfm)	2.71
Max HGL Elevation Attained (ft)	1634.93
Max HGL Depth Attained (ft)	5.77
Average HGL Elevation Attained (ft)	1631.03
Average HGL Depth Attained (ft)	1.87
Time of Max HGL Occurrence (days hh:mm)	0 12:07
Total Exfiltration Volume (1000-ft³)	0.937
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_SW2

Input Data

Invert Elevation (ft)	1634.25
Max (Rim) Elevation (ft)	1640.25
Max (Rim) Offset (ft)	6.00
Initial Water Elevation (ft)	1634.25
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	10.00
Evaporation Loss	0.00

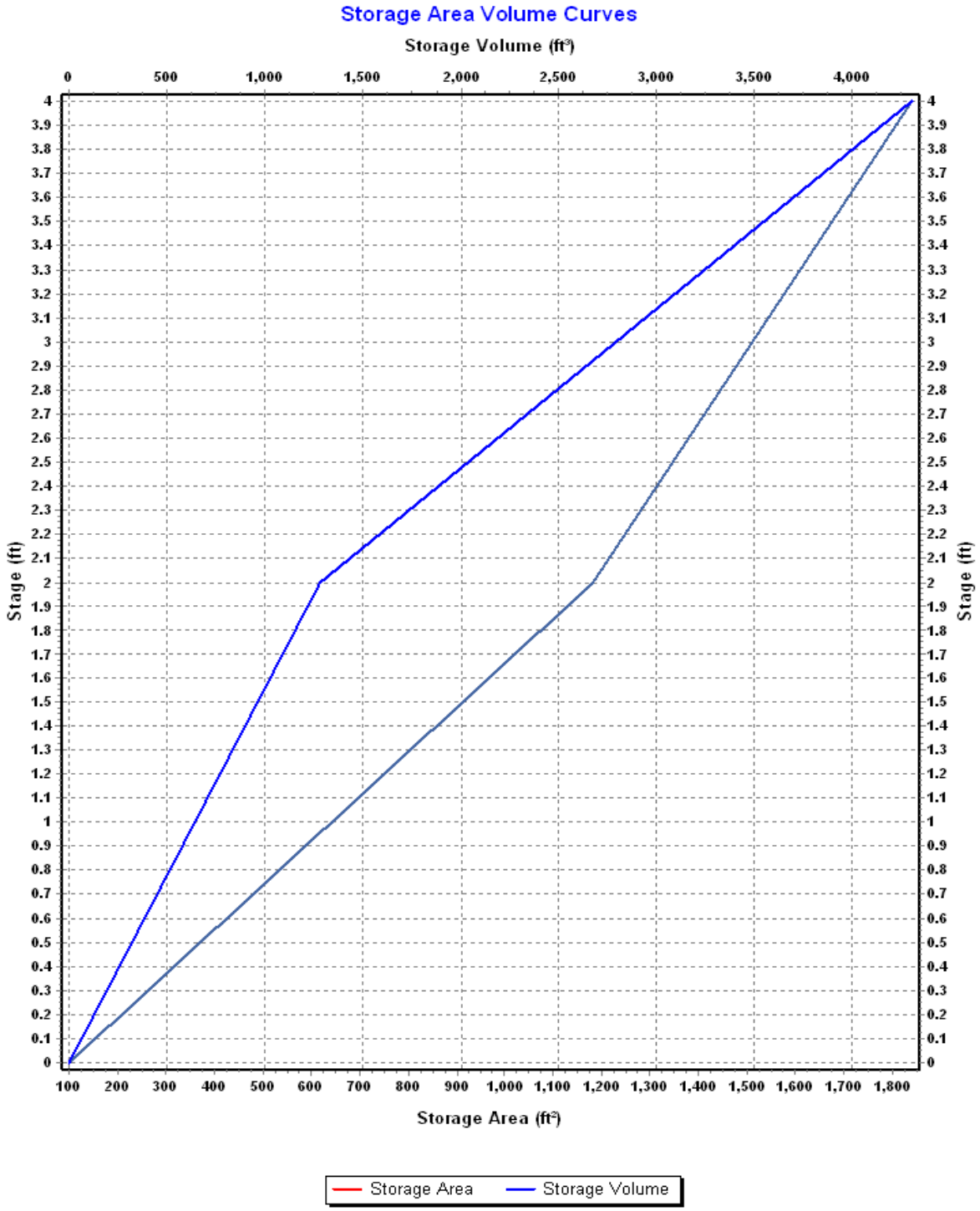
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.0850

Storage Area Volume Curves

Storage Curve : Pond-SW2

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	100	0.000
2	1181.3357	1281.34
4	1839.8713	4302.55


Storage Area Volume Curves
Storage Volume (ft³)
0 500 1,000 1,500 2,000 2,500 3,000 3,500 4,000
Stage (ft)
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3 3.1 3.2 3.3 3.4 3.5 3.6 3.7 3.8 3.9 4
100 200 300 400 500 600 700 800 900 1,000 1,100 1,200 1,300 1,400 1,500 1,600 1,700 1,800
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Pond_SW2 (continued)

Output Summary Results

Peak Inflow (cfs)	5.57
Peak Lateral Inflow (cfs)	5.57
Peak Outflow (cfs)	5.33
Peak Exfiltration Flow Rate (cfm)	0.09
Max HGL Elevation Attained (ft)	1635.43
Max HGL Depth Attained (ft)	1.18
Average HGL Elevation Attained (ft)	1634.37
Average HGL Depth Attained (ft)	0.12
Time of Max HGL Occurrence (days hh:mm)	0 11:57
Total Exfiltration Volume (1000-ft³)	0.024
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_SW3

Input Data

Invert Elevation (ft)	1578.00
Max (Rim) Elevation (ft)	1583.00
Max (Rim) Offset (ft)	5.00
Initial Water Elevation (ft)	1578.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	10.00
Evaporation Loss	0.00

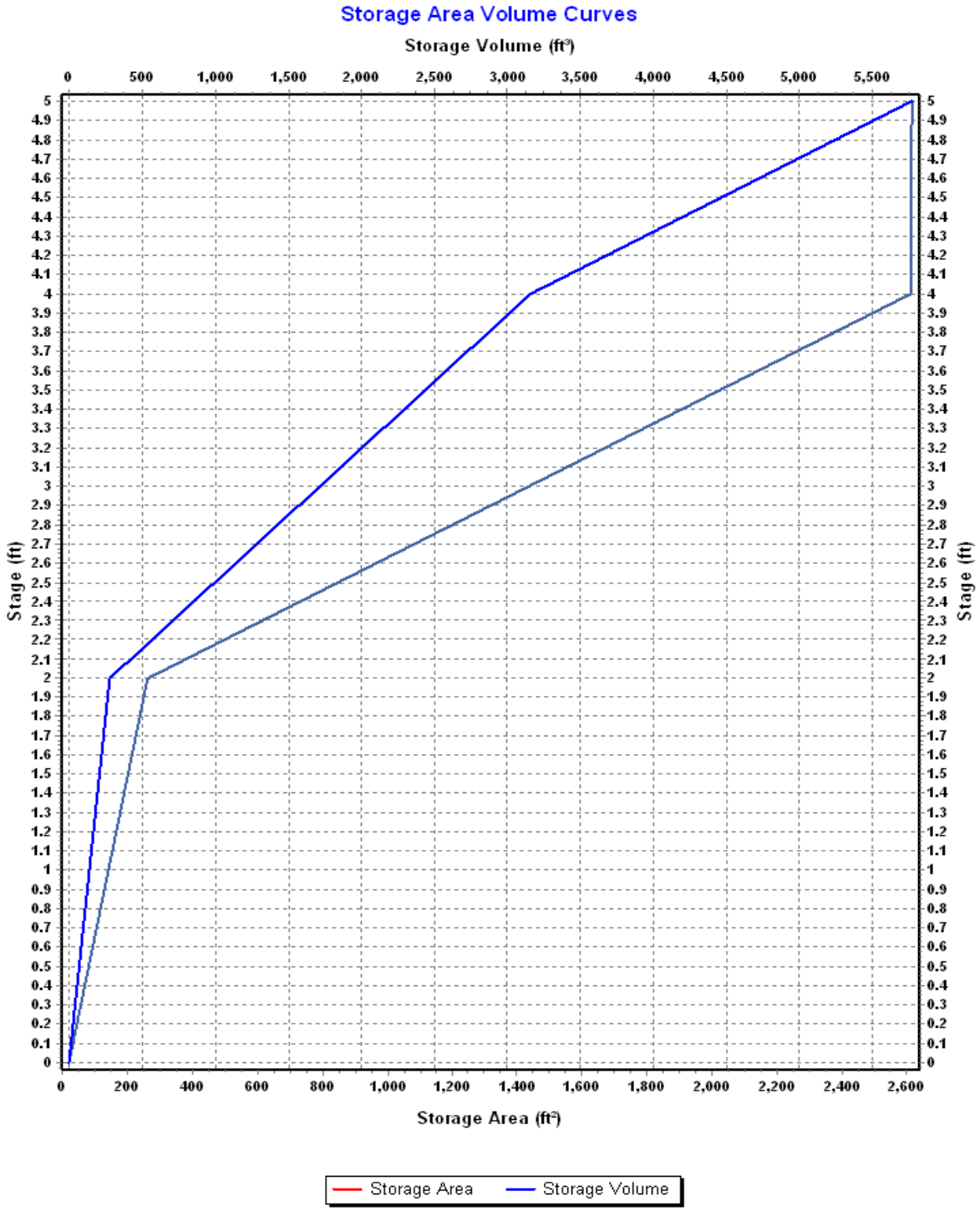
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.2600

Storage Area Volume Curves

Storage Curve : Storage-SW3

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	19.1651	0.000
2	261.3794	280.54
4	2611.6257	3153.55
5	2615	5766.86


Storage Area Volume Curves
Storage Volume (ft³)
0 500 1,000 1,500 2,000 2,500 3,000 3,500 4,000 4,500 5,000 5,500
Stage (ft)
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3 3.1 3.2 3.3 3.4 3.5 3.6 3.7 3.8 3.9 4 4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.8 4.9 5
0 200 400 600 800 1,000 1,200 1,400 1,600 1,800 2,000 2,200 2,400 2,600
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Pond_SW3 (continued)

Output Summary Results

Peak Inflow (cfs)	30.63
Peak Lateral Inflow (cfs)	30.63
Peak Outflow (cfs)	30.53
Peak Exfiltration Flow Rate (cfm)	0.50
Max HGL Elevation Attained (ft)	1580.96
Max HGL Depth Attained (ft)	2.96
Average HGL Elevation Attained (ft)	1578.52
Average HGL Depth Attained (ft)	0.52
Time of Max HGL Occurrence (days hh:mm)	0 12:41
Total Exfiltration Volume (1000-ft³)	0.052
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_SW4

Input Data

Invert Elevation (ft)	1602.72
Max (Rim) Elevation (ft)	1608.72
Max (Rim) Offset (ft)	6.00
Initial Water Elevation (ft)	1602.72
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	10.00
Evaporation Loss	0.00

Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.2600

Output Summary Results

Peak Inflow (cfs)	51.87
Peak Lateral Inflow (cfs)	0.00
Peak Outflow (cfs)	51.79
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	1607.12
Max HGL Depth Attained (ft)	4.4
Average HGL Elevation Attained (ft)	1603.37
Average HGL Depth Attained (ft)	0.65
Time of Max HGL Occurrence (days hh:mm)	0 12:29
Total Exfiltration Volume (1000-ft³)	0.003
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_SW5

Input Data

Invert Elevation (ft)	1647.36
Max (Rim) Elevation (ft)	1653.36
Max (Rim) Offset (ft)	6.00
Initial Water Elevation (ft)	1647.36
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	10.00
Evaporation Loss	0.00

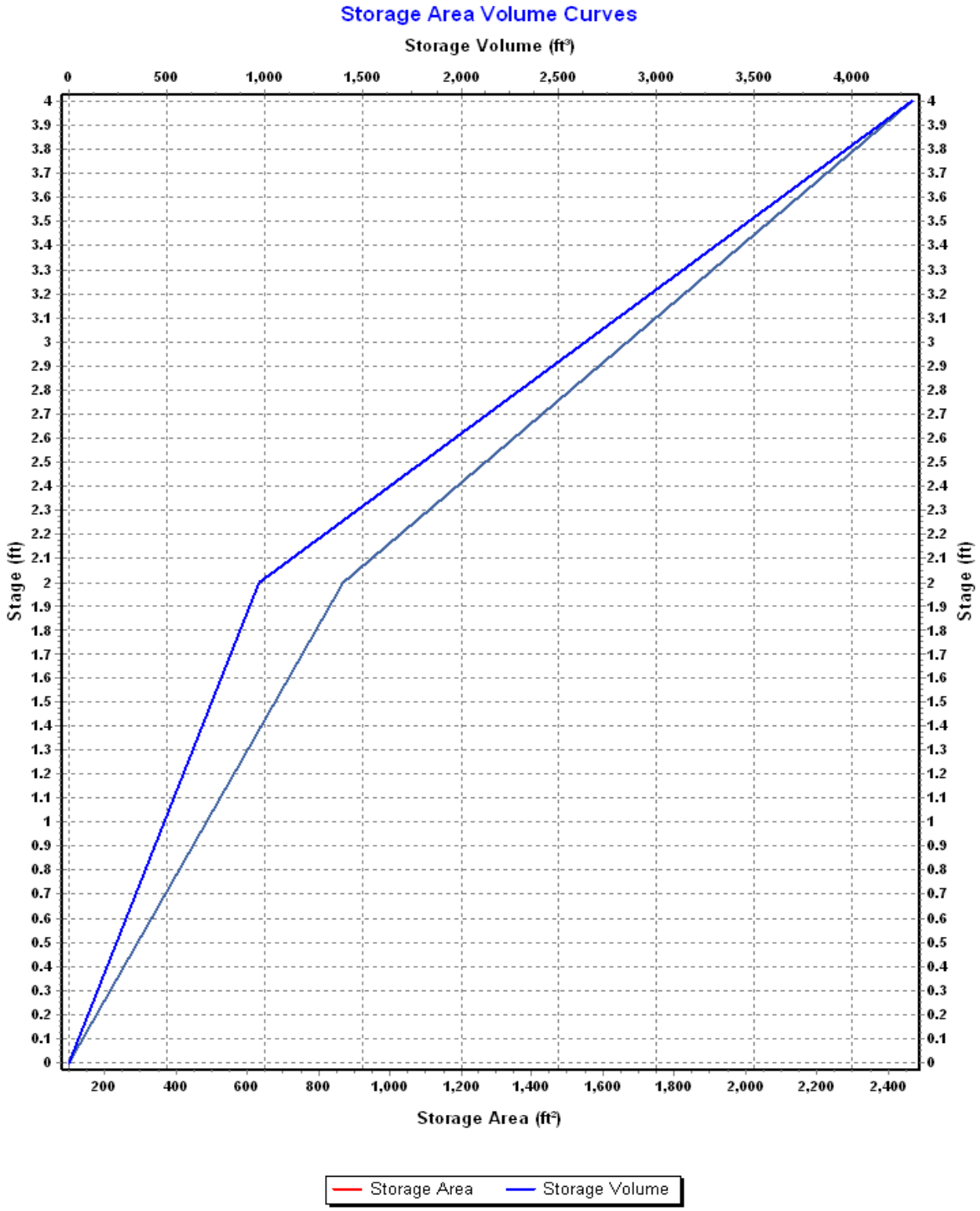
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.0850

Storage Area Volume Curves

Storage Curve : Storage-SW5

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	100	0.000
2	870	970.00
4	2465	4305.00


Storage Area Volume Curves
Storage Volume (ft³)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
Stage (ft)
Storage Area (ft²)
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200
2,400
Storage Area
Storage Volume

Storage Node : Pond_SW5 (continued)

Output Summary Results

Peak Inflow (cfs)	19.34
Peak Lateral Inflow (cfs)	19.34
Peak Outflow (cfs)	19.40
Peak Exfiltration Flow Rate (cfm)	0.13
Max HGL Elevation Attained (ft)	1649.62
Max HGL Depth Attained (ft)	2.26
Average HGL Elevation Attained (ft)	1647.57
Average HGL Depth Attained (ft)	0.21
Time of Max HGL Occurrence (days hh:mm)	0 11:57
Total Exfiltration Volume (1000-ft³)	0.024
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_SW6

Input Data

Invert Elevation (ft)	1650.36
Max (Rim) Elevation (ft)	1656.36
Max (Rim) Offset (ft)	6.00
Initial Water Elevation (ft)	1650.36
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	10.00
Evaporation Loss	0.00

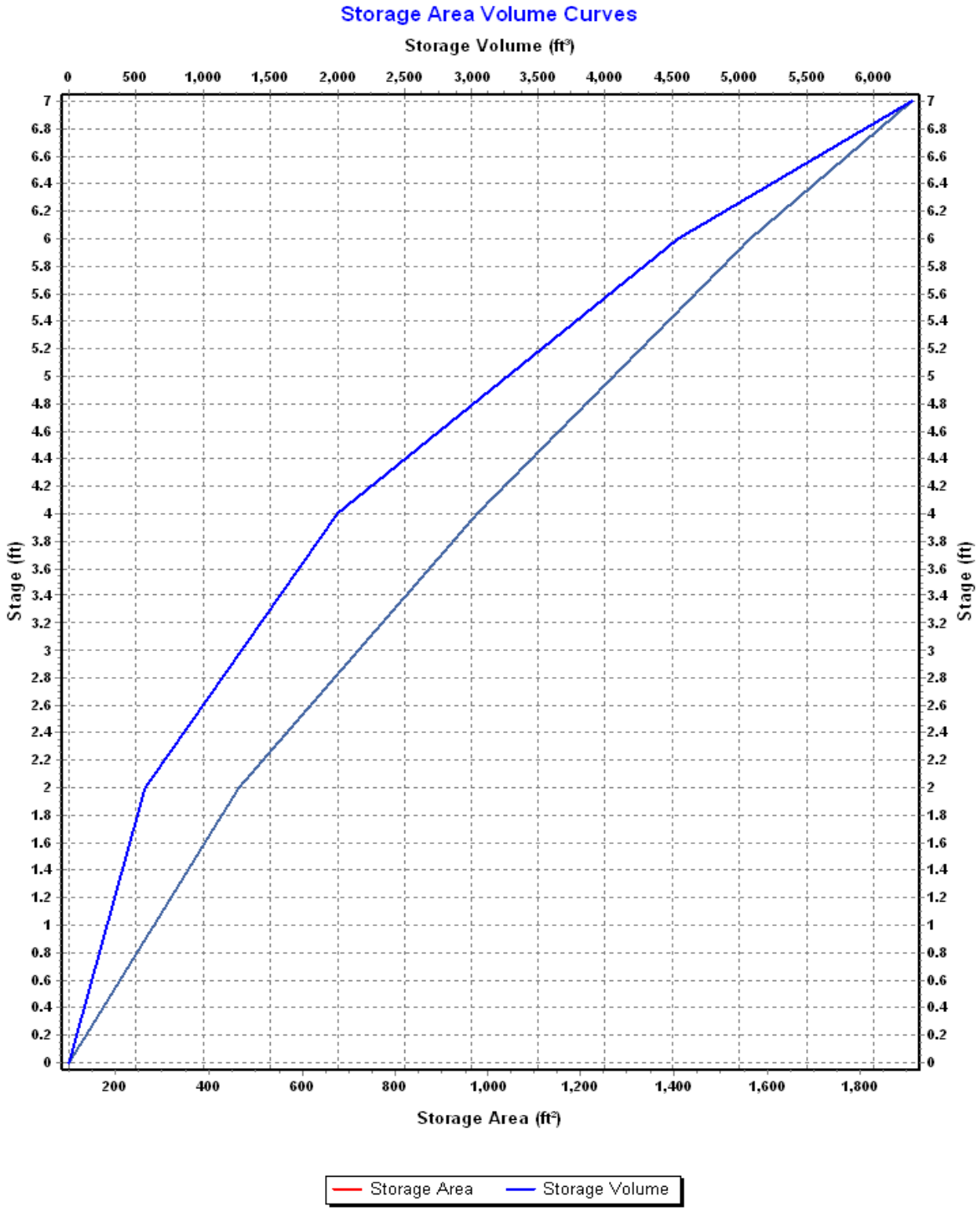
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.0850

Storage Area Volume Curves

Storage Curve : Pond-SW6

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	100	0.000
2	463	563.00
4	977	2003.00
6	1564	4544.00
7	1910	6281.00


Storage Area Volume Curves
Storage Volume (ft³)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
5,500
6,000
Stage (ft)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
4.4
4.6
4.8
5
5.2
5.4
5.6
5.8
6
6.2
6.4
6.6
6.8
7
Storage Area (ft²)
200
400
600
800
1,000
1,200
1,400
1,600
1,800
Storage Area
Storage Volume

Storage Node : Pond_SW6 (continued)

Output Summary Results

Peak Inflow (cfs)	66.85
Peak Lateral Inflow (cfs)	66.85
Peak Outflow (cfs)	65.39
Peak Exfiltration Flow Rate (cfm)	0.25
Max HGL Elevation Attained (ft)	1657.89
Max HGL Depth Attained (ft)	7.53
Average HGL Elevation Attained (ft)	1650.88
Average HGL Depth Attained (ft)	0.52
Time of Max HGL Occurrence (days hh:mm)	0 11:57
Total Exfiltration Volume (1000-ft³)	0.033
Total Flooded Volume (ac-in)	0.03
Total Time Flooded (min)	3
Total Retention Time (sec)	0.00

Storage Node : Pond-NW3

Input Data

Invert Elevation (ft)	1647.91
Max (Rim) Elevation (ft)	1653.91
Max (Rim) Offset (ft)	6.00
Initial Water Elevation (ft)	1647.91
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	10.00
Evaporation Loss	0.00

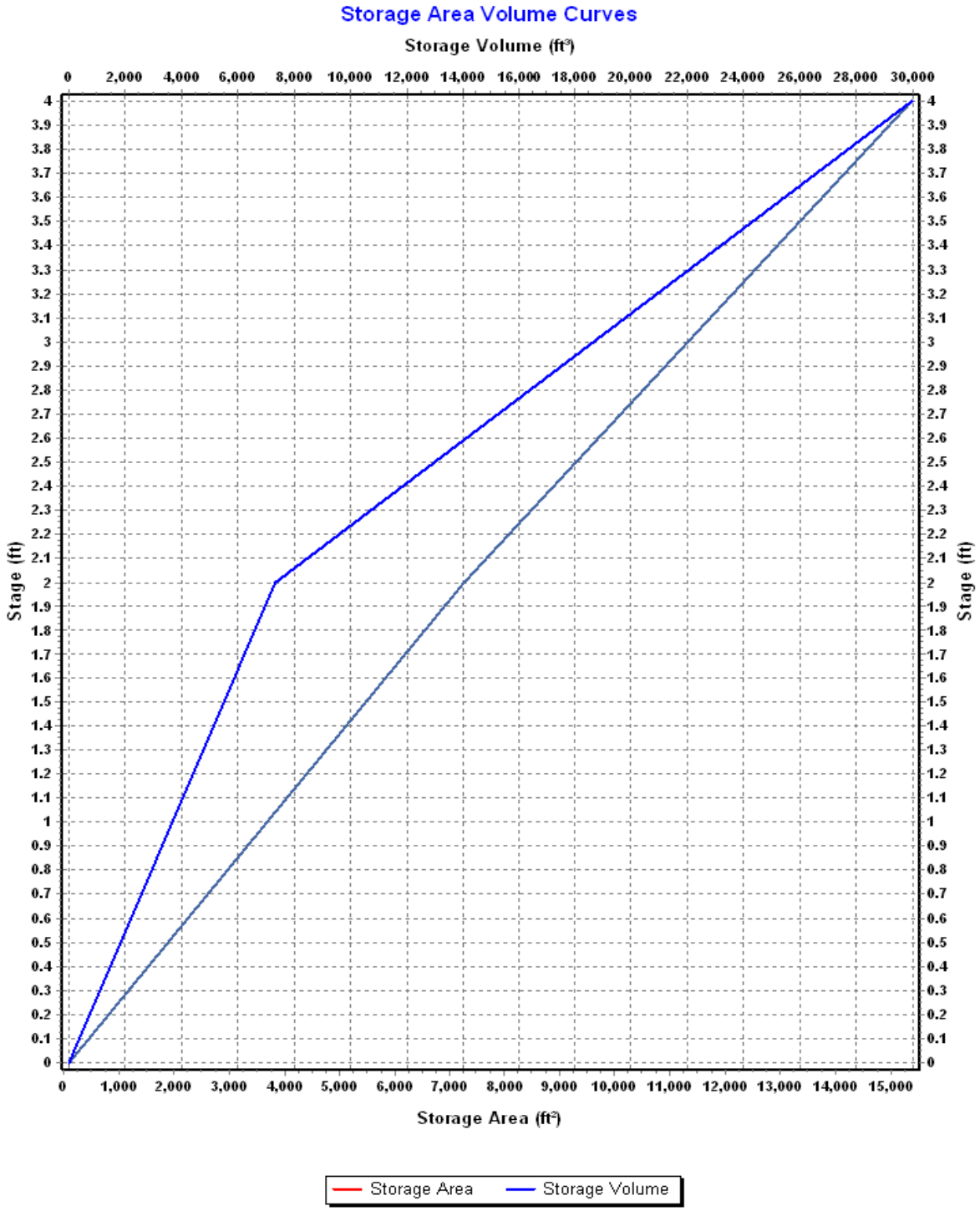
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.2600

Storage Area Volume Curves

Storage Curve : Pond-NW3

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	100	0.000
2	7247	7347.00
4	15378	29972.00


Storage Area Volume Curves
Storage Volume (ft³)
0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000 18,000 20,000 22,000 24,000 26,000 28,000 30,000
Stage (ft)
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3 3.1 3.2 3.3 3.4 3.5 3.6 3.7 3.8 3.9 4
0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000 11,000 12,000 13,000 14,000 15,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Pond-NW3 (continued)

Output Summary Results

Peak Inflow (cfs)	60.27
Peak Lateral Inflow (cfs)	0.00
Peak Outflow (cfs)	47.59
Peak Exfiltration Flow Rate (cfm)	3.08
Max HGL Elevation Attained (ft)	1650.23
Max HGL Depth Attained (ft)	2.32
Average HGL Elevation Attained (ft)	1648.14
Average HGL Depth Attained (ft)	0.23
Time of Max HGL Occurrence (days hh:mm)	0 12:02
Total Exfiltration Volume (1000-ft³)	0.469
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond-NW4

Input Data

Invert Elevation (ft)	1651.04
Max (Rim) Elevation (ft)	1654.00
Max (Rim) Offset (ft)	2.96
Initial Water Elevation (ft)	1651.04
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	10.00
Evaporation Loss	0.00

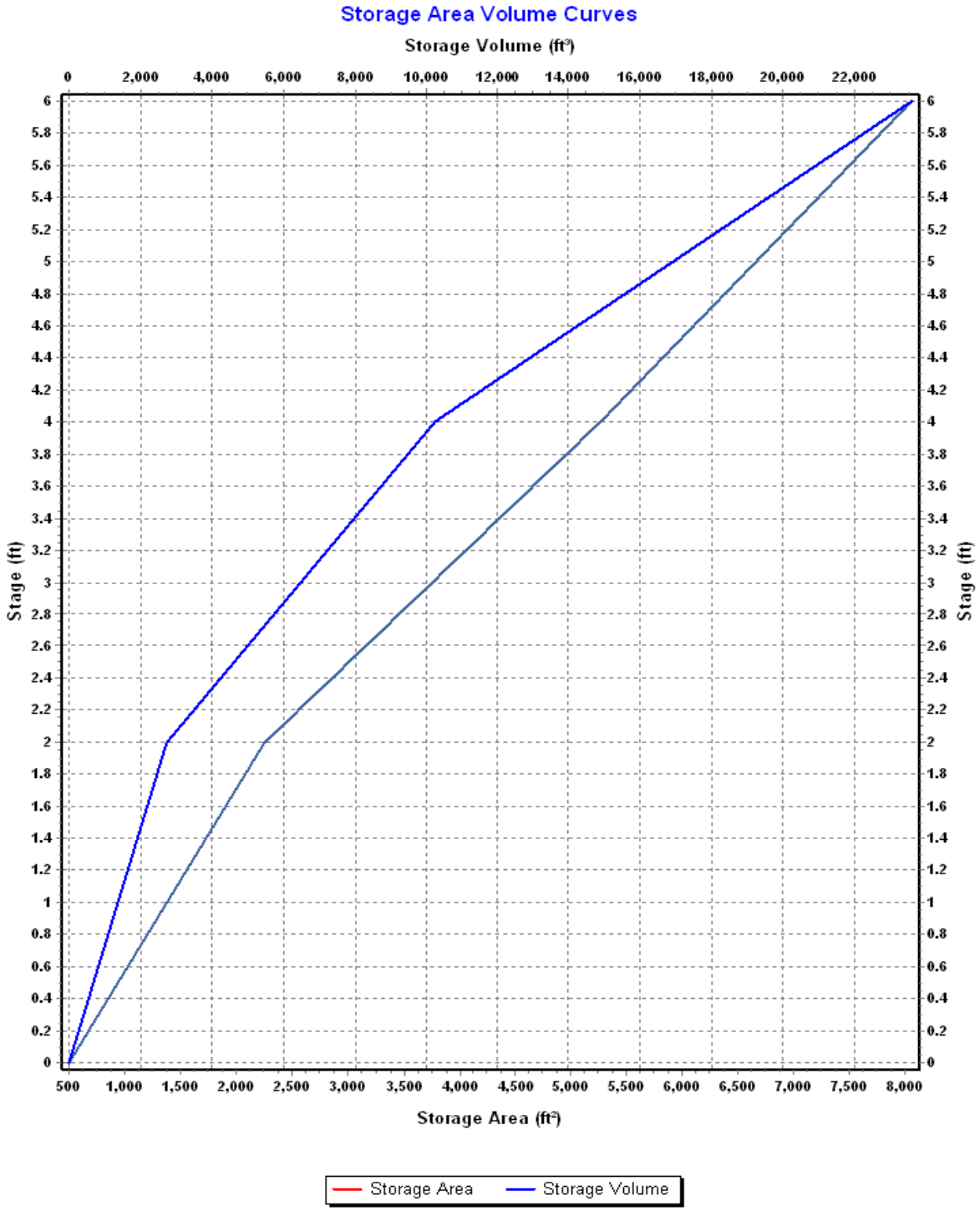
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.0850

Storage Area Volume Curves

Storage Curve : Storage-NW4

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	500	0.000
2	2246.2497	2746.25
4	5274.7688	10267.27
6	8056	23598.04


Storage Area Volume Curves
Storage Volume (ft³)
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
22,000
Stage (ft)
6
5.8
5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
5,500
6,000
6,500
7,000
7,500
8,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Pond-NW4 (continued)

Output Summary Results

Peak Inflow (cfs)	61.06
Peak Lateral Inflow (cfs)	61.06
Peak Outflow (cfs)	60.02
Peak Exfiltration Flow Rate (cfm)	0.32
Max HGL Elevation Attained (ft)	1653.35
Max HGL Depth Attained (ft)	2.31
Average HGL Elevation Attained (ft)	1651.41
Average HGL Depth Attained (ft)	0.37
Time of Max HGL Occurrence (days hh:mm)	0 11:57
Total Exfiltration Volume (1000-ft³)	0.133
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

INTERMEDIATE-DEVELOPMENT
2, 10, 25, & 50-YEAR, 24 HOUR STORM EVENT
ANALYSIS & CALCULATIONS SUMMARIES

CMA ENGINEERS, Inc.
CIVIL/ENVIRONMENTAL ENGINEERS
35 Bow Street
Portsmouth, NH 03801
Phone: (603) 431-6196
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PROJECT: AVRRDD Phase IIIA Expansion

PROJECT NO: 777
DATE: April 1, 2020
CALC. BY: JHK

Table 1: Pre-Development vs Intermediate Development Peak Flow Summary Table for 2-year 24-hour Storm

Discharge Area	Sub-basin	Area	Peak Runoff	Offsite Discharge	Sub-basin	Area	Peak Runoff	Pond Flow In	Pond Flow Out	Offsite Discharge	Comments
		(acre)	(cfs)			(acre)	(cfs)	(cfs)	(cfs)	(cfs)	
North	Northeast	63.00	12.84	**63.94**	NW2	6.62	4.08	47.11	10.08	**63.23**	Pond-NW2 accepts stormwater from subbasins NW3, NW4, and NW5. Pond-NW5 accepts stormwater from NW7. Other ponds only receive stormwater from their respective subbasins.
	Northwest	249.98	53.85		NW3	8.26	22.44	29.20	22.82		
	Subtotal	312.98	.		NW4	10.99	31.82	31.82	31.27		
					NW5	248.50	43.27	5.57	0.56		
					NW7	3.02	2.09				
					SE1	20.91	5.16	21.33	1.83		
					N1	57.90	14.16				
					Subtotal	356.19					
South	Southeast	115.72	20.74	**53.29**	SW1	5.70	2.68	40.18	25.00	**54.11**	Pond-SW1 accepts stormwater from subbasins SW1, SW2, and SW6. Pond-SW4 accepts stormwater from subbasins SW1, SW2, SW4, SW5, and SW6. Pond-SE2 accepts stormwater from subbasins SE5, SE6, SE7, SE8, and SE12. Pond-SE1 accepts stormwater from subbasins SE10, SE11, and SE14. Other ponds only receive stormwater from their respective subbasins.
	East	49.63	10.02		SW2	1.16	2.44	2.44	2.33		
	West	88.34	20.59		SW3	58.50	3.65	3.65	3.65		
	Southwest	22.18	4.25		SW4	17.30	3.86	22.44	22.41		
	Subtotal	275.87			SW5	6.36	5.40	5.40	5.71		
					SW6	11.72	36.37	36.31	35.94		
					S1	2.83	7.86	7.85	7.31		
					S2	9.03	26.34	26.31	26.00		
					S3	7.51	18.47	18.45	18.34		
					SE2	19.47	4.53	22.54	4.02		
					SE3	26.27	9.34				
					SE4	4.93	0.45				
					SE5	7.32	22.73				
					SE6	2.36	7.18				
					SE7	7.69	23.87				
					SE8	14.13	44.05				
					SE10	3.42	10.48				
					SE11	3.48	10.73				
					SE12	4.97	7.34				
					SE13	2.03	1.57				
					SE14	2.20	2.21				
					SE15	10.09	5.17				
					Subtotal	228.45					
	Total	**588.85**			**Total**	**584.64**					

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PROJECT: AVRRDD Phase IIIA Expansion

PROJECT NO: 777
DATE: April 1, 2020
CALC. BY: JHK

Table 2: Pre-Development vs Intermediate Development Peak Flow Summary Table for 10-year 24-hour Storm

Discharge Area	Sub-basin	Area	Peak Runoff	Offsite Discharge	Sub-basin	Area	Peak Runoff	Pond Flow In	Pond Flow Out	Offsite Discharge	Comments
		(acre)	(cfs)			(acre)	(cfs)	(cfs)	(cfs)	(cfs)	
					NW2	6.62	9.83	76.18	13.38		Pond-NW2 accepts stormwater from subbasins NW3, NW4, and NW5. Pond-NW5 accepts stormwater from NW7. Other ponds only receive stormwater from their respective subbasins.
	Northeast	63.00	39.36		NW3	8.26	35.14	46.88	36.86		
North	Northwest	249.98	141.81	**173.03**	NW4	10.99	48.56	48.46	47.77	**166.76**	
	Subtotal	312.98			NW5	248.50	123.76	15.55	0.74		
					NW7	3.02	4.99				
					SE1	20.91	14.60	32.51	6.14		
					N1	57.90	40.99				
					Subtotal	356.19					
					SW1	5.70	6.59	65.78	32.98		Pond-SW1 accepts stormwater from subbasins SW1, SW2, and SW6. Pond-SW4 accepts stormwater from subbasins SW1, SW2, SW4, SW5, and SW6. Pond-SE2 accepts stormwater from subbasins SE5, SE6, SE7, SE8, and SE12. Pond-SE1 accepts stormwater from subbasins SE10, SE11, and SE14. Other ponds only receive stormwater from their respective subbasins.
					SW2	1.16	4.20	4.20	4.02		
					SW3	58.50	16.44	16.44	16.43		
	Southeast	115.72	53.03		SW4	17.30	10.91	40.15	40.11		
South	East	49.63	25.91		SW5	6.36	12.87	12.87	13.10		
	West	88.34	53.19	**137.52**	SW6	11.72	53.76	53.67	50.60	**99.73**	
	Southwest	22.18	10.97		S1	2.83	12.20	12.17	11.47		
	Subtotal	275.87			S2	9.03	40.04	39.99	38.66		
					S3	7.51	30.06	30.05	29.49		
					SE2	19.47	13.35	52.80	8.05		
					SE3	26.27	26.33				
					SE4	4.93	2.51				
					SE5	7.32	33.59				
					SE6	2.36	10.72				
					SE7	7.69	35.29				
					SE8	14.13	65.00				
					SE10	3.42	15.58				
					SE11	3.48	15.91				
					SE12	4.97	14.30				
					SE13	2.03	3.86				
					SE14	2.20	4.69				
					SE15	10.09	12.98				
					Subtotal	228.45					
	Total	**588.85**			**Total**	**584.64**					

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PROJECT NO: 777
DATE: April 1, 2020
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Table 3: Pre-Development vs Intermediate Development Peak Flow Summary Table for 25-year 24-hour Storm

Discharge Area	Sub-basin	Area	Peak Runoff	Offsite Discharge	Sub-basin	Area	Peak Runoff	Pond Flow In	Pond Flow Out	Offsite Discharge	Comments
		(acre)	(cfs)			(acre)	(cfs)	(cfs)	(cfs)	(cfs)	
North	Northeast	63.00	64.50	**272.75**	NW2	6.62	14.85	99.07	14.96	**262.2**	Pond-NW2 accepts stormwater from subbasins NW3, NW4, and NW5. Pond-NW5 accepts stormwater from NW7. Other ponds only receive stormwater from their respective subbasins.
	Northwest	249.98	221.48		NW3	8.26	44.77	60.34	47.62		
	Subtotal	312.98			NW4	10.99	61.18	61.06	60.16		
					NW5	248.50	199.20	24.74	0.82		
					NW7	3.02	7.51				
					SE1	20.91	23.29	40.98	7.98		
					N1	57.90	65.62				
					Subtotal	356.19					
South	Southeast	115.72	81.88	**213.18**	SW1	5.70	9.99	86.90	36.57	**139.26**	Pond-SW1 accepts stormwater from subbasins SW1, SW2, and SW6. Pond-SW4 accepts stormwater from subbasins SW1, SW2, SW4, SW5, and SW6. Pond-SE2 accepts stormwater from subbasins SE5, SE6, SE7, SE8, and SE12. Pond-SE1 accepts stormwater from subbasins SE10, SE11, and SE14. Other ponds only receive stormwater from their respective subbasins.
	East	49.63	40.22		SW2	1.16	5.57	5.57	5.33		
	West	88.34	82.44		SW3	58.50	30.63	30.63	30.53		
	Southwest	22.18	17.06		SW4	17.30	17.42	51.87	51.79		
	Subtotal	275.87			SW5	6.36	19.38	19.34	19.40		
					SW6	11.72	66.93	66.85	65.38		
					S1	2.83	15.48	15.46	14.62		
					S2	9.03	50.39	50.28	47.49		
					S3	7.51	38.90	38.85	37.92		
					SE2	19.47	21.57	79.59	12.40		
					SE3	26.27	41.72				
					SE4	4.93	4.81				
					SE5	7.32	41.82				
					SE6	2.36	13.39				
					SE7	7.69	43.96				
					SE8	14.13	80.86				
					SE10	3.42	19.44				
					SE11	3.48	19.83				
					SE12	4.97	19.97				
					SE13	2.03	5.89				
					SE14	2.20	6.77				
					SE15	10.09	19.92				
					Subtotal	228.45					
	Total	**588.85**			**Total**	**584.64**					

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PROJECT: AVRRDD Phase IIIA Expansion

PROJECT NO: 777
DATE: April 1, 2020
CALC. BY: JHK

Table 4: Pre-Development vs Intermediate Development Peak Flow Summary Table for 50-year 24-hour Storm

Discharge Area	Sub-basin	Area	Peak Runoff	Offsite Discharge	Sub-basin	Area	Peak Runoff	Pond Flow In	Pond Flow Out	Offsite Discharge	Comments
		(acre)	(cfs)			(acre)	(cfs)	(cfs)	(cfs)	(cfs)	
					NW2	6.62	19.74	120.23	17.06		Pond-NW2 accepts stormwater from subbasins NW3, NW4, and NW5. Pond-NW5 accepts stormwater from NW7. Other ponds only receive stormwater from their respective subbasins.
	Northeast	63.00	89.72		NW3	8.26	53.50	72.69	57.55		
North	Northwest	249.98	299.44	**370.81**	NW4	10.99	72.71	72.61	71.54	**357.78**	
	Subtotal	312.98			NW5	248.50	274.23	33.90	0.89		
					NW7	3.02	9.97				
					SE1	20.91	31.97	48.17	9.04		
					N1	57.90	90.45				
					Subtotal	356.19					
					SW1	5.70	13.36	107.84	39.37		Pond-SW1 accepts stormwater from subbasins SW1, SW2, and SW6. Pond-SW4 accepts stormwater from subbasins SW1, SW2, SW4, SW5, and SW6. Pond-SE2 accepts stormwater from subbasins SE5, SE6, SE7, SE8, and SE12. Pond-SE1 accepts stormwater from subbasins SE10, SE11, and SE14. Other ponds only receive stormwater from their respective subbasins.
					SW2	1.16	6.82	6.82	6.54		
					SW3	58.50	45.81	45.80	45.49		
	Southeast	115.72	110.77		SW4	17.30	23.93	62.01	61.87		
South	East	49.63	54.37		SW5	6.36	25.70	25.66	25.40		
	West	88.34	111.25	**288.41**	SW6	11.72	79.08	78.99	78.96	**174.24**	
	Southwest	22.18	23.12		S1	2.83	18.47	18.43	17.49		
	Subtotal	275.87			S2	9.03	59.89	59.75	56.20		
					S3	7.51	46.96	46.96	45.06		
					SE2	19.47	29.90	105.75	23.68		
					SE3	26.27	57.09				
					SE4	4.93	7.25				
					SE5	7.32	49.41				
					SE6	2.36	15.84				
					SE7	7.69	51.87				
					SE8	14.13	95.42				
					SE10	3.42	22.99				
					SE11	3.48	23.41				
					SE12	4.97	25.26				
					SE13	2.03	7.86				
					SE14	2.20	8.76				
					SE15	10.09	26.62				
					Subtotal	228.45					
	Total	**588.85**			**Total**	**584.64**					

APPENDIX F.3

POST-DEVELOPMENT CONDITIONS

- DRAINAGE DIAGRAM & HSG PLAN
- DRAINAGE ANALYSIS AND CALCULATIONS (25–YR, 24-HOUR STORM EVENTS)
- DRAINAGE ANALYSIS AND CALCULATIONS SUMMARIES (2-YEAR, 10-YEAR, 25-YEAR, AND 50-YEAR/24-HOUR STORM EVENT)

POND-NW5

SP-2

nw-2
AREA: 6.62 AC
Tc: 18.5 MIN.
CN:

NW-5
AREA: 6.49 AC
Tc: 8.3 MIN.
CN:

NW-4
AREA: 6.40 AC
Tc: 14.2 MIN.
CN:

NW-3
AREA: 8.50 AC
Tc: 14.6 MIN.
CN:

SE-5
AREA: 3.03 AC
Tc: 11.5 MIN.
CN:

SE-6
AREA: 2.68 AC
Tc: 9.5 MIN.
CN:

SE-3
AREA: 20.43 AC
Tc: 42.7 MIN.
CN:

SE-7
AREA: 4.34 AC
Tc: 12.0 MIN.
CN:

SE-8
AREA: 4.86 AC
Tc: 10.8 MIN.
CN:

SE-9S
AREA: 9.33 AC
Tc: 21.4 MIN.
CN:

SE-9
AREA: 4.45 AC
Tc: 10.0 MIN.
CN:

POND-SE2

se-12
AREA: 4.97 AC
Tc: 0.0 MIN.
CN:

se-4
AREA: 4.93 AC
Tc: 28.2 MIN.
CN:

SE-13
AREA: 2.03 AC
Tc: 9.1 MIN.
CN:

SE-14
AREA: 2.20 AC
Tc: 8.3 MIN.
CN:

POND-SE1

SE-10
AREA: 3.43 AC
Tc: 9.8 MIN.
CN:

SE-11
AREA: 3.61 AC
Tc: 11.3 MIN.
CN:

SP-SE

SW-5
AREA: 15.54 AC
Tc: 14.0 MIN.
CN:

SW-6
AREA: 10.08 AC
Tc: 13.1 MIN.
CN:

SW-1
AREA: 5.73 AC
Tc: 25.5 MIN.
CN:

SW-2
AREA: 1.16 AC
Tc: 9.9 MIN.
CN:

SW-4
AREA: 17.27 AC
Tc: 53.4 MIN.
CN:

S-2
AREA: 11.16 AC
Tc: 17.1 MIN.
CN:

S-3
AREA: 7.51 AC
Tc: 9.9 MIN.
CN:

S-1
AREA: 2.83 AC
Tc: 9.9 MIN.
CN:

STAGE 15

STAGE 14

STAGE 13

no.	revision	date	by

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designed by: JHK
drawn by: NJM
approved by: PDS
date: April 2020
project no: 777
file name: 777-PH 3-POST-DEV-WSP.dwg
scale: 1" = 120'

Androscoggin Valley Regional Refuse Disposal District
Phase IIIA Expansion
Stormwater Report
Post-Development Watershed Diagram

drawing no. POSTDEV-1
sheet: 4 of 5

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SP-N
SP-NW
134A (D)
N-1
AREA: 57.87 AC
Tc: 43.4 MIN.
CN:
NW-6
AREA: 248.54 AC
Tc: 70.9 MIN.
CN:
POND-NW5
SP-2
nw-2
AREA: 6.62 AC
Tc: 18.5 MIN.
CN:
NW-5
AREA: 6.49 AC
Tc: 8.3 MIN.
CN:
NW-4
AREA: 6.40 AC
Tc: 14.2 MIN.
CN:
NW-3
AREA: 8.50 AC
Tc: 14.6 MIN.
CN:
SE-1
AREA: 20.91 AC
Tc: 82.2 MIN.
CN:
SE-2
AREA: 19.47 AC
Tc: 77.4 MIN.
CN:
SE-3
AREA: 20.43 AC
Tc: 42.7 MIN.
CN:
S-6
AREA: 2.68 AC
Tc: 9.5 MIN.
CN:
SE-7
AREA: 4.34 AC
Tc: 12.0 MIN.
CN:
SE-5
AREA: 3.03 AC
Tc: 11.5 MIN.
CN:
SE-8
AREA: 4.86 AC
Tc: 10.8 MIN.
CN:
SE-9S
AREA: 9.33 AC
Tc: 21.4 MIN.
CN:
se-12
AREA: 4.97 AC
Tc: 0.0 MIN.
CN:
POND-SE2
SE-4
AREA: 4.93 AC
Tc: 28.2 MIN.
CN:
SE-9
AREA: 4.45 AC
Tc: 10.0 MIN.
CN:
SE-13
AREA: 2.03 AC
Tc: 9.1 MIN.
CN:
SW-5
AREA: 15.54 AC
Tc: 14.0 MIN.
CN:
SW-1
AREA: 5.73 AC
Tc: 25.5 MIN.
CN:
SW-6
AREA: 10.08 AC
Tc: 13.1 MIN.
CN:
SE-14
AREA: 2.20 AC
Tc: 8.3 MIN.
CN:
POND-SE1
S-2
AREA: 11.16 AC
Tc: 17.1 MIN.
CN:
SW-2
AREA: 1.19 AC
Tc: 9.9 MIN.
CN:
SW-4
AREA: 17.27 AC
Tc: 53.4 MIN.
CN:
SW-3
AREA: 58.54 AC
Tc: 68.3 MIN.
CN:
S-3
AREA: 7.51 AC
Tc: 9.9 MIN.
CN:
SE-10
AREA: 3.43 AC
Tc: 9.8 MIN.
CN:
SE-11
AREA: 3.61 AC
Tc: 11.3 MIN.
CN:
S-1
AREA: 2.83 AC
Tc: 9.9 MIN.
CN:
SP-SE
SP-S
SP-SW
SP-W-2
SP-W

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scale: 300' 0 300' 600' Scale: 1" = 300'

Androscoggin Valley Regional Refuse Disposal District
Phase IIIA Expansion
Stormwater Report
Post-Development Watershed Diagram

drawing no.
POSTDEV-2

sheet: 5 of 5

POST-DEVELOPMENT
25-YEAR, 24 HOUR STORM EVENT
FULL REPORT

Project Description

File Name 777-POST-DEVELOPMENT.SPF

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... SCS TR-20
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Hydrodynamic
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ... YES

Analysis Options

Start Analysis On ..... Mar 03, 2020 00:00:00
End Analysis On ..... Mar 04, 2020 00:00:00
Start Reporting On ..... Mar 03, 2020 00:00:00
Antecedent Dry Days ..... 0 days
Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss
Reporting Time Step ..... 0 00:00:36 days hh:mm:ss
Routing Time Step ..... 1 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	32
Nodes	75
Junctions	54
Outfalls	3
Flow Diversions	0
Inlets	0
Storage Nodes	18
Links	84
Channels	29
Pipes	40
Pumps	0
Orifices	9
Weirs	6
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	25-Year	Cumulative	inches	New Hampshire	Coos (North)	25	4.49	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	N-1	57.90	70.55	4.49	1.71	98.78	65.62	0 00:43:26
2	NW2	6.62	74.39	4.49	2.00	13.20	15.01	0 00:18:24
3	NW3	8.50	73.94	4.49	1.96	16.67	20.78	0 00:14:38
4	NW4	6.39	74.03	4.49	1.97	12.58	15.86	0 00:14:11
5	NW-5	6.48	74.52	4.49	2.01	12.98	18.67	0 00:08:16
6	NW6	248.50	70.66	4.49	1.71	425.93	199.20	0 01:10:54
7	NW7	3.02	73.97	4.49	1.96	5.92	6.94	0 00:17:10
8	S1	2.83	74.13	4.49	1.98	5.59	7.75	0 00:09:49
9	S2	11.17	75.69	4.49	2.10	23.43	27.56	0 00:17:06
10	S3	7.51	74.16	4.49	1.98	14.85	20.57	0 00:09:55
11	SE-1	20.91	71.02	4.49	1.74	36.40	23.29	0 00:46:09
12	SE-10	3.44	81.02	4.49	2.54	8.74	12.18	0 00:09:39
13	SE-11	3.60	77.72	4.49	2.26	8.14	10.99	0 00:11:16
14	SE-12	4.97	81.82	4.49	2.61	12.96	19.97	0 00:06:00
15	SE-13	2.03	73.24	4.49	1.91	3.86	5.89	0 00:06:09
16	SE-14	2.20	77.76	4.49	2.27	4.99	7.18	0 00:08:22
17	SE-15	10.09	73.22	4.49	1.91	19.22	19.92	0 00:22:03
18	SE-2	19.47	70.16	4.49	1.68	32.68	21.57	0 00:43:40
19	SE-3	26.27	70.87	4.49	1.73	45.44	41.72	0 00:26:39
20	SE-4	4.93	61.99	4.49	1.13	5.59	4.81	0 00:25:22
21	SE-5	3.03	75.83	4.49	2.11	6.40	8.59	0 00:11:32
22	SE-6	2.68	82.41	4.49	2.66	7.13	9.95	0 00:09:31
23	SE-7	4.34	77.55	4.49	2.25	9.75	12.98	0 00:11:58
24	SE-8	4.86	77.38	4.49	2.23	10.85	14.81	0 00:10:47
25	SE-9	4.45	75.90	4.49	2.11	9.41	12.99	0 00:10:09
26	SE-9S	9.65	77.31	4.49	2.23	21.51	22.82	0 00:21:26
27	SW1	5.70	74.04	4.49	1.97	11.22	9.92	0 00:29:07
28	SW2	1.16	73.09	4.49	1.90	2.19	3.02	0 00:09:55
29	SW3	58.50	63.03	4.49	1.20	70.08	30.63	0 01:08:20
30	SW4	17.30	71.04	4.49	1.74	30.14	17.42	0 00:53:12
31	SW5	15.25	74.68	4.49	2.02	30.77	38.99	0 00:14:01
32	SW6	10.08	79.10	4.49	2.38	23.95	31.12	0 00:13:03

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Culv-SE4-Out	Junction	1641.18	1646.00	1641.00	0.00	0.00	16.12	1641.89	0.00	4.29	0 00:00	0.00	0.00
2	Culv-SE5-Out	Junction	1676.00	1680.00	0.00	0.00	0.00	8.59	1676.65	0.00	3.35	0 00:00	0.00	0.00
3	Culv-SW4_Out	Junction	1633.28	1639.28	1633.28	1639.28	10.00	2.95	1633.58	0.00	5.70	0 00:00	0.00	0.00
4	Culv-SW5_Out	Junction	1645.73	1651.73	1645.73	1651.73	10.00	34.30	1645.98	0.00	5.75	0 00:00	0.00	0.00
5	Culv-SW6_Out	Junction	1648.73	1654.73	1648.73	1654.73	1000.00	30.93	1649.27	0.00	5.46	0 00:00	0.00	0.00
6	DMH-1	Junction	1619.16	1640.00	1618.00	0.00	0.00	20.76	1620.35	0.00	19.65	0 00:00	0.00	0.00
7	DMH-2	Junction	1620.64	1640.00	1619.50	0.00	0.00	20.84	1622.43	0.00	17.57	0 00:00	0.00	0.00
8	DMH-3	Junction	1621.47	1626.75	1621.00	0.00	0.00	4.04	1622.46	0.00	4.29	0 00:00	0.00	0.00
9	DMH-4	Junction	1622.06	1626.75	1620.70	0.00	10.00	4.04	1622.76	0.00	3.99	0 00:00	0.00	0.00
10	DMH-5	Junction	1622.75	1626.75	1622.00	0.00	0.00	0.51	1623.50	0.00	3.25	0 00:00	0.00	0.00
11	DMH-6	Junction	1625.27	1631.10	1625.00	0.00	0.00	0.51	1625.52	0.00	5.58	0 00:00	0.00	0.00
12	DMH-7	Junction	1630.32	1642.00	1600.00	0.00	0.00	18.04	1631.05	0.00	10.95	0 00:00	0.00	0.00
13	E2.1_in	Junction	1620.10	1625.00	1620.10	1625.00	0.00	0.08	1621.67	0.00	3.33	0 00:00	0.00	0.00
14	E2.1_out	Junction	1620.00	1625.00	1620.00	1625.00	0.00	1.55	1621.67	0.00	3.33	0 00:00	0.00	0.00
15	HW-1	Junction	1634.75	1639.75	1634.50	0.00	0.00	10.68	1637.21	0.00	2.54	0 00:00	0.00	0.00
16	HW-10	Junction	1638.00	1644.00	1638.00	1645.00	9000.00	18.08	1640.01	0.00	3.99	0 00:00	0.00	0.00
17	HW-14	Junction	1643.32	1650.00	1642.00	0.00	0.00	19.89	1647.33	0.00	3.08	0 00:00	0.00	0.00
18	HW-16	Junction	1642.65	1648.00	1642.00	0.00	0.00	4.80	1643.43	0.00	4.57	0 00:00	0.00	0.00
19	HW-5	Junction	1647.50	1652.00	0.00	0.00	10.00	33.39	1649.01	0.00	2.99	0 00:00	0.00	0.00
20	HW-7	Junction	1649.25	1654.00	0.00	0.00	0.00	44.51	1651.34	0.00	2.66	0 00:00	0.00	0.00
21	Intr-SE4	Junction	1644.14	1650.00	1644.00	0.00	0.00	14.67	1647.29	0.00	2.71	0 00:00	0.00	0.00
22	Intr-SE6	Junction	1674.07	1678.07	0.00	0.00	0.00	18.09	1675.23	0.00	2.84	0 00:00	0.00	0.00
23	Intr-SE7	Junction	1668.00	1672.00	0.00	0.00	0.00	30.44	1668.88	0.00	3.12	0 00:00	0.00	0.00
24	Intr-SE8	Junction	1662.00	1666.00	0.00	0.00	0.00	44.69	1663.02	0.00	2.98	0 00:00	0.00	0.00
25	Intr-Swale-SE11	Junction	1635.50	1639.75	1635.50	0.00	10.00	10.98	1637.31	0.00	3.19	0 00:00	0.00	0.00
26	Int-SE1	Junction	1668.33	1677.00	0.00	0.00	0.00	23.28	1669.51	0.00	7.49	0 00:00	0.00	0.00
27	Int-SE15	Junction	1646.44	1648.50	1648.00	0.00	0.00	19.92	1648.00	0.00	0.50	0 00:00	0.00	0.00
28	Int-SE2	Junction	1664.17	1665.06	0.00	0.00	10.00	21.57	1679.23	13.96	0.00	0 12:22	4.43	96.00
29	Int-SE3	Junction	1658.26	1660.25	1658.00	0.00	0.00	52.79	1660.25	0.00	0.00	0 12:11	74.78	732.00
30	Jun-151	Junction	1654.00	1660.00	1654.00	1660.00	0.00	44.58	1655.08	0.00	4.92	0 00:00	0.00	0.00
31	Jun-177	Junction	1654.80	1655.00	0.00	0.00	0.00	4.37	1660.28	0.00	163822.72	0 00:00	0.00	0.00
32	Jun-189	Junction	1657.30	1659.00	0.00	0.00	0.00	0.83	1657.56	0.00	2.44	0 00:00	0.00	0.00
33	Jun-190	Junction	1665.25	1670.00	0.00	0.00	0.00	23.29	1667.41	0.00	4.34	0 00:00	0.00	0.00
34	Jun-194	Junction	1640.00	1646.00	1640.00	0.00	0.00	17.09	1640.79	0.00	7.41	0 00:00	0.00	0.00
35	Jun-250	Junction	1672.00	1676.00	0.00	0.00	0.00	17.77	1672.62	0.00	3.38	0 00:00	0.00	0.00
36	Jun-NW3	Junction	1650.16	1654.00	0.00	1654.00	1000.00	25.64	1650.80	0.00	3.20	0 00:00	0.00	0.00
37	Jun-SW4A	Junction	1628.38	1634.38	1628.38	1634.38	10.00	51.31	1632.04	0.00	2.34	0 00:00	0.00	0.00
38	Jun-SW4B	Junction	1612.00	1618.00	1612.00	1618.00	1000.00	51.77	1616.10	0.00	1.90	0 00:00	0.00	0.00
39	NW-1	Junction	1260.00	1270.00	1260.00	1270.00	10.00	199.07	1260.00	0.00	10.00	0 00:00	0.00	0.00
40	NW-2	Junction	1220.00	1226.00	1220.00	1226.00	10.00	76.19	1220.00	0.00	6.00	0 00:00	0.00	0.00
41	Out-N	Junction	1100.00	1120.00	1100.00	1120.00	100000.00	259.06	1106.51	0.00	13.49	0 00:00	0.00	0.00
42	Out-S	Junction	1500.00	1650.00	1500.00	1650.00	1000.00	107.56	1502.07	0.00	147.93	0 00:00	0.00	0.00
43	Out-SE(HW-1)	Junction	1618.10	1628.00	1617.00	1628.00	0.00	20.76	1618.86	0.00	9.14	0 00:00	0.00	0.00
44	Pond_NW2-Out	Junction	1642.00	1650.00	1642.00	1650.00	1000.00	11.81	1642.75	0.00	7.25	0 00:00	0.00	0.00
45	Pond_NW-5-OCS	Junction	1660.50	1670.00	1662.50	0.00	10.00	0.83	1662.88	0.00	7.12	0 00:00	0.00	0.00
46	Pond_PH3-OCS	Junction	1641.80	1651.00	0.00	1651.00	4.00	4.51	1642.79	0.00	8.21	0 00:00	0.00	0.00
47	Pond_SE1-Out	Junction	1658.30	1660.30	0.00	0.00	10.00	0.83	1658.53	0.00	7.60	0 00:00	0.00	0.00
48	Pond_SE-2-Out	Junction	1641.50	1648.00	0.00	0.00	0.00	4.56	1641.81	0.00	6.19	0 00:00	0.00	0.00
49	SE-1-OCS-1	Junction	1625.25	1633.50	1625.00	0.00	10.00	0.51	1626.03	0.00	7.47	0 00:00	0.00	0.00
50	SE-1-OCS-2	Junction	1622.75	1633.50	1625.50	0.00	36.00	3.53	1626.29	0.00	7.21	0 00:00	0.00	0.00
51	South-1	Junction	1613.00	1620.00	1613.00	1620.00	1000.00	33.32	1613.48	0.00	8.32	0 00:00	0.00	0.00
52	South-3	Junction	1613.00	1620.00	1613.00	1620.00	1000.00	20.52	1613.31	0.00	6.69	0 00:00	0.00	0.00
53	Southwest	Junction	1570.00	1610.00	1570.00	1610.00	10.00	80.13	1571.39	0.00	38.61	0 00:00	0.00	0.00
54	Swale-NW4	Junction	1650.04	1656.04	1650.04	0.00	10.00	28.72	1652.28	0.00	3.76	0 00:00	0.00	0.00
55	Out-North	Outfall	1000.00					259.06	1000.00					
56	Out-South	Outfall	1400.00					107.52	1400.00					
57	Pond_SE-1-OFW	Outfall	1632.00					0.00	1632.00					
58	HW-3	Storage Node	1638.78	1642.00	1638.78		3500.00	12.18	1640.63				0.00	0.00
59	Pond_NW2	Storage Node	1642.00	1650.00	1642.00		54786.20	61.26	1646.75				0.00	0.00
60	Pond_NW-5	Storage Node	1662.50	1670.00	1663.00		65300.00	25.08	1667.41				0.00	0.00
61	Pond_S1	Storage Node	1616.46	1622.46	1616.46		10.00	7.75	1617.77				0.00	0.00
62	Pond_S2	Storage Node	1619.20	1624.00	1619.20		10.00	27.56	1621.67				0.00	0.00
63	Pond_S3	Storage Node	1615.31	1621.31	1615.31		10.00	20.56	1617.60				0.00	0.00
64	Pond_SE-1	Storage Node	1628.00	1633.50	1628.40		26200.00	27.87	1630.92				0.00	0.00
65	Pond_SE-1-FB	Storage Node	1632.50	1636.00	1632.50		5410.00	22.05	1635.08				0.00	0.00
66	Pond_SE-2	Storage Node	1642.80	1651.00	1644.20		75400.00	22.10	1646.76				0.00	0.00
67	Pond_SE-2-FB	Storage Node	1645.30	1651.00	0.00		116600.00	94.24	1647.95				0.00	0.00
68	Pond_SW1	Storage Node	1629.16	1636.00	1629.16		10.00	71.26	1634.81				0.00	0.00
69	Pond_SW2	Storage Node	1634.25	1640.25	1634.25		10.00	3.02	1635.10				0.00	0.00
70	Pond_SW3	Storage Node	1578.00	1583.00	1578.00		10.00	30.63	1580.96				0.00	0.00
71	Pond_SW4	Storage Node	1602.72	1608.72	1602.72		10.00	50.20	1606.98				0.00	0.00
72	Pond_SW5	Storage Node	1647.36	1653.36	1647.36		10.00	38.97	1651.68				0.00	0.00
73	Pond_SW6	Storage Node	1650.36	1656.36	1650.36		10.00	31.12	1653.36				0.00	0.00
74	Pond-NW3	Storage Node	1647.91	1653.91	1647.91		10.00	28.51	1649.46				0.00	0.00
75	Pond-NW4	Storage Node	1651.04	1654.00	1651.04		10.00	33.47	1652.77				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1	Cul-SW4	Pipe	Pond_SW4	Southwest	41.14	1602.72	1601.68	2.5300	30.000	0.0110	50.11	77.07	0.65	11.99	1.98	0.79	0.00
2	Culv_SE-11	Pipe	HW-1	Pond_SE-1-FB	150.33	1635.50	1633.60	1.2600	24.000	0.0120	10.46	27.55	0.38	4.21	1.59	0.80	0.00
3	Culv-E2.1	Pipe	E2.1_in	E2.1_out	24.00	1620.10	1620.00	0.4200	30.000	0.0150	0.08	22.95	0.00	0.43	1.62	0.65	0.00
4	Culvert-SW4	Pipe	Pond_SW2	Culv-SW4_Out	82.60	1634.25	1633.28	1.1700	24.000	0.0100	2.95	31.87	0.09	4.00	0.57	0.29	0.00
5	Culv-NW3A	Pipe	Pond-NW3	Pond_NW2	63.30	1647.91	1646.75	1.8300	36.000	0.0110	11.53	106.71	0.11	4.86	1.11	0.37	0.00
6	Culv-NW3B	Pipe	Pond-NW3	Pond_NW2	63.30	1647.91	1647.43	0.7600	36.000	0.0110	11.53	68.64	0.17	4.41	1.19	0.40	0.00
7	Culv-NW4A	Pipe	Pond-NW4	Swale-NW4	40.02	1651.04	1651.57	-1.3200	36.000	0.0110	8.00	90.71	0.09	2.98	1.22	0.41	0.00
8	Culv-NW4B	Pipe	Pond-NW4	Jun-NW3	81.71	1651.14	1650.16	1.2000	36.000	0.0110	25.27	172.65	0.15	5.19	1.13	0.38	0.00
9	Culv-S1	Pipe	Pond_S1	South-1	62.08	1616.46	1616.45	0.0200	30.000	0.0110	7.46	6.15	1.21	3.56	1.11	0.44	0.00
10	Culv-S2	Pipe	Pond_S2	South-1	90.97	1619.20	1618.80	0.4400	36.000	0.0110	26.67	52.27	0.51	5.35	1.99	0.66	0.00
11	Culv-S3	Pipe	Pond_S3	South-3	61.14	1615.31	1614.18	1.8500	30.000	0.0110	20.52	65.90	0.31	6.08	1.62	0.65	0.00
12	Culv-SE10	Pipe	HW-3	Pond_SE-1-FB	73.94	1638.78	1636.26	3.4100	24.000	0.0120	12.04	45.24	0.27	5.69	1.28	0.64	0.00
13	Culv-SE3	Pipe	HW-14	Intr-SE4	120.00	1645.24	1644.64	0.5000	30.000	0.0120	14.67	62.84	0.23	3.75	2.30	0.92	0.00
14	Culv-SE4	Pipe	HW-16	Culv-SE4-Out	104.00	1642.65	1641.68	0.9300	36.000	0.0120	4.80	69.78	0.07	4.16	0.66	0.22	0.00
15	Culv-SE8	Pipe	HW-7	Pond_SE-2-FB	71.80	1649.50	1646.00	4.8700	30.000	0.0120	44.41	294.32	0.15	5.16	1.69	0.67	0.00
16	Culv-SE9	Pipe	HW-5	Pond_SE-2-FB	63.20	1647.50	1645.30	3.4800	30.000	0.0120	35.09	248.71	0.14	3.22	1.92	0.77	0.00
17	Culv-SW3	Pipe	Pond_SW3	Southwest	59.15	1578.00	1576.00	3.3800	30.000	0.0110	30.53	89.14	0.34	8.30	1.75	0.70	0.00
18	Culv-SW4	Pipe	Pond_SW1	Jun-SW4A	52.00	1629.16	1628.38	1.5000	24.000	0.0110	34.87	32.74	1.06	11.10	2.00	1.00	655.00
19	Culv-SW5	Pipe	Pond_SW5	Culv-SW5_Out	59.57	1647.36	1645.73	2.7400	36.000	0.0240	34.30	59.76	0.57	8.77	1.63	0.54	0.00
20	Culv-SW6	Pipe	Pond_SW6	Culv-SW6_Out	71.39	1650.36	1648.73	2.2800	30.000	0.0110	30.93	73.25	0.42	9.92	1.52	0.61	0.00
21	EPIPE-SE1	Pipe	DMH-1	Out-SE(HW-1)	50.94	1619.16	1618.14	2.0000	30.000	0.0120	20.76	62.88	0.33	10.11	1.09	0.44	0.00
22	Link-389	Pipe	Intr-SE4	Culv-SE4-Out	215.13	1644.14	1641.18	1.3800	18.000	0.0150	11.46	10.68	1.07	8.33	1.10	0.74	0.00
23	NW_Direct_Rout-1	Pipe	NW-1	Out-N	1.00	1260.00	1100.00	16000.0000	0.000	0.0300	199.07	0.00	0.61	0.00	3.67	0.92	0.00
24	NW_Direct_Rout-2	Pipe	NW-2	Out-N	1.00	1220.00	1100.00	12000.0000	0.000	0.0300	76.19	0.00	0.61	0.00	3.67	0.92	0.00
25	PIPE-0	Pipe	DMH-2	DMH-1	275.30	1620.64	1619.26	0.5000	30.000	0.0120	20.76	31.46	0.66	6.10	1.64	0.65	0.00
26	PIPE-1	Pipe	DMH-3	DMH-2	145.60	1621.47	1620.74	0.5000	30.000	0.0120	4.08	31.46	0.13	2.71	1.34	0.54	0.00
27	PIPE-11	Pipe	Pond_PH3-OCS	Pond_SE-2-Out	57.10	1641.80	1641.50	0.5300	24.000	0.0120	4.56	17.76	0.26	5.53	0.65	0.33	0.00
28	PIPE-15	Pipe	HW-10	DMH-7	73.90	1638.00	1630.42	10.2600	30.000	0.0120	18.04	142.31	0.13	7.10	1.32	0.53	0.00
29	PIPE-2	Pipe	DMH-4	DMH-3	97.70	1622.06	1621.57	0.5000	30.000	0.0120	4.04	31.47	0.13	3.88	0.78	0.31	0.00
30	PIPE-3	Pipe	DMH-5	DMH-4	75.50	1623.18	1622.80	0.5000	12.000	0.0120	0.51	2.74	0.19	2.49	0.31	0.31	0.00
31	PIPE-4	Pipe	DMH-6	DMH-5	202.70	1625.27	1623.28	0.9800	12.000	0.0120	0.51	3.82	0.13	3.31	0.25	0.25	0.00
32	PIPE-5	Pipe	SE-1-OCS-1	DMH-6	37.50	1625.75	1625.37	1.0100	12.000	0.0120	0.51	3.89	0.13	3.08	0.26	0.26	0.00
33	PIPE-6	Pipe	SE-1-OCS-2	DMH-4	58.20	1625.75	1622.55	5.5000	12.000	0.0120	3.53	9.05	0.39	9.28	0.49	0.49	0.00
34	PIPE-9	Pipe	DMH-7	DMH-2	201.30	1630.32	1620.74	4.7600	30.000	0.0120	18.04	96.94	0.19	9.01	1.20	0.48	0.00
35	Pond_NW2-Prime	Pipe	Pond_NW2	Pond_NW2-Out	42.84	1643.88	1643.04	1.9600	15.000	0.0110	11.81	10.69	1.10	9.62	1.25	1.00	79.00
36	Pond_NW-5-Primary	Pipe	Pond_NW-5-OCS	Pond_SE1-Out	58.10	1662.50	1660.50	3.4400	18.000	0.0120	0.83	21.11	0.04	3.45	0.29	0.19	0.00
37	S_Direct_Rout-2	Pipe	South-1	Out-S	575.23	1613.00	1500.00	19.6400	0.000	0.0150	33.32	0.00	0.04	0.00	0.29	0.19	0.00
38	S_Direct_Rout-3	Pipe	South-3	Out-S	115.53	1613.00	1500.00	97.8100	0.000	0.0150	20.52	0.00	0.04	0.00	0.29	0.19	0.00
39	SE_Direct_Rout-1	Pipe	Out-SE(HW-1)	Out-S	1422.07	1618.10	1500.00	8.3000	30.000	0.0150	20.75	102.44	0.20	7.58	1.41	0.56	0.00
40	SW_Rout-1	Pipe	Southwest	Out-S	1606.22	1570.00	1500.00	4.3600	60.000	0.0150	80.11	471.21	0.17	13.29	1.73	0.35	0.00
41	Link-315	Channel	E2.1_out	Pond_S2	80.00	1620.00	1619.20	1.0000	24.000	0.0320	1.55	187.10	0.01	0.11	1.83	0.92	0.00
42	Link-387	Channel	Jun-189	Jun-NW3	366.60	1657.30	1650.16	1.9500	15.000	0.0300	0.83	31.32	0.03	2.78	0.40	0.32	0.00
43	Link-392	Channel	Jun-151	HW-7	180.74	1646.00	1650.00	-2.2100	48.000	0.0330	44.51	602.01	0.07	5.47	1.21	0.30	0.00
44	N_Routing	Channel	Out-N	Out-North	0.10	1100.00	1099.99	10.0000	48.000	0.0300	259.06	421.70	0.61	15.42	3.67	0.92	0.00
45	NW2-Swale	Channel	Pond_NW2-Out	NW-2	2505.00	1642.00	1220.00	16.8500	24.000	0.0300	11.78	344.99	0.03	10.00	0.38	0.19	0.00
46	S_Rout	Channel	Out-S	Out-South	0.10	1500.00	1499.90	100.0000	48.000	0.0300	107.52	6208.64	0.02	9.93	1.47	0.37	0.00
47	Swale-NW2	Channel	Jun-NW3	Pond_NW2	651.44	1650.16	1643.88	0.9600	24.000	0.0300	25.30	214.63	0.12	2.60	1.29	0.64	0.00
48	Swale-NW3	Channel	Swale-NW4	Pond-NW3	449.31	1651.57	1647.91	0.8100	24.000	0.0300	28.51	197.45	0.14	2.01	1.11	0.55	0.00
49	Swale-NW7	Channel	Pond_SE1-Out	Jun-189	32.50	1658.30	1658.00	0.9200	24.000	0.0300	0.83	80.76	0.01	1.64	0.20	0.10	0.00
50	Swale-SE11	Channel	Intr-Swale-SE11	HW-1	200.00	1636.50	1635.50	0.5000	48.000	0.0330	10.68	286.14	0.04	1.26	1.26	0.31	0.00
51	Swale-SE15	Channel	Int-SE15	HW-14	664.00	1646.44	1643.32	0.4700	24.000	0.0300	19.89	57.62	0.35	5.26	1.63	0.81	0.00
52	Swale-SE1-A	Channel	Int-SE1	Jun-190	612.50	1668.33	1665.25	0.5000	60.000	0.0300	23.29	641.71	0.04	2.97	1.17	0.23	0.00
53	Swale-SE1-B	Channel	Jun-190	Pond_NW-5	211.00	1665.25	1663.60	0.7800	78.000	0.0300	23.21	1508.76	0.02	1.76	2.98	0.46	0.00
54	Swale-SE2	Channel	Int-SE2	Int-SE3	465.30	1664.17	1658.26	1.2700	13.200	0.0300	11.10	11.10	1.00	3.74	1.10	1.00	96.00
55	Swale-SE20	Channel	Pond_SE-2-Out	Jun-194	58.20	1641.50	1640.00	2.5800	24.000	0.0330	4.52	163.38	0.03	2.35	0.47	0.23	0.00
56	Swale-SE21	Channel	Jun-194	HW-10	197.10	1640.00	1638.00	1.0100	36.000	0.0300	17.06	276.92	0.06	1.49	1.40	0.47	0.00
57	Swale-SE3	Channel	Int-SE3	Jun-177	701.00	1658.26	1654.80	0.4900	13.200	0.0300	4.37	5.91	0.74	1.66	1.10	1.00	733.00
58	Swale-SE3b	Channel	Jun-177	HW-14	219.80	165480.00	1647.41	74537.1200	36.000	0.0300	0.00	31307.60	0.00	0.00	0.00	0.00	0.00

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Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
59	SWALE-SE4B	Channel	Culv-SE4-Out	Jun-194	86.86	1641.18	1640.00	1.3600	60.000	0.0300	15.96	1054.75	0.02	3.42	0.75	0.15	0.00
60	Swale-SE5	Channel	Culv-SE5-Out	Intr-SE6	385.20	1676.00	1674.07	0.5000	48.000	0.0330	8.50	286.44	0.03	1.38	0.91	0.23	0.00
61	Swale-SE6A	Channel	Intr-SE6	Jun-250	398.10	1674.07	1672.00	0.5200	48.000	0.0330	17.77	291.80	0.06	2.96	0.89	0.22	0.00
62	Swale-SE6B	Channel	Jun-250	Intr-SE7	150.50	1672.00	1668.00	2.6600	48.000	0.0330	17.70	659.72	0.03	3.63	0.75	0.19	0.00
63	Swale-SE7	Channel	Intr-SE7	Intr-SE8	274.50	1668.00	1662.00	2.1900	48.000	0.0330	30.39	598.28	0.05	4.64	0.95	0.24	0.00
64	Swale-SE8	Channel	Intr-SE8	Jun-151	283.30	1662.00	1654.00	2.8200	48.000	0.0330	44.58	680.02	0.07	5.99	1.05	0.26	0.00
65	Swale-SW4A-Routing	Channel	Jun-SW4A	Jun-SW4B	775.76	1631.00	1614.00	2.1900	24.000	0.1000	51.14	163.89	0.31	1.98	1.52	0.76	0.00
66	Swale-SW4B-Routing	Channel	Culv-SW4_Out	Jun-SW4B	414.00	1633.43	1612.00	5.1800	24.000	0.1000	2.78	251.89	0.01	0.22	1.07	0.54	0.00
67	Swale-SW4C	Channel	Jun-SW4B	Pond_SW4	254.98	1614.00	1602.72	4.4200	48.000	0.0300	50.20	280.48	0.18	5.87	3.05	0.76	0.00
68	Swale-SW5-Routing	Channel	Culv-SW5_Out	Pond_SW1	390.00	1645.00	1634.00	2.8200	12.000	0.0300	34.26	332.62	0.10	3.36	0.50	0.50	0.00
69	Swale-SW6-Routing	Channel	Culv-SW6_Out	Pond_SW1	170.69	1639.00	1634.00	2.9300	48.000	0.0300	30.91	2449.26	0.01	7.62	0.55	0.14	0.00
70	Pond_NW-5-Dev 2	Orifice	Pond_NW-5	Pond_NW-5-OCS		1662.50	1660.50		30.000		0.00						
71	Pond_NW-5-orifice	Orifice	Pond_NW-5	Pond_NW-5-OCS		1662.50	1660.50		4.000		0.83						
72	Pond_SE-1-FB-Drawdown	Orifice	Pond_SE-1-FB	Pond_SE-1		1632.50	1628.00		8.000		2.58						
73	Pond_SE-1-WQV	Orifice	Pond_SE-1	SE-1-OCS-1		1628.00	1625.25		3.500		0.51						
74	Pond_SE-2-2_YR	Orifice	Pond_SE-2	Pond_PH3-OCS		1642.80	1641.80		6.000		2.19						
75	Pond_SE-2-25_YR	Orifice	Pond_SE-2	Pond_PH3-OCS		1642.80	1641.80		48.000		0.00						
76	Pond_SE-2-FB-Drawdown	Orifice	Pond_SE-2-FB	Pond_SE-2		1645.30	1642.80		12.000		5.68						
77	Pond_SE-2-WQV	Orifice	Pond_SE-2	Pond_PH3-OCS		1642.80	1641.80		7.600		2.32						
78	SE-1-OCS-2-2-Year	Orifice	Pond_SE-1	SE-1-OCS-2		1628.00	1622.75		15.000		3.53						
79	Pond_NW2-Over	Weir	Pond_NW2	Pond_NW2-Out		1642.00	1642.00				0.00						
80	Pond_NW-5-Weir-1	Weir	Pond_NW-5	Pond_SE1-Out		1662.50	1658.30				0.00						
81	Pond_SE-1-Weir-1	Weir	Pond_SE-1-FB	Pond_SE-1		1632.50	1628.00				19.10						
82	Pond_SE-1-Weir-3	Weir	Pond_SE-1	Pond_SE-1-OFW		1628.00	1632.00				0.00						
83	Pond_SE-2-Weir-1	Weir	Pond_SE-2-FB	Pond_SE-2		1645.30	1642.80				16.42						
84	Pond_SE-2-Weir-3	Weir	Pond_SE-2	Jun-194		1642.80	1640.00				0.00						

Reported
Condition

Subbasin Hydrology

Subbasin : N-1

Input Data

Area (ac) 57.90
Weighted Curve Number 70.55
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	54.52	C	70.00
Gravel roads	0.17	C	89.00
Meadow, non-grazed	2.28	C	71.00
GravellPavement	0.94	C	98.00
Composite Area & Weighted CN	57.91		70.55

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	12.25	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.10	0.00	0.00
Computed Flow Time (min) :	16.34	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	2236	199	168
Slope (%) :	9.76	10.42	10.42
Surface Type :	Woodland	Grass pasture	Woodland
Velocity (ft/sec) :	1.56	2.26	1.61
Computed Flow Time (min) :	23.89	1.47	1.74

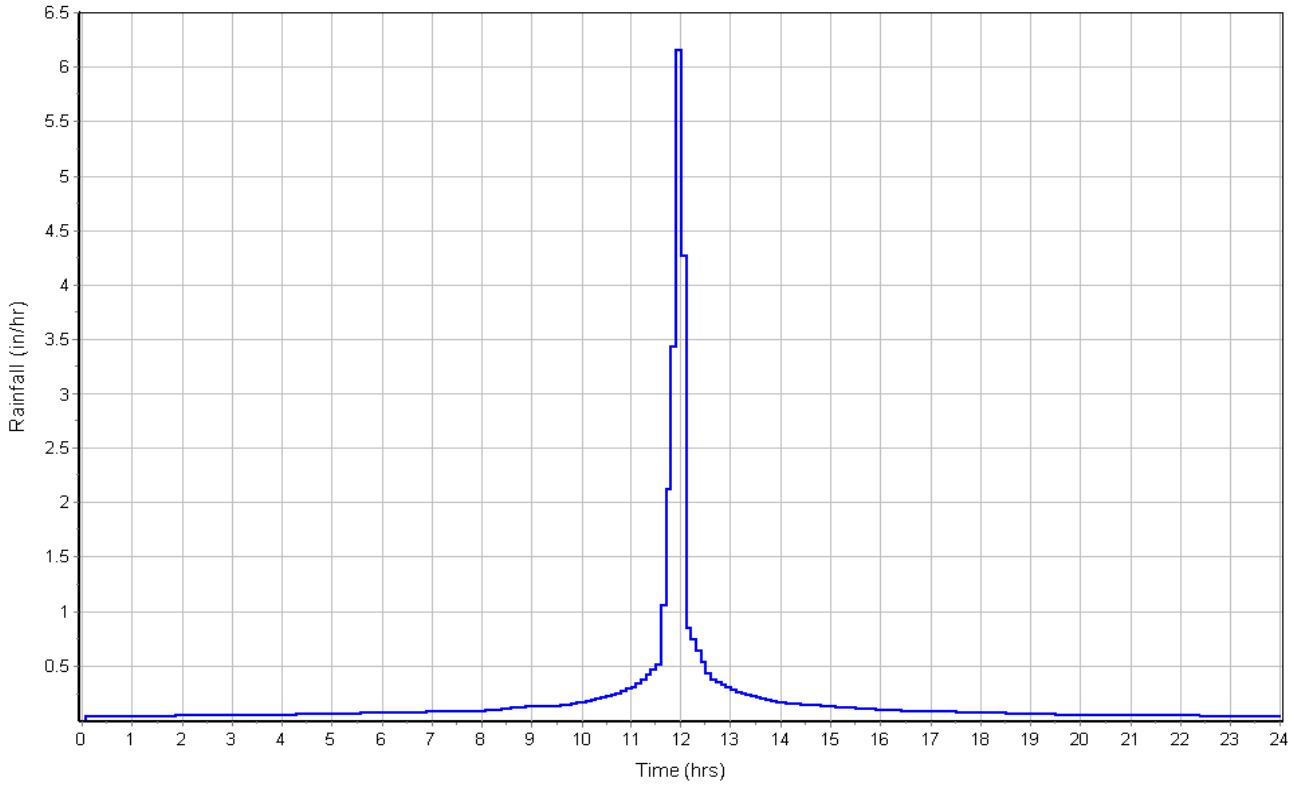
Total TOC (min) 43.44

Subbasin Runoff Results

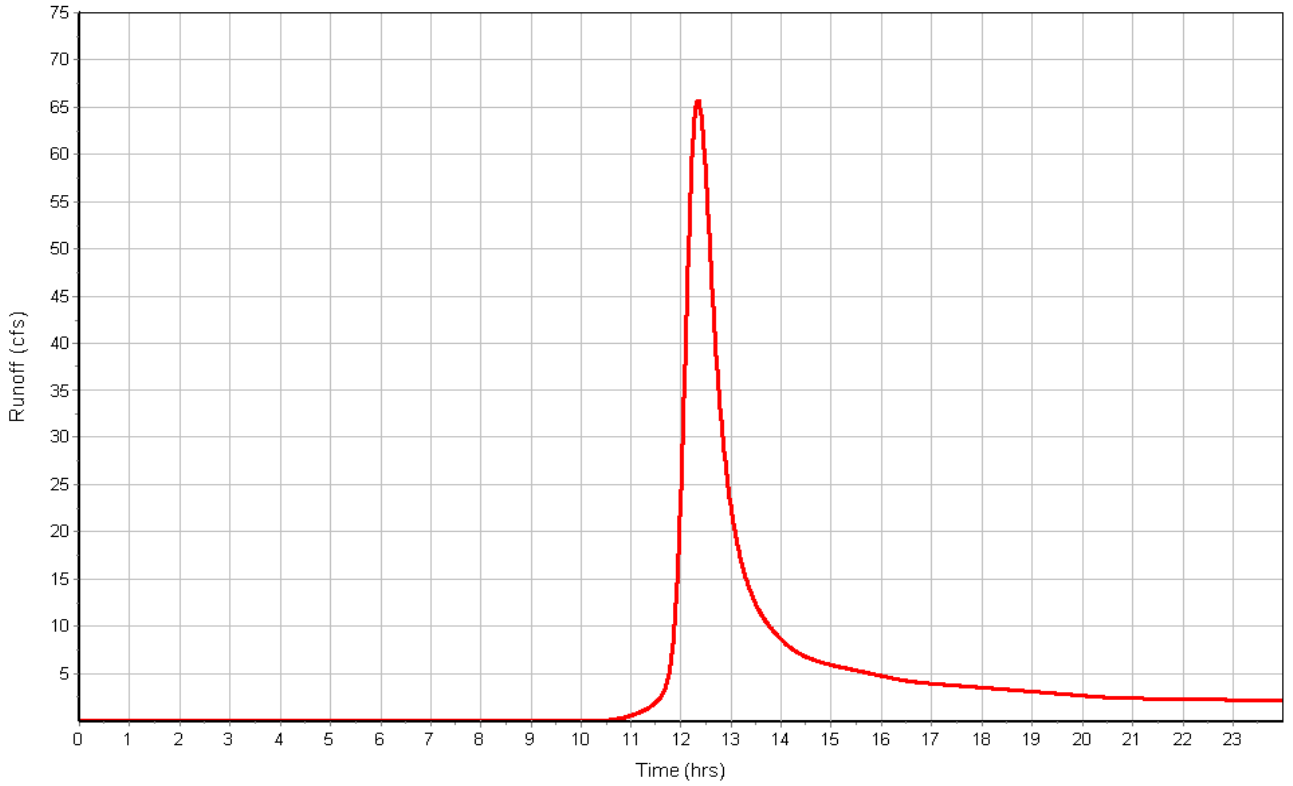
Total Rainfall (in)	4.49
Total Runoff (in)	1.71
Peak Runoff (cfs)	65.62
Weighted Curve Number	70.55
Time of Concentration (days hh:mm:ss)	0 00:43:26

Subbasin : N-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NW2

Input Data

Area (ac) 6.62
Weighted Curve Number 74.39
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.52	C	96.00
Woods, Good	1.91	C	70.00
Meadow, non-grazed	2.51	C	71.00
Meadow,non-grazed	0.79	D	78.00
Woods	1.06	D	77.00
Composite Area & Weighted CN	6.79		74.39

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.24	0.24	0.00
Flow Length (ft) :	26.22	41.145	0.00
Slope (%) :	33.33	4.19	0.00
2 yr, 24 hr Rainfall (in) :	2.48	2.48	0.00
Velocity (ft/sec) :	0.24	0.12	0.00
Computed Flow Time (min) :	1.80	5.93	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	301.114	0.00	0.00
Slope (%) :	3.46	0.00	0.00
Surface Type :	Forest	Unpaved	Unpaved
Velocity (ft/sec) :	0.47	0.00	0.00
Computed Flow Time (min) :	10.68	0.00	0.00

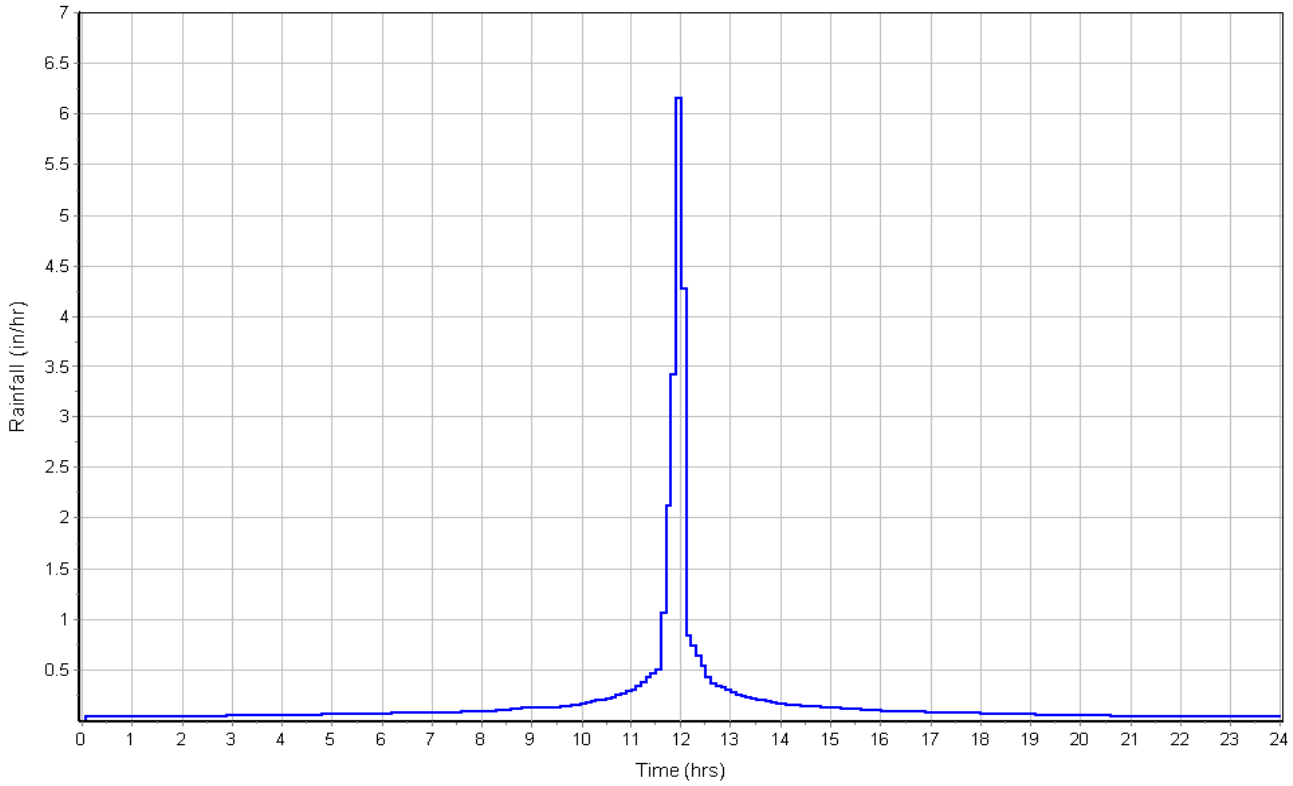
Total TOC (min) 18.41

Subbasin Runoff Results

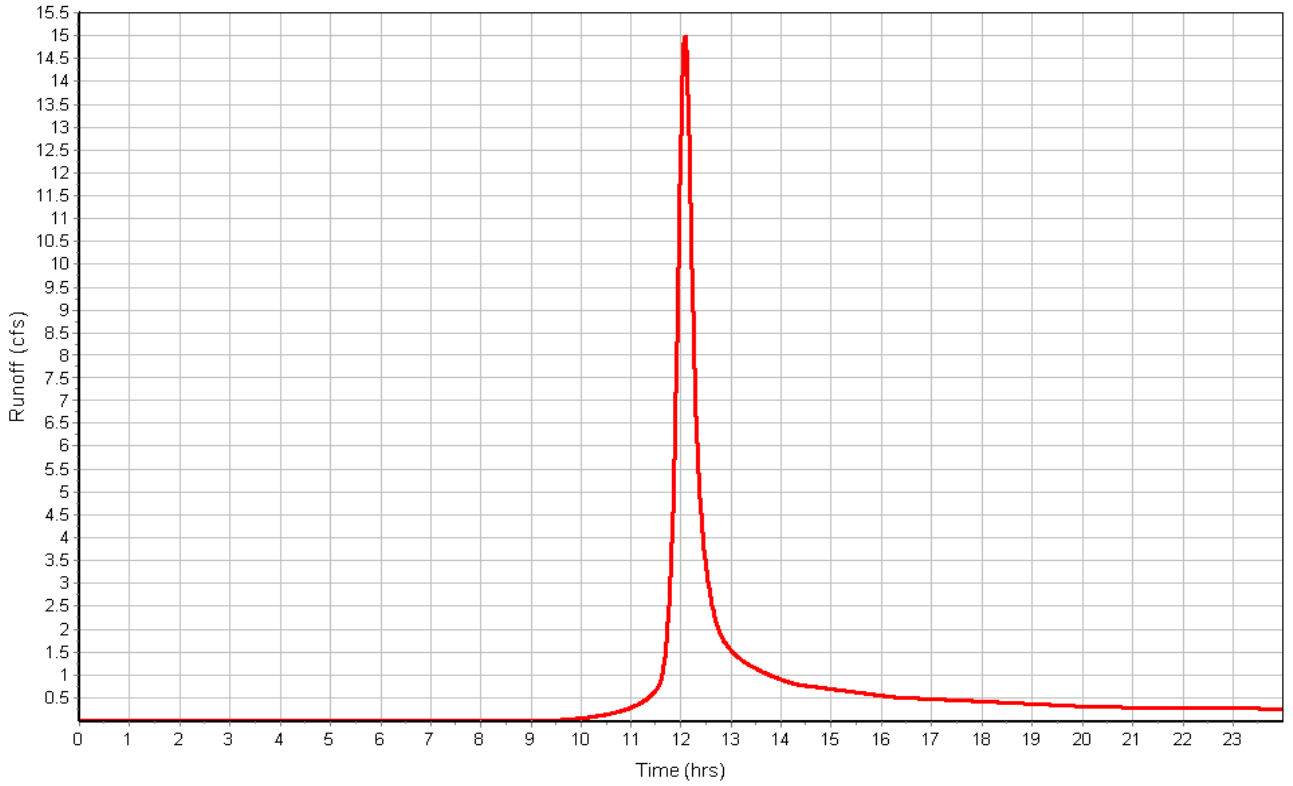
Total Rainfall (in) 4.49
Total Runoff (in) 2.00
Peak Runoff (cfs) 15.01
Weighted Curve Number 74.39
Time of Concentration (days hh:mm:ss) 0 00:18:25

Subbasin : NW2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NW3

Input Data

Area (ac) 8.50
Weighted Curve Number 73.94
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	0.16	C	96.00
Paved parking & roofs	0.00	C	98.00
Grassed Landfill Cap	6.96	C	74.00
Meadow, non-grazed	1.38	C	71.00
Composite Area & Weighted CN	8.50		73.94

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.24	0.24	0.00
Flow Length (ft) :	79.23	20.767	0.00
Slope (%) :	5.28	6.20	0.00
2 yr, 24 hr Rainfall (in) :	2.48	2.48	0.00
Velocity (ft/sec) :	0.14	0.12	0.00
Computed Flow Time (min) :	9.13	2.93	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	53.296	185.263	0.00
Slope (%) :	6.20	23.02	0.00
Surface Type :	Grass pasture	Grass pasture	Unpaved
Velocity (ft/sec) :	1.74	3.36	0.00
Computed Flow Time (min) :	0.51	0.92	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.033	0.033	0.033
Flow Length (ft) :	387.14	286.212	96.891
Channel Slope (%) :	5	30.75	21.66
Cross Section Area (ft^2) :	4.5	8.48	8.48
Wetted Perimeter (ft) :	6.71	10.9	10.9
Velocity (ft/sec) :	7.74	21.18	17.78
Computed Flow Time (min) :	0.83	0.23	0.09

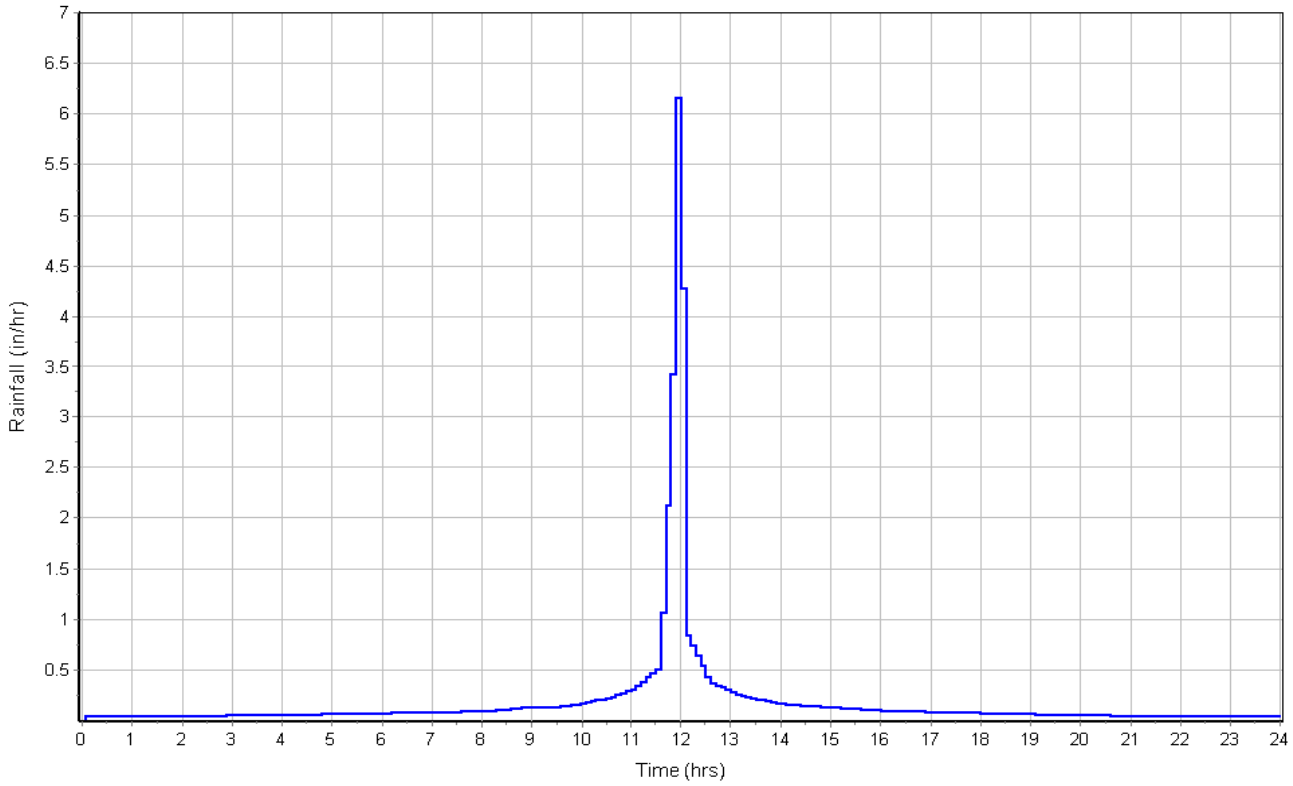
Total TOC (min) 14.64

Subbasin Runoff Results

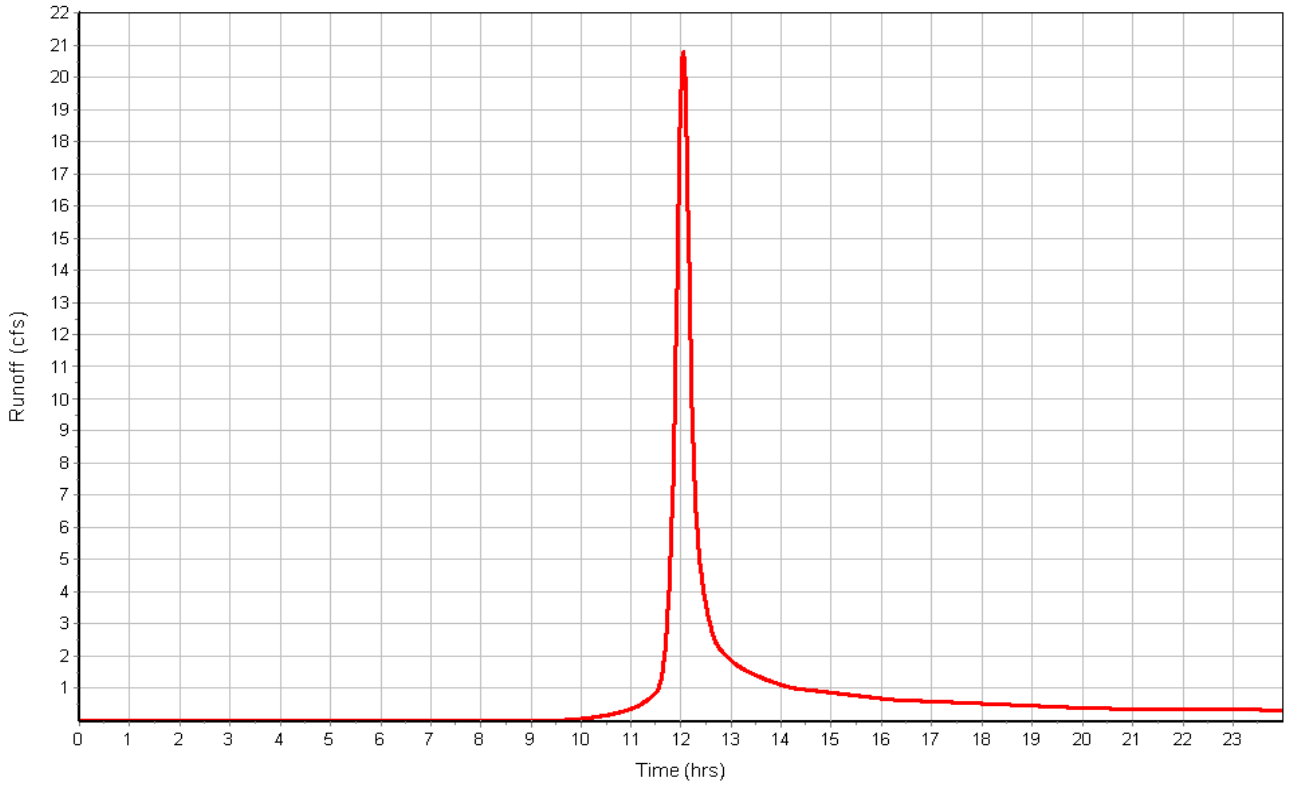
Total Rainfall (in) 4.49
Total Runoff (in) 1.96
Peak Runoff (cfs) 20.78
Weighted Curve Number 73.94
Time of Concentration (days hh:mm:ss) 0 00:14:38

Subbasin : NW3

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NW4

Input Data

Area (ac) 6.39
Weighted Curve Number 74.03
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	0.04	C	96.00
Grassed Landfill Cap	6.12	C	74.00
Meadow, non-grazed	0.24	C	71.00
Composite Area & Weighted CN	6.40		74.03

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.24	0.00	0.00
Flow Length (ft) :	96.407	0.00	0.00
Slope (%) :	4.15	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.14	0.00	0.00
Computed Flow Time (min) :	11.76	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	139.901	36.816	0.00
Slope (%) :	7.15	20	0.00
Surface Type :	Grass pasture	Grass pasture	Unpaved
Velocity (ft/sec) :	1.87	3.13	0.00
Computed Flow Time (min) :	1.25	0.20	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.033	0.033	0.033
Flow Length (ft) :	257.842	440.77	83.537
Channel Slope (%) :	5	29.29	21.55
Cross Section Area (ft^2) :	4.5	8.48	8.48
Wetted Perimeter (ft) :	6.71	10.9	10.9
Velocity (ft/sec) :	7.74	20.67	17.73
Computed Flow Time (min) :	0.56	0.36	0.08

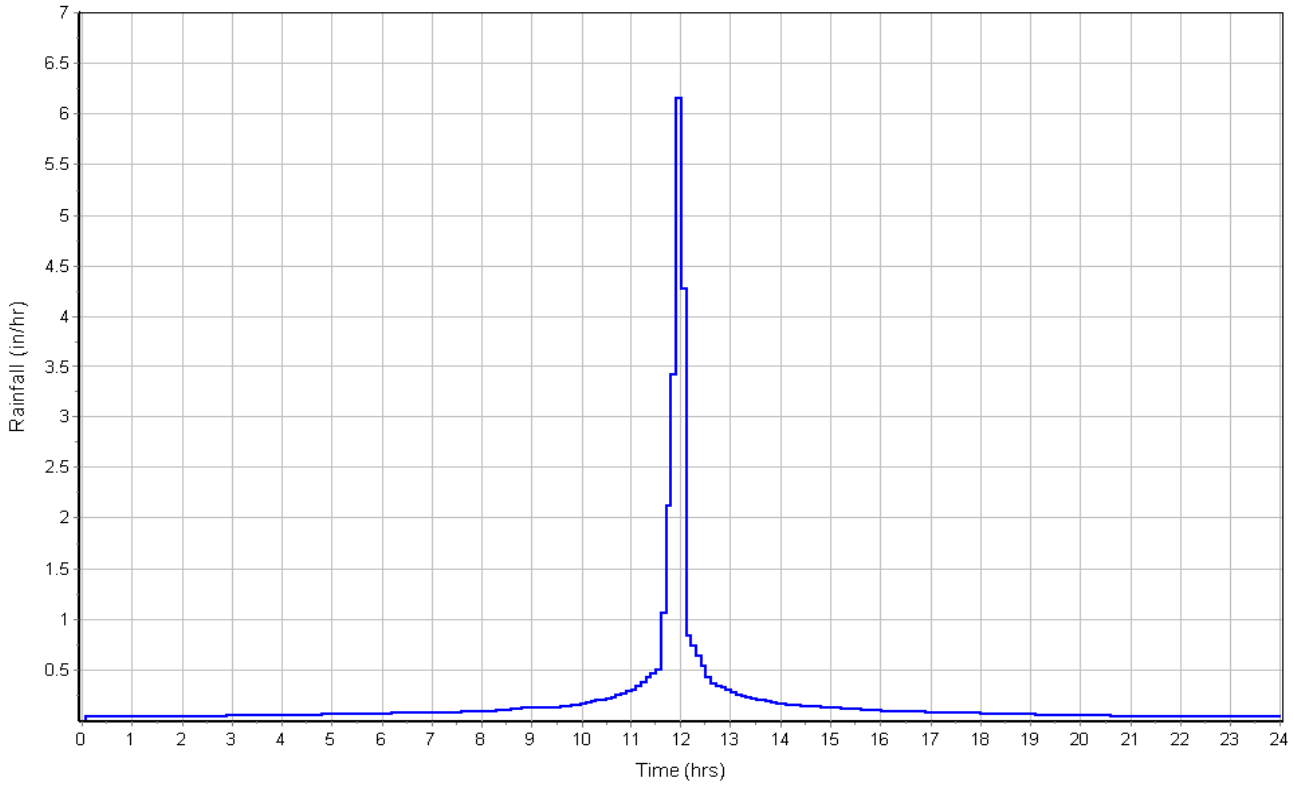
Total TOC (min) 14.19

Subbasin Runoff Results

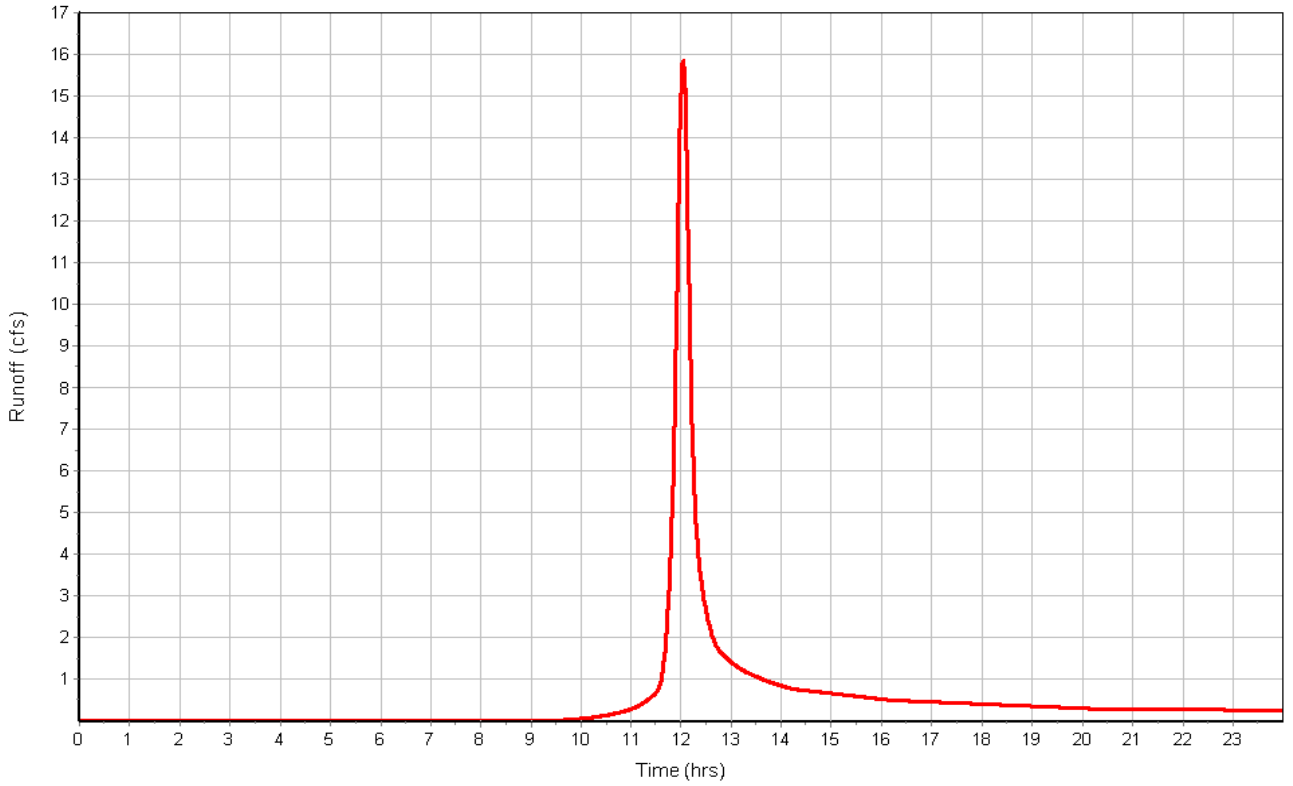
Total Rainfall (in) 4.49
Total Runoff (in) 1.97
Peak Runoff (cfs) 15.86
Weighted Curve Number 74.03
Time of Concentration (days hh:mm:ss) 0 00:14:11

Subbasin : NW4

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NW-5

Input Data

Area (ac) 6.48
Weighted Curve Number 74.52
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Meadow,non-grzed	0.91	C	71.00
Impervious,Gravel	0.28	C	96.00
FinalCap,Grass	5.29	C	74.00
Composite Area & Weighted CN	6.48		74.52

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.24	0.00	0.00
Flow Length (ft) :	140.074	0.00	0.00
Slope (%) :	33.29	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.34	0.00	0.00
Computed Flow Time (min) :	6.89	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.033	0.033	0.033
Flow Length (ft) :	555.071	103.095	98.6
Channel Slope (%) :	5	20.93	24.54
Cross Section Area (ft^2) :	4.5	8.48	8.48
Wetted Perimeter (ft) :	6.71	10.9	10.9
Velocity (ft/sec) :	7.74	17.47	18.92
Computed Flow Time (min) :	1.20	0.10	0.09

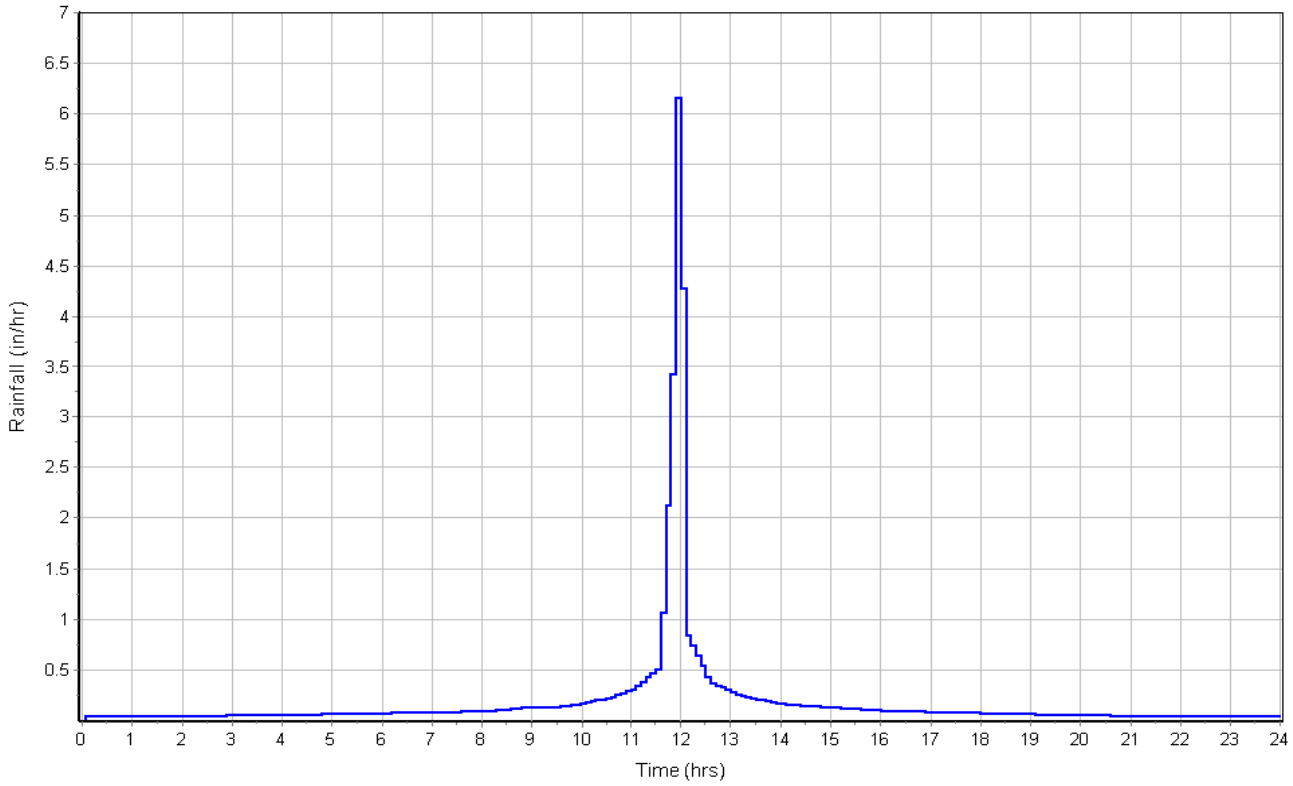
Total TOC (min) 8.27

Subbasin Runoff Results

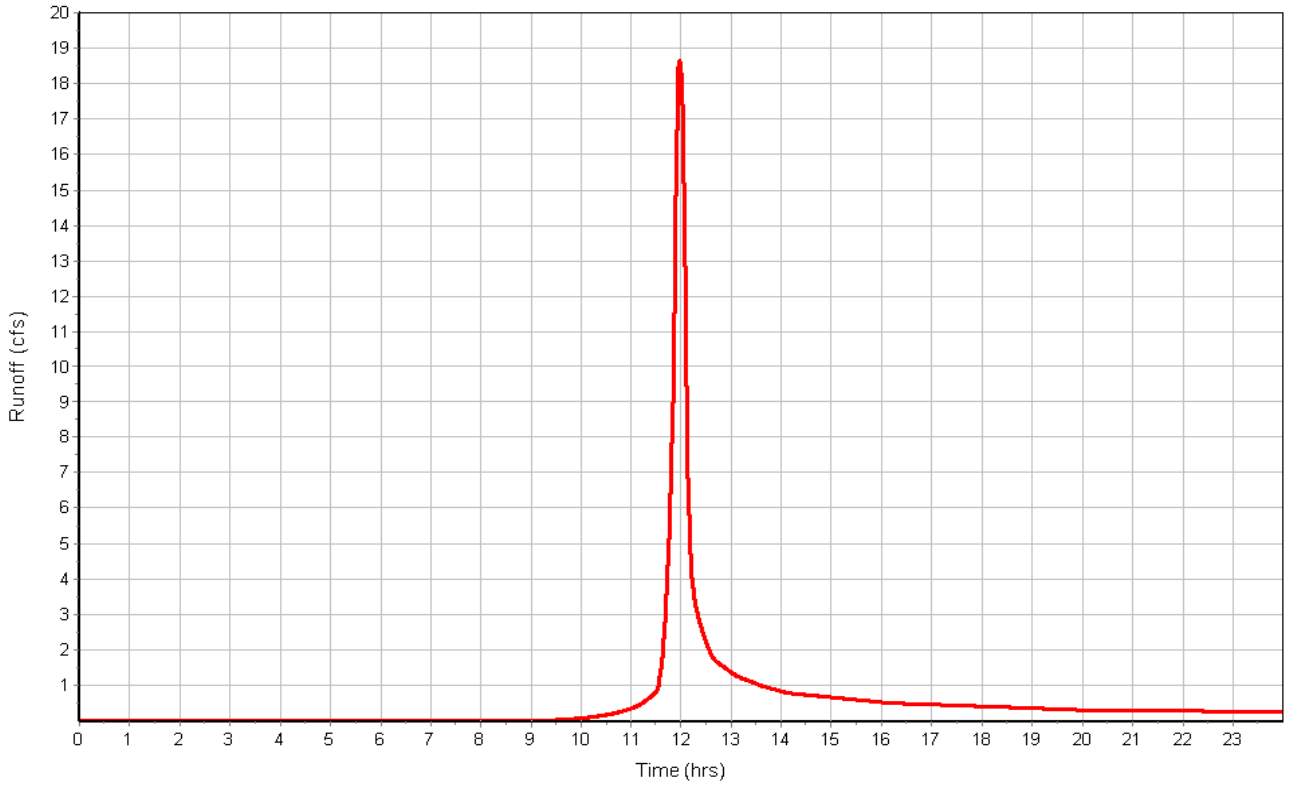
Total Rainfall (in) 4.49
Total Runoff (in) 2.01
Peak Runoff (cfs) 18.67
Weighted Curve Number 74.52
Time of Concentration (days hh:mm:ss) 0 00:08:16

Subbasin : NW-5

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NW6

Input Data

Area (ac) 248.50
Weighted Curve Number 70.66
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.22	B	55.00
Woods, Good	218.61	C	70.00
Woods, Good	8.92	D	77.00
Gravel roads	0.62	C	89.00
Meadow, non-grazed	12.18	C	71.00
Paved parking & roofs	2.73	C	98.00
Composite Area & Weighted CN	243.28		70.66

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	3.00	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.06	0.00	0.00
Computed Flow Time (min) :	28.69	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1716.085	160.816	1973.584
Slope (%) :	6.44	11.69	12.55
Surface Type :	Woodland	Grass pasture	Woodland
Velocity (ft/sec) :	1.27	2.39	1.77
Computed Flow Time (min) :	22.52	1.12	18.58

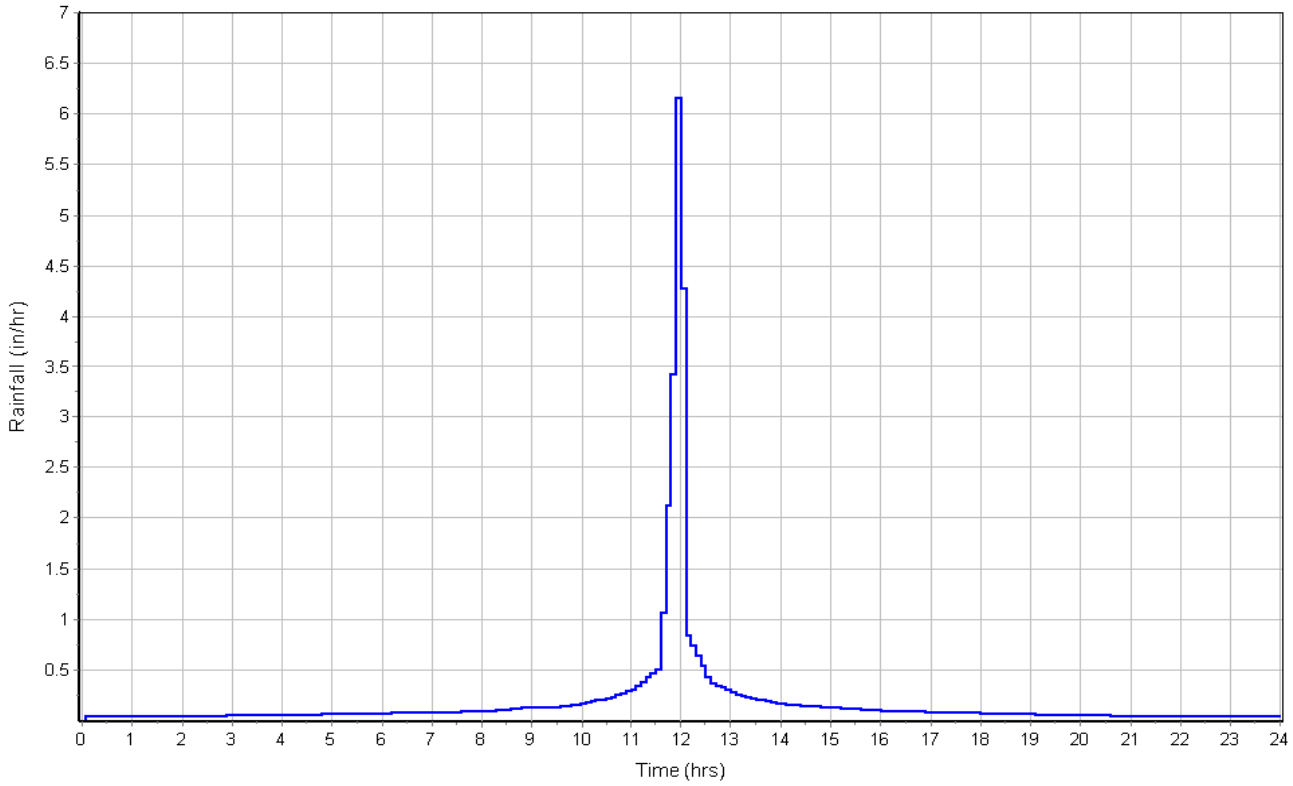
Total TOC (min) 70.91

Subbasin Runoff Results

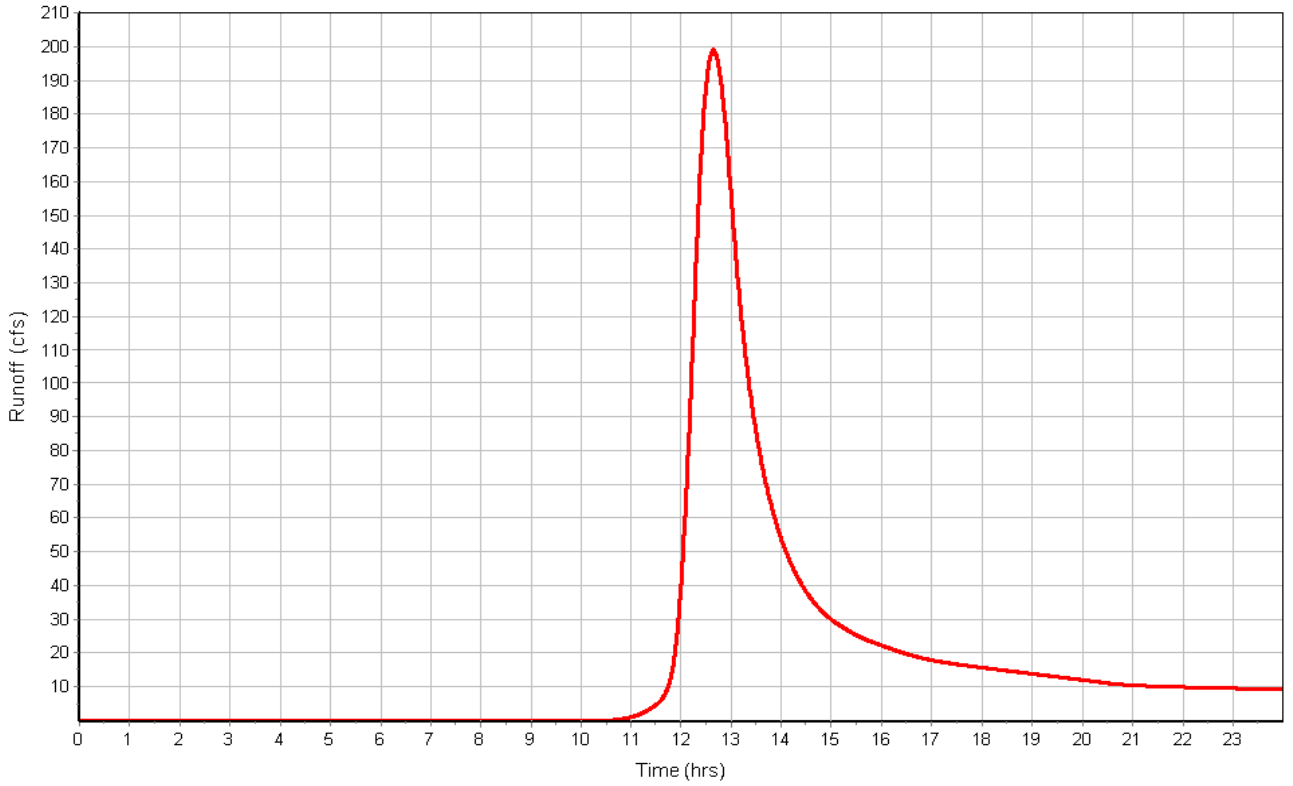
Total Rainfall (in) 4.49
Total Runoff (in) 1.71
Peak Runoff (cfs) 199.20
Weighted Curve Number 70.66
Time of Concentration (days hh:mm:ss) 0 01:10:55

Subbasin : NW6

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : NW7

Input Data

Area (ac) 3.02
Weighted Curve Number 73.97
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.92	C	70.00
Meadow,non-grazed	0.68	C	71.00
Meadow,non-grazed	1.41	D	78.00
Composite Area & Weighted CN	3.01		73.97

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.6	0.00	0.00
Flow Length (ft) :	24.91	0.00	0.00
Slope (%) :	2.34	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.04	0.00	0.00
Computed Flow Time (min) :	10.42	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	230.79	26.23	0.00
Slope (%) :	5.60	7.45	0.00
Surface Type :	Forest	Grass pasture	Unpaved
Velocity (ft/sec) :	0.59	1.91	0.00
Computed Flow Time (min) :	6.52	0.23	0.00

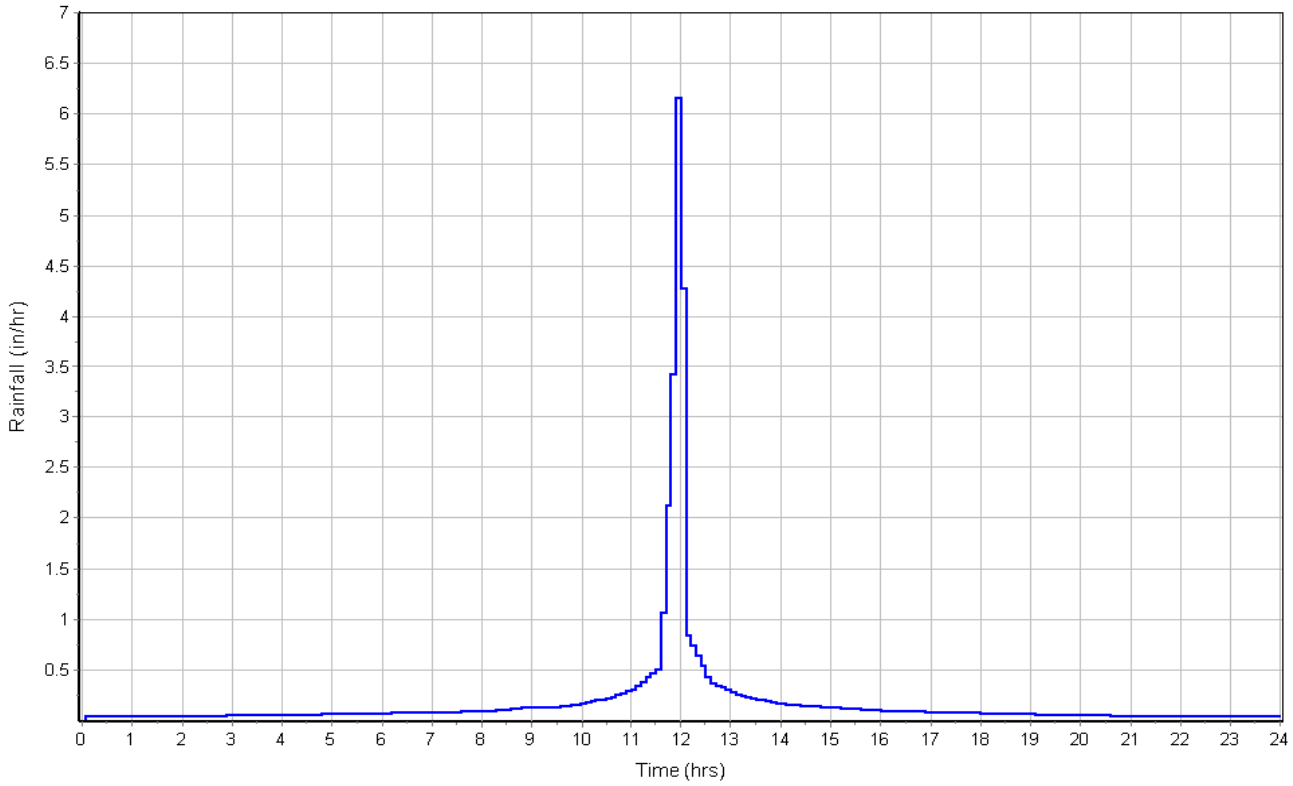
Total TOC (min) 17.17

Subbasin Runoff Results

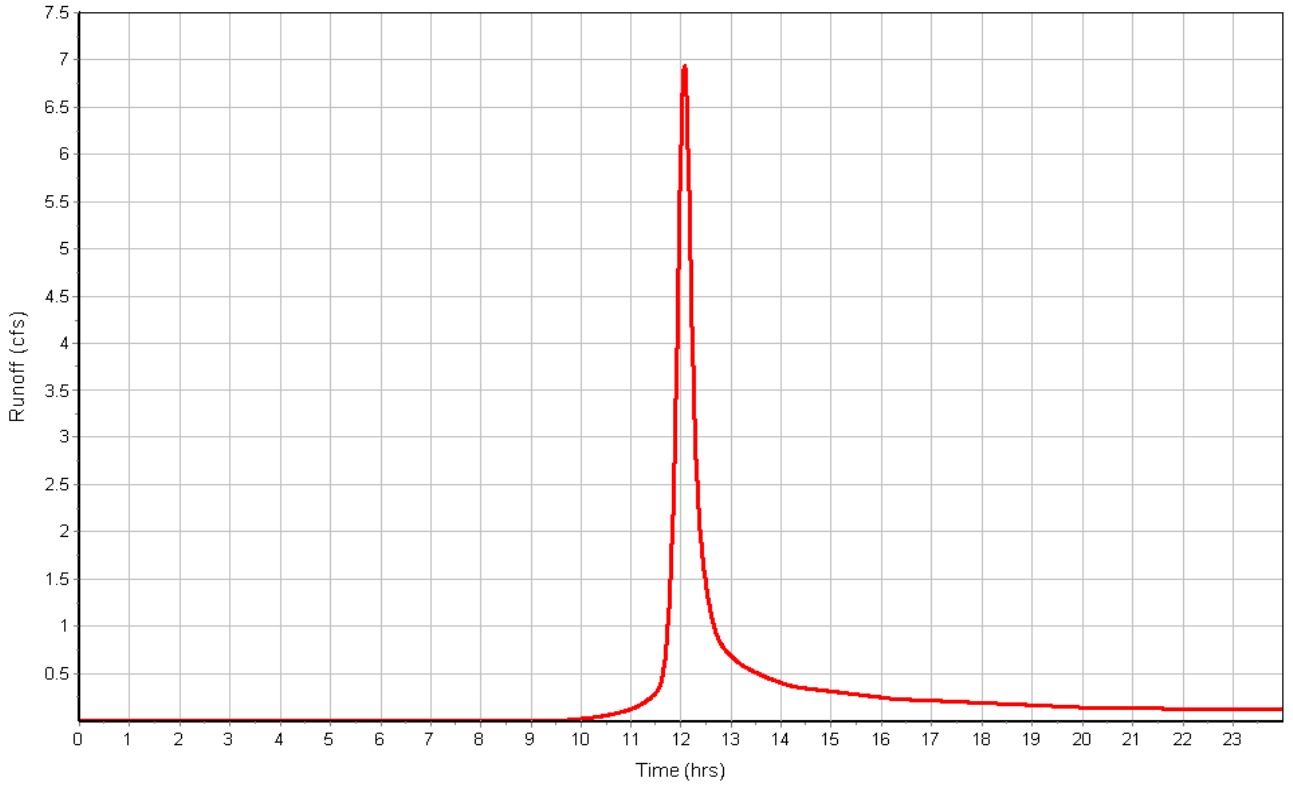
Total Rainfall (in) 4.49
Total Runoff (in) 1.96
Peak Runoff (cfs) 6.94
Weighted Curve Number 73.97
Time of Concentration (days hh:mm:ss) 0 00:17:10

Subbasin : NW7

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : S1

Input Data

Area (ac) 2.83
Weighted Curve Number 74.13
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	0.07	C	96.00
Grassed Landfill Cap	2.36	C	74.00
Meadow, non-grazed	0.40	C	71.00
Paved parking & roofs	0.00	C	98.00
Composite Area & Weighted CN	2.83		74.13

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.24	0.00	0.00
Flow Length (ft) :	166.736	0.00	0.00
Slope (%) :	24.89	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.31	0.00	0.00
Computed Flow Time (min) :	8.90	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.033	0.033	0.033
Flow Length (ft) :	387.213	124.591	30.932
Channel Slope (%) :	5	24.01	26.2
Cross Section Area (ft²) :	4.5	8.48	8.48
Wetted Perimeter (ft) :	6.17	10.9	10.9
Velocity (ft/sec) :	8.18	18.71	19.55
Computed Flow Time (min) :	0.79	0.11	0.03

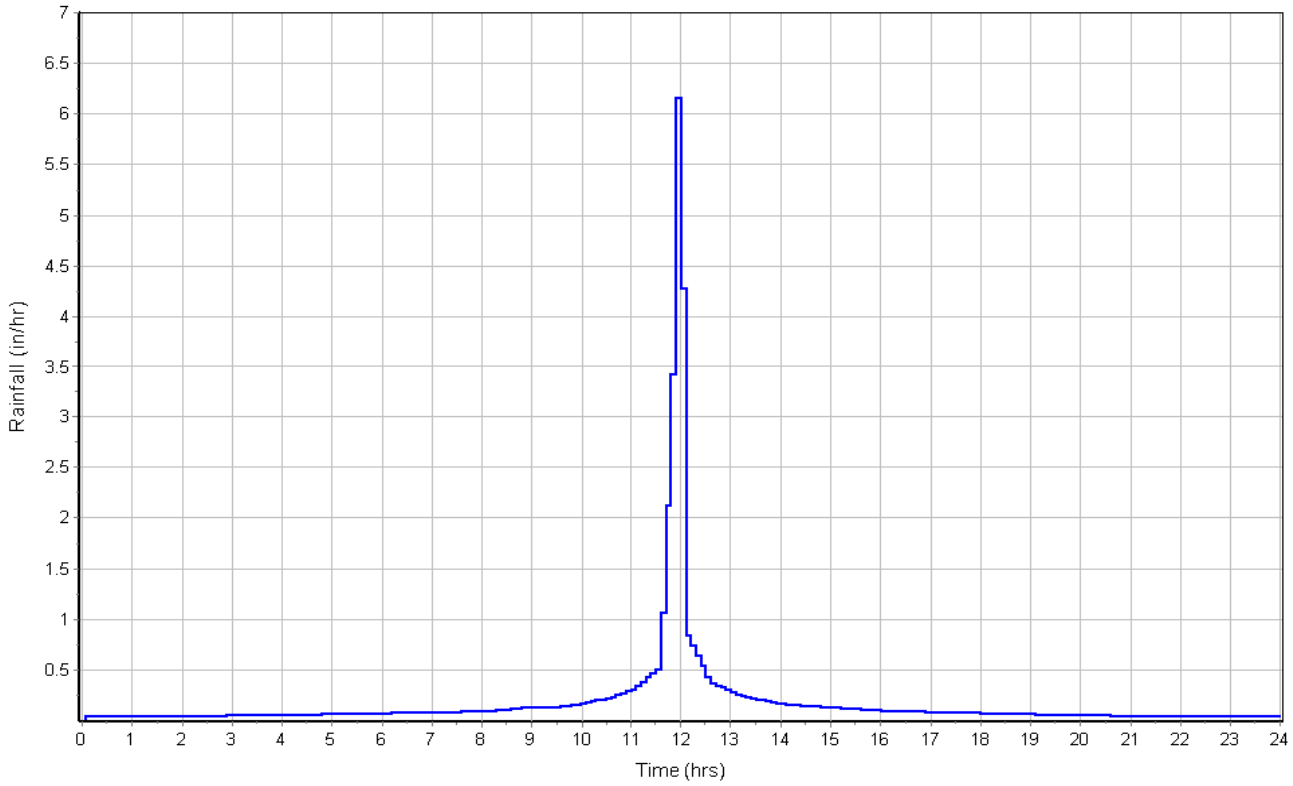
Total TOC (min) 9.83

Subbasin Runoff Results

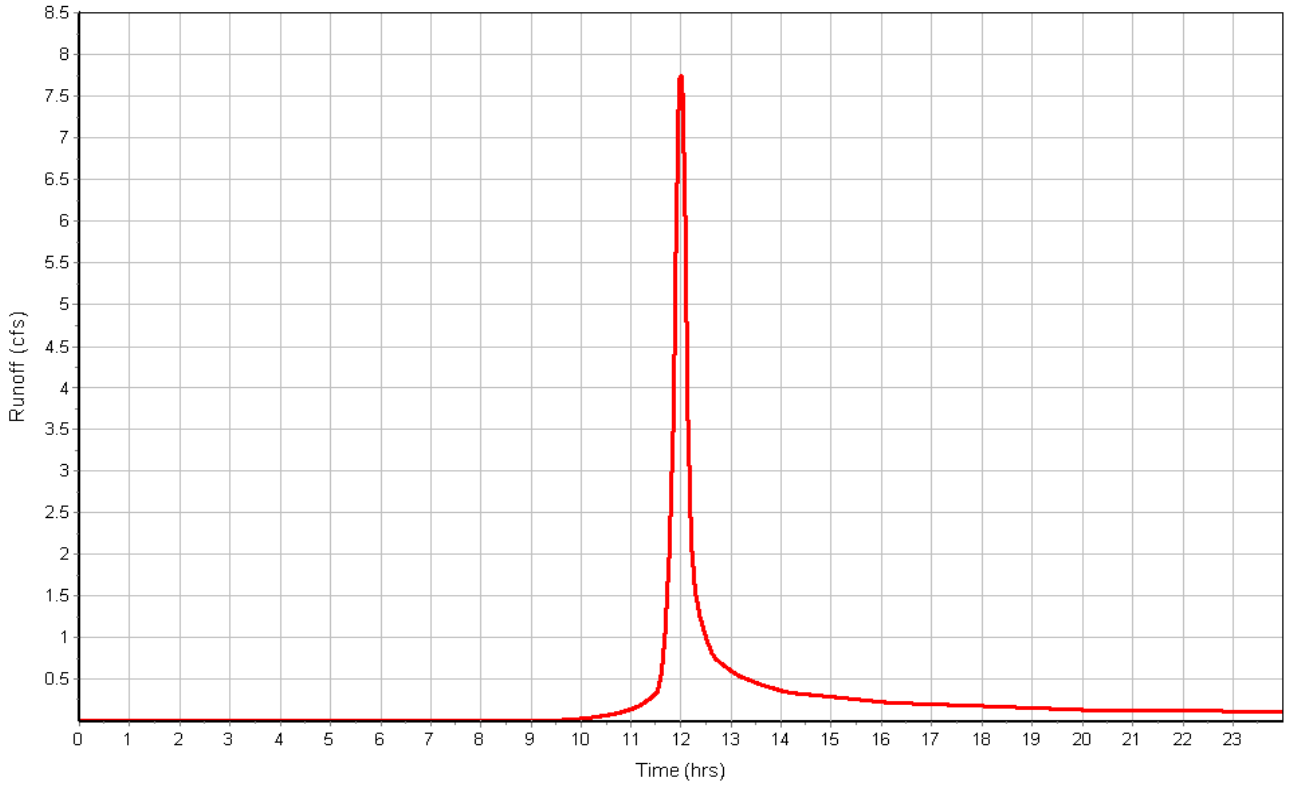
Total Rainfall (in) 4.49
Total Runoff (in) 1.98
Peak Runoff (cfs) 7.75
Weighted Curve Number 74.13
Time of Concentration (days hh:mm:ss) 0 00:09:50

Subbasin : S1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : S2

Input Data

Area (ac) 11.17
Weighted Curve Number 75.69
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	0.97	C	96.00
Meadow, non-grazed	0.82	C	71.00
Grassed Landfill Cap	9.38	C	74.00
Composite Area & Weighted CN	11.17		75.69

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.24	0.24	0.00
Flow Length (ft) :	51.891	140.446	0.00
Slope (%) :	5	24.8	0.00
2 yr, 24 hr Rainfall (in) :	2.48	2.48	0.00
Velocity (ft/sec) :	0.13	0.30	0.00
Computed Flow Time (min) :	6.65	7.77	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.033	0.033	0.033
Flow Length (ft) :	976.434	527.099	42.478
Channel Slope (%) :	5	12.97	16.41
Cross Section Area (ft^2) :	4.5	9.63	9.63
Wetted Perimeter (ft) :	6.71	9.62	9.62
Velocity (ft/sec) :	7.74	16.27	18.30
Computed Flow Time (min) :	2.10	0.54	0.04

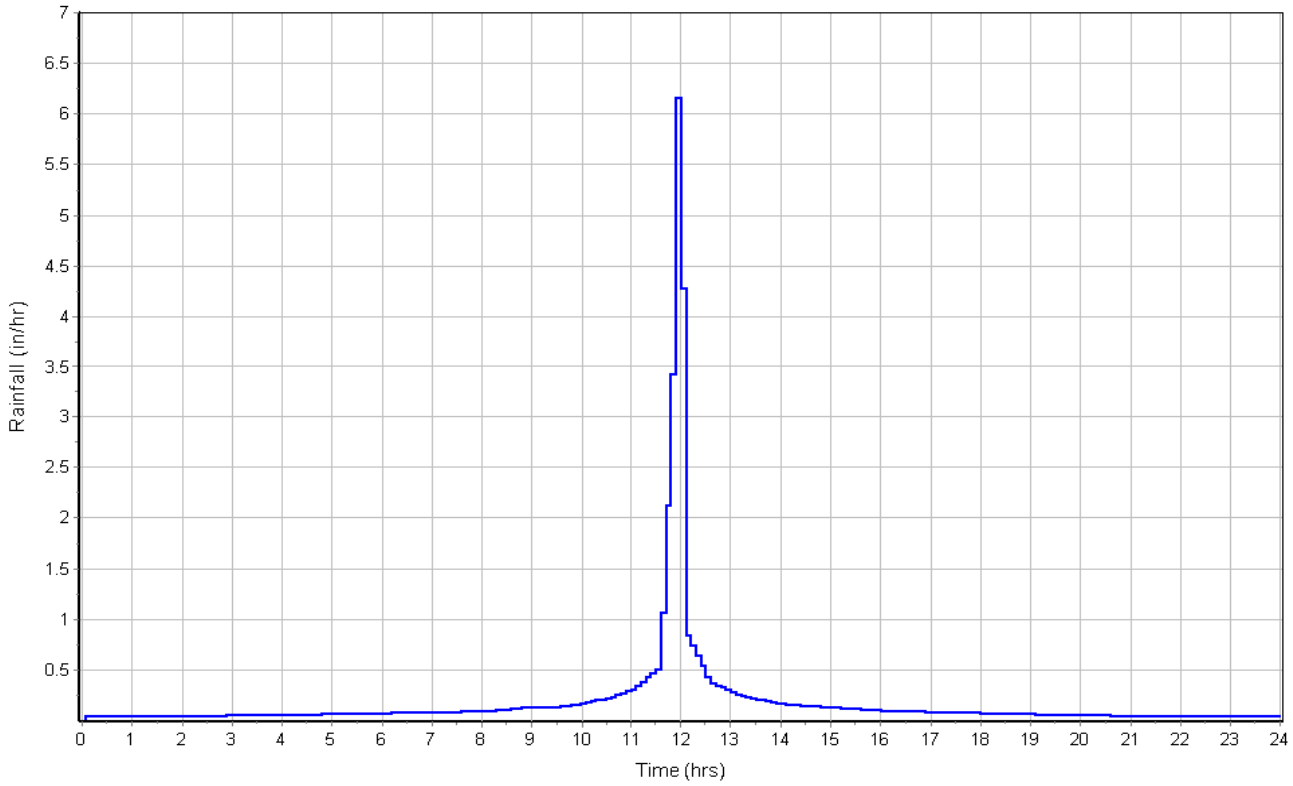
Total TOC (min) 17.10

Subbasin Runoff Results

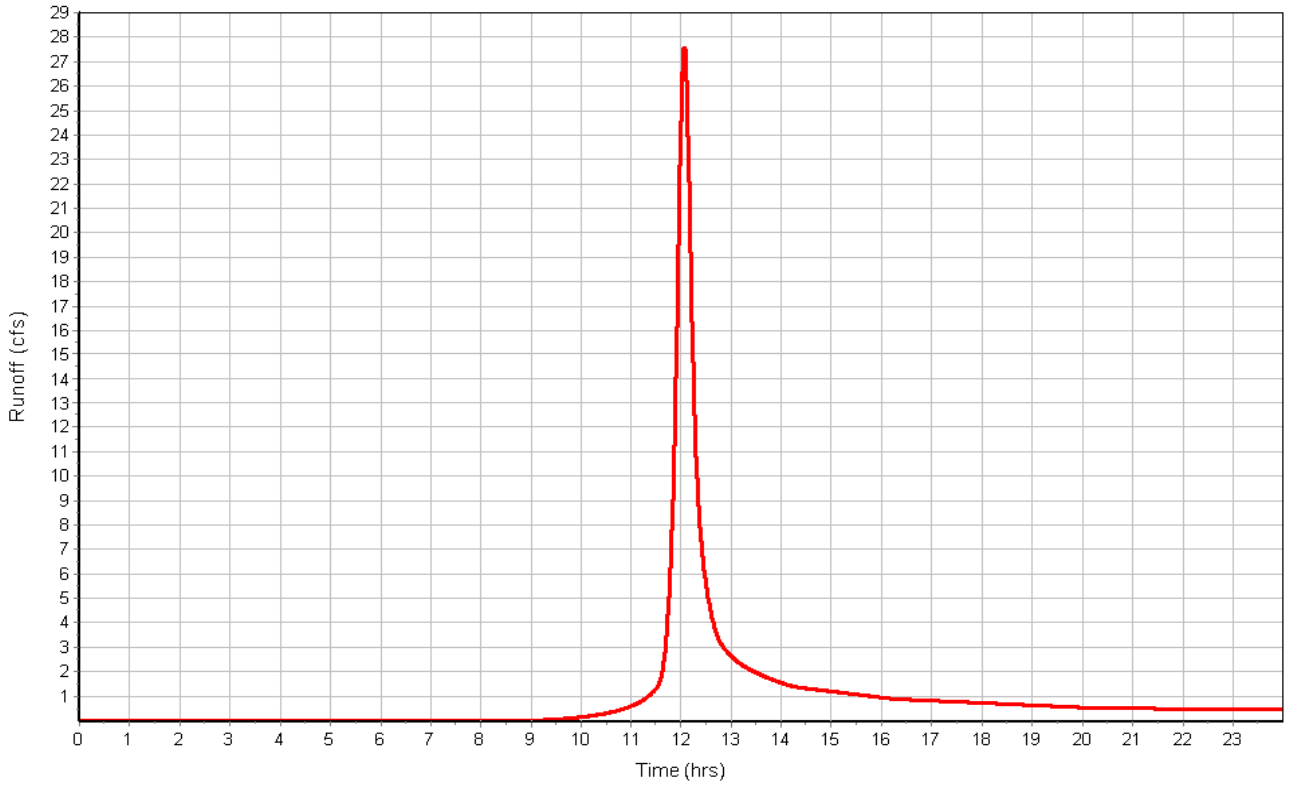
Total Rainfall (in) 4.49
Total Runoff (in) 2.10
Peak Runoff (cfs) 27.56
Weighted Curve Number 75.69
Time of Concentration (days hh:mm:ss) 0 00:17:06

Subbasin : S2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : S3

Input Data

Area (ac) 7.51
Weighted Curve Number 74.16
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.31	C	96.00
Grassed Landfill Cap	5.31	C	74.00
Meadow, non-grazed	1.89	C	71.00
Composite Area & Weighted CN	7.51		74.16

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.24	0.00	0.00
Flow Length (ft) :	167.369	0.00	0.00
Slope (%) :	21.81	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.30	0.00	0.00
Computed Flow Time (min) :	9.41	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.033	0.033	0.033
Flow Length (ft) :	170.12	152.767	18.691
Channel Slope (%) :	5	24.87	33.07
Cross Section Area (ft^2) :	4.5	8.48	8.48
Wetted Perimeter (ft) :	6.71	10.9	10.9
Velocity (ft/sec) :	7.74	19.05	21.96
Computed Flow Time (min) :	0.37	0.13	0.01

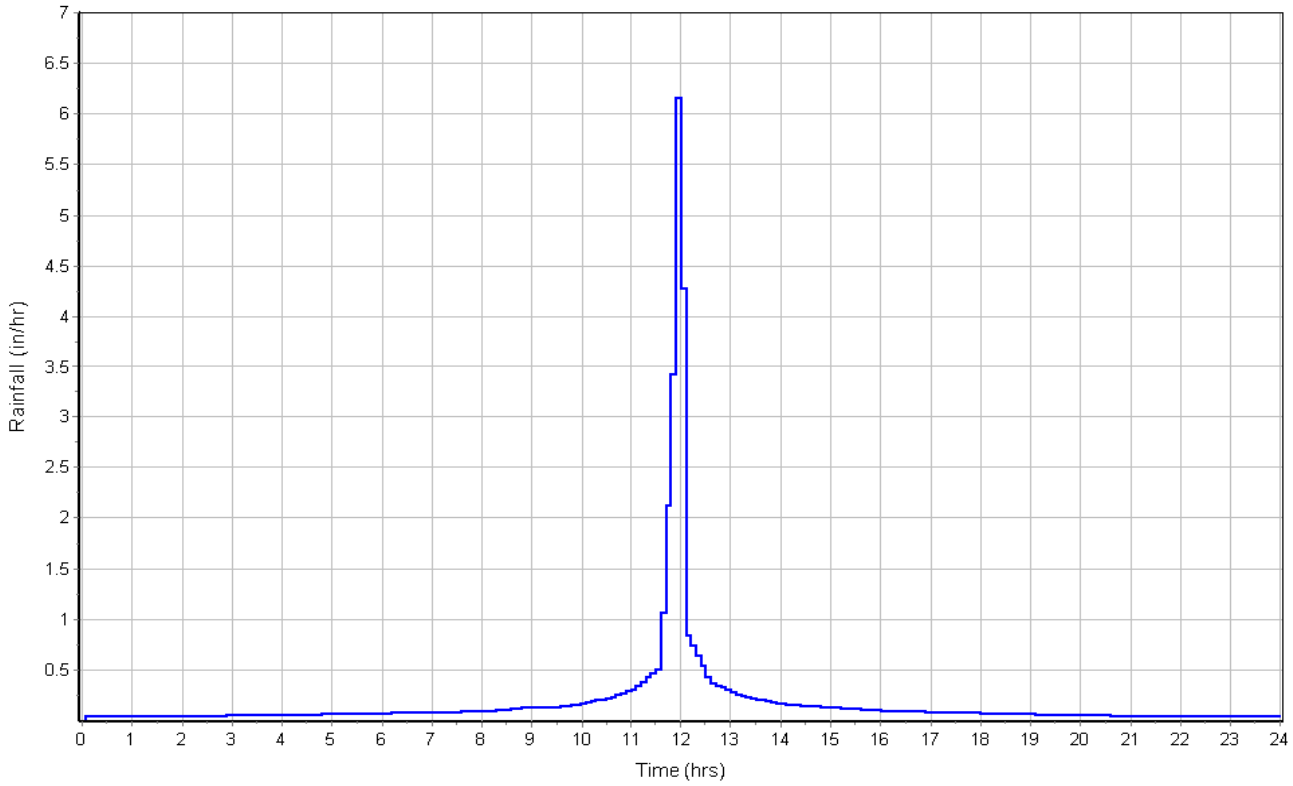
Total TOC (min) 9.93

Subbasin Runoff Results

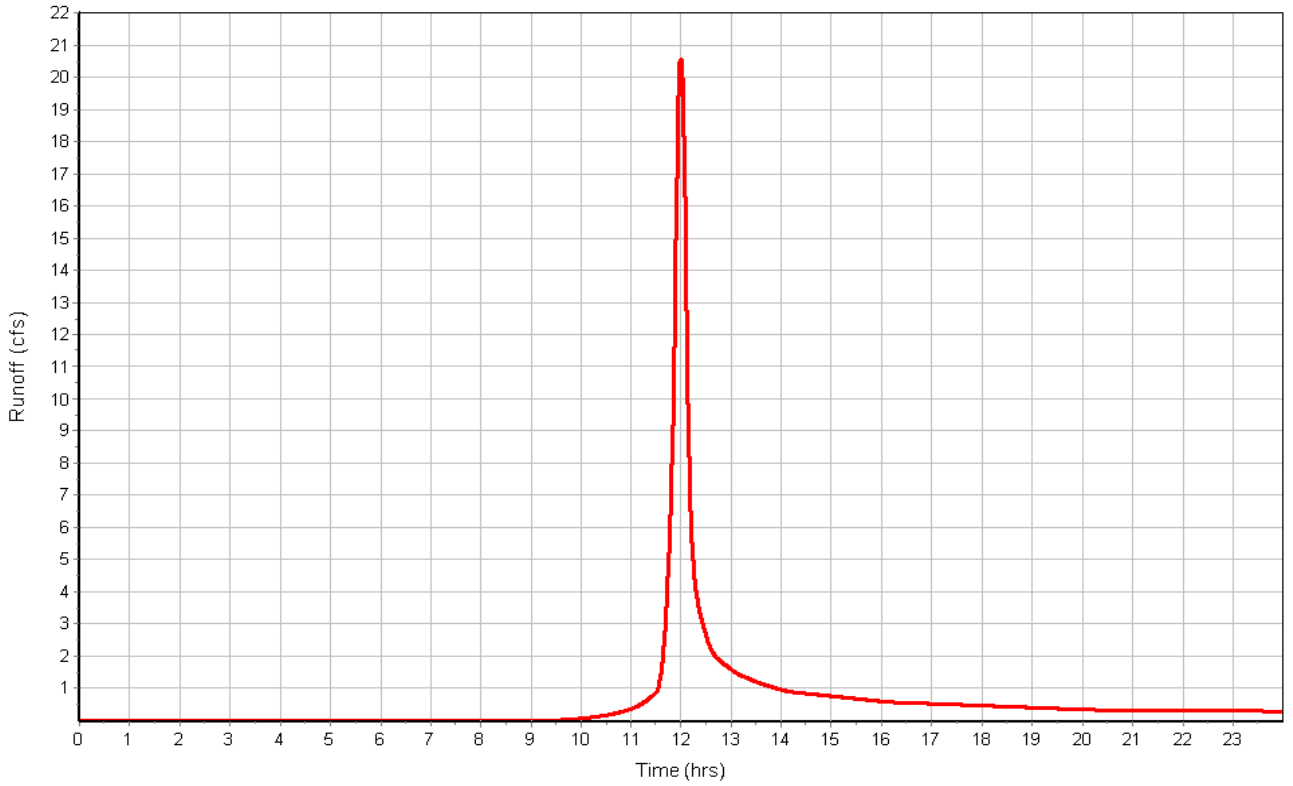
Total Rainfall (in) 4.49
Total Runoff (in) 1.98
Peak Runoff (cfs) 20.57
Weighted Curve Number 74.16
Time of Concentration (days hh:mm:ss) 0 00:09:56

Subbasin : S3

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-1

Input Data

Area (ac) 20.91
Weighted Curve Number 71.02
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	17.73	C	70.00
Meadow, non-grazed	0.29	C	71.00
Meadow, non-grazed	0.91	D	78.00
Woods,Good	1.97	D	77.00
Composite Area & Weighted CN	20.90		71.02

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.6	0.00	0.00
Flow Length (ft) :	41.87	0.00	0.00
Slope (%) :	6.80	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.07	0.00	0.00
Computed Flow Time (min) :	10.31	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1147	788	346
Slope (%) :	7.47	3.74	1.91
Surface Type :	Woodland	Woodland	Woodland
Velocity (ft/sec) :	1.37	0.97	0.69
Computed Flow Time (min) :	13.95	13.54	8.36

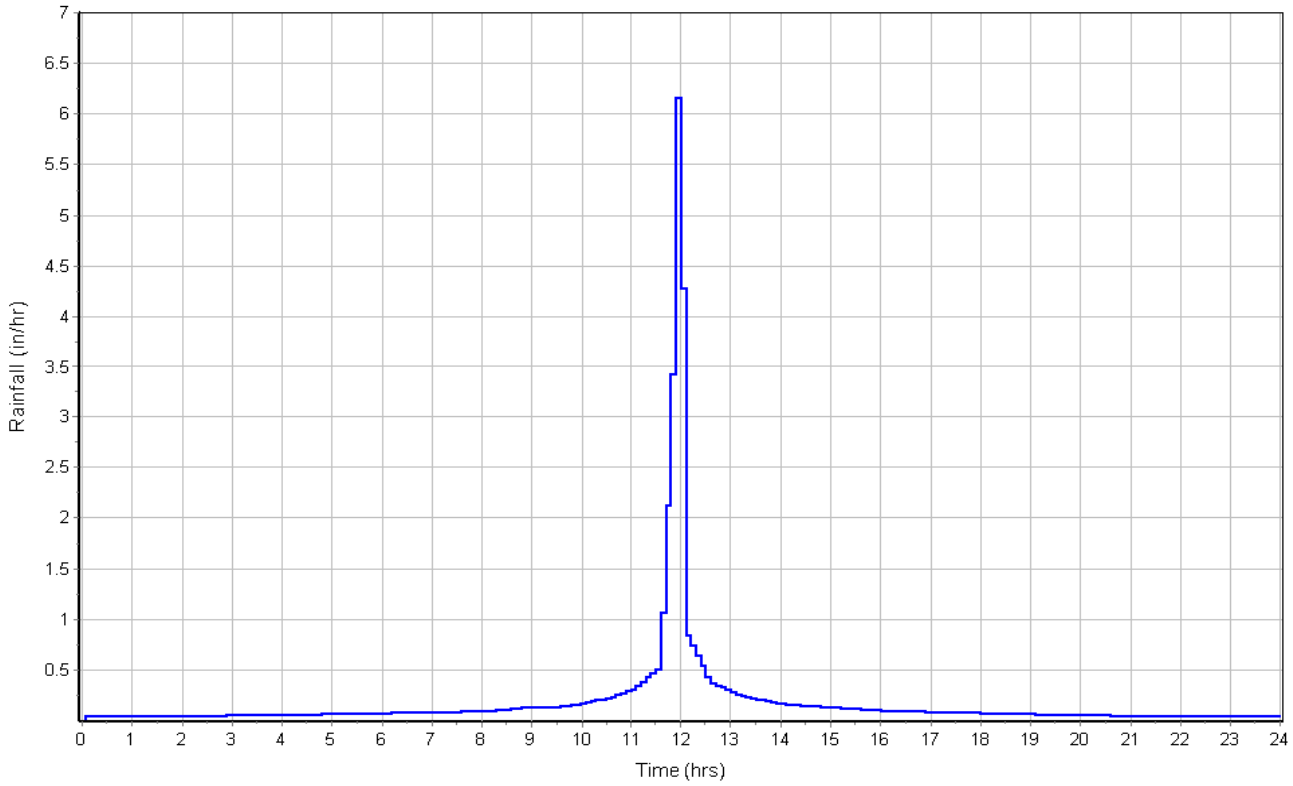
Total TOC (min) 46.16

Subbasin Runoff Results

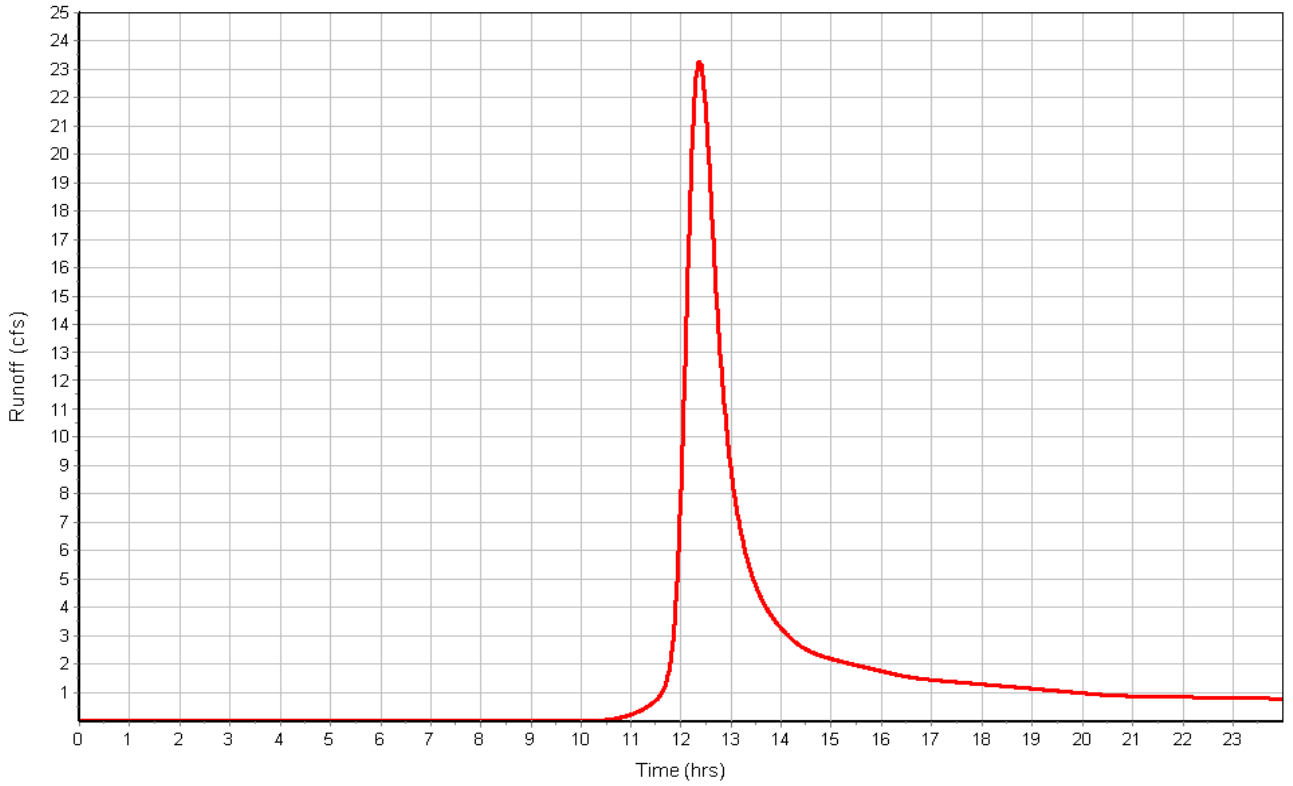
Total Rainfall (in) 4.49
Total Runoff (in) 1.74
Peak Runoff (cfs) 23.29
Weighted Curve Number 71.02
Time of Concentration (days hh:mm:ss) 0 00:46:10

Subbasin : SE-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-10

Input Data

Area (ac) 3.44
Weighted Curve Number 81.02
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
FinalCap-Grass	2.27	C	74.00
Swale, riprap over soils	0.50	C	93.00
Paved roads	0.66	C	96.00
Composite Area & Weighted CN	3.43		81.02

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.24	0.24	0.00
Flow Length (ft) :	43.858	45.816	0.00
Slope (%) :	33.38	4.24	0.00
2 yr, 24 hr Rainfall (in) :	2.48	2.48	0.00
Velocity (ft/sec) :	0.27	0.12	0.00
Computed Flow Time (min) :	2.72	6.43	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	45.056	0.00	0.00
Slope (%) :	4.31	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.45	0.00	0.00
Computed Flow Time (min) :	0.52	0.00	0.00

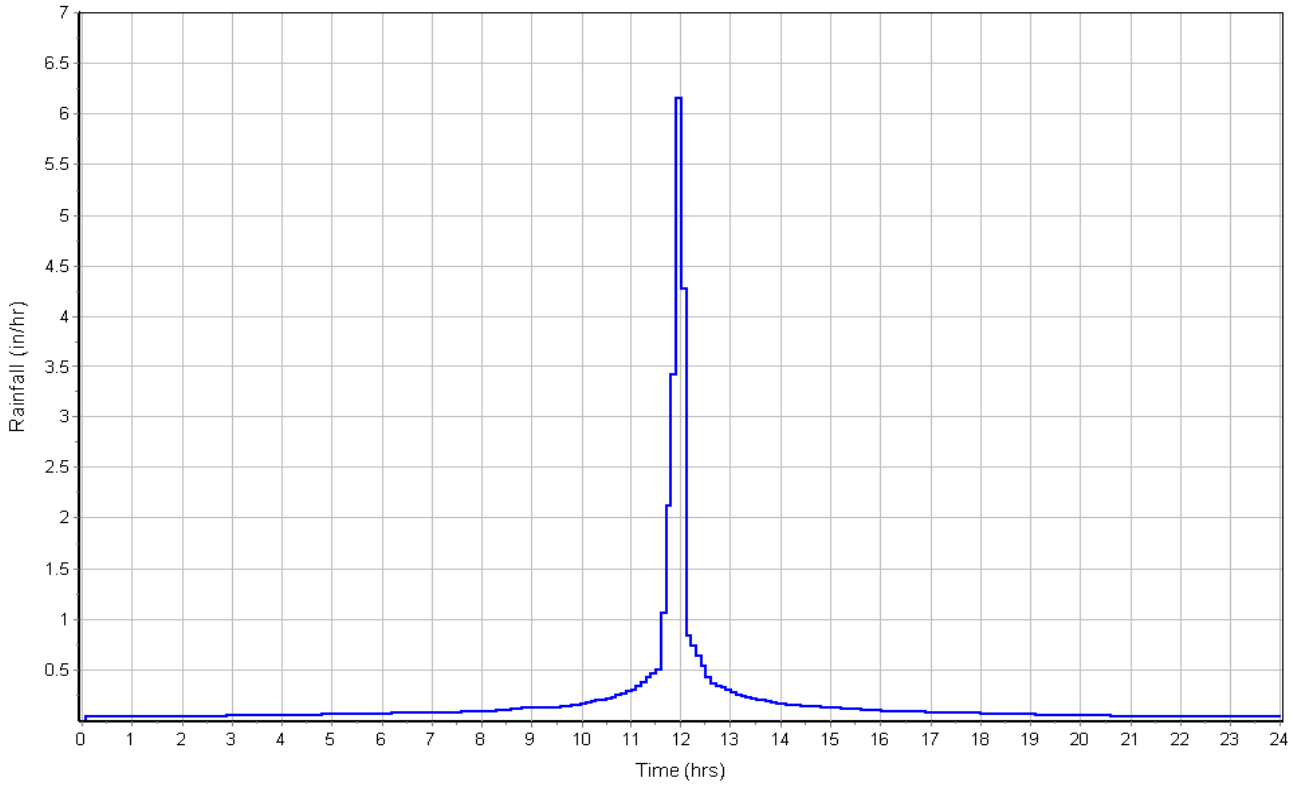
Total TOC (min) 9.66

Subbasin Runoff Results

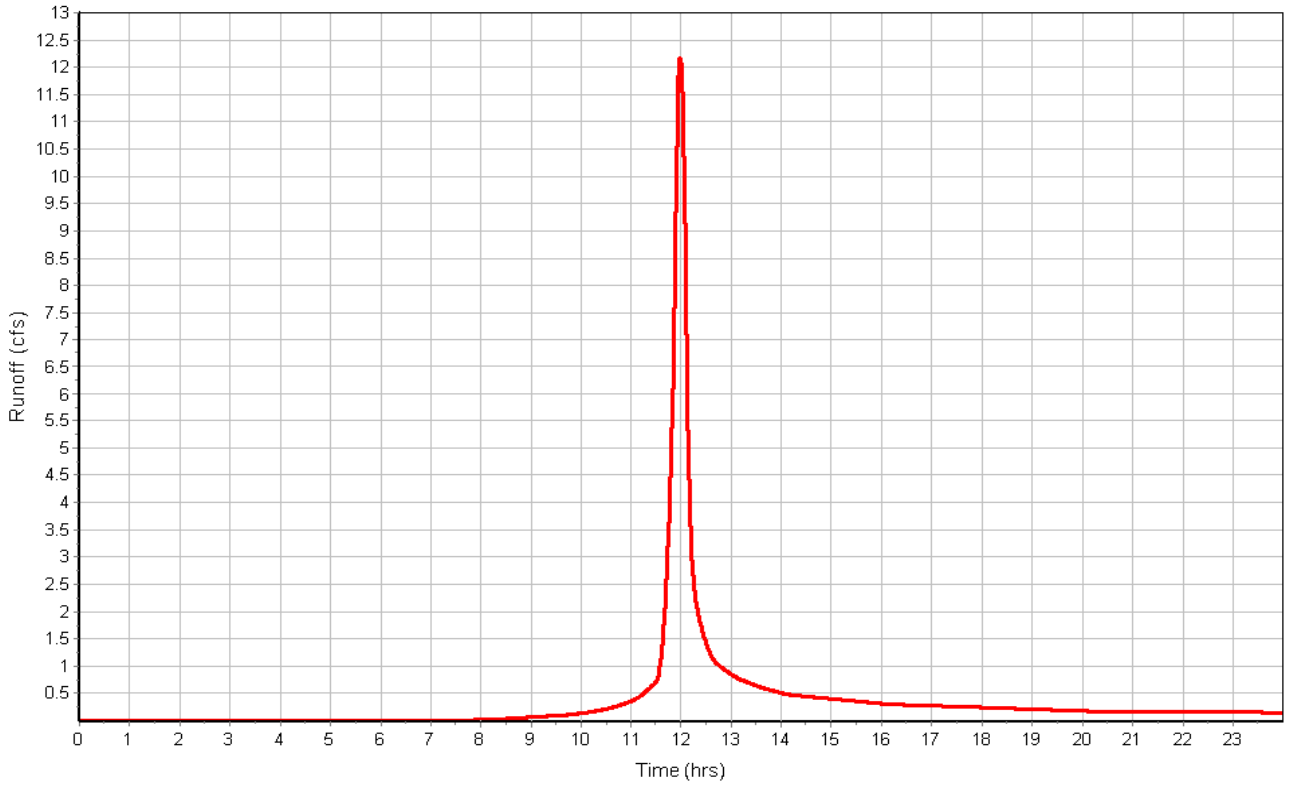
Total Rainfall (in) 4.49
Total Runoff (in) 2.54
Peak Runoff (cfs) 12.18
Weighted Curve Number 81.02
Time of Concentration (days hh:mm:ss) 0 00:09:40

Subbasin : SE-10

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-11

Input Data

Area (ac) 3.60
Weighted Curve Number 77.72
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Landfill cap, interim (exposed geomembrane), 100% imp	2.95	C	74.00
Swale, riprap over soils	0.30	C	93.00
Paved roads	0.35	C	96.00
Composite Area & Weighted CN	3.60		77.72

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.24	0.00	0.00
Flow Length (ft) :	212.627	0.00	0.00
Slope (%) :	26.79	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.34	0.00	0.00
Computed Flow Time (min) :	10.50	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.033	0.033	0.033
Flow Length (ft) :	275.895	219.638	24.578
Channel Slope (%) :	5	33.33	21.59
Cross Section Area (ft^2) :	4.5	8.48	8.48
Wetted Perimeter (ft) :	6.71	10.9	10.9
Velocity (ft/sec) :	7.74	22.05	17.75
Computed Flow Time (min) :	0.59	0.17	0.02

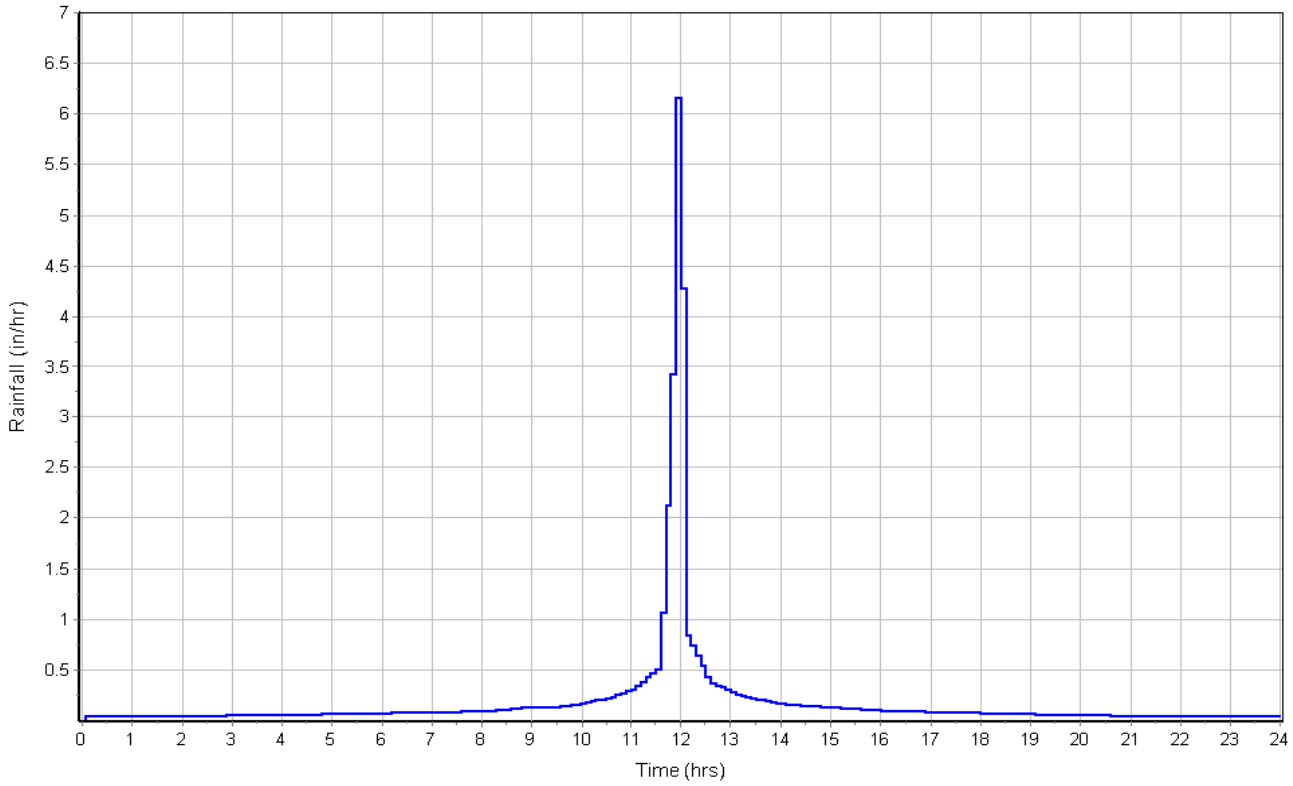
Total TOC (min) 11.28

Subbasin Runoff Results

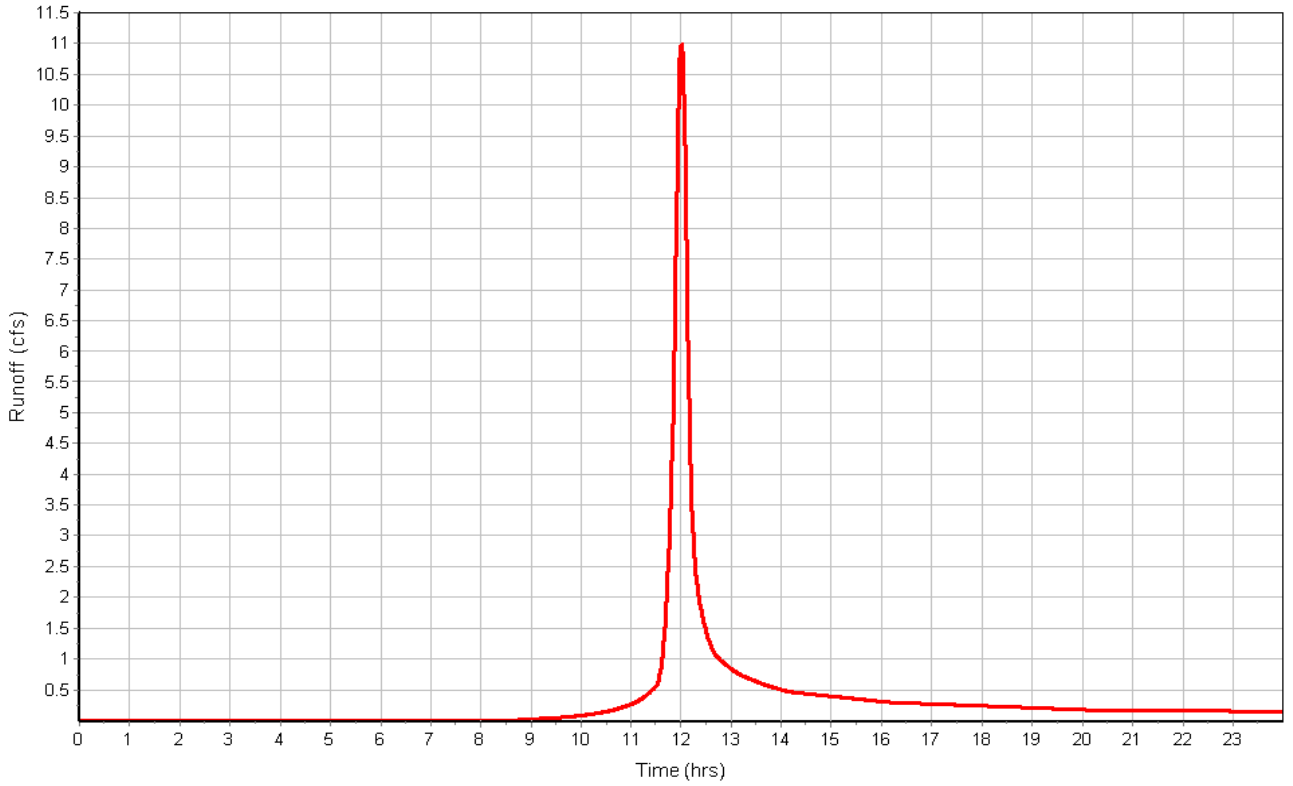
Total Rainfall (in) 4.49
Total Runoff (in) 2.26
Peak Runoff (cfs) 10.99
Weighted Curve Number 77.72
Time of Concentration (days hh:mm:ss) 0 00:11:17

Subbasin : SE-11

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-12

Input Data

Area (ac) 4.97
Weighted Curve Number 81.82
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Meadow, non-grazed	2.06	C	71.00
Meadow	1.24	D	78.00
Impervious,Pond	1.67	C	98.00
Composite Area & Weighted CN	4.97		81.82

Time of Concentration

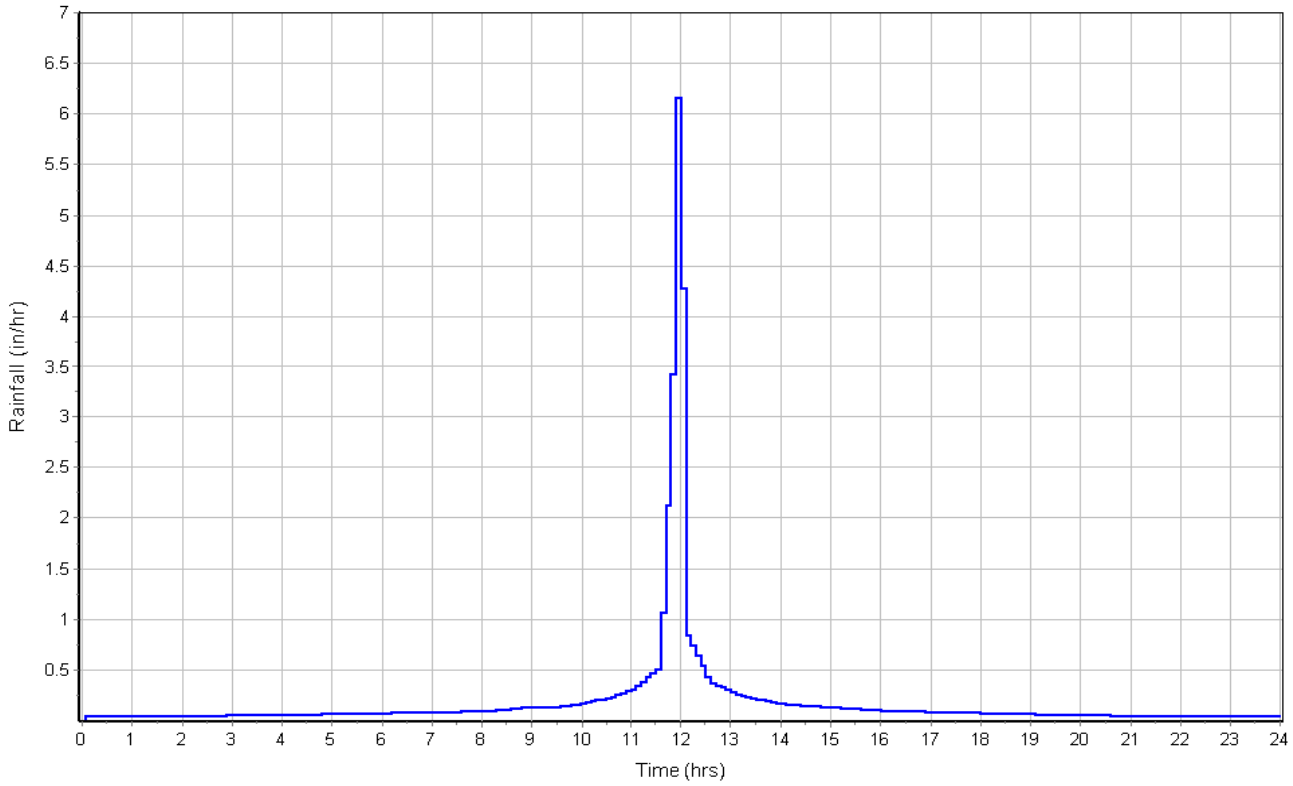
User-Defined TOC override (minutes): 6

Subbasin Runoff Results

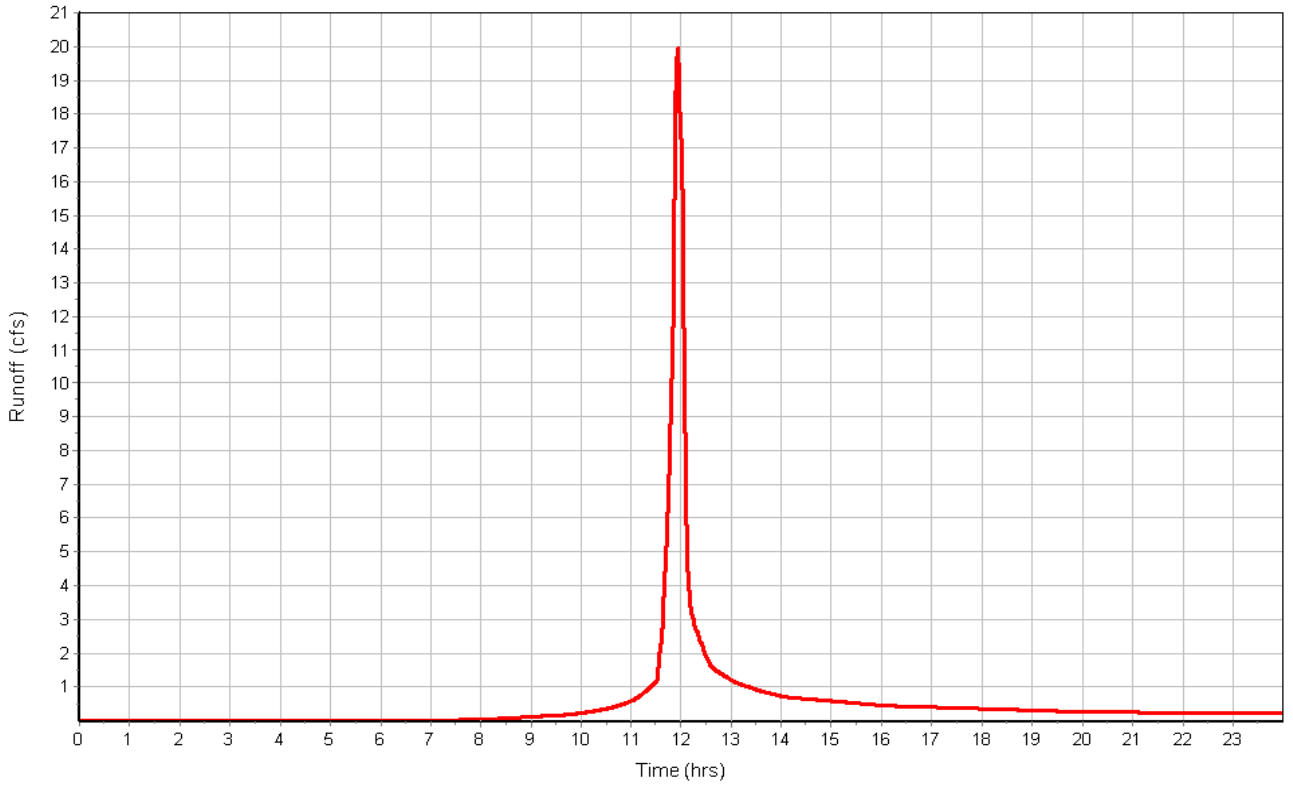
Total Rainfall (in) 4.49
Total Runoff (in) 2.61
Peak Runoff (cfs) 19.97
Weighted Curve Number 81.82
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : SE-12

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-13

Input Data

Area (ac) 2.03
Weighted Curve Number 73.24
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Meadow, non-grazed	1.84	C	71.00
Gravel roads	0.18	D	96.00
Woods	0.00	C	70.00
Composite Area & Weighted CN	2.02		73.24

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.24	0.00	0.00
Flow Length (ft) :	20	0.00	0.00
Slope (%) :	33.33	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.23	0.00	0.00
Computed Flow Time (min) :	1.45	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	144	102.67	0.00
Slope (%) :	2.64	0.43	0.00
Surface Type :	Woodland	Grassed waterwa	Unpaved
Velocity (ft/sec) :	0.81	0.98	0.00
Computed Flow Time (min) :	2.96	1.75	0.00

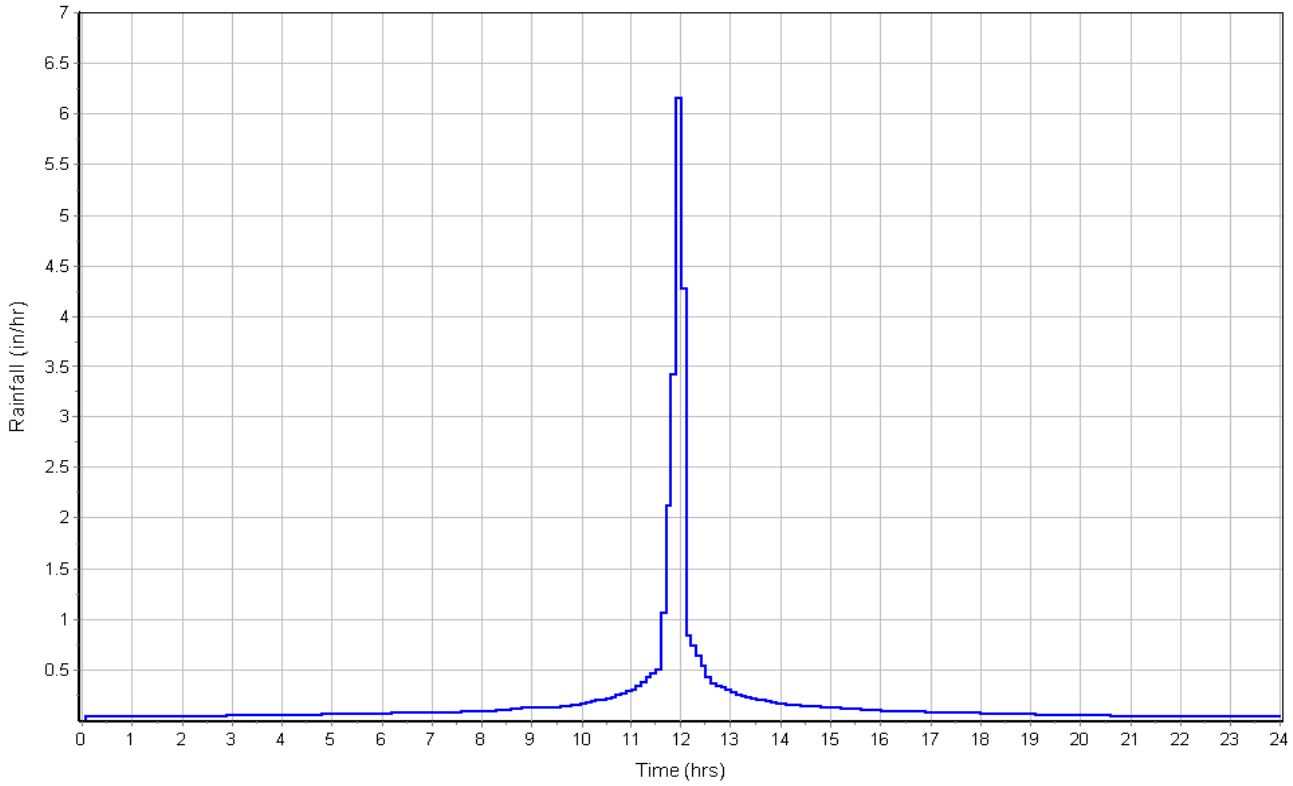
Total TOC (min) 6.16

Subbasin Runoff Results

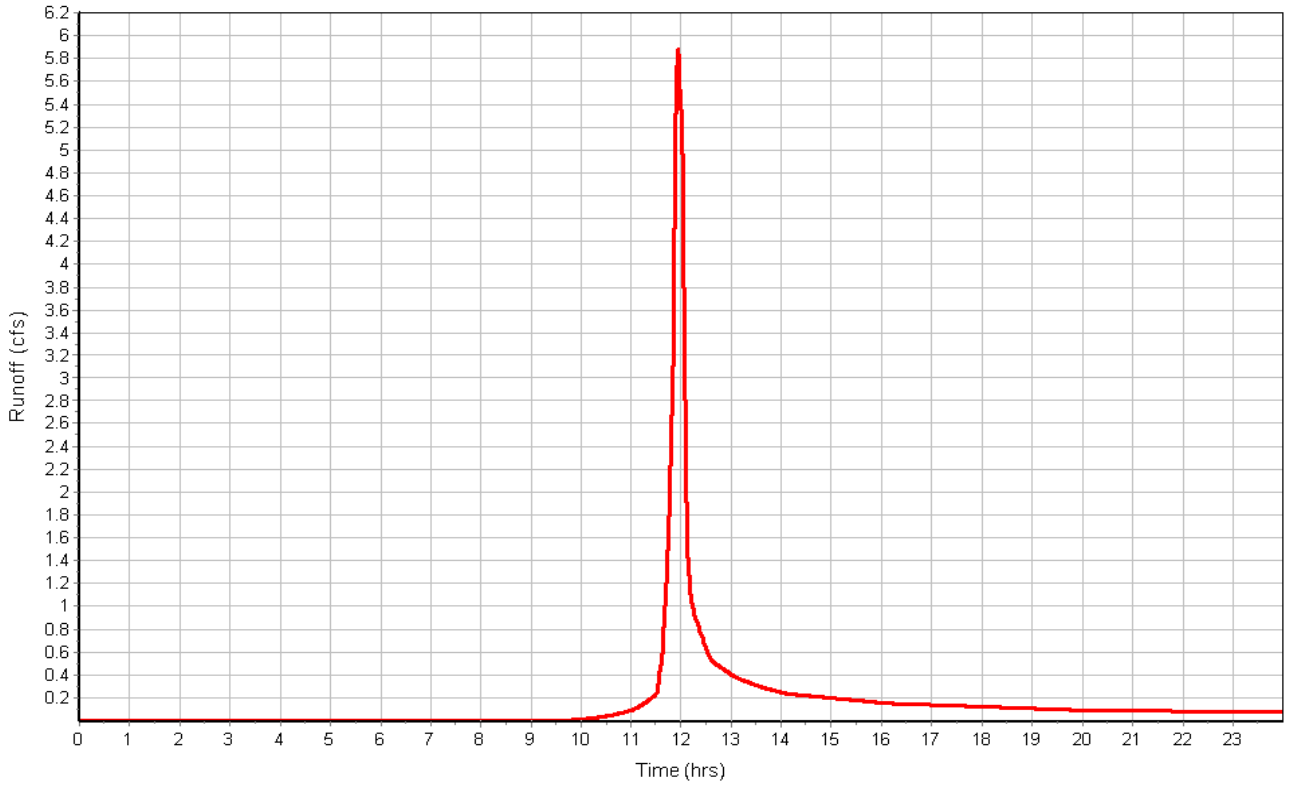
Total Rainfall (in) 4.49
Total Runoff (in) 1.91
Peak Runoff (cfs) 5.89
Weighted Curve Number 73.24
Time of Concentration (days hh:mm:ss) 0 00:06:10

Subbasin : SE-13

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-14

Input Data

Area (ac) 2.20
Weighted Curve Number 77.76
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Meadow, non-grazed	1.64	C	71.00
Pond	0.41	D	98.00
Gravel,Road	0.15	C	96.00
Composite Area & Weighted CN	2.20		77.76

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.24	0.00	0.00
Flow Length (ft) :	75.869	0.00	0.00
Slope (%) :	14	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.21	0.00	0.00
Computed Flow Time (min) :	5.97	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	367.727	0.00	0.00
Slope (%) :	2.88	0.00	0.00
Surface Type :	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec) :	2.55	0.00	0.00
Computed Flow Time (min) :	2.40	0.00	0.00

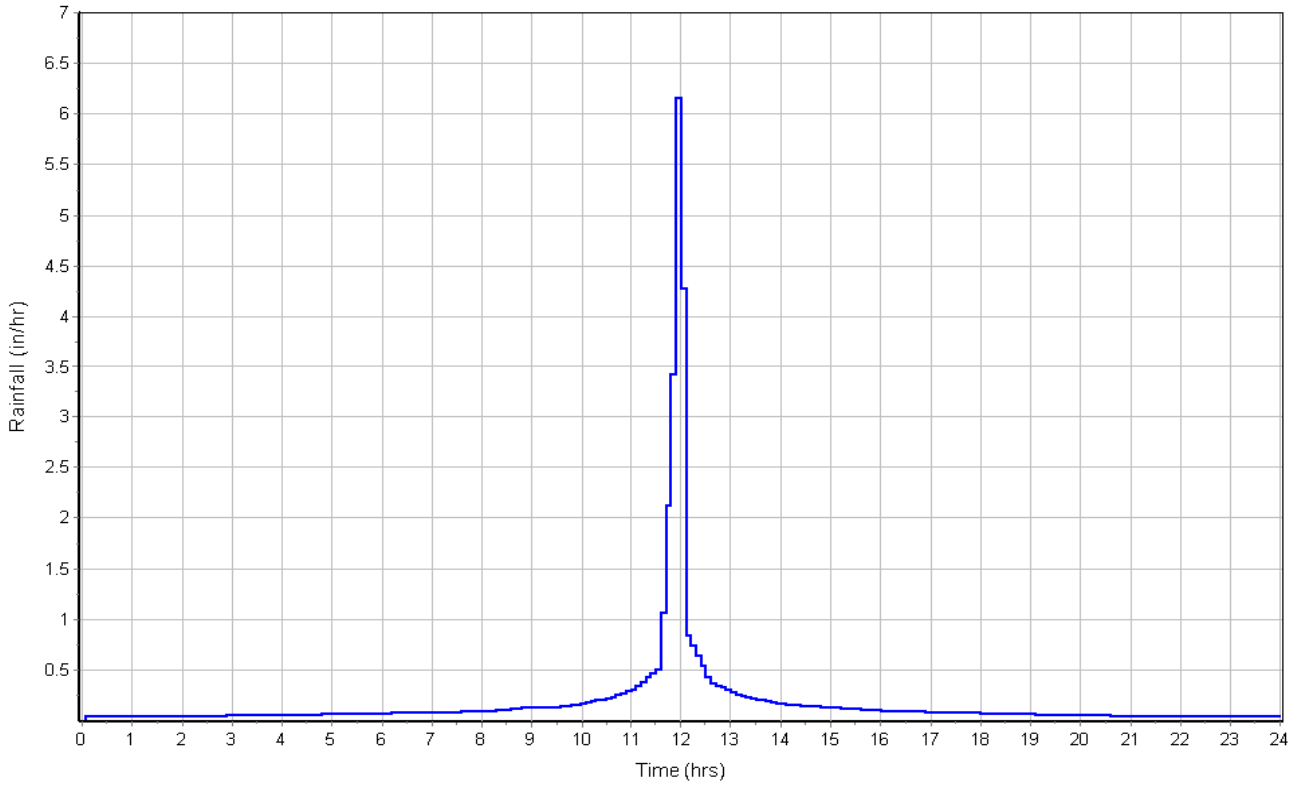
Total TOC (min) 8.37

Subbasin Runoff Results

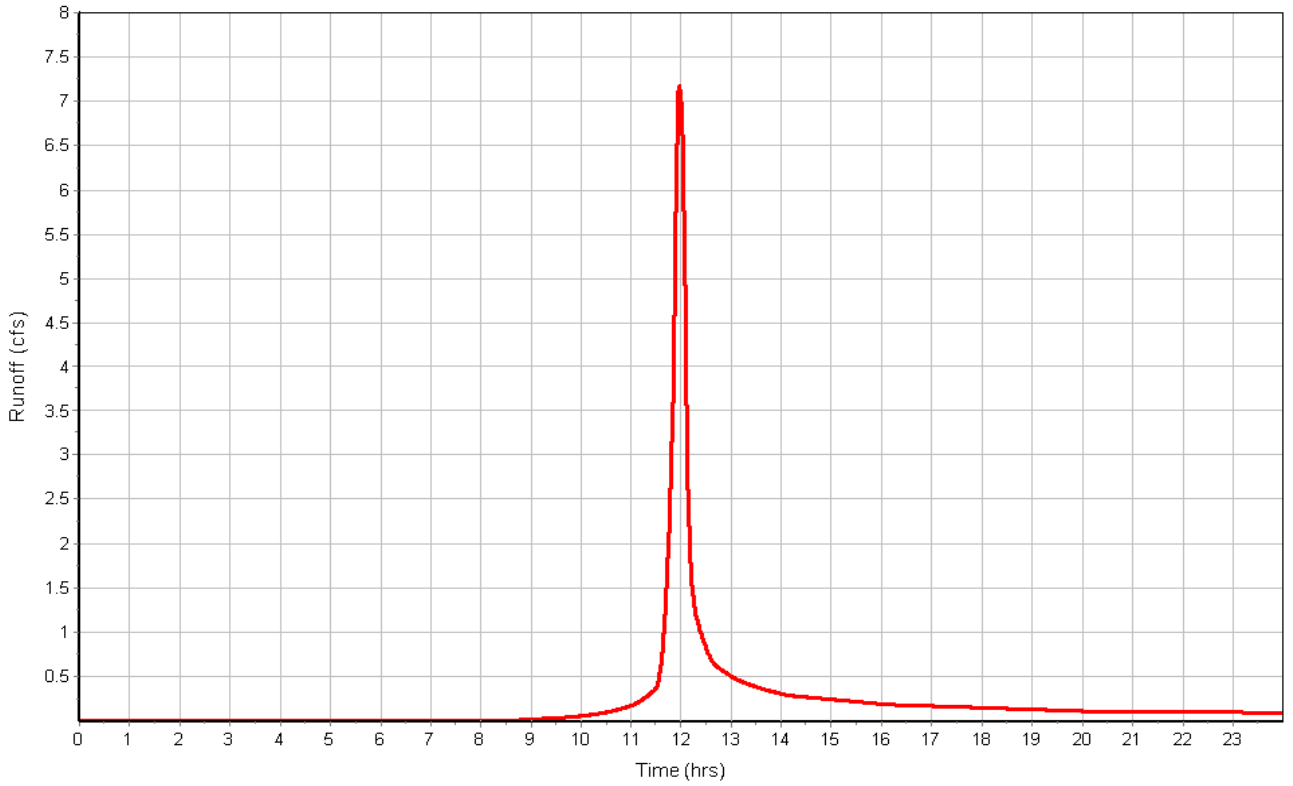
Total Rainfall (in) 4.49
Total Runoff (in) 2.27
Peak Runoff (cfs) 7.18
Weighted Curve Number 77.76
Time of Concentration (days hh:mm:ss) 0 00:08:22

Subbasin : SE-14

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-15

Input Data

Area (ac) 10.09
Weighted Curve Number 73.22
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Meadow,non-grazed	3.19	C	71.00
Woods	2.44	C	70.00
Gravel,Road	0.00	C	96.00
Meadow,non-grazed	3.13	D	78.00
Composite Area & Weighted CN	8.76		73.22

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.24	.6	0.00
Flow Length (ft) :	25	24.733	0.00
Slope (%) :	40	6.73	0.00
2 yr, 24 hr Rainfall (in) :	2.48	2.48	0.00
Velocity (ft/sec) :	0.26	0.06	0.00
Computed Flow Time (min) :	1.61	6.79	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	120.942	429.581	283.342
Slope (%) :	3.27	2.55	1.64
Surface Type :	Woodland	Woodland	ıssed waterway
Velocity (ft/sec) :	0.90	0.80	1.92
Computed Flow Time (min) :	2.24	8.95	2.46

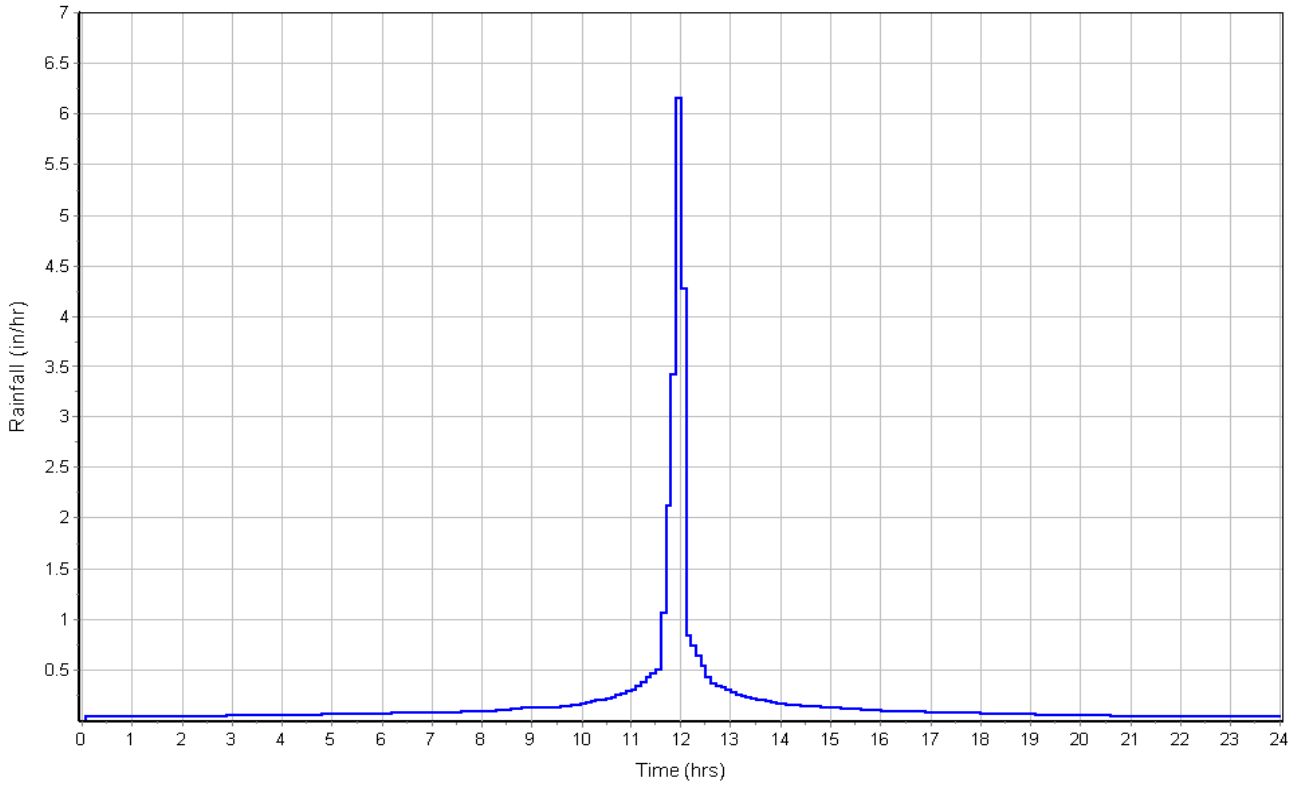
Total TOC (min) 22.05

Subbasin Runoff Results

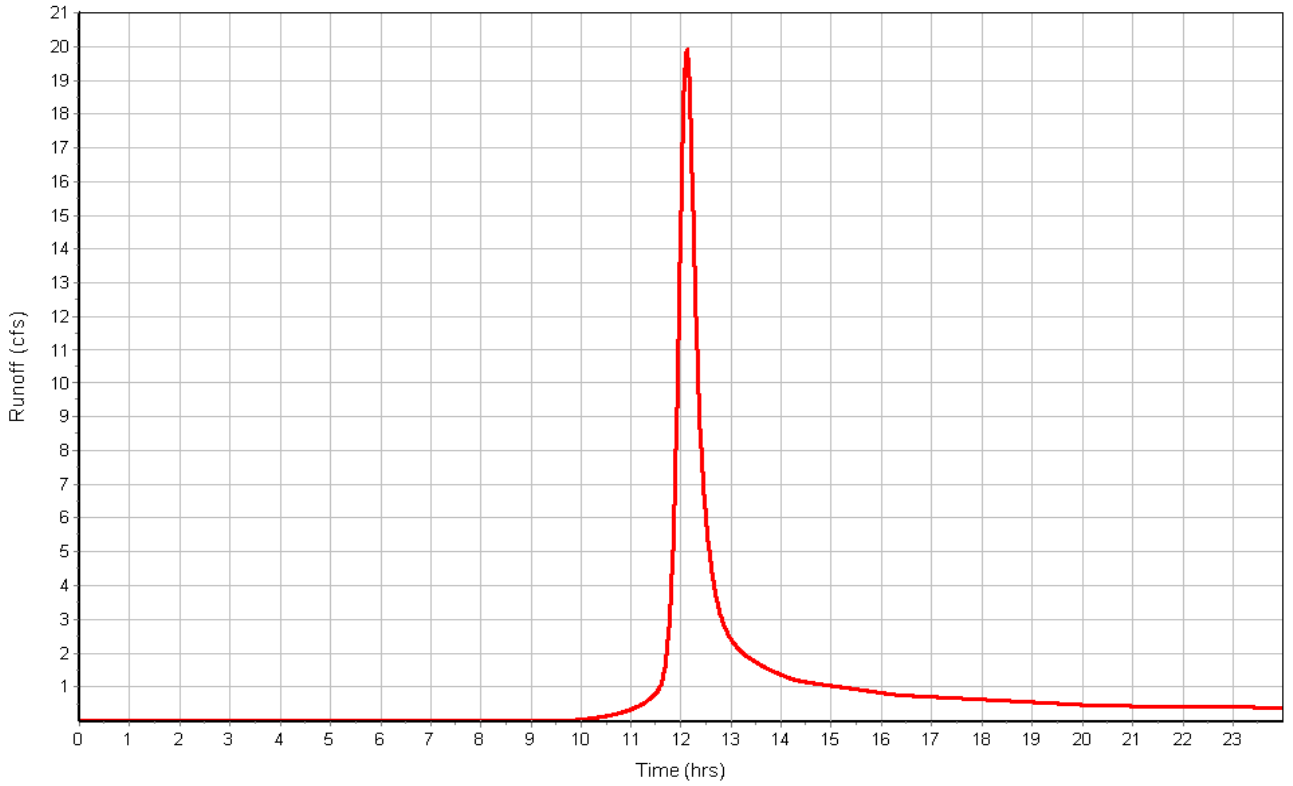
Total Rainfall (in) 4.49
Total Runoff (in) 1.91
Peak Runoff (cfs) 19.92
Weighted Curve Number 73.22
Time of Concentration (days hh:mm:ss) 0 00:22:03

Subbasin : SE-15

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-2

Input Data

Area (ac) 19.47
Weighted Curve Number 70.16
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	18.86	C	70.00
Woods, Good	0.14	D	77.00
Meadow, non-grazed	0.41	C	71.00
Gravel pavements, 100% imp	0.07	C	96.00
Composite Area & Weighted CN	19.48		70.16

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.6	0.00	0.00
Flow Length (ft) :	36.92	0.00	0.00
Slope (%) :	5.87	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.06	0.00	0.00
Computed Flow Time (min) :	9.88	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1130	99	855
Slope (%) :	7.41	0.7	3.18
Surface Type :	Woodland	Woodland	Woodland
Velocity (ft/sec) :	1.36	0.42	0.89
Computed Flow Time (min) :	13.85	3.93	16.01

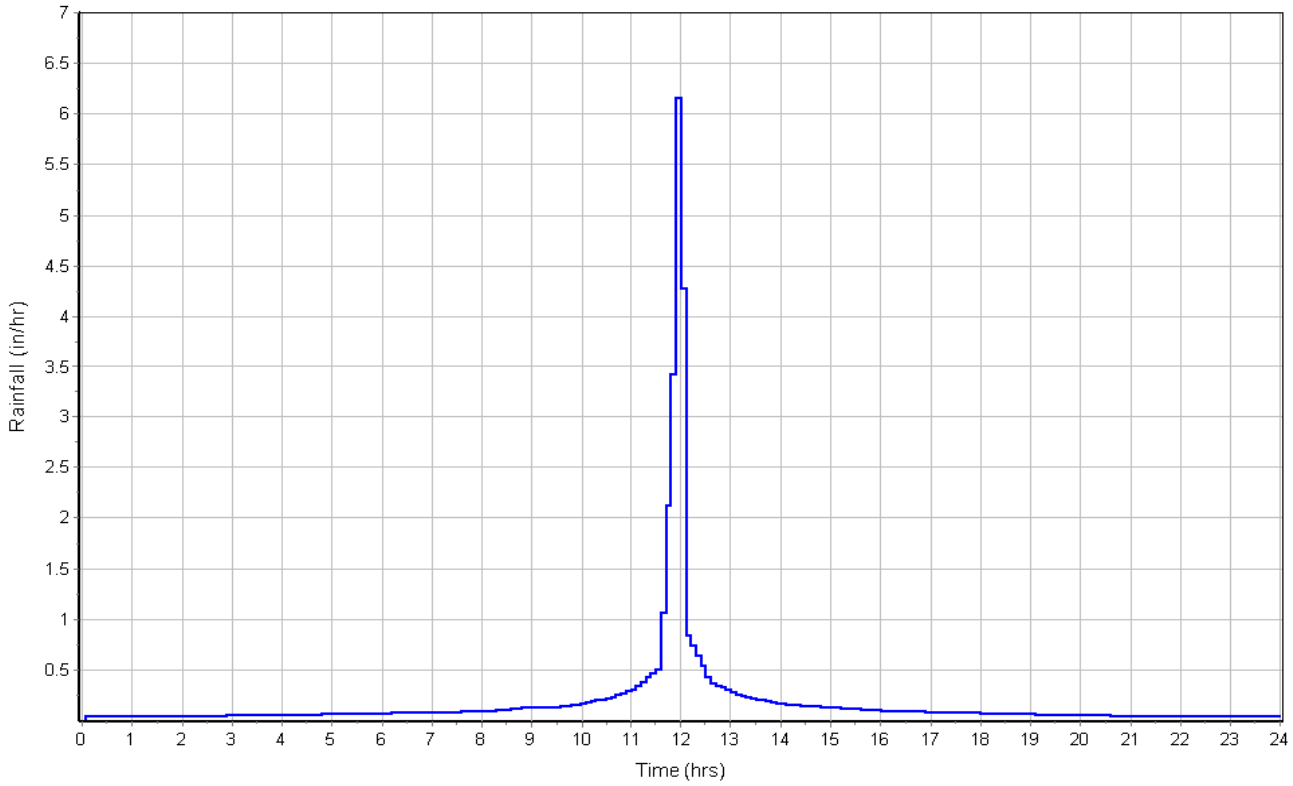
Total TOC (min) 43.67

Subbasin Runoff Results

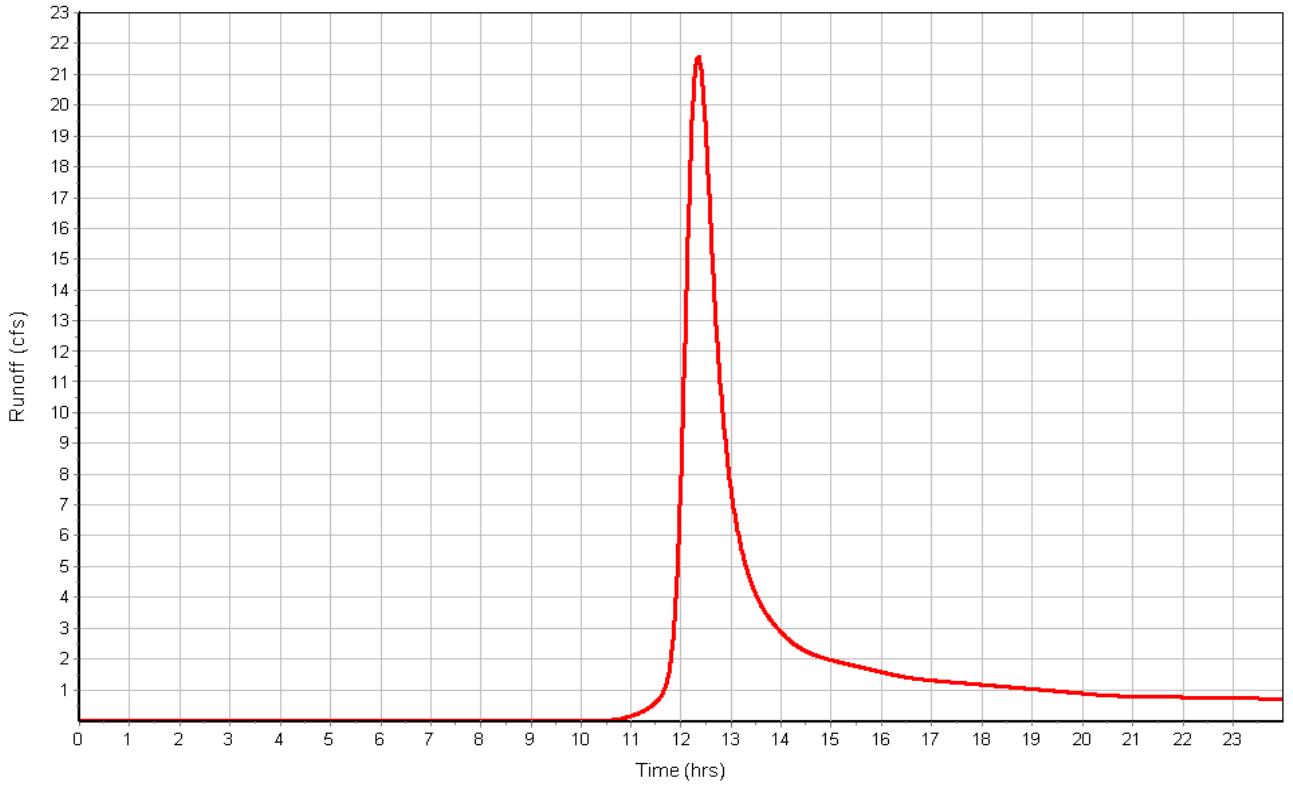
Total Rainfall (in) 4.49
Total Runoff (in) 1.68
Peak Runoff (cfs) 21.57
Weighted Curve Number 70.16
Time of Concentration (days hh:mm:ss) 0 00:43:40

Subbasin : SE-2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-3

Input Data

Area (ac) 26.27
Weighted Curve Number 70.87
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	1.00	C	96.00
Meadow, non-grazed	4.24	C	71.00
Woods, Good	18.38	C	70.00
Woods, Good	0.24	D	77.00
Woods, Good	1.23	B	55.00
Fill,sand	1.18	D	78.00
Composite Area & Weighted CN	26.27		70.87

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.60	0.00	0.00
Flow Length (ft) :	45.53	0.00	0.00
Slope (%) :	7.40	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.07	0.00	0.00
Computed Flow Time (min) :	10.65	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	645.06	125.19	276.34
Slope (%) :	4.89	2.40	6.58
Surface Type :	Woodland	Woodland	Woodland
Velocity (ft/sec) :	1.11	0.77	1.28
Computed Flow Time (min) :	9.69	2.71	3.60

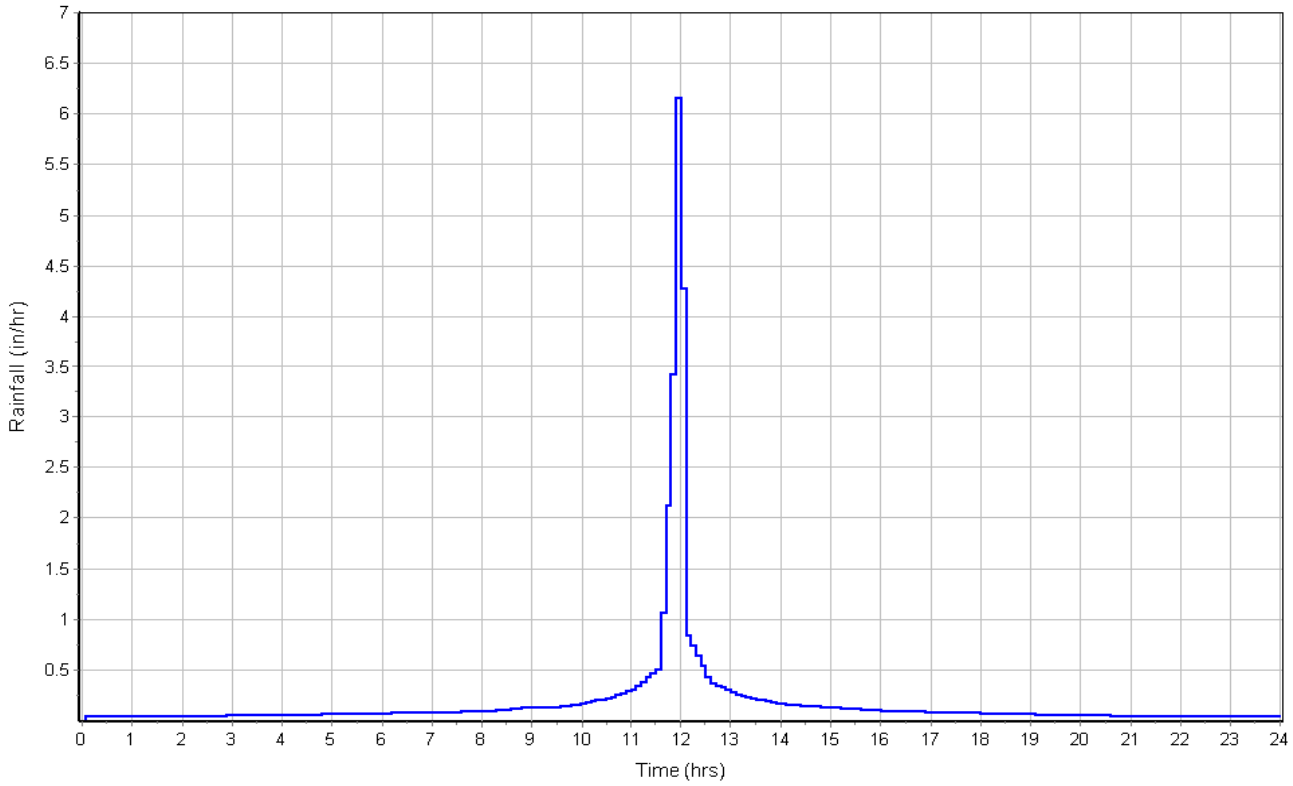
Total TOC (min) 26.65

Subbasin Runoff Results

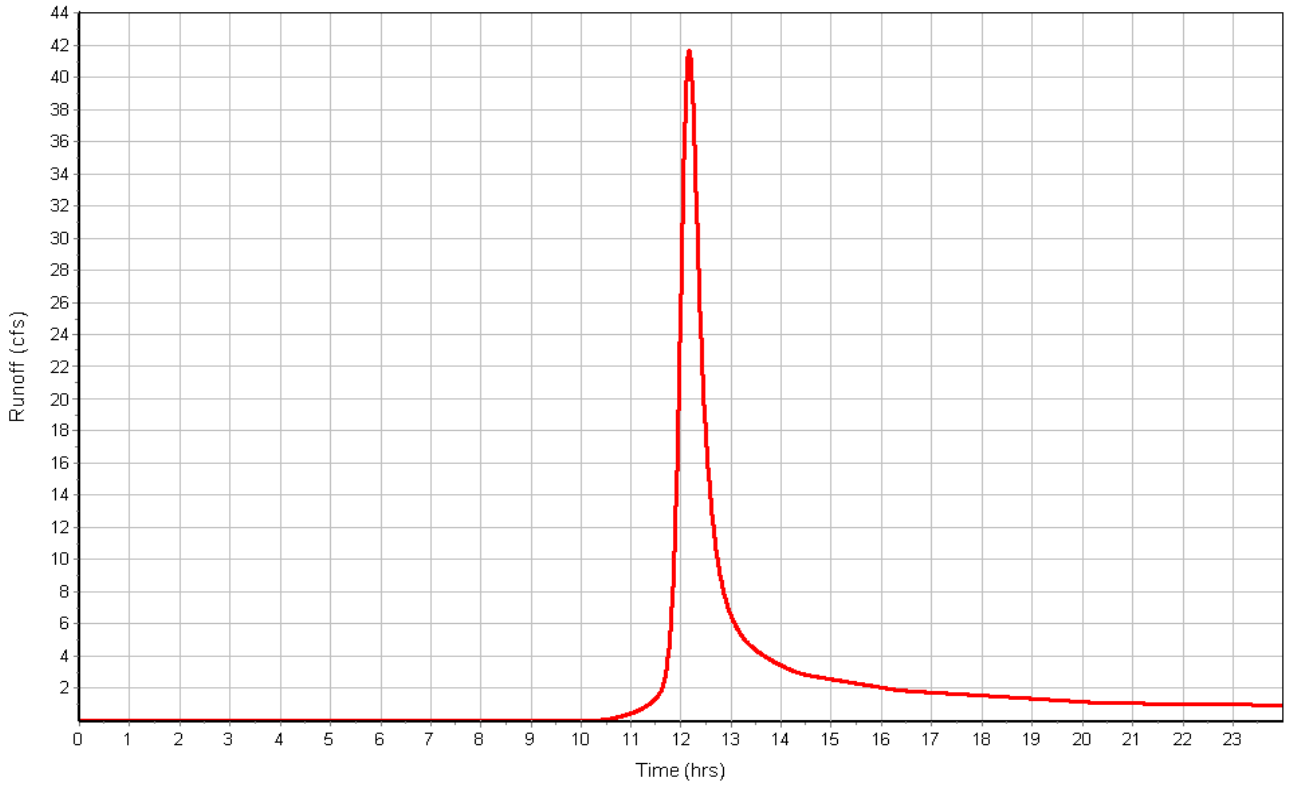
Total Rainfall (in) 4.49
Total Runoff (in) 1.73
Peak Runoff (cfs) 41.72
Weighted Curve Number 70.87
Time of Concentration (days hh:mm:ss) 0 00:26:39

Subbasin : SE-3

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-4

Input Data

Area (ac) 4.93
Weighted Curve Number 61.99
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Good	0.79	C	70.00
Meadow, non-grazed	1.08	C	71.00
Gravel roads	0.11	C	96.00
Woods, Good	2.65	B	55.00
Meadow, non-grazed	0.30	B	58.00
Composite Area & Weighted CN	4.93		61.99

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.60	0.00	0.00
Flow Length (ft) :	37.14	0.00	0.00
Slope (%) :	4.75	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.06	0.00	0.00
Computed Flow Time (min) :	10.81	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	252.7	760.9	0.00
Slope (%) :	8.92	2.37	0.00
Surface Type :	Woodland	Grass pasture	Unpaved
Velocity (ft/sec) :	1.49	1.08	0.00
Computed Flow Time (min) :	2.83	11.74	0.00

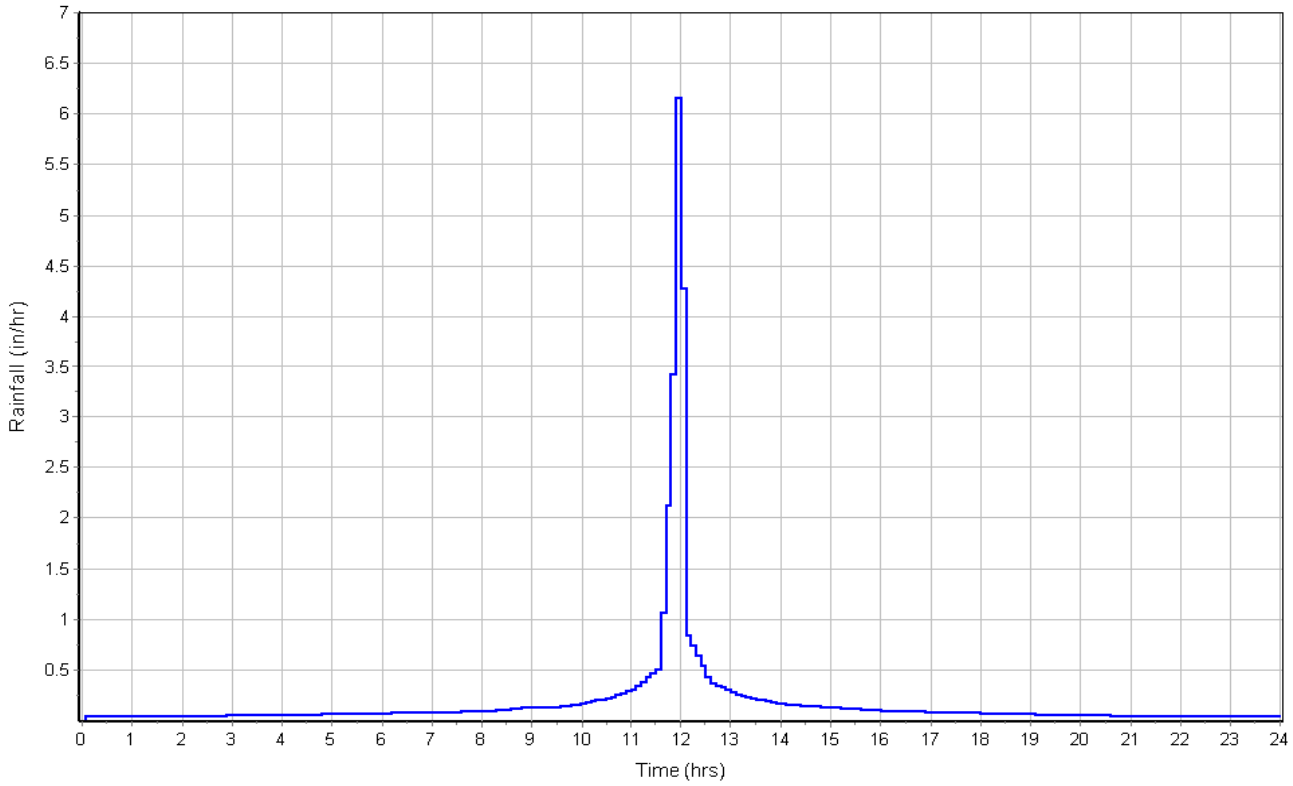
Total TOC (min) 25.38

Subbasin Runoff Results

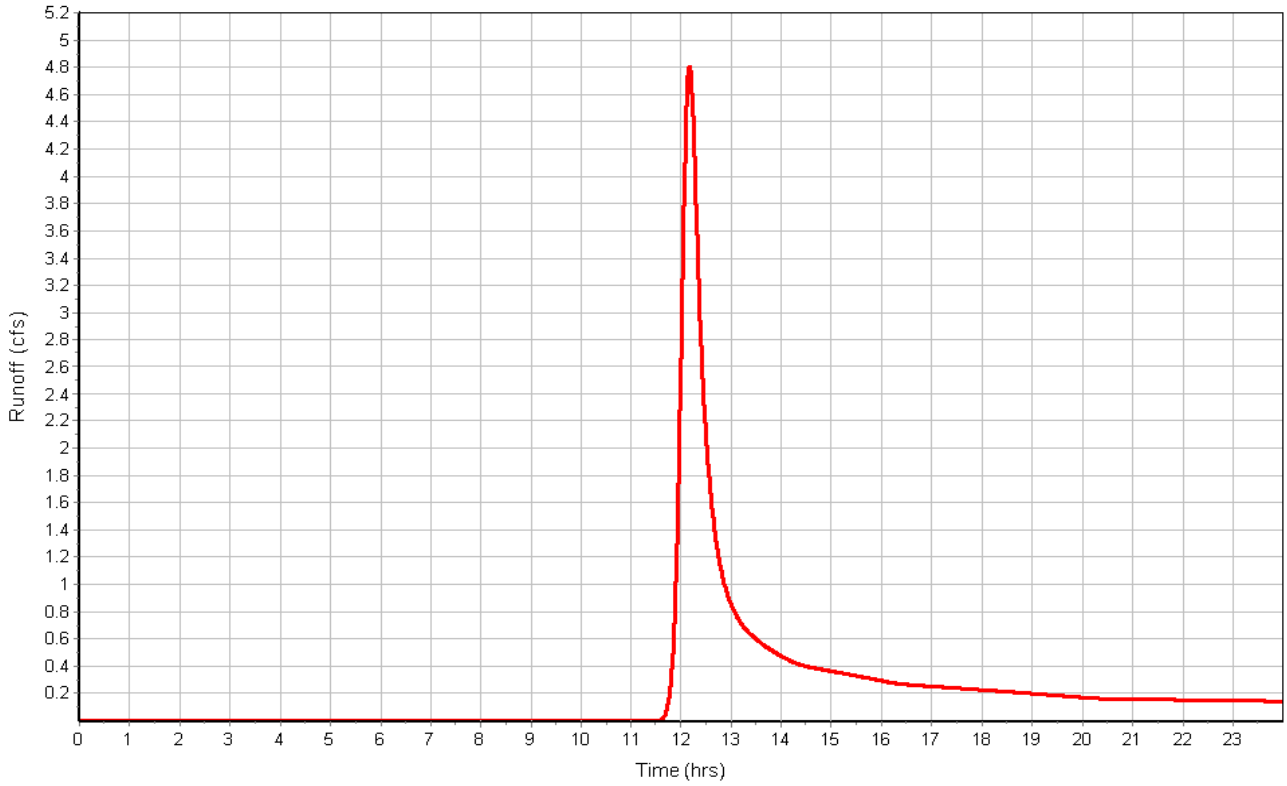
Total Rainfall (in) 4.49
Total Runoff (in) 1.13
Peak Runoff (cfs) 4.81
Weighted Curve Number 61.99
Time of Concentration (days hh:mm:ss) 0 00:25:23

Subbasin : SE-4

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-5

Input Data

Area (ac) 3.03
Weighted Curve Number 75.83
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
LandfillCap,Grass	2.76	C	74.00
Swale, riprap over soils	0.16	C	93.00
Paved roads	0.12	C	96.00
Composite Area & Weighted CN	3.04		75.83

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.24	0.24	0.00
Flow Length (ft) :	41.995	160.833	0.00
Slope (%) :	20	33.33	0.00
2 yr, 24 hr Rainfall (in) :	2.48	2.48	0.00
Velocity (ft/sec) :	0.22	0.35	0.00
Computed Flow Time (min) :	3.22	7.69	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.033	0.033	0.033
Flow Length (ft) :	233.674	139.524	15.865
Channel Slope (%) :	5	33.33	18.20
Cross Section Area (ft^2) :	4.5	8.48	8.48
Wetted Perimeter (ft) :	6.71	10.9	10.9
Velocity (ft/sec) :	7.74	22.05	16.29
Computed Flow Time (min) :	0.50	0.11	0.02

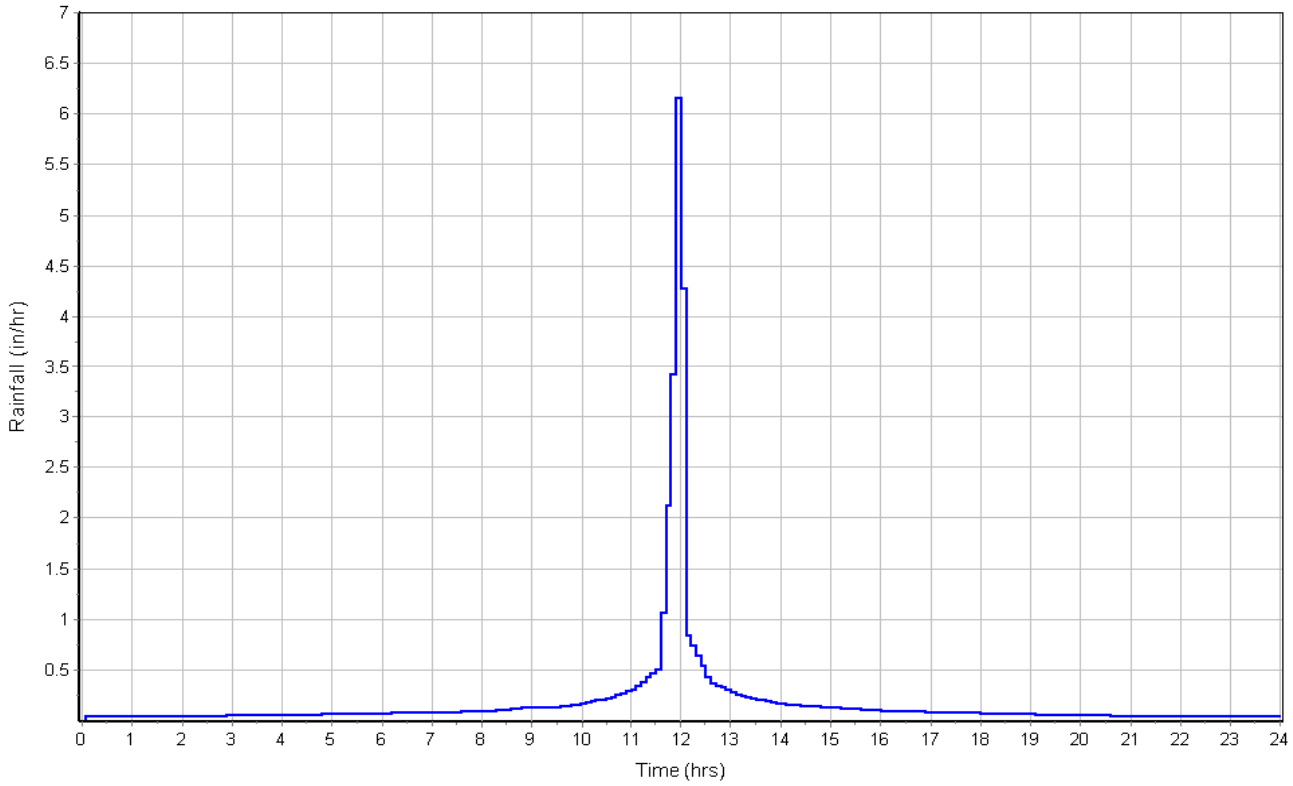
Total TOC (min) 11.54

Subbasin Runoff Results

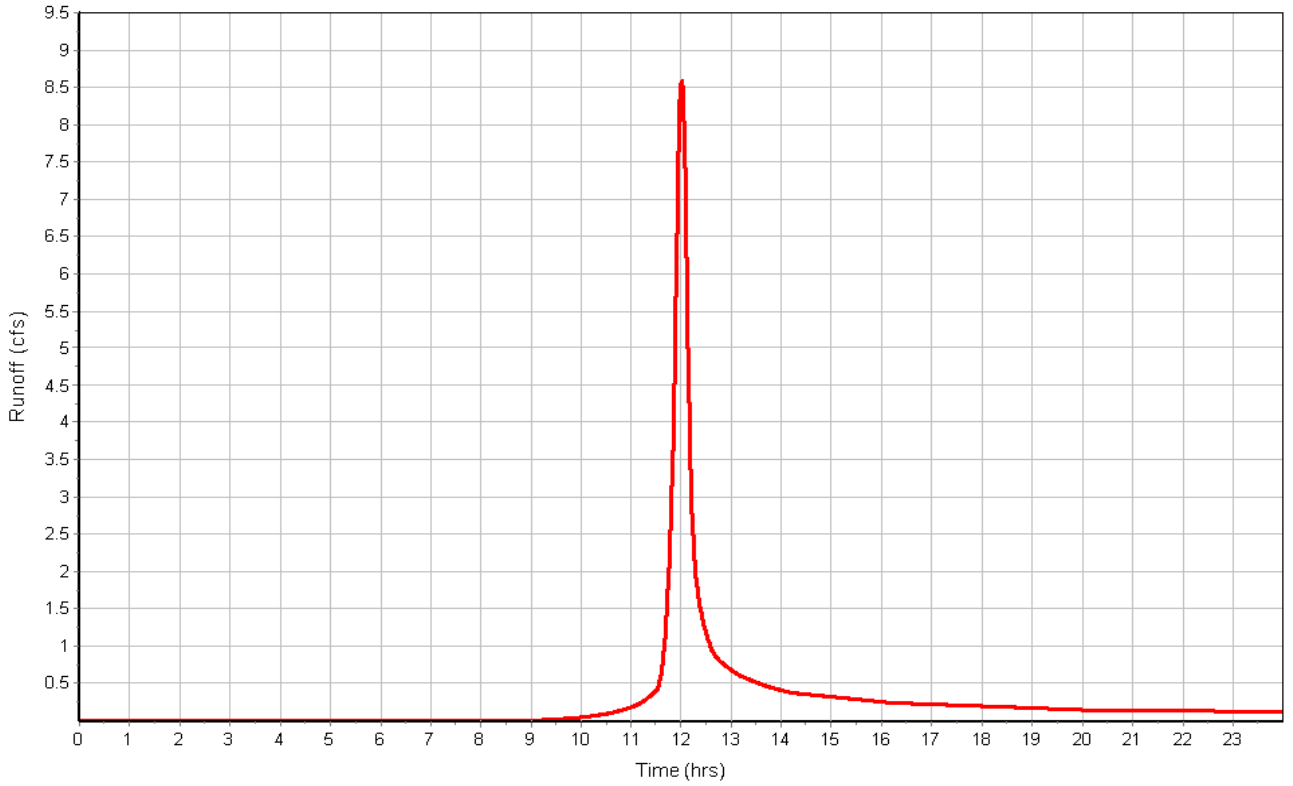
Total Rainfall (in) 4.49
Total Runoff (in) 2.11
Peak Runoff (cfs) 8.59
Weighted Curve Number 75.83
Time of Concentration (days hh:mm:ss) 0 00:11:32

Subbasin : SE-5

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-6

Input Data

Area (ac) 2.68
Weighted Curve Number 82.41
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Landfill cap, interim (exposed geomembrane), 100% imp	1.64	C	74.00
Swale, riprap over soils	0.50	C	93.00
Paved roads	0.54	C	98.00
Composite Area & Weighted CN	2.68		82.41

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.24	0.08	0.00
Flow Length (ft) :	191.463	19.182	0.00
Slope (%) :	33.33	23.01	0.00
2 yr, 24 hr Rainfall (in) :	2.48	2.48	0.00
Velocity (ft/sec) :	0.36	0.47	0.00
Computed Flow Time (min) :	8.85	0.68	0.00

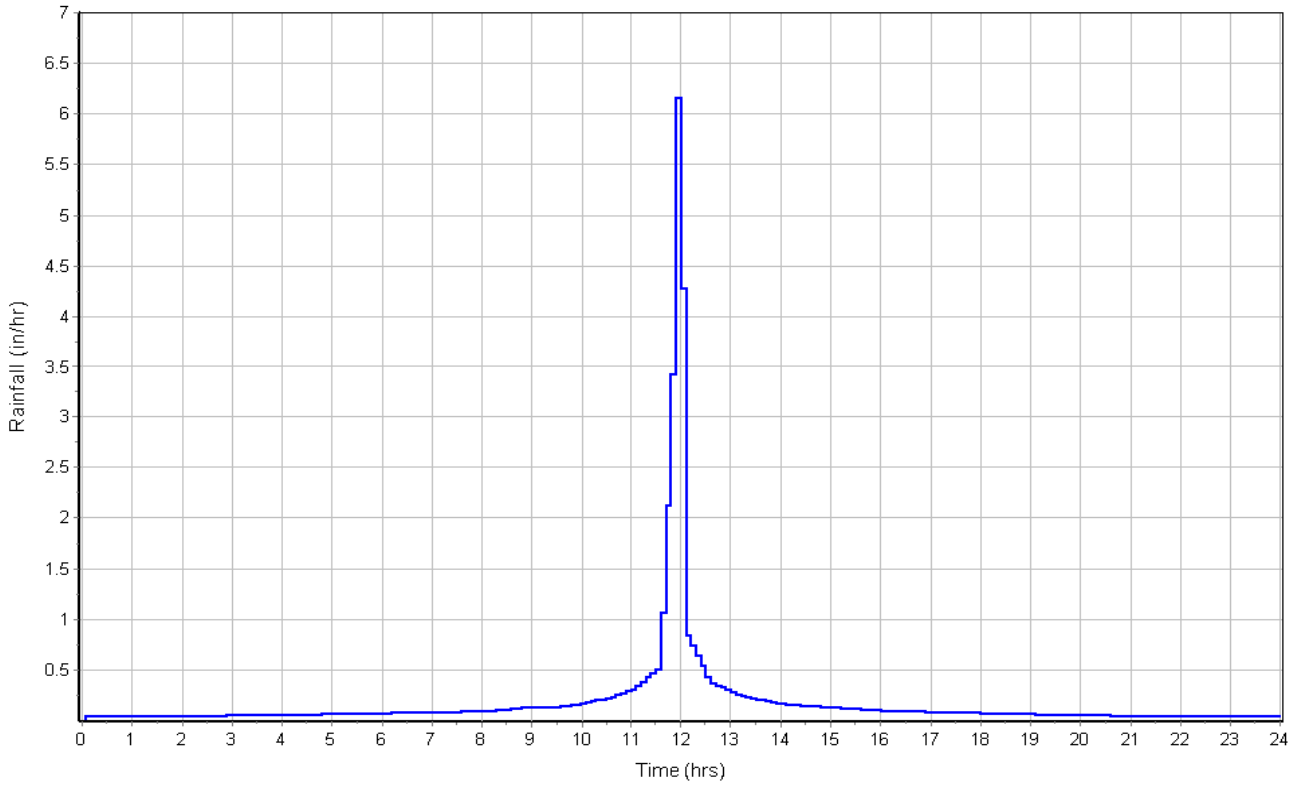
Total TOC (min) 9.52

Subbasin Runoff Results

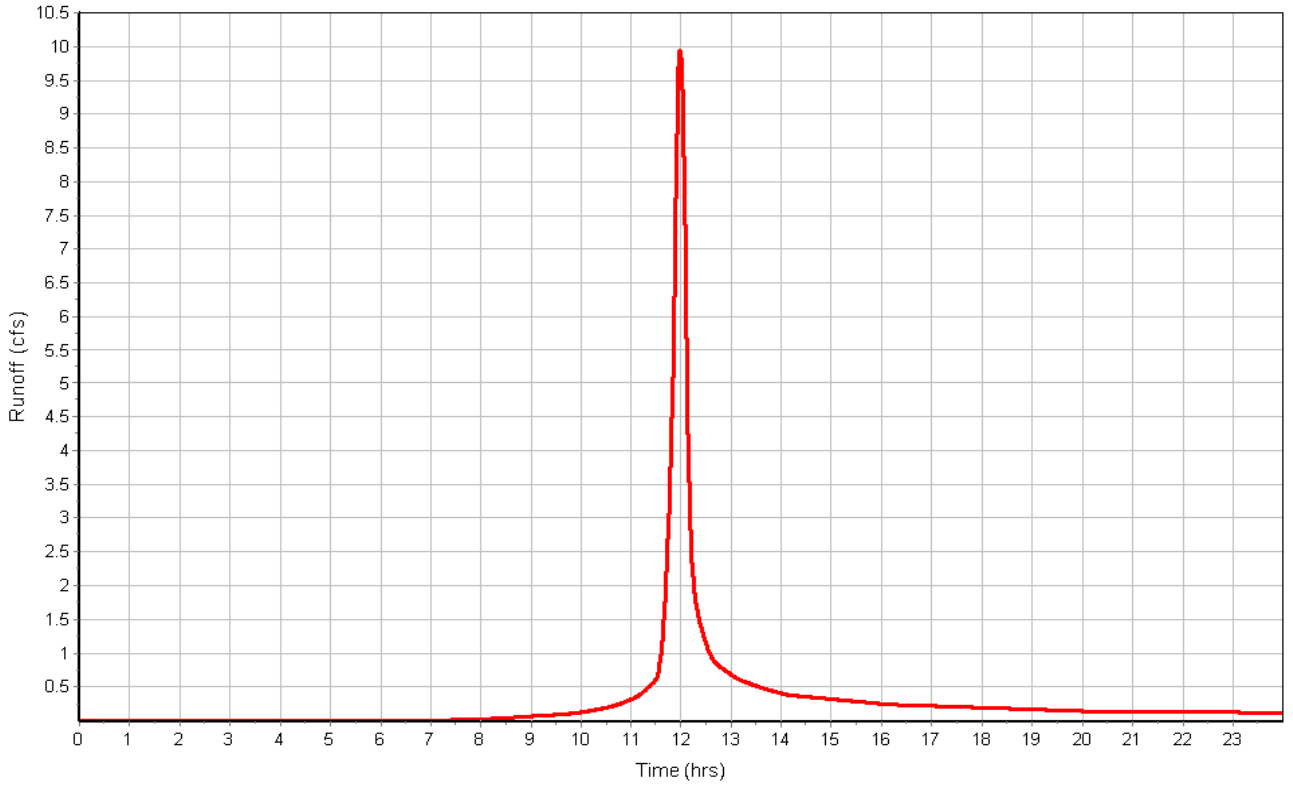
Total Rainfall (in) 4.49
Total Runoff (in) 2.66
Peak Runoff (cfs) 9.95
Weighted Curve Number 82.41
Time of Concentration (days hh:mm:ss) 0 00:09:31

Subbasin : SE-6

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-7

Input Data

Area (ac) 4.34
Weighted Curve Number 77.55
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Landfill cap, interim (exposed geomembrane), 100% imp	3.64	C	74.00
Swale, riprap over soils	0.26	C	93.00
Paved roads	0.44	C	98.00
Composite Area & Weighted CN	4.34		77.55

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.24	0.00	0.00
Flow Length (ft) :	123.733	0.00	0.00
Slope (%) :	7.77	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.18	0.00	0.00
Computed Flow Time (min) :	11.17	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	101.839	0.00	0.00
Slope (%) :	33.33	0.00	0.00
Surface Type :	Grass pasture	Paved	Paved
Velocity (ft/sec) :	4.04	0.00	0.00
Computed Flow Time (min) :	0.42	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.033	0.033	0.033
Flow Length (ft) :	67.110	290.555	31.009
Channel Slope (%) :	5	33.33	27.22
Cross Section Area (ft^2) :	4.5	8.48	8.48
Wetted Perimeter (ft) :	6.71	10.9	10.9
Velocity (ft/sec) :	7.74	22.05	19.93
Computed Flow Time (min) :	0.14	0.22	0.03

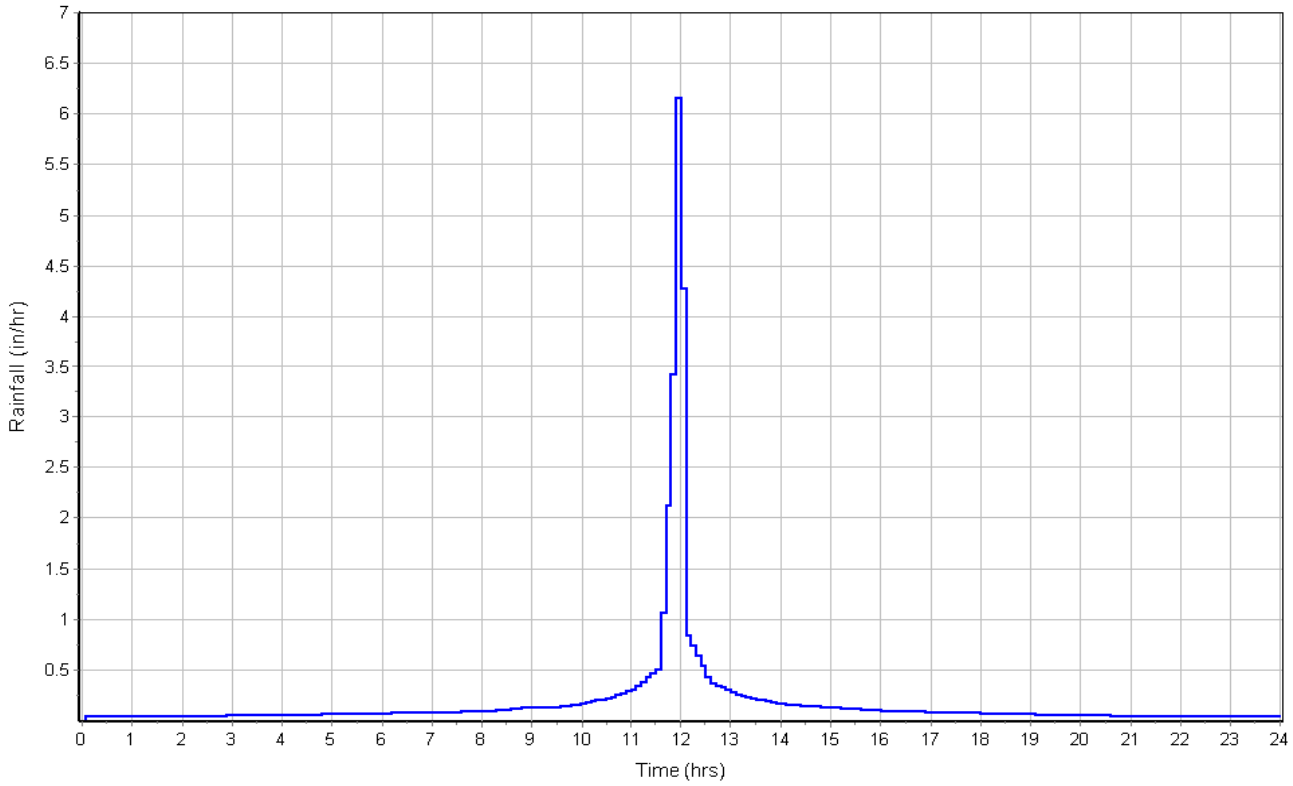
Total TOC (min) 11.98

Subbasin Runoff Results

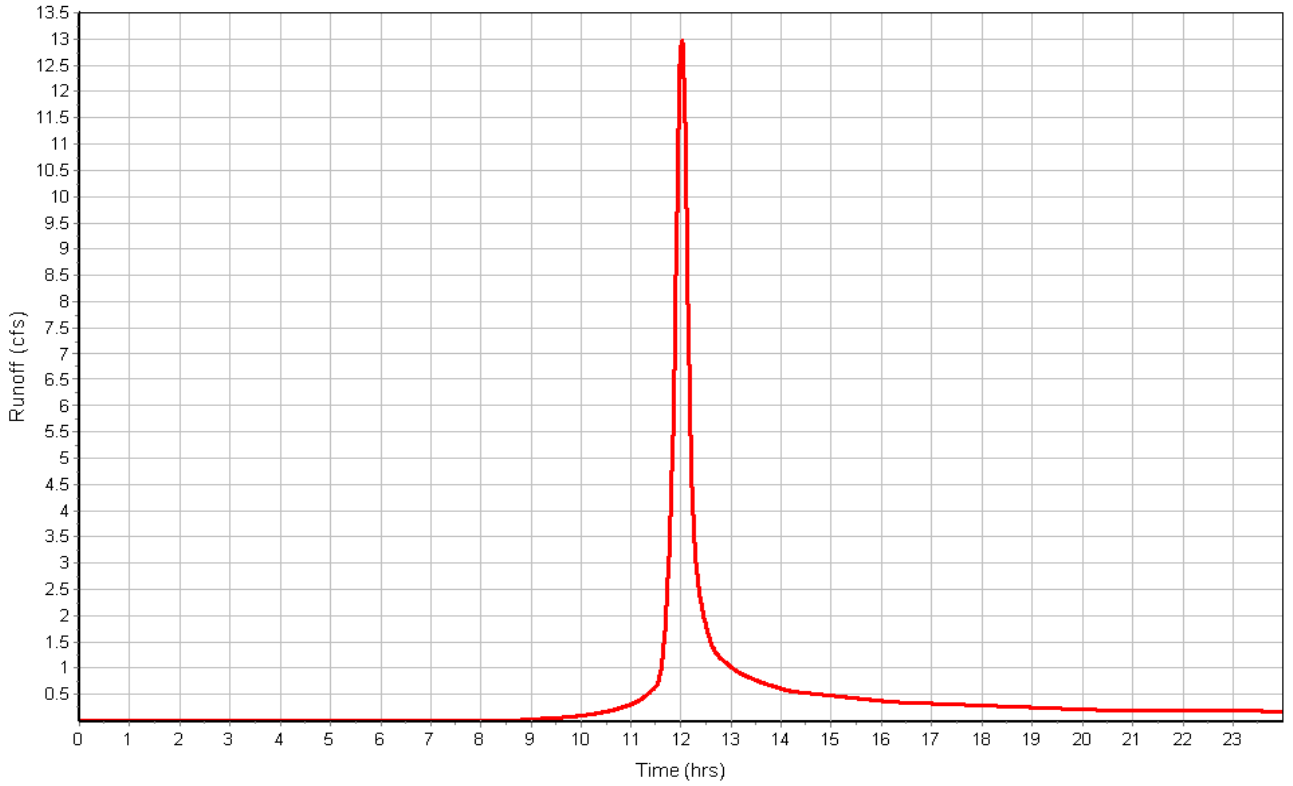
Total Rainfall (in) 4.49
Total Runoff (in) 2.25
Peak Runoff (cfs) 12.98
Weighted Curve Number 77.55
Time of Concentration (days hh:mm:ss) 0 00:11:59

Subbasin : SE-7

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-8

Input Data

Area (ac) 4.86
Weighted Curve Number 77.38
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Landfill cap, interim (exposed geomembrane), 100% imp	4.06	C	74.00
Swale, riprap over soils	0.37	C	93.00
Paved roads	0.43	C	96.00
Composite Area & Weighted CN	4.86		77.38

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.24	0.00	0.00
Flow Length (ft) :	227.841	0.00	0.00
Slope (%) :	33.33	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.37	0.00	0.00
Computed Flow Time (min) :	10.17	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.033	0.033	0.033
Flow Length (ft) :	223.324	151.093	31.025
Channel Slope (%) :	5	33.33	26.48
Cross Section Area (ft^2) :	4.5	8.48	8.48
Wetted Perimeter (ft) :	6.71	10.9	10.9
Velocity (ft/sec) :	7.74	22.05	19.65
Computed Flow Time (min) :	0.48	0.11	0.03

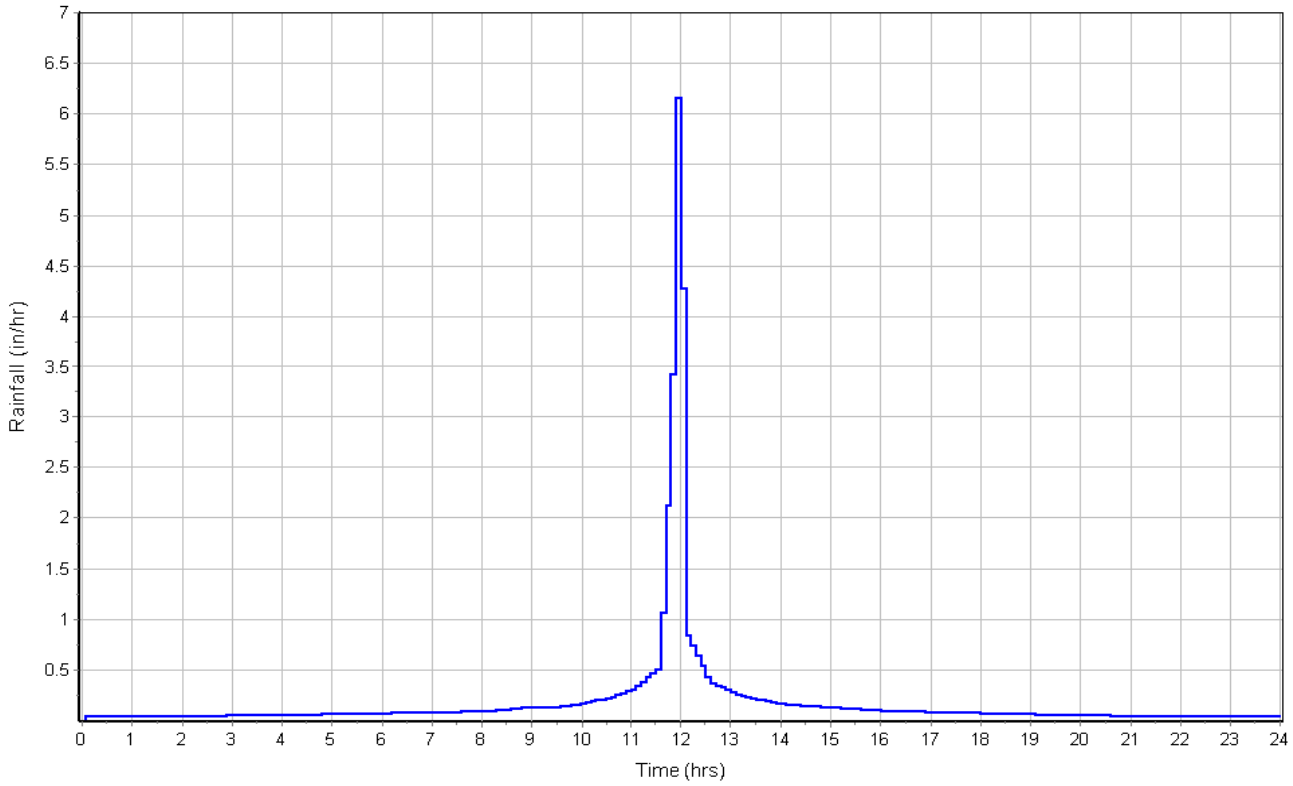
Total TOC (min) 10.79

Subbasin Runoff Results

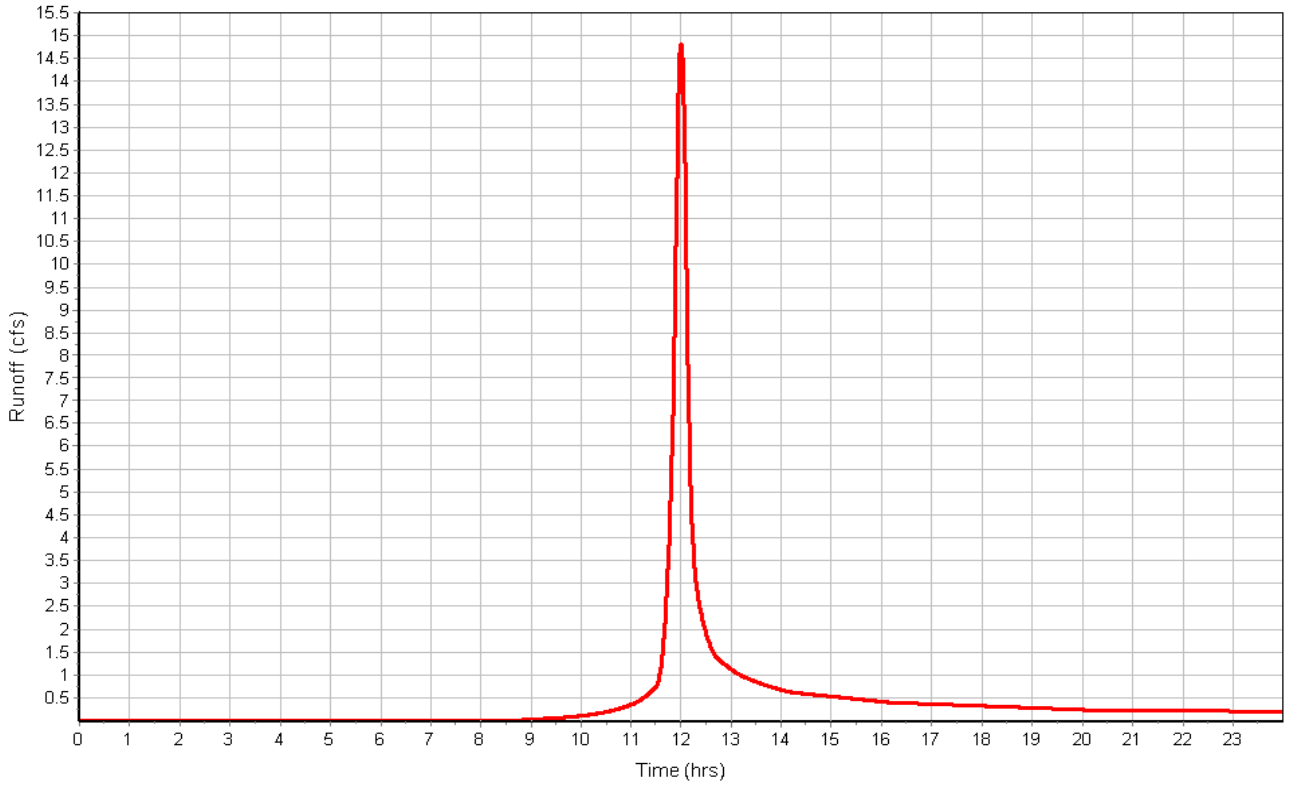
Total Rainfall (in) 4.49
Total Runoff (in) 2.23
Peak Runoff (cfs) 14.81
Weighted Curve Number 77.38
Time of Concentration (days hh:mm:ss) 0 00:10:47

Subbasin : SE-8

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-9

Input Data

Area (ac) 4.45
Weighted Curve Number 75.90
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Landfill cap, interim (exposed geomembrane), 100% imp	4.04	C	74.00
Swale, riprap over soils	0.19	C	93.00
Paved roads	0.22	C	96.00
Composite Area & Weighted CN	4.45		75.90

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.24	0.00	0.00
Flow Length (ft) :	204.611	0.00	0.00
Slope (%) :	33.33	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.37	0.00	0.00
Computed Flow Time (min) :	9.33	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	104.611	0.00	0.00
Slope (%) :	33.33	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	11.74	0.00	0.00
Computed Flow Time (min) :	0.15	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.033	0.033	0.033
Flow Length (ft) :	269.04	94.884	31.022
Channel Slope (%) :	5	33.33	29.46
Cross Section Area (ft^2) :	4.5	8.48	8.48
Wetted Perimeter (ft) :	6.71	10.9	10.9
Velocity (ft/sec) :	7.74	22.05	20.73
Computed Flow Time (min) :	0.58	0.07	0.02

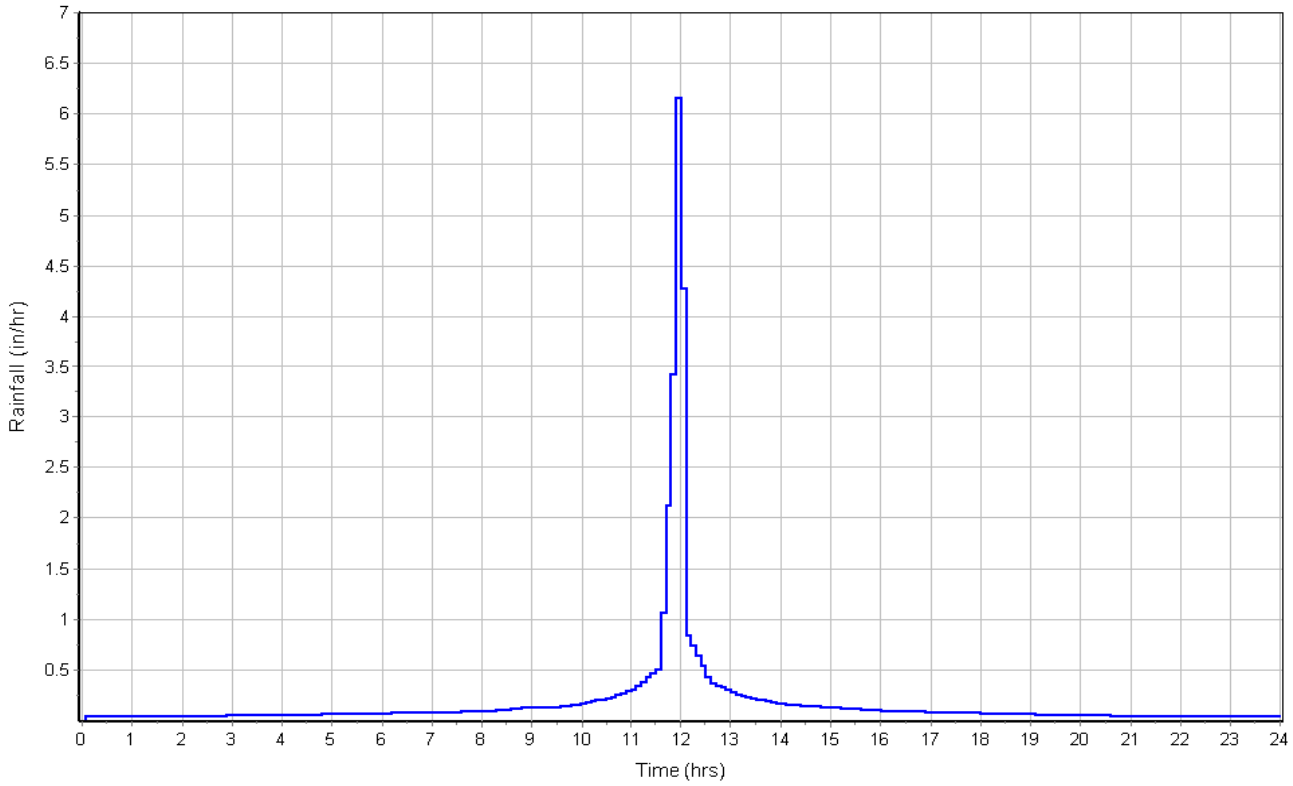
Total TOC (min) 10.15

Subbasin Runoff Results

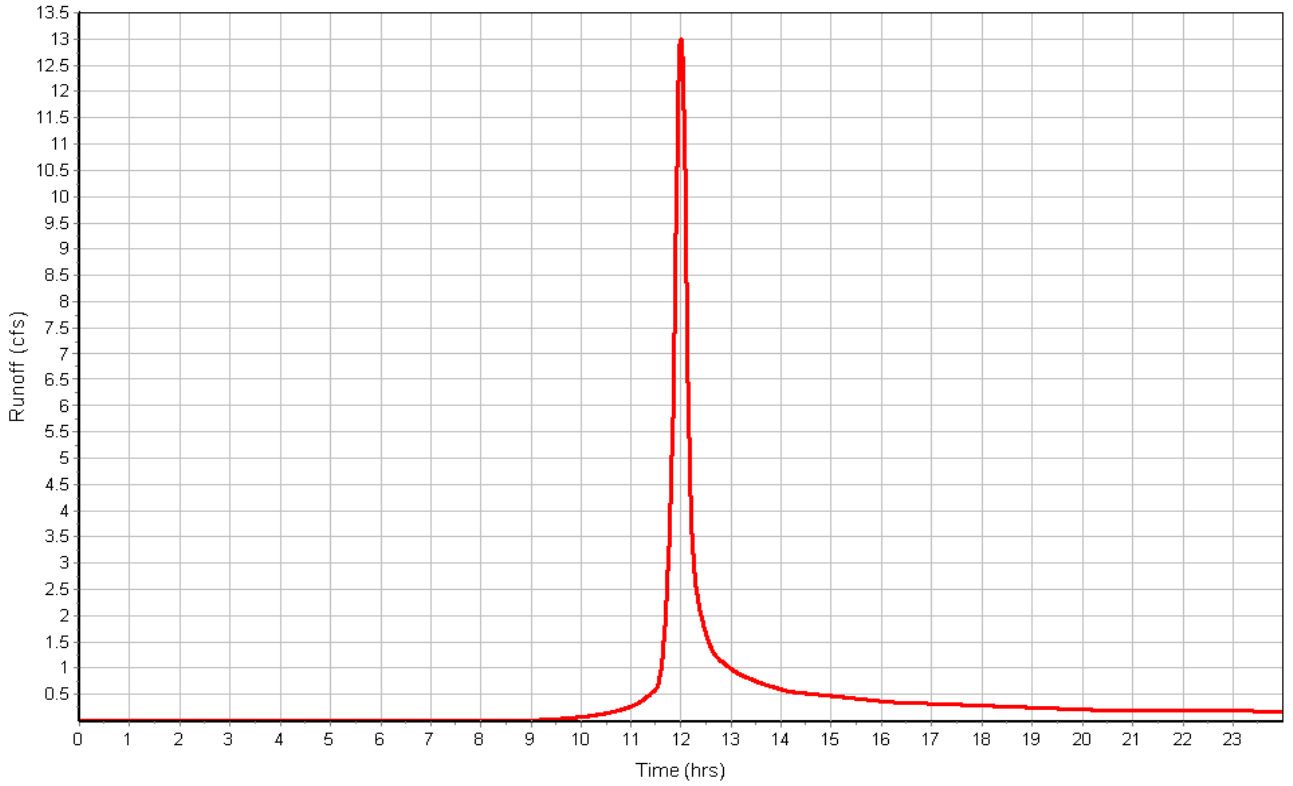
Total Rainfall (in) 4.49
Total Runoff (in) 2.11
Peak Runoff (cfs) 12.99
Weighted Curve Number 75.90
Time of Concentration (days hh:mm:ss) 0 00:10:09

Subbasin : SE-9

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SE-9S

Input Data

Area (ac) 9.65
Weighted Curve Number 77.31
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel,Road	1.45	C	96.00
Cap,Grass	8.20	C	74.00
Composite Area & Weighted CN	9.65		77.31

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.24	0.00	0.00
Flow Length (ft) :	200	0.00	0.00
Slope (%) :	5	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.17	0.00	0.00
Computed Flow Time (min) :	19.56	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.033	0.033	0.00
Flow Length (ft) :	697.446	459.822	0.00
Channel Slope (%) :	5	28.02	0.00
Cross Section Area (ft^2) :	4.5	8.48	0.00
Wetted Perimeter (ft) :	6.71	10.91	0.00
Velocity (ft/sec) :	7.74	20.20	0.00
Computed Flow Time (min) :	1.50	0.38	0.00

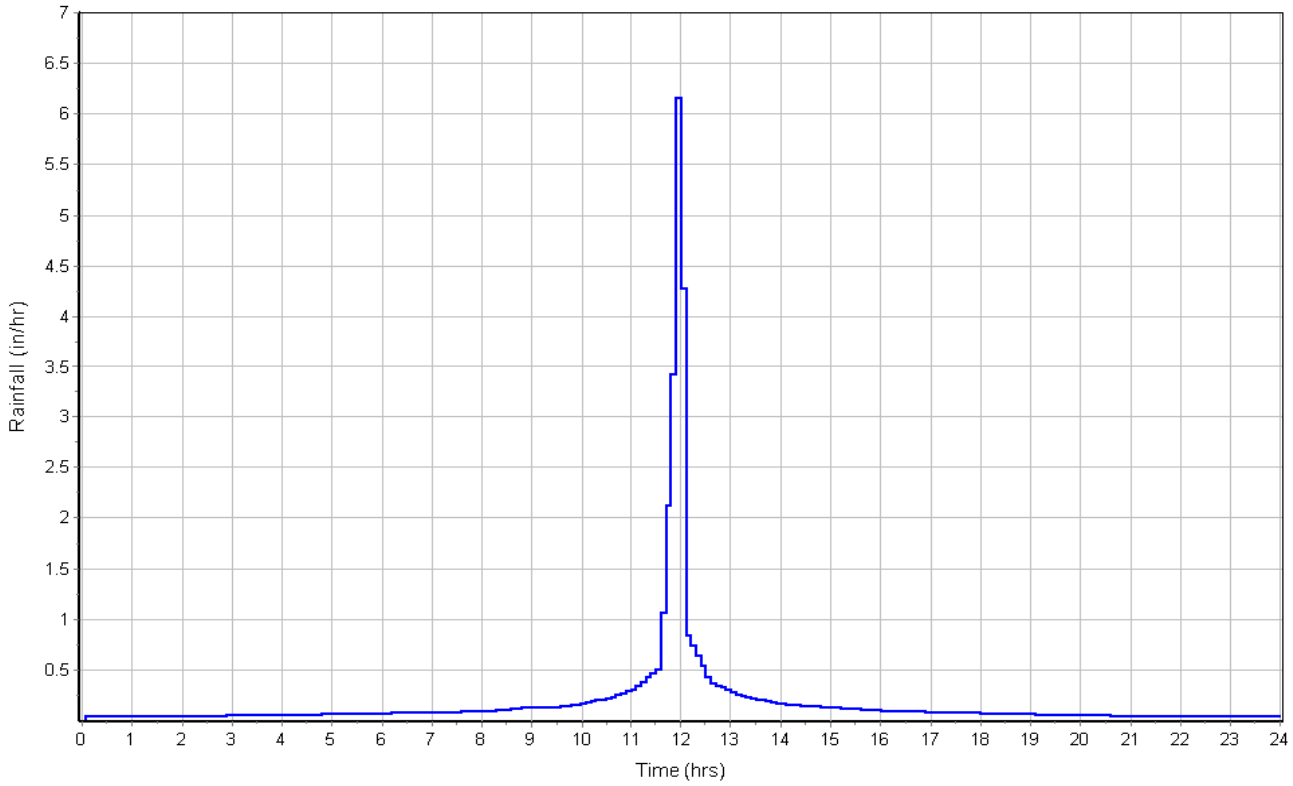
Total TOC (min) 21.44

Subbasin Runoff Results

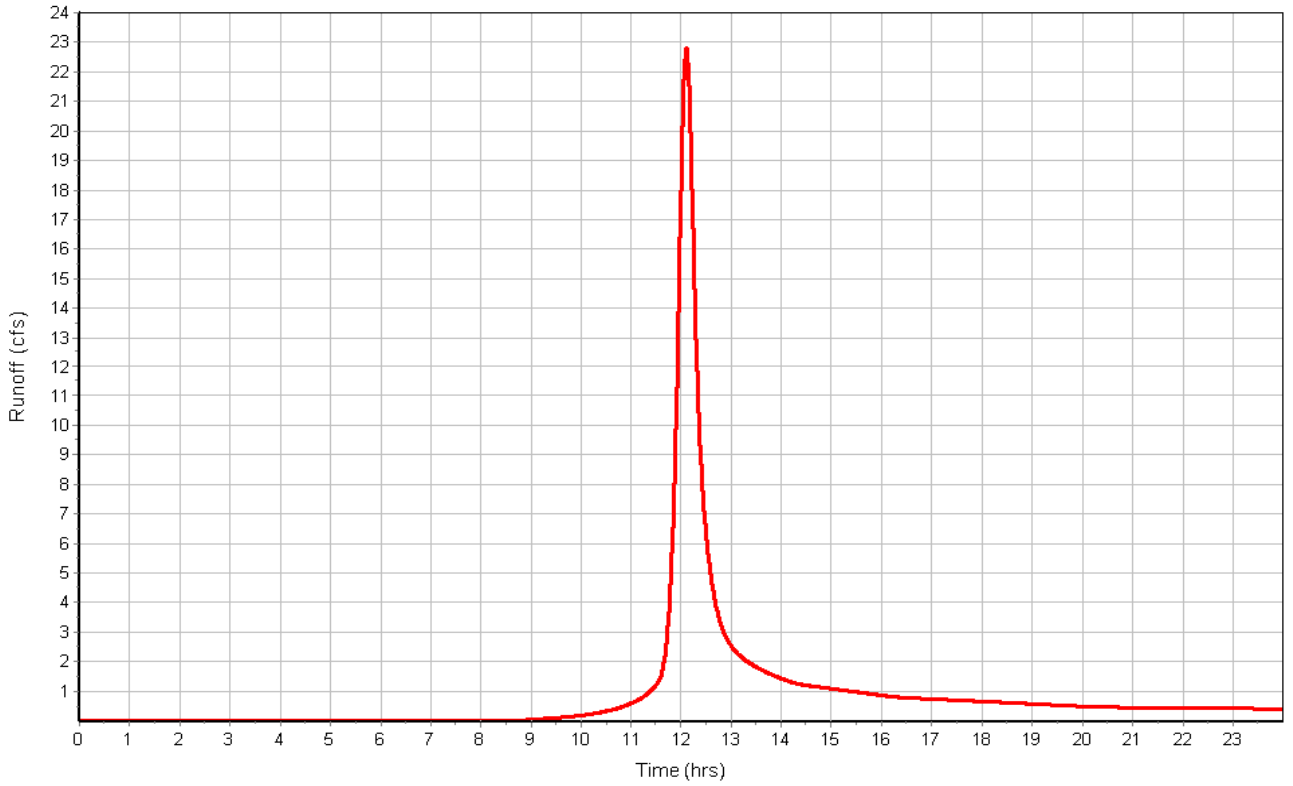
Total Rainfall (in) 4.49
Total Runoff (in) 2.23
Peak Runoff (cfs) 22.82
Weighted Curve Number 77.31
Time of Concentration (days hh:mm:ss) 0 00:21:26

Subbasin : SE-9S

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SW1

Input Data

Area (ac) 5.70
Weighted Curve Number 74.04
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	0.00	C	89.00
GravelParking	0.89	C	96.00
Woods, Good	4.84	C	70.00
Composite Area & Weighted CN	5.73		74.04

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.6	0.00	0.00
Flow Length (ft) :	64.9	0.00	0.00
Slope (%) :	8.10	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.08	0.00	0.00
Computed Flow Time (min) :	13.64	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	576	0.00	0.00
Slope (%) :	1.55	0.00	0.00
Surface Type :	Woodland	Woodland	Unpaved
Velocity (ft/sec) :	0.62	0.00	0.00
Computed Flow Time (min) :	15.48	0.00	0.00

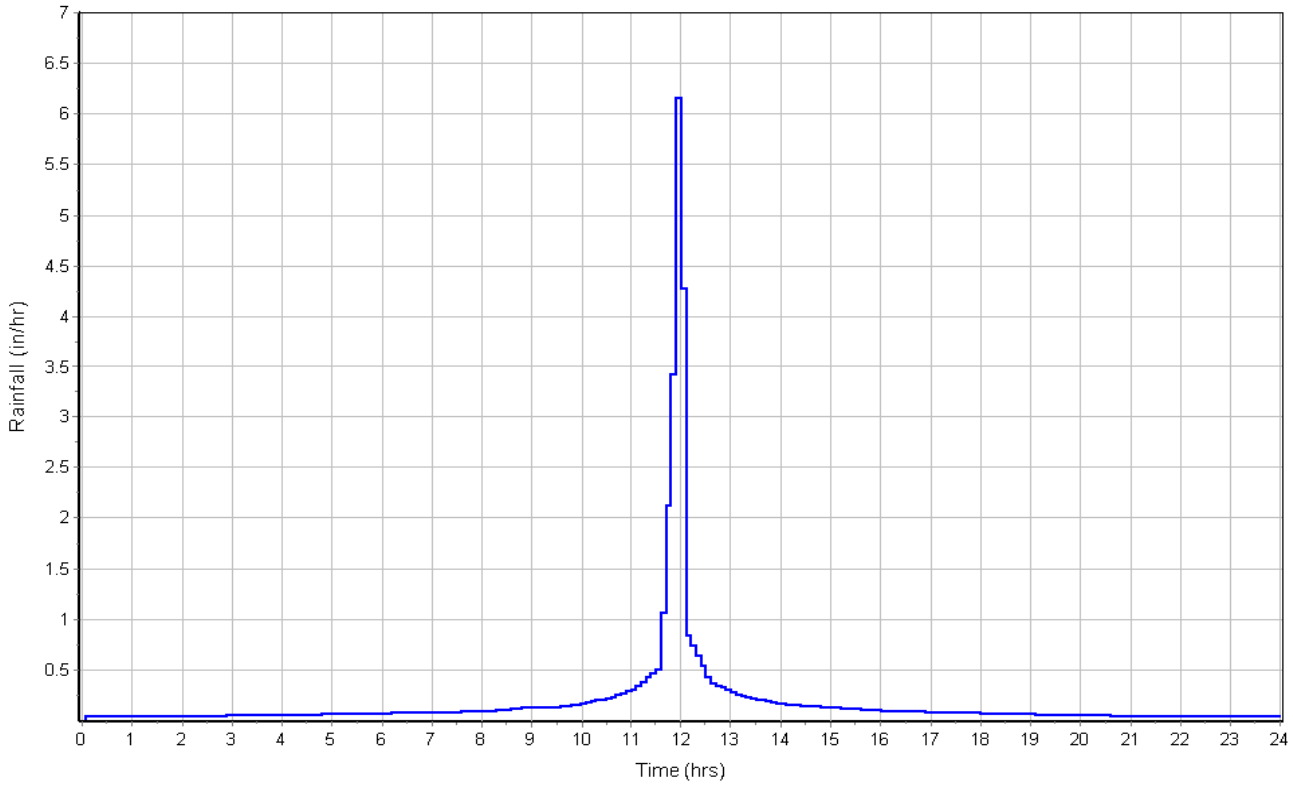
Total TOC (min) 29.13

Subbasin Runoff Results

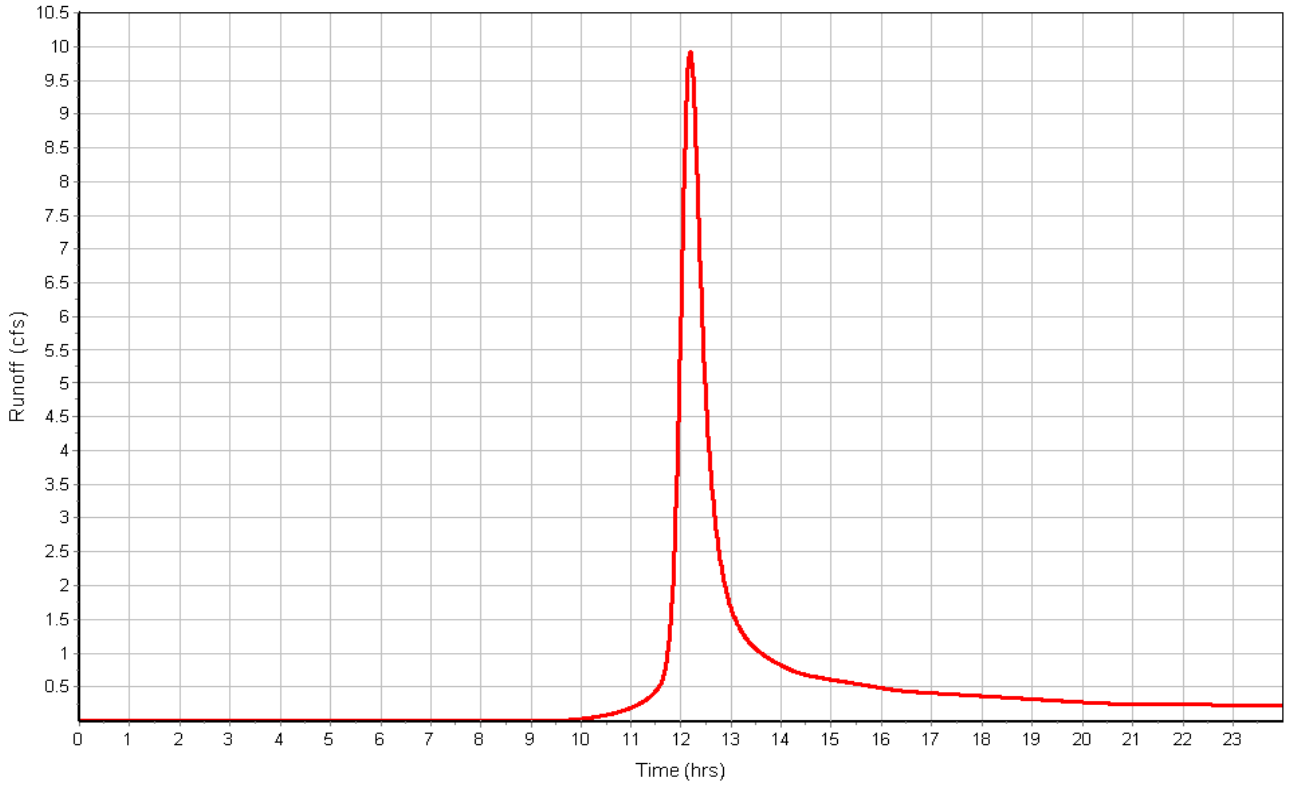
Total Rainfall (in) 4.49
Total Runoff (in) 1.97
Peak Runoff (cfs) 9.92
Weighted Curve Number 74.04
Time of Concentration (days hh:mm:ss) 0 00:29:08

Subbasin : SW1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SW2

Input Data

Area (ac) 1.16
Weighted Curve Number 73.09
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	0.01	C	96.00
Paved parking & roofs	0.00	C	98.00
Grassed Landfill Cap	0.73	C	74.00
Meadow, non-grazed	0.42	C	71.00
Composite Area & Weighted CN	1.16		73.09

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.24	0.08	0.00
Flow Length (ft) :	162.049	56.743	0.00
Slope (%) :	27.15	26.07	0.00
2 yr, 24 hr Rainfall (in) :	2.48	2.48	0.00
Velocity (ft/sec) :	0.32	0.62	0.00
Computed Flow Time (min) :	8.40	1.53	0.00

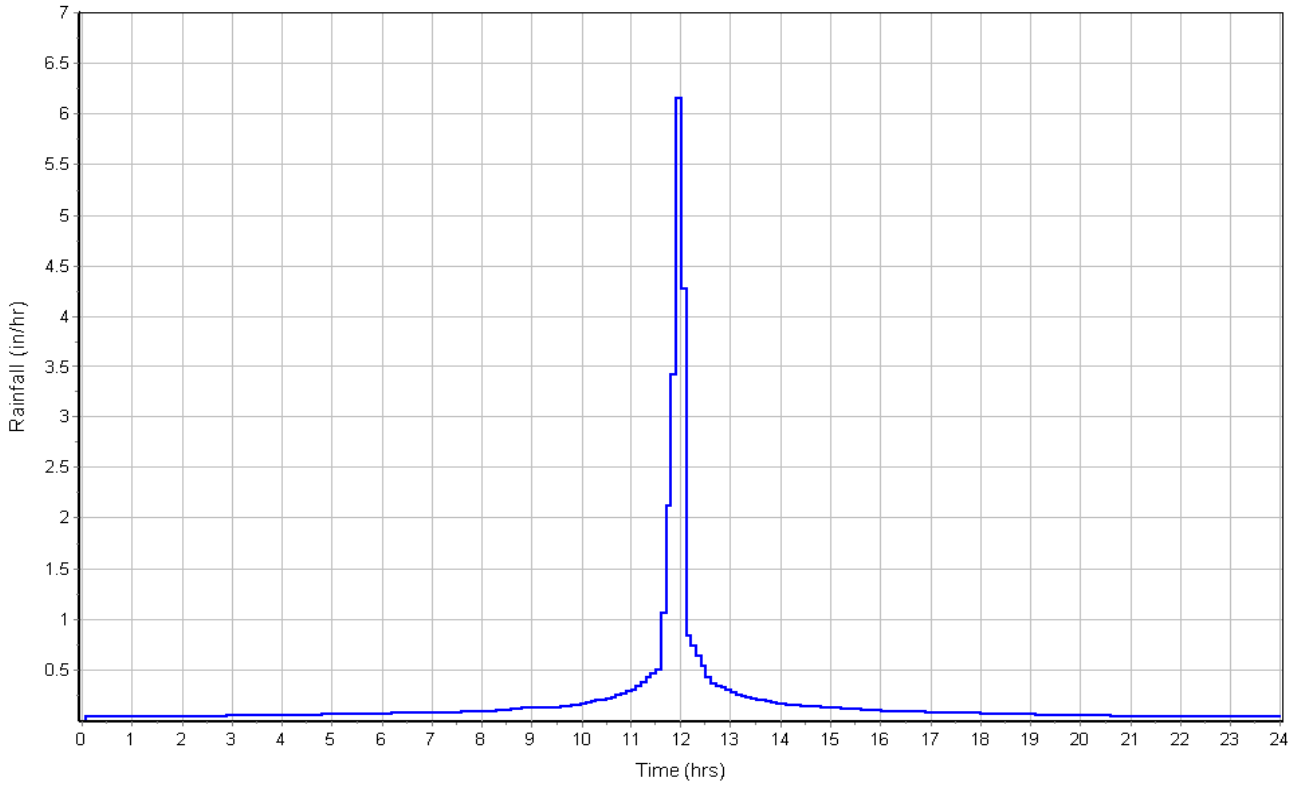
Total TOC (min) 9.93

Subbasin Runoff Results

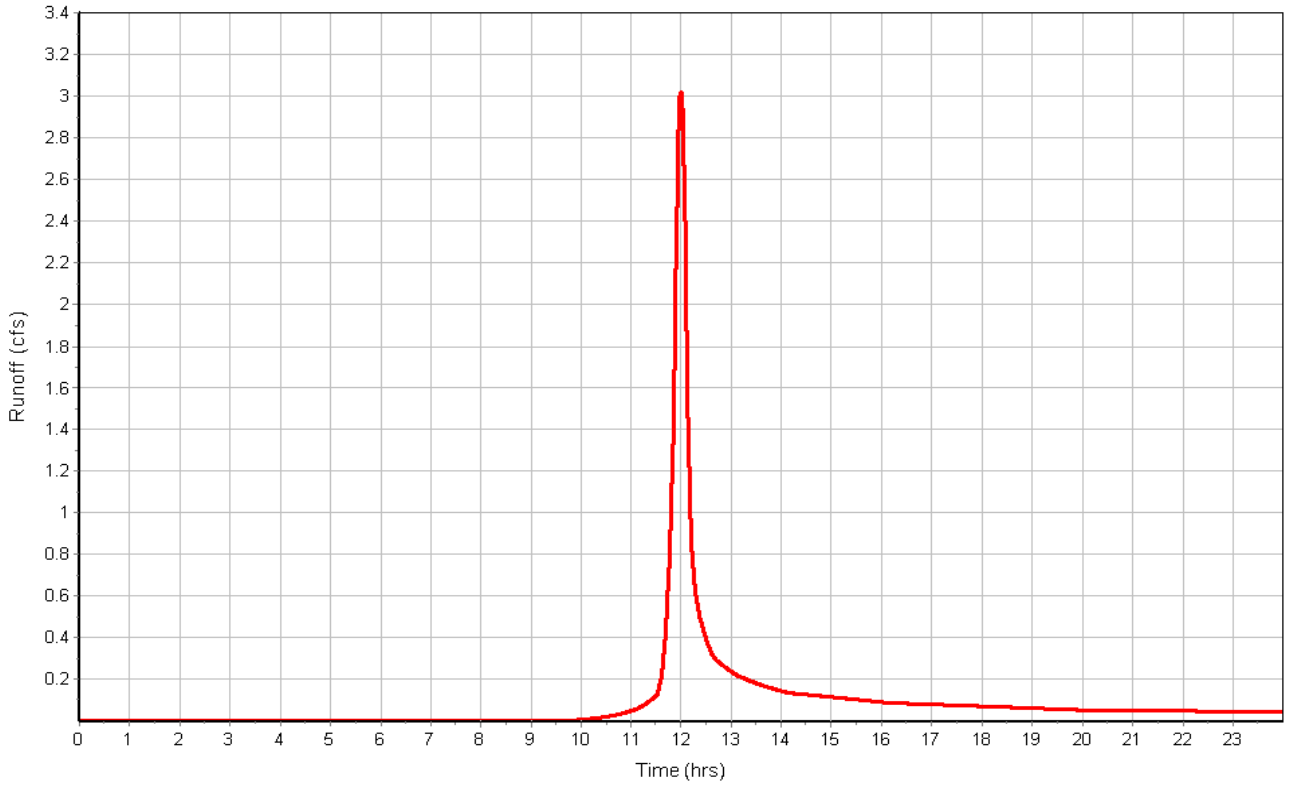
Total Rainfall (in) 4.49
Total Runoff (in) 1.90
Peak Runoff (cfs) 3.02
Weighted Curve Number 73.09
Time of Concentration (days hh:mm:ss) 0 00:09:56

Subbasin : SW2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SW3

Input Data

Area (ac) 58.50
Weighted Curve Number 63.03
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.51	C	98.00
Meadow, non-grazed	7.10	B	58.00
Woods,Good	21.04	B	55.00
Woods, Good	5.67	D	77.00
Woods, Good	15.42	C	70.00
Composite Area & Weighted CN	49.74		63.03

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.6	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	7.22	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.08	0.00	0.00
Computed Flow Time (min) :	20.19	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	698	617	548
Slope (%) :	3.87	0.6	1.12
Surface Type :	Woodland	Grass pasture	Woodland
Velocity (ft/sec) :	0.98	0.54	0.53
Computed Flow Time (min) :	11.87	19.04	17.23

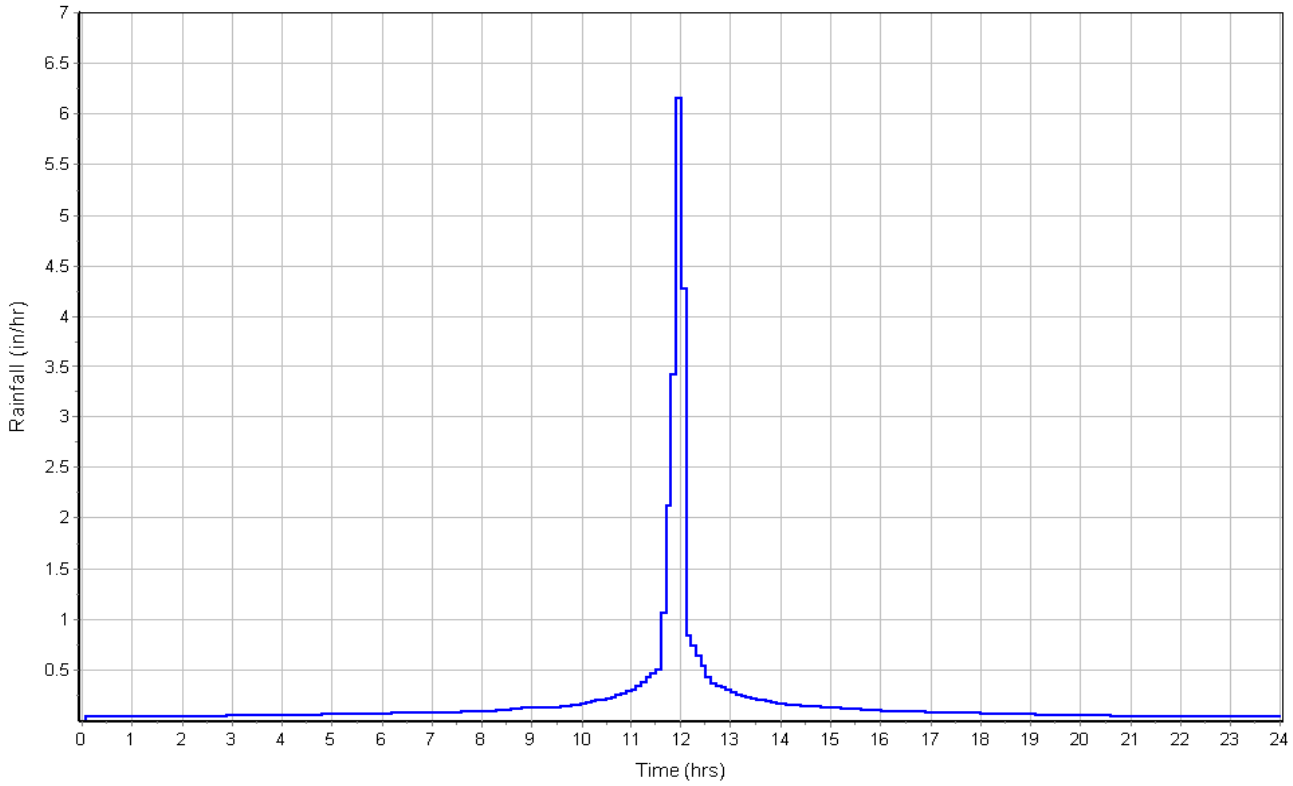
Total TOC (min) 68.34

Subbasin Runoff Results

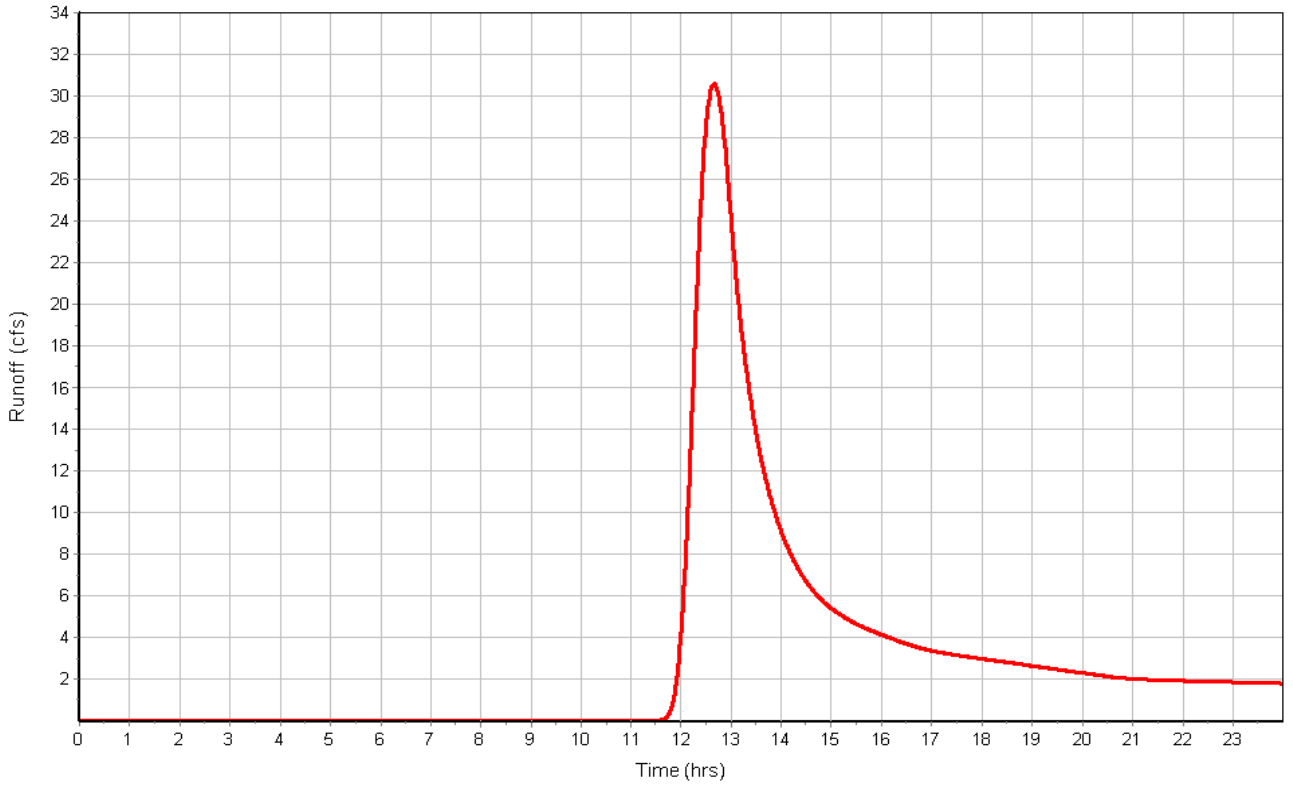
Total Rainfall (in) 4.49
Total Runoff (in) 1.20
Peak Runoff (cfs) 30.63
Weighted Curve Number 63.03
Time of Concentration (days hh:mm:ss) 0 01:08:20

Subbasin : SW3

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SW4

Input Data

Area (ac) 17.30
Weighted Curve Number 71.04
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	0.31	C	89.00
Paved parking & roofs	1.17	C	98.00
Woods, Good	10.46	C	70.00
Meadow, non-grazed	2.00	B	58.00
Meadow, non-grazed	2.74	C	71.00
Composite Area & Weighted CN	16.68		71.04

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.6	0.00	0.00
Flow Length (ft) :	99.5	0.00	0.00
Slope (%) :	1.45	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.04	0.00	0.00
Computed Flow Time (min) :	38.22	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	703	0.00	0.00
Slope (%) :	2.64	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	0.81	0.00	0.00
Computed Flow Time (min) :	14.47	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.033	0.00	0.00
Flow Length (ft) :	316	0.00	0.00
Channel Slope (%) :	3.48	0.00	0.00
Cross Section Area (ft^2) :	14	0.00	0.00
Wetted Perimeter (ft) :	11	0.00	0.00
Velocity (ft/sec) :	9.89	0.00	0.00
Computed Flow Time (min) :	0.53	0.00	0.00

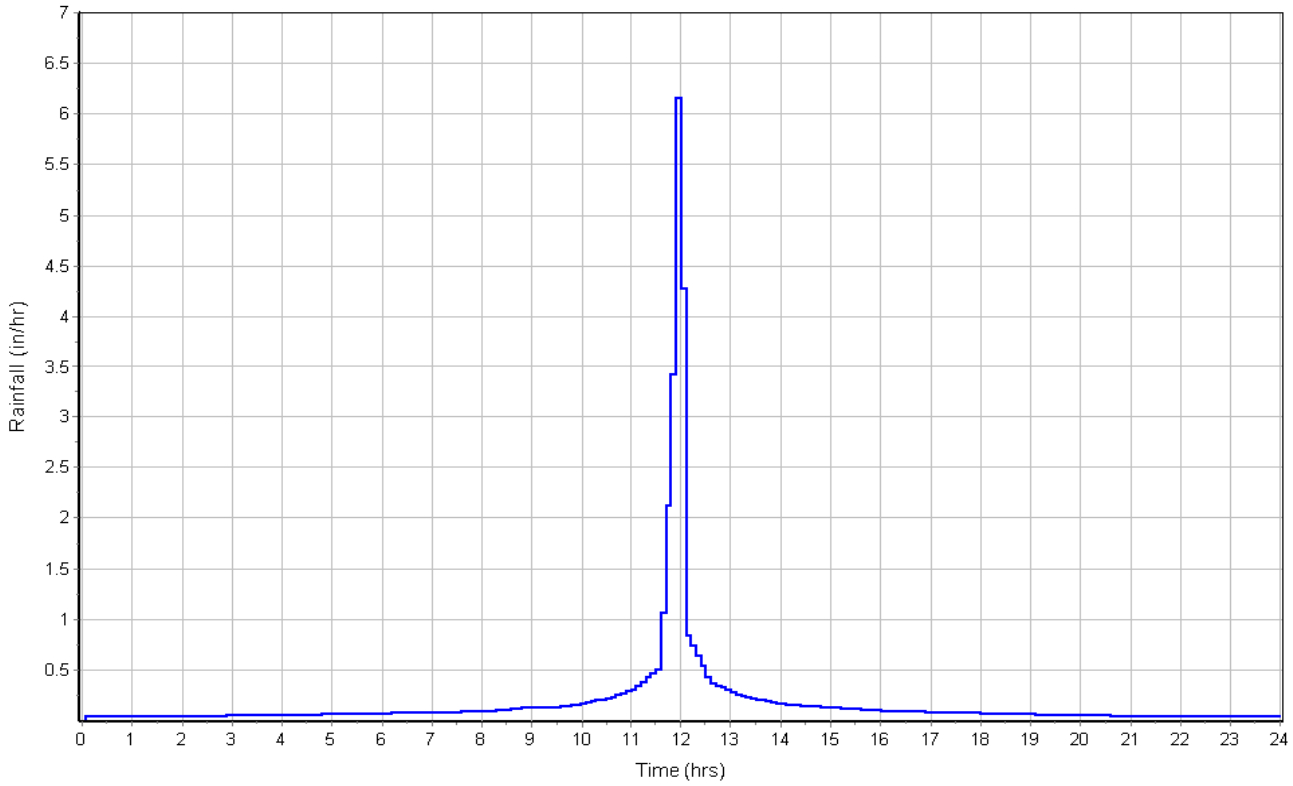
Total TOC (min) 53.21

Subbasin Runoff Results

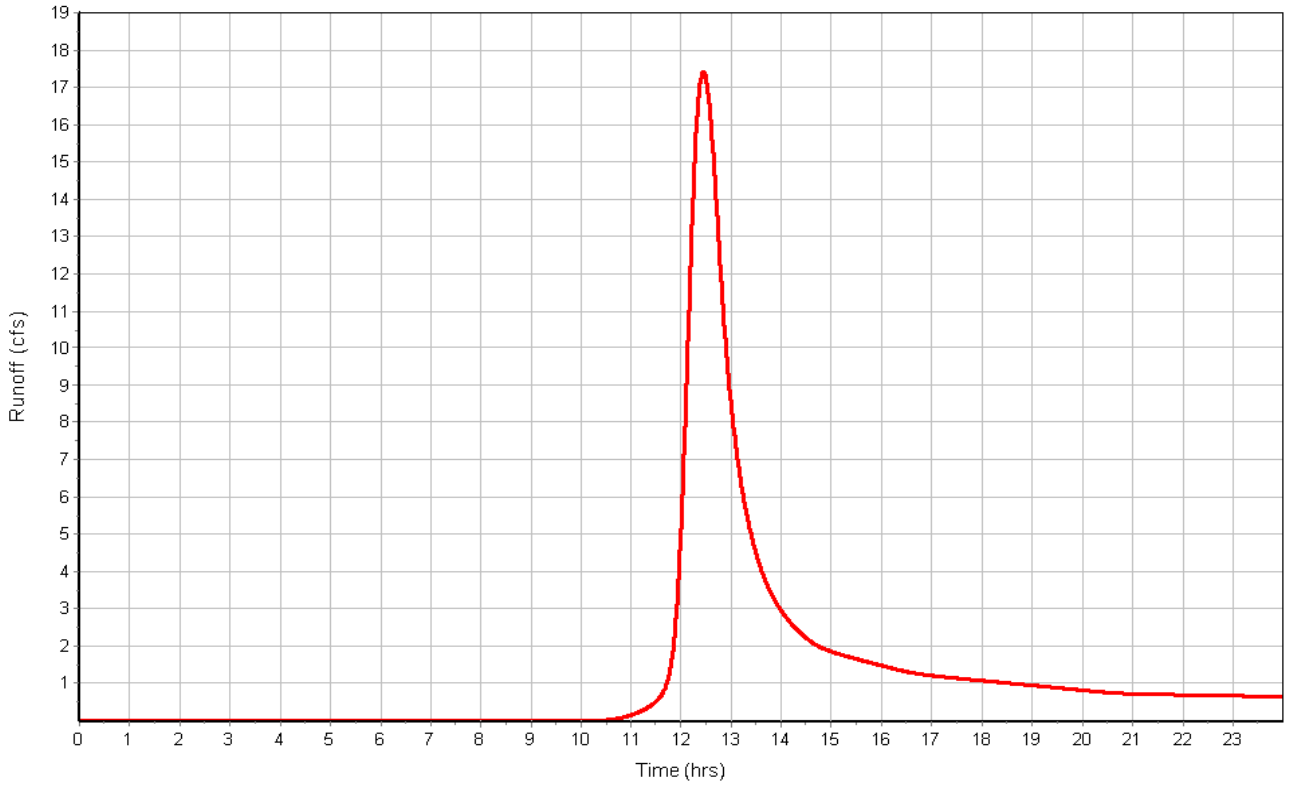
Total Rainfall (in) 4.49
Total Runoff (in) 1.74
Peak Runoff (cfs) 17.42
Weighted Curve Number 71.04
Time of Concentration (days hh:mm:ss) 0 00:53:13

Subbasin : SW4

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SW5

Input Data

Area (ac) 15.25
Weighted Curve Number 74.68
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	0.51	C	96.00
Grassed Landfill Cap	14.41	C	74.00
Meadow, non-grazed	0.33	C	71.00
Composite Area & Weighted CN	15.25		74.68

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.24	0.00	0.00
Flow Length (ft) :	93.54	0.00	0.00
Slope (%) :	5	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.15	0.00	0.00
Computed Flow Time (min) :	10.65	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	103.531	0.00	0.00
Slope (%) :	21.78	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	3.27	0.00	0.00
Computed Flow Time (min) :	0.53	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.033	0.033	0.033
Flow Length (ft) :	1186.413	302.86	30.591
Channel Slope (%) :	5	26.13	39.09
Cross Section Area (ft^2) :	4.5	8.48	8.48
Wetted Perimeter (ft) :	6.71	10.9	10.9
Velocity (ft/sec) :	7.74	19.52	23.88
Computed Flow Time (min) :	2.56	0.26	0.02

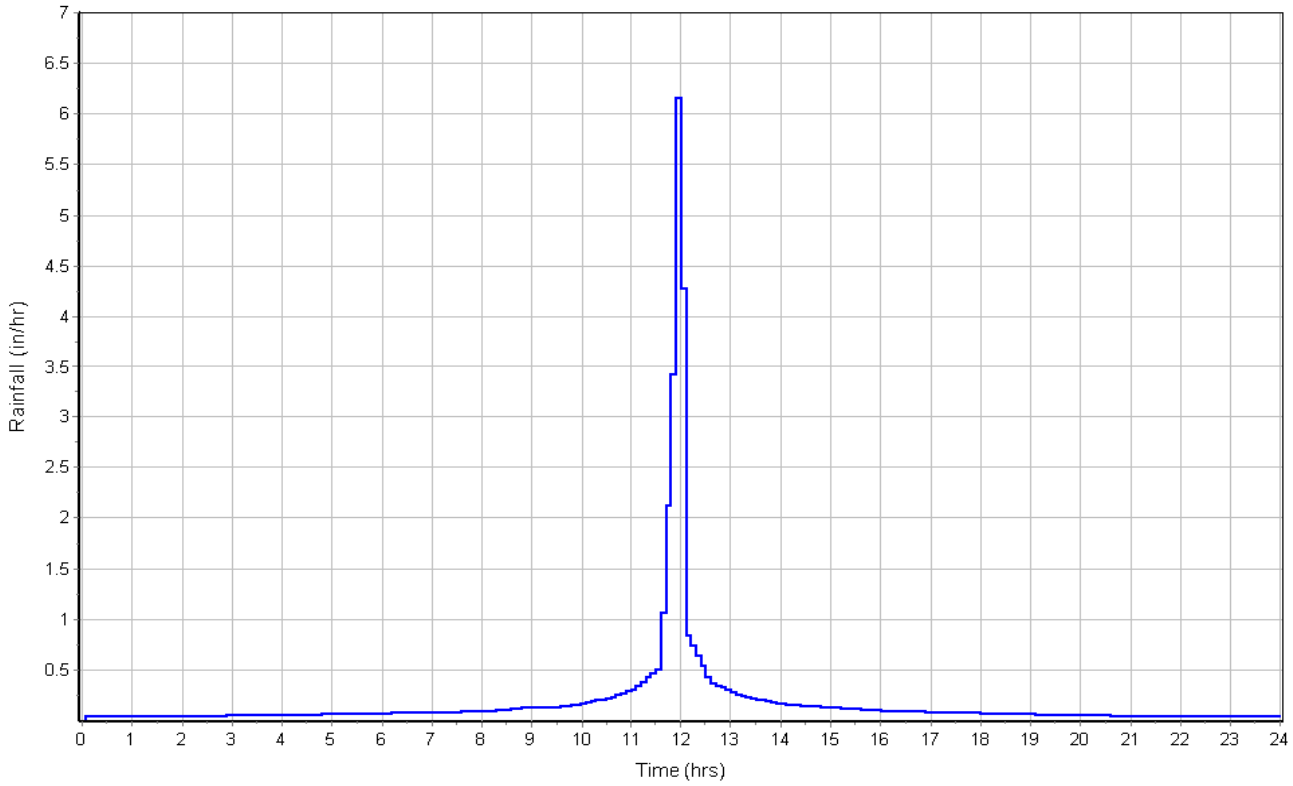
Total TOC (min) 14.02

Subbasin Runoff Results

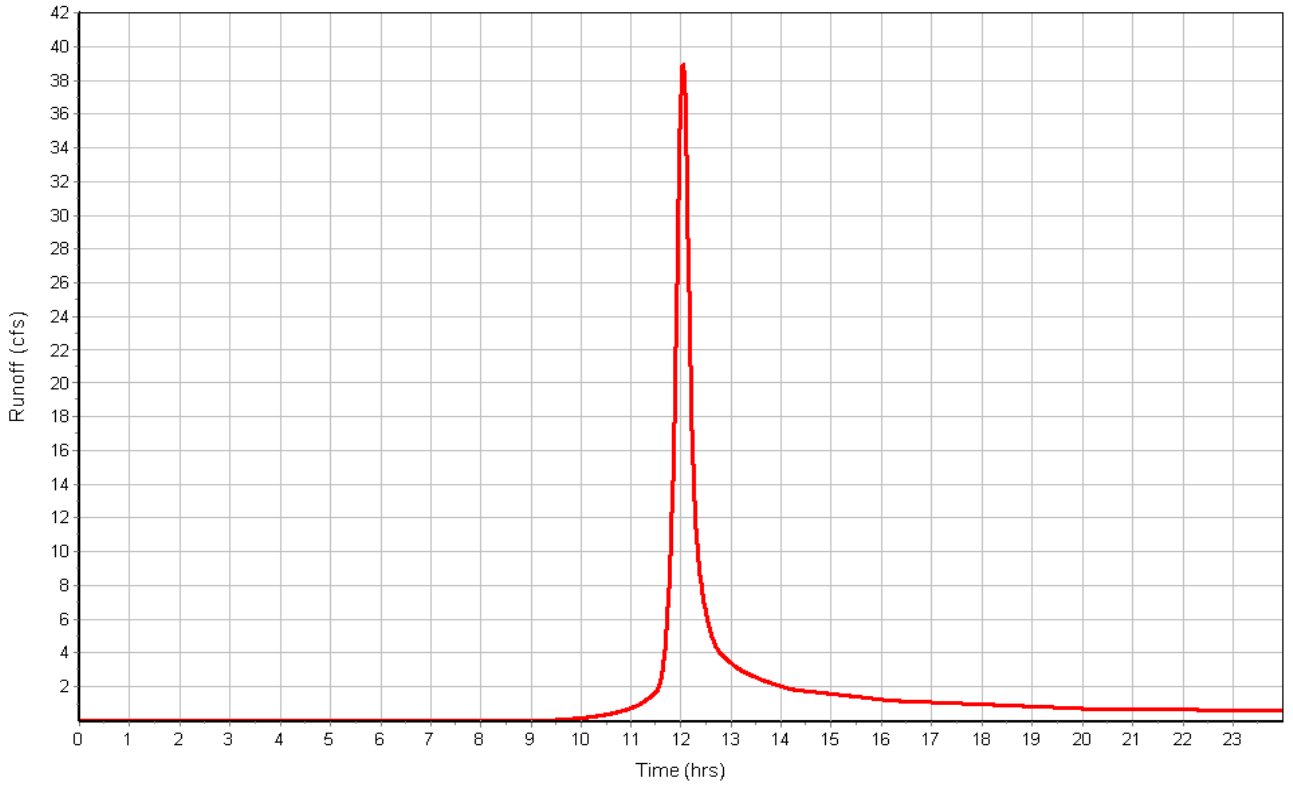
Total Rainfall (in) 4.49
Total Runoff (in) 2.02
Peak Runoff (cfs) 38.99
Weighted Curve Number 74.68
Time of Concentration (days hh:mm:ss) 0 00:14:01

Subbasin : SW5

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : SW6

Input Data

Area (ac) 10.08
Weighted Curve Number 79.10
Rain Gage ID ..... NRCC

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	2.34	C	96.00
Grassed Landfill Cap	7.74	C	74.00
Meadow, non-grazed	0.00	C	71.00
Composite Area & Weighted CN	10.08		79.10

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.24	0.00	0.00
Flow Length (ft) :	200.001	0.00	0.00
Slope (%) :	21.77	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.48	0.00	0.00
Velocity (ft/sec) :	0.31	0.00	0.00
Computed Flow Time (min) :	10.86	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	95.674	0.00	0.00
Slope (%) :	24.7	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	3.48	0.00	0.00
Computed Flow Time (min) :	0.46	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.033	0.033	0.033
Flow Length (ft) :	447.812	746.481	88.646
Channel Slope (%) :	5	8.84	20.31
Cross Section Area (ft^2) :	9.63	9.63	9.63
Wetted Perimeter (ft) :	9.62	9.62	9.62
Velocity (ft/sec) :	10.10	13.43	20.36
Computed Flow Time (min) :	0.74	0.93	0.07

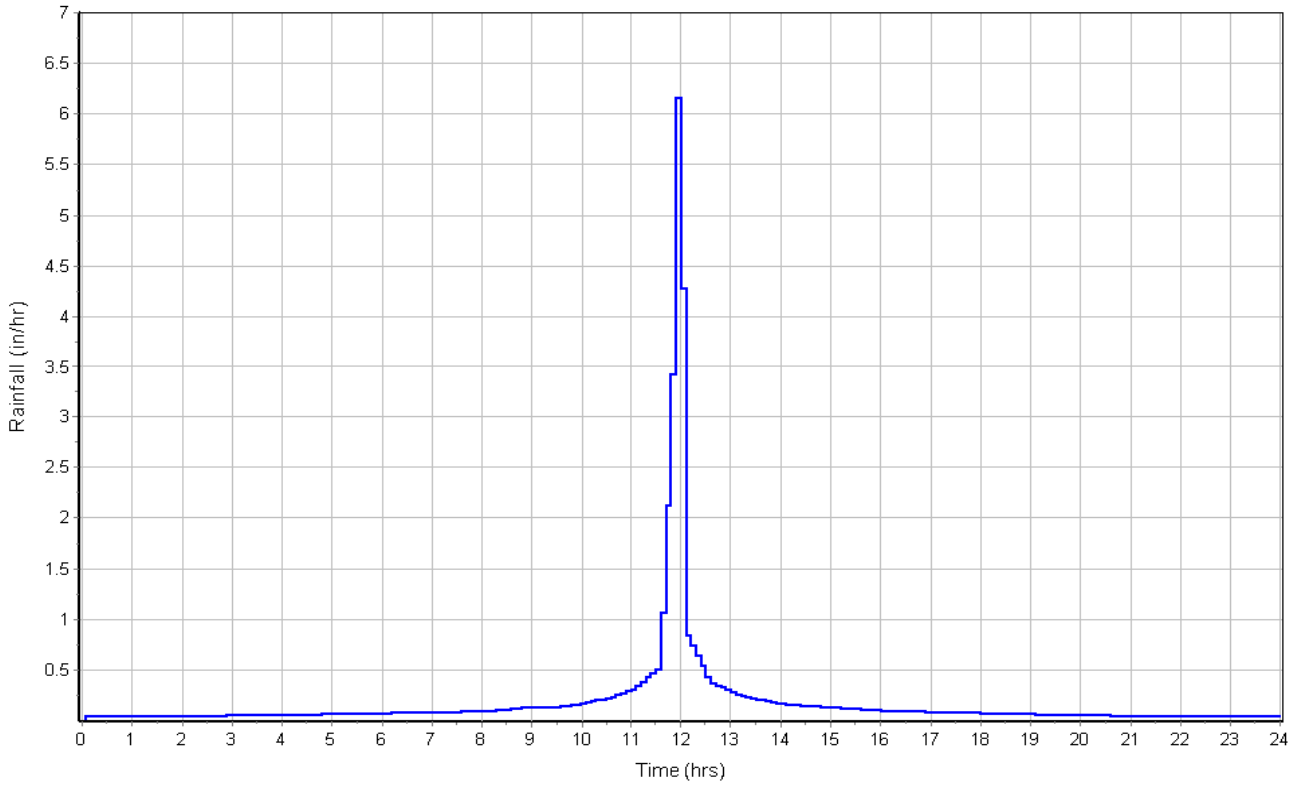
Total TOC (min) 13.06

Subbasin Runoff Results

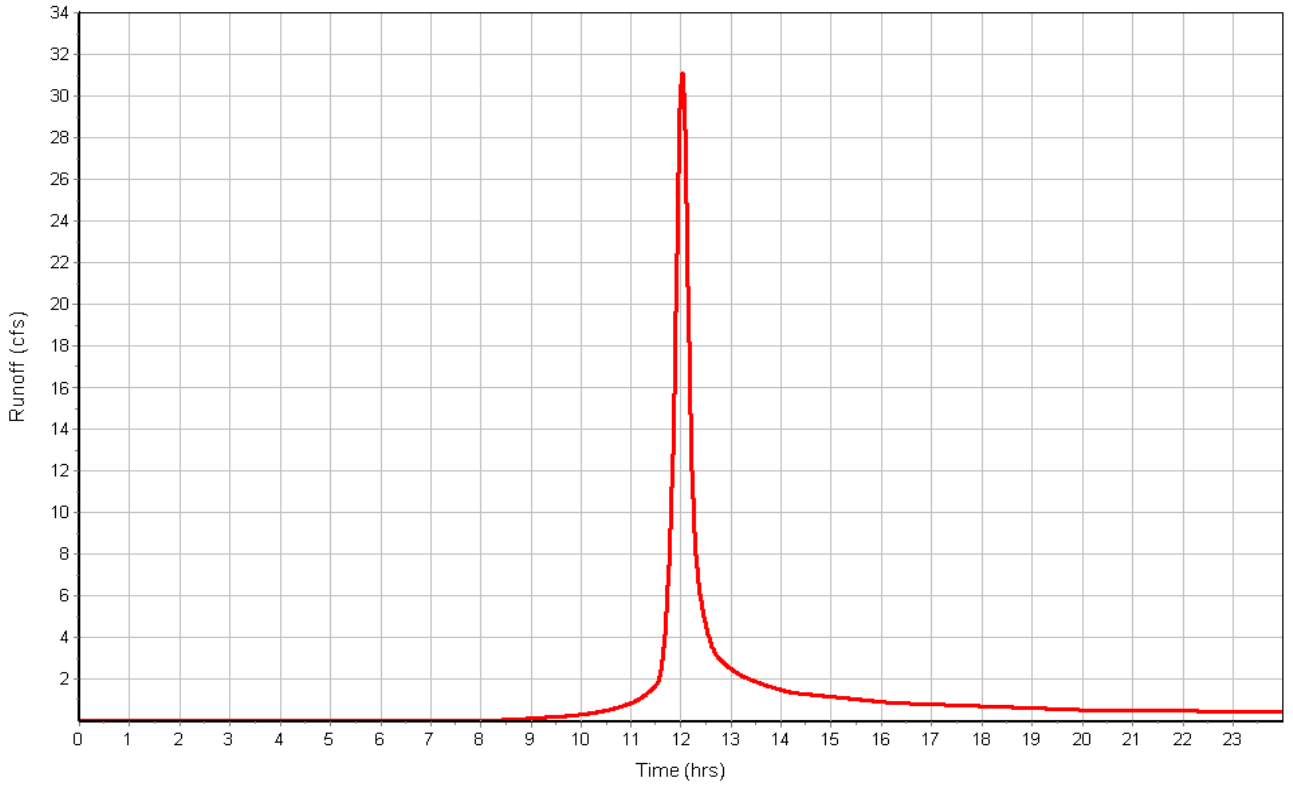
Total Rainfall (in) 4.49
Total Runoff (in) 2.38
Peak Runoff (cfs) 31.12
Weighted Curve Number 79.10
Time of Concentration (days hh:mm:ss) 0 00:13:04

Subbasin : SW6

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1	Culv-SE4-Out	1641.18	1646.00	4.82	1641.00	-0.18	0.00	-1646.00	0.00	0.00
2	Culv-SE5-Out	1676.00	1680.00	4.00	0.00	-1676.00	0.00	-1680.00	0.00	0.00
3	Culv-SW4_Out	1633.28	1639.28	6.00	1633.28	0.00	1639.28	0.00	10.00	46.20
4	Culv-SW5_Out	1645.73	1651.73	6.00	1645.73	0.00	1651.73	0.00	10.00	36.00
5	Culv-SW6_Out	1648.73	1654.73	6.00	1648.73	0.00	1654.73	0.00	1000.00	42.00
6	DMH-1	1619.16	1640.00	20.84	1618.00	-1.16	0.00	-1640.00	0.00	218.88
7	DMH-2	1620.64	1640.00	19.36	1619.50	-1.14	0.00	-1640.00	0.00	201.12
8	DMH-3	1621.47	1626.75	5.28	1621.00	-0.47	0.00	-1626.75	0.00	32.16
9	DMH-4	1622.06	1626.75	4.69	1620.70	-1.36	0.00	-1626.75	10.00	26.28
10	DMH-5	1622.75	1626.75	4.00	1622.00	-0.75	0.00	-1626.75	0.00	29.64
11	DMH-6	1625.27	1631.10	5.83	1625.00	-0.27	0.00	-1631.10	0.00	56.76
12	DMH-7	1630.32	1642.00	11.68	1600.00	-30.32	0.00	-1642.00	0.00	108.96
13	E2.1_in	1620.10	1625.00	4.90	1620.10	0.00	1625.00	0.00	0.00	28.80
14	E2.1_out	1620.00	1625.00	5.00	1620.00	0.00	1625.00	0.00	0.00	30.00
15	HW-1	1634.75	1639.75	5.00	1634.50	-0.25	0.00	-1639.75	0.00	3.00
16	HW-10	1638.00	1644.00	6.00	1638.00	0.00	1645.00	1.00	9000.00	36.00
17	HW-14	1643.32	1650.00	6.68	1642.00	-1.32	0.00	-1650.00	0.00	0.00
18	HW-16	1642.65	1648.00	5.35	1642.00	-0.65	0.00	-1648.00	0.00	28.20
19	HW-5	1647.50	1652.00	4.50	0.00	-1647.50	0.00	-1652.00	10.00	24.00
20	HW-7	1649.25	1654.00	4.75	0.00	-1649.25	0.00	-1654.00	0.00	0.00
21	Intr-SE4	1644.14	1650.00	5.86	1644.00	-0.14	0.00	-1650.00	0.00	34.32
22	Intr-SE6	1674.07	1678.07	4.00	0.00	-1674.07	0.00	-1678.07	0.00	0.00
23	Intr-SE7	1668.00	1672.00	4.00	0.00	-1668.00	0.00	-1672.00	0.00	0.00
24	Intr-SE8	1662.00	1666.00	4.00	0.00	-1662.00	0.00	-1666.00	0.00	0.00
25	Intr-Swale-SE11	1635.50	1639.75	4.25	1635.50	0.00	0.00	-1639.75	10.00	0.00
26	Int-SE1	1668.33	1677.00	8.67	0.00	-1668.33	0.00	-1677.00	0.00	44.04
27	Int-SE15	1646.44	1648.50	2.06	1648.00	1.56	0.00	-1648.50	0.00	0.72
28	Int-SE2	1664.17	1665.06	0.89	0.00	-1664.17	0.00	-1665.06	10.00	0.00
29	Int-SE3	1658.26	1660.25	1.99	1658.00	-0.26	0.00	-1660.25	0.00	10.68
30	Jun-151	1654.00	1660.00	6.00	1654.00	0.00	1660.00	0.00	0.00	24.00
31	Jun-177	1654.80	1655.00	0.20	0.00	-1654.80	0.00	-1655.00	0.00	0.00
32	Jun-189	1657.30	1659.00	1.70	0.00	-1657.30	0.00	-1659.00	0.00	0.00
33	Jun-190	1665.25	1670.00	4.75	0.00	-1665.25	0.00	-1670.00	0.00	0.00
34	Jun-194	1640.00	1646.00	6.00	1640.00	0.00	0.00	-1646.00	0.00	0.00
35	Jun-250	1672.00	1676.00	4.00	0.00	-1672.00	0.00	-1676.00	0.00	0.00
36	Jun-NW3	1650.16	1654.00	3.84	0.00	-1650.16	1654.00	0.00	1000.00	10.08
37	Jun-SW4A	1628.38	1634.38	6.00	1628.38	0.00	1634.38	0.00	10.00	16.56
38	Jun-SW4B	1612.00	1618.00	6.00	1612.00	0.00	1618.00	0.00	1000.00	0.00
39	NW-1	1260.00	1270.00	10.00	1260.00	0.00	1270.00	0.00	10.00	120.00
40	NW-2	1220.00	1226.00	6.00	1220.00	0.00	1226.00	0.00	10.00	48.00
41	Out-N	1100.00	1120.00	20.00	1100.00	0.00	1120.00	0.00	100000.00	192.00
42	Out-S	1500.00	1650.00	150.00	1500.00	0.00	1650.00	0.00	1000.00	1740.00
43	Out-SE(HW-1)	1618.10	1628.00	9.90	1617.00	-1.10	1628.00	0.00	0.00	88.32
44	Pond_NW2-Out	1642.00	1650.00	8.00	1642.00	0.00	1650.00	0.00	1000.00	0.00
45	Pond_NW-5-OCS	1660.50	1670.00	9.50	1662.50	2.00	0.00	-1670.00	10.00	0.00
46	Pond_PH3-OCS	1641.80	1651.00	9.20	0.00	-1641.80	1651.00	0.00	4.00	0.00
47	Pond_SE1-Out	1658.30	1660.30	2.00	0.00	-1658.30	0.00	-1660.30	10.00	0.00
48	Pond_SE-2-Out	1641.50	1648.00	6.50	0.00	-1641.50	0.00	-1648.00	0.00	54.00
49	SE-1-OCS-1	1625.25	1633.50	8.25	1625.00	-0.25	0.00	-1633.50	10.00	0.00
50	SE-1-OCS-2	1622.75	1633.50	10.75	1625.50	2.75	0.00	-1633.50	36.00	0.00
51	South-1	1613.00	1620.00	7.00	1613.00	0.00	1620.00	0.00	1000.00	0.00
52	South-3	1613.00	1620.00	7.00	1613.00	0.00	1620.00	0.00	1000.00	39.84
53	Southwest	1570.00	1610.00	40.00	1570.00	0.00	1610.00	0.00	10.00	69.84
54	Swale-NW4	1650.04	1656.04	6.00	1650.04	0.00	0.00	-1656.04	10.00	17.64

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Culv-SE4-Out	16.12	0.00	1641.89	0.71	0.00	4.29	1641.28	0.10	0 12:12	0 00:00	0.00	0.00
2	Culv-SE5-Out	8.59	8.59	1676.65	0.65	0.00	3.35	1676.06	0.06	0 12:02	0 00:00	0.00	0.00
3	Culv-SW4_Out	2.95	0.00	1633.58	0.30	0.00	5.70	1633.38	0.10	0 12:04	0 00:00	0.00	0.00
4	Culv-SW5_Out	34.30	0.00	1645.98	0.25	0.00	5.75	1645.75	0.02	0 12:07	0 00:00	0.00	0.00
5	Culv-SW6_Out	30.93	0.00	1649.27	0.54	0.00	5.46	1648.78	0.05	0 12:03	0 00:00	0.00	0.00
6	DMH-1	20.76	0.00	1620.35	1.19	0.00	19.65	1619.49	0.33	0 12:22	0 00:00	0.00	0.00
7	DMH-2	20.84	0.00	1622.43	1.79	0.00	17.57	1621.11	0.47	0 12:22	0 00:00	0.00	0.00
8	DMH-3	4.04	0.00	1622.46	0.99	0.00	4.29	1621.66	0.19	0 12:22	0 00:00	0.00	0.00
9	DMH-4	4.04	0.00	1622.76	0.70	0.00	3.99	1622.25	0.19	0 12:32	0 00:00	0.00	0.00
10	DMH-5	0.51	0.00	1623.50	0.75	0.00	3.25	1623.22	0.47	0 12:33	0 00:00	0.00	0.00
11	DMH-6	0.51	0.00	1625.52	0.25	0.00	5.58	1625.41	0.14	0 12:32	0 00:00	0.00	0.00
12	DMH-7	18.04	0.00	1631.05	0.73	0.00	10.95	1630.54	0.22	0 12:14	0 00:00	0.00	0.00
13	E2.1_in	0.08	0.00	1621.67	1.57	0.00	3.33	1620.13	0.03	0 12:06	0 00:00	0.00	0.00
14	E2.1_out	1.55	0.00	1621.67	1.67	0.00	3.33	1620.03	0.03	0 12:06	0 00:00	0.00	0.00
15	HW-1	10.68	0.00	1637.21	2.46	0.00	2.54	1635.40	0.65	0 12:03	0 00:00	0.00	0.00
16	HW-10	18.08	5.88	1640.01	2.01	0.00	3.99	1638.48	0.48	0 12:14	0 00:00	0.00	0.00
17	HW-14	19.89	0.00	1647.33	4.01	0.00	3.08	1645.27	1.95	0 12:20	0 00:00	0.00	0.00
18	HW-16	4.80	4.80	1643.43	0.78	0.00	4.57	1642.79	0.14	0 12:10	0 00:00	0.00	0.00
19	HW-5	33.39	33.39	1649.01	1.51	0.00	2.99	1647.69	0.19	0 12:03	0 00:00	0.00	0.00
20	HW-7	44.51	0.00	1651.34	2.09	0.00	2.66	1649.60	0.35	0 12:04	0 00:00	0.00	0.00
21	Intr-SE4	14.67	0.00	1647.29	3.15	0.00	2.71	1644.37	0.23	0 12:20	0 00:00	0.00	0.00
22	Intr-SE6	18.09	9.94	1675.23	1.16	0.00	2.84	1674.19	0.12	0 12:02	0 00:00	0.00	0.00
23	Intr-SE7	30.44	12.98	1668.88	0.88	0.00	3.12	1668.08	0.08	0 12:03	0 00:00	0.00	0.00
24	Intr-SE8	44.69	14.81	1663.02	1.02	0.00	2.98	1662.09	0.09	0 12:03	0 00:00	0.00	0.00
25	Intr-Swale-SE11	10.98	10.98	1637.31	1.81	0.00	3.19	1636.20	0.70	0 12:03	0 00:00	0.00	0.00
26	Int-SE1	23.28	23.28	1669.51	1.18	0.00	7.49	1668.50	0.17	0 12:22	0 00:00	0.00	0.00
27	Int-SE15	19.92	19.92	1648.00	1.56	0.00	0.50	1646.61	0.17	0 00:00	0 00:00	0.00	0.00
28	Int-SE2	21.57	21.57	1679.23	15.06	13.96	0.00	1665.00	0.83	0 12:47	0 12:22	4.43	96.00
29	Int-SE3	52.79	41.68	1660.25	1.99	0.00	0.00	1659.30	1.04	0 11:47	0 12:11	74.78	732.00
30	Jun-151	44.58	0.00	1655.08	1.08	0.00	4.92	1654.10	0.10	0 12:03	0 00:00	0.00	0.00
31	Jun-177	4.37	0.00	1660.28	5.48	0.00	163822.72	1657.62	2.82	0 12:11	0 00:00	0.00	0.00
32	Jun-189	0.83	0.00	1657.56	0.26	0.00	2.44	1657.43	0.13	1 00:00	0 00:00	0.00	0.00
33	Jun-190	23.29	0.00	1667.41	2.16	0.00	4.34	1666.23	0.98	1 00:00	0 00:00	0.00	0.00
34	Jun-194	17.09	0.00	1640.79	0.79	0.00	7.41	1640.22	0.22	0 12:14	0 00:00	0.00	0.00
35	Jun-250	17.77	0.00	1672.62	0.62	0.00	3.38	1672.05	0.05	0 12:03	0 00:00	0.00	0.00
36	Jun-NW3	25.64	0.00	1650.80	0.64	0.00	3.20	1650.25	0.09	0 12:03	0 00:00	0.00	0.00
37	Jun-SW4A	51.31	17.41	1632.04	3.66	0.00	2.34	1630.09	1.71	0 12:26	0 00:00	0.00	0.00
38	Jun-SW4B	51.77	0.00	1616.10	4.10	0.00	1.90	1613.46	1.46	0 12:33	0 00:00	0.00	0.00
39	NW-1	199.07	199.07	1260.00	0.00	0.00	10.00	1260.00	0.00	0 00:00	0 00:00	0.00	0.00
40	NW-2	76.19	65.62	1220.00	0.00	0.00	6.00	1220.00	0.00	0 12:45	0 00:00	0.00	0.00
41	Out-N	259.06	0.00	1106.51	6.51	0.00	13.49	1101.24	1.24	0 12:34	0 00:00	0.00	0.00
42	Out-S	107.56	0.00	1502.07	2.07	0.00	147.93	1500.55	0.55	0 12:34	0 00:00	0.00	0.00
43	Out-SE(HW-1)	20.76	0.00	1618.86	0.76	0.00	9.14	1618.33	0.23	0 12:22	0 00:00	0.00	0.00
44	Pond_NW2-Out	11.81	0.00	1642.75	0.75	0.00	7.25	1642.20	0.20	0 12:45	0 00:00	0.00	0.00
45	Pond_NW-5-OCS	0.83	0.00	1662.88	2.38	0.00	7.12	1662.69	2.19	1 00:00	0 00:00	0.00	0.00
46	Pond_PH3-OCS	4.51	0.00	1642.79	0.99	0.00	8.21	1642.27	0.47	0 15:54	0 00:00	0.00	0.00
47	Pond_SE1-Out	0.83	0.00	1658.53	0.23	0.00	7.60	1658.42	0.12	1 00:00	0 00:00	0.00	0.00
48	Pond_SE-2-Out	4.56	0.00	1641.81	0.31	0.00	6.19	1641.64	0.14	0 15:35	0 00:00	0.00	0.00
49	SE-1-OCS-1	0.51	0.00	1626.03	0.78	0.00	7.47	1625.75	0.50	0 12:32	0 00:00	0.00	0.00
50	SE-1-OCS-2	3.53	0.00	1626.29	3.54	0.00	7.21	1625.71	2.96	0 12:31	0 00:00	0.00	0.00
51	South-1	33.32	0.00	1613.48	0.48	0.00	8.32	1613.02	0.02	0 12:05	0 00:00	0.00	0.00
52	South-3	20.52	0.00	1613.31	0.31	0.00	6.69	1613.01	0.01	0 12:00	0 00:00	0.00	0.00
53	Southwest	80.13	0.00	1571.39	1.39	0.00	38.61	1570.26	0.26	0 12:38	0 00:00	0.00	0.00
54	Swale-NW4	28.72	20.78	1652.28	2.24	0.00	3.76	1651.01	0.97	0 12:03	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Shape	Height (ft)	Width (ft)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses
1	Link-315	80.00	1620.00	0.00	1619.20	0.00	0.80	1.0000	Trapezoidal	2.000	22.000	0.0320	0.5000	0.5000	0.0000
2	Link-387	366.60	1657.30	0.00	1650.16	0.00	7.14	1.9500	Trapezoidal	1.250	8.500	0.0300	0.0000	0.0000	0.0000
3	Link-392	180.74	1646.00	-8.00	1650.00	0.75	-4.00	-2.2100	Trapezoidal	4.000	21.000	0.0330	0.0000	0.0000	0.0000
4	N_Routing	0.10	1100.00	0.00	1099.99	99.99	0.01	10.0000	Triangular	4.000	10.000	0.0300	0.5000	0.5000	0.0000
5	NW2-Swale	2505.00	1642.00	0.00	1220.00	0.00	422.00	16.8500	Trapezoidal	2.000	14.000	0.0300	0.5000	0.5000	0.0000
6	S_Rout	0.10	1500.00	0.00	1499.90	99.90	0.10	100.0000	Triangular	4.000	40.000	0.0300	0.5000	0.5000	0.0000
7	Swale-NW2	651.44	1650.16	0.00	1643.88	1.88	6.28	0.9600	Trapezoidal	2.000	26.000	0.0300	0.5000	0.5000	0.0000
8	Swale-NW3	449.31	1651.57	1.53	1647.91	0.00	3.66	0.8100	Trapezoidal	2.000	26.000	0.0300	0.5000	0.5000	0.0000
9	Swale-NW7	32.50	1658.30	0.00	1658.00	0.70	0.30	0.9200	Trapezoidal	2.000	14.000	0.0300	0.0000	0.0000	0.0000
10	Swale-SE11	200.00	1636.50	1.00	1635.50	0.75	1.00	0.5000	Trapezoidal	4.000	21.000	0.0330	0.0000	0.0000	0.0000
11	Swale-SE15	664.00	1646.44	0.00	1643.32	0.00	3.12	0.4700	Trapezoidal	2.000	14.000	0.0300	0.0000	0.0000	0.0000
12	Swale-SE1-A	612.50	1668.33	0.00	1665.25	0.00	3.08	0.5000	Trapezoidal	5.000	34.000	0.0300	0.0000	0.0000	0.0000
13	Swale-SE1-B	211.00	1665.25	0.00	1663.60	1.10	1.65	0.7800	Trapezoidal	6.500	43.000	0.0300	0.0000	0.0000	0.0000
14	Swale-SE2	465.30	1664.17	0.00	1658.26	0.00	5.91	1.2700	Trapezoidal	1.100	4.900	0.0300	0.0000	0.0000	0.0000
15	Swale-SE20	58.20	1641.50	0.00	1640.00	0.00	1.50	2.5800	Trapezoidal	2.000	16.000	0.0330	0.0000	0.0000	0.0000
16	Swale-SE21	197.10	1640.00	0.00	1638.00	0.00	2.00	1.0100	Trapezoidal	3.000	22.000	0.0300	0.0000	0.0000	0.0000
17	Swale-SE3	701.00	1658.26	0.00	1654.80	0.00	3.46	0.4900	Trapezoidal	1.100	4.600	0.0300	0.0000	0.0000	0.0000
18	Swale-SE3b	219.80	165480.00	163825.20	1647.41	4.09	163832.59	74537.1200	Trapezoidal	3.000	12.250	0.0300	0.5000	0.5000	0.0000
19	SWALE-SE4B	86.86	1641.18	0.00	1640.00	0.00	1.18	1.3600	Trapezoidal	5.000	34.000	0.0300	0.0000	0.0000	0.0000
20	Swale-SE5	385.20	1676.00	0.00	1674.07	0.00	1.93	0.5000	Trapezoidal	4.000	21.000	0.0330	0.0000	0.0000	0.0000
21	Swale-SE6A	398.10	1674.07	0.00	1672.00	0.00	2.07	0.5200	Trapezoidal	4.000	21.000	0.0330	0.0000	0.0000	0.0000
22	Swale-SE6B	150.50	1672.00	0.00	1668.00	0.00	4.00	2.6600	Trapezoidal	4.000	21.000	0.0330	0.0000	0.0000	0.0000
23	Swale-SE7	274.50	1668.00	0.00	1662.00	0.00	6.00	2.1900	Trapezoidal	4.000	21.000	0.0330	0.0000	0.0000	0.0000
24	Swale-SE8	283.30	1662.00	0.00	1654.00	0.00	8.00	2.8200	Trapezoidal	4.000	21.000	0.0330	0.0000	0.0000	0.0000
25	Swale-SW4A-Routing	775.76	1631.00	2.62	1614.00	2.00	17.00	2.1900	Trapezoidal	2.000	36.000	0.1000	0.5000	0.5000	0.0000
26	Swale-SW4B-Routing	414.00	1633.43	0.15	1612.00	0.00	21.43	5.1800	Trapezoidal	2.000	36.000	0.1000	0.5000	0.5000	0.0000
27	Swale-SW4C	254.98	1614.00	2.00	1602.72	0.00	11.28	4.4200	Triangular	4.000	10.000	0.0300	0.5000	0.5000	0.0000
28	Swale-SW5-Routing	390.00	1645.00	-0.73	1634.00	4.84	11.00	2.8200	Rectangular	1.000	40.000	0.0300	0.5000	0.5000	0.0000
29	Swale-SW6-Routing	170.69	1639.00	-9.73	1634.00	4.84	5.00	2.9300	Trapezoidal	4.000	45.000	0.0300	0.5000	0.5000	0.0000

Initial Flow (cfs)	Flap Gate
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No
0.00	No

Channel Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	Link-315	1.55	0 11:58	187.10	0.01	0.11	12.12	1.83	0.92	0.00		
2	Link-387	0.83	1 00:00	31.32	0.03	2.78	2.20	0.40	0.32	0.00		
3	Link-392	44.51	0 12:03	602.01	0.07	5.47	0.55	1.21	0.30	0.00		
4	N_Routing	259.06	0 12:34	421.70	0.61	15.42	0.00	3.67	0.92	0.00		
5	NW2-Swale	11.78	0 12:45	344.99	0.03	10.00	4.18	0.38	0.19	0.00		
6	S_Rout	107.52	0 12:34	6208.64	0.02	9.93	0.00	1.47	0.37	0.00		
7	Swale-NW2	25.30	0 12:03	214.63	0.12	2.60	4.18	1.29	0.64	0.00		
8	Swale-NW3	28.51	0 12:03	197.45	0.14	2.01	3.73	1.11	0.55	0.00		
9	Swale-NW7	0.83	1 00:00	80.76	0.01	1.64	0.33	0.20	0.10	0.00		
10	Swale-SE11	10.68	0 11:59	286.14	0.04	1.26	2.65	1.26	0.31	0.00		
11	Swale-SE15	19.89	0 00:00	57.62	0.35	5.26	2.10	1.63	0.81	0.00		
12	Swale-SE1-A	23.29	0 12:23	641.71	0.04	2.97	3.44	1.17	0.23	0.00		
13	Swale-SE1-B	23.21	0 12:25	1508.76	0.02	1.76	2.00	2.98	0.46	0.00		
14	Swale-SE2	11.10	0 12:09	11.10	1.00	3.74	2.07	1.10	1.00	96.00		
15	Swale-SE20	4.52	0 15:35	163.38	0.03	2.35	0.41	0.47	0.23	0.00		
16	Swale-SE21	17.06	0 12:14	276.92	0.06	1.49	2.20	1.40	0.47	0.00		
17	Swale-SE3	4.37	0 11:48	5.91	0.74	1.66	7.04	1.10	1.00	733.00		
18	Swale-SE3b	0.00	0 00:00	31307.60	0.00	0.00		0.00	0.00	0.00		
19	SWALE-SE4B	15.96	0 12:12	1054.75	0.02	3.42	0.42	0.75	0.15	0.00		
20	Swale-SE5	8.50	0 12:02	286.44	0.03	1.38	4.65	0.91	0.23	0.00		
21	Swale-SE6A	17.77	0 12:02	291.80	0.06	2.96	2.24	0.89	0.22	0.00		
22	Swale-SE6B	17.70	0 12:03	659.72	0.03	3.63	0.69	0.75	0.19	0.00		
23	Swale-SE7	30.39	0 12:03	598.28	0.05	4.64	0.99	0.95	0.24	0.00		
24	Swale-SE8	44.58	0 12:03	680.02	0.07	5.99	0.79	1.05	0.26	0.00		
25	Swale-SW4A-Routing	51.14	0 12:26	163.89	0.31	1.98	6.53	1.52	0.76	0.00		
26	Swale-SW4B-Routing	2.78	0 12:04	251.89	0.01	0.22	31.36	1.07	0.54	0.00		
27	Swale-SW4C	50.20	0 12:33	280.48	0.18	5.87	0.72	3.05	0.76	0.00		
28	Swale-SW5-Routing	34.26	0 12:07	332.62	0.10	3.36	1.93	0.50	0.50	0.00		
29	Swale-SW6-Routing	30.91	0 12:03	2449.26	0.01	7.62	0.37	0.55	0.14	0.00		

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)
1	Cul-SW4	41.14	1602.72	0.00	1601.68	31.68	1.04	2.5300	CIRCULAR	30.000	30.000	0.0110	0.5000	0.5000	0.0000	0.00
2	Culv_SE-11	150.33	1635.50	0.75	1633.60	1.10	1.90	1.2600	CIRCULAR	24.000	24.000	0.0120	0.0000	0.0000	0.0000	0.00
3	Culv-E2.1	24.00	1620.10	0.00	1620.00	0.00	0.10	0.4200	CIRCULAR	30.000	30.000	0.0150	0.5000	0.5000	0.0000	0.00
4	Culvert-SW4	82.60	1634.25	0.00	1633.28	0.00	0.97	1.1700	CIRCULAR	24.000	24.000	0.0100	0.5000	0.5000	0.0000	0.00
5	Culv-NW3A	63.30	1647.91	0.00	1646.75	4.75	1.16	1.8300	CIRCULAR	36.000	36.000	0.0110	0.5000	0.5000	0.0000	0.00
6	Culv-NW3B	63.30	1647.91	0.00	1647.43	5.43	0.48	0.7600	CIRCULAR	36.000	36.000	0.0110	0.5000	0.5000	0.0000	0.00
7	Culv-NW4A	40.02	1651.04	0.00	1651.57	1.53	-0.53	-1.3200	CIRCULAR	36.000	36.000	0.0110	0.5000	0.5000	0.0000	0.00
8	Culv-NW4B	81.71	1651.14	0.10	1650.16	0.00	0.98	1.2000	CIRCULAR	36.000	36.000	0.0110	0.5000	0.5000	0.0000	0.00
9	Culv-S1	62.08	1616.46	0.00	1616.45	3.45	0.01	0.0200	CIRCULAR	30.000	30.000	0.0110	0.5000	0.5000	0.0000	0.00
10	Culv-S2	90.97	1619.20	0.00	1618.80	5.80	0.40	0.4400	CIRCULAR	36.000	36.000	0.0110	0.5000	0.5000	0.0000	0.00
11	Culv-S3	61.14	1615.31	0.00	1614.18	1.18	1.13	1.8500	CIRCULAR	30.000	30.000	0.0110	0.5000	0.5000	0.0000	0.00
12	Culv-SE10	73.94	1638.78	0.00	1636.26	3.76	2.52	3.4100	CIRCULAR	24.000	24.000	0.0120	0.0000	0.0000	0.0000	0.00
13	Culv-SE3	120.00	1645.24	1.92	1644.64	0.50	0.60	0.5000	CIRCULAR	30.000	30.000	0.0120	0.9000	0.3000	0.0000	0.00
14	Culv-SE4	104.00	1642.65	0.00	1641.68	0.50	0.97	0.9300	CIRCULAR	36.000	36.000	0.0120	0.0000	0.0000	0.0000	0.00
15	Culv-SE8	71.80	1649.50	0.25	1646.00	0.70	3.50	4.8700	CIRCULAR	30.000	30.000	0.0120	0.5000	0.5000	0.0000	0.00
16	Culv-SE9	63.20	1647.50	0.00	1645.30	0.00	2.20	3.4800	CIRCULAR	30.000	30.000	0.0120	0.5000	0.5000	0.0000	0.00
17	Culv-SW3	59.15	1578.00	0.00	1576.00	6.00	2.00	3.3800	CIRCULAR	30.000	30.000	0.0110	0.5000	0.5000	0.0000	0.00
18	Culv-SW4	52.00	1629.16	0.00	1628.38	0.00	0.78	1.5000	CIRCULAR	24.000	24.000	0.0110	0.5000	0.5000	0.0000	0.00
19	Culv-SW5	59.57	1647.36	0.00	1645.73	0.00	1.63	2.7400	CIRCULAR	36.000	36.000	0.0240	0.5000	0.5000	0.0000	0.00
20	Culv-SW6	71.39	1650.36	0.00	1648.73	0.00	1.63	2.2800	CIRCULAR	30.000	30.000	0.0110	0.5000	0.5000	0.0000	0.00
21	EPIPE-SE1	50.94	1619.16	0.00	1618.14	0.04	1.02	2.0000	CIRCULAR	30.000	30.000	0.0120	0.5000	0.0000	0.0000	0.00
22	Link-389	215.13	1644.14	0.00	1641.18	0.00	2.96	1.3800	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00
23	NW_Direct_Rout-1	1.00	1260.00	0.00	1100.00	0.00	160.00	16000.0000	Dummy	0.000	0.000	0.0300	0.5000	0.5000	0.0000	0.00
24	NW_Direct_Rout-2	1.00	1220.00	0.00	1100.00	0.00	120.00	12000.0000	Dummy	0.000	0.000	0.0300	0.5000	0.5000	0.0000	0.00
25	PIPE-0	275.30	1620.64	0.00	1619.26	0.10	1.38	0.5000	CIRCULAR	30.000	30.000	0.0120	0.5000	0.8000	0.0000	0.00
26	PIPE-1	145.60	1621.47	0.00	1620.74	0.10	0.73	0.5000	CIRCULAR	30.000	30.000	0.0120	0.5000	0.8000	0.0000	0.00
27	PIPE-11	57.10	1641.80	0.00	1641.50	0.00	0.30	0.5300	CIRCULAR	24.000	24.000	0.0120	0.0000	0.0000	0.0000	0.00
28	PIPE-15	73.90	1638.00	0.00	1630.42	0.10	7.58	10.2600	CIRCULAR	30.000	30.000	0.0120	0.0000	0.0000	0.0000	0.00
29	PIPE-2	97.70	1622.06	0.00	1621.57	0.10	0.49	0.5000	CIRCULAR	30.000	30.000	0.0120	0.5000	0.6000	0.0000	0.00
30	PIPE-3	75.50	1623.18	0.43	1622.80	0.74	0.38	0.5000	CIRCULAR	12.000	12.000	0.0120	0.5000	0.8000	0.0000	0.00
31	PIPE-4	202.70	1625.27	0.00	1623.28	0.53	1.99	0.9800	CIRCULAR	12.000	12.000	0.0120	0.5000	0.6000	0.0000	0.00
32	PIPE-5	37.50	1625.75	0.50	1625.37	0.10	0.38	1.0100	CIRCULAR	12.000	12.000	0.0120	0.5000	0.8000	0.0000	0.00
33	PIPE-6	58.20	1625.75	3.00	1622.55	0.49	3.20	5.5000	CIRCULAR	12.000	12.000	0.0120	0.5000	0.8000	0.0000	0.00
34	PIPE-9	201.30	1630.32	0.00	1620.74	0.10	9.58	4.7600	CIRCULAR	30.000	30.000	0.0120	0.5000	0.8000	0.0000	0.00
35	Pond_NW2-Prime	42.84	1643.88	1.88	1643.04	1.04	0.84	1.9600	CIRCULAR	15.000	15.000	0.0110	0.5000	0.5000	0.0000	0.00
36	Pond_NW-5-Primary	58.10	1662.50	2.00	1660.50	2.20	2.00	3.4400	CIRCULAR	18.000	18.000	0.0120	0.5000	0.5000	0.0000	0.00
37	S_Direct_Rout-2	575.23	1613.00	0.00	1500.00	0.00	113.00	19.6400	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00
38	S_Direct_Rout-3	115.53	1613.00	0.00	1500.00	0.00	113.00	97.8100	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00
39	SE_Direct_Rout-1	1422.07	1618.10	0.00	1500.00	0.00	118.10	8.3000	CIRCULAR	30.000	30.000	0.0150	0.5000	0.5000	0.0000	0.00
40	SW_Rout-1	1606.22	1570.00	0.00	1500.00	0.00	70.00	4.3600	CIRCULAR	60.000	60.000	0.0150	0.5000	0.5000	0.0000	0.00

Flap Gate	No. of Barrels
No	1
No	1
No	1
No	1
No	1
No	1
No	1
No	2
No	1
No	1
No	1
No	1
No	2
No	1
No	3
No	3
No	1
No	1
No	1
No	1
No	1
No	1
No	1
No	1
No	1
No	1
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No	1
No	1
No	1
No	1
No	1
No	1
No	1
No	1
No	1
No	1
No	1
No	1
No	1

Pipe Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	Cul-SW4	50.11	0 12:35	77.07	0.65	11.99	0.06	1.98	0.79	0.00		Calculated
2	Culv_SE-11	10.46	0 12:03	27.55	0.38	4.21	0.60	1.59	0.80	0.00		Calculated
3	Culv-E2.1	0.08	0 11:57	22.95	0.00	0.43	0.93	1.62	0.65	0.00		Calculated
4	Culvert-SW4	2.95	0 12:02	31.87	0.09	4.00	0.34	0.57	0.29	0.00		Calculated
5	Culv-NW3A	11.53	0 12:08	106.71	0.11	4.86	0.22	1.11	0.37	0.00		Calculated
6	Culv-NW3B	11.53	0 12:08	68.64	0.17	4.41	0.24	1.19	0.40	0.00		Calculated
7	Culv-NW4A	8.00	0 12:02	90.71	0.09	2.98	0.22	1.22	0.41	0.00		Calculated
8	Culv-NW4B	25.27	0 12:02	172.65	0.15	5.19	0.26	1.13	0.38	0.00		Calculated
9	Culv-S1	7.46	0 12:02	6.15	1.21	3.56	0.29	1.11	0.44	0.00		> CAPACITY
10	Culv-S2	26.67	0 12:06	52.27	0.51	5.35	0.28	1.99	0.66	0.00		Calculated
11	Culv-S3	20.52	0 12:00	65.90	0.31	6.08	0.17	1.62	0.65	0.00		Calculated
12	Culv-SE10	12.04	0 12:00	45.24	0.27	5.69	0.22	1.28	0.64	0.00		Calculated
13	Culv-SE3	14.67	0 12:06	62.84	0.23	3.75	0.53	2.30	0.92	0.00		Calculated
14	Culv-SE4	4.80	0 12:10	69.78	0.07	4.16	0.42	0.66	0.22	0.00		Calculated
15	Culv-SE8	44.41	0 12:04	294.32	0.15	5.16	0.23	1.69	0.67	0.00		Calculated
16	Culv-SE9	35.09	0 12:03	248.71	0.14	3.22	0.33	1.92	0.77	0.00		Calculated
17	Culv-SW3	30.53	0 12:41	89.14	0.34	8.30	0.12	1.75	0.70	0.00		Calculated
18	Culv-SW4	34.87	0 12:16	32.74	1.06	11.10	0.08	2.00	1.00	655.00		SURCHARGED
19	Culv-SW5	34.30	0 12:07	59.76	0.57	8.77	0.11	1.63	0.54	0.00		Calculated
20	Culv-SW6	30.93	0 12:03	73.25	0.42	9.92	0.12	1.52	0.61	0.00		Calculated
21	EPIPE-SE1	20.76	0 12:22	62.88	0.33	10.11	0.08	1.09	0.44	0.00		Calculated
22	Link-389	11.46	0 12:19	10.68	1.07	8.33	0.43	1.10	0.74	0.00		> CAPACITY
23	NW_Direct_Rout-1	199.07	0 12:39	0.00	0.61	0.00		3.67	0.92	0.00		Calculated
24	NW_Direct_Rout-2	76.19	0 12:22	0.00	0.61	0.00		3.67	0.92	0.00		Calculated
25	PIPE-0	20.76	0 12:22	31.46	0.66	6.10	0.75	1.64	0.65	0.00		Calculated
26	PIPE-1	4.08	0 12:32	31.46	0.13	2.71	0.90	1.34	0.54	0.00		Calculated
27	PIPE-11	4.56	0 15:54	17.76	0.26	5.53	0.17	0.65	0.33	0.00		Calculated
28	PIPE-15	18.04	0 12:14	142.31	0.13	7.10	0.17	1.32	0.53	0.00		Calculated
29	PIPE-2	4.04	0 12:32	31.47	0.13	3.88	0.42	0.78	0.31	0.00		Calculated
30	PIPE-3	0.51	0 12:33	2.74	0.19	2.49	0.51	0.31	0.31	0.00		Calculated
31	PIPE-4	0.51	0 12:32	3.82	0.13	3.31	1.02	0.25	0.25	0.00		Calculated
32	PIPE-5	0.51	0 12:32	3.89	0.13	3.08	0.20	0.26	0.26	0.00		Calculated
33	PIPE-6	3.53	0 12:32	9.05	0.39	9.28	0.10	0.49	0.49	0.00		Calculated
34	PIPE-9	18.04	0 12:14	96.94	0.19	9.01	0.37	1.20	0.48	0.00		Calculated
35	Pond_NW2-Prime	11.81	0 12:38	10.69	1.10	9.62	0.07	1.25	1.00	79.00		SURCHARGED
36	Pond_NW-5-Primary	0.83	1 00:00	21.11	0.04	3.45	0.28	0.29	0.19	0.00		Calculated
37	S_Direct_Rout-2	33.32	0 12:05	0.00	0.04	0.00		0.29	0.19	0.00		Calculated
38	S_Direct_Rout-3	20.52	0 12:00	0.00	0.04	0.00		0.29	0.19	0.00		Calculated
39	SE_Direct_Rout-1	20.75	0 12:22	102.44	0.20	7.58	3.13	1.41	0.56	0.00		Calculated
40	SW_Rout-1	80.11	0 12:38	471.21	0.17	13.29	2.01	1.73	0.35	0.00		Calculated

Storage Nodes

Storage Node : HW-3

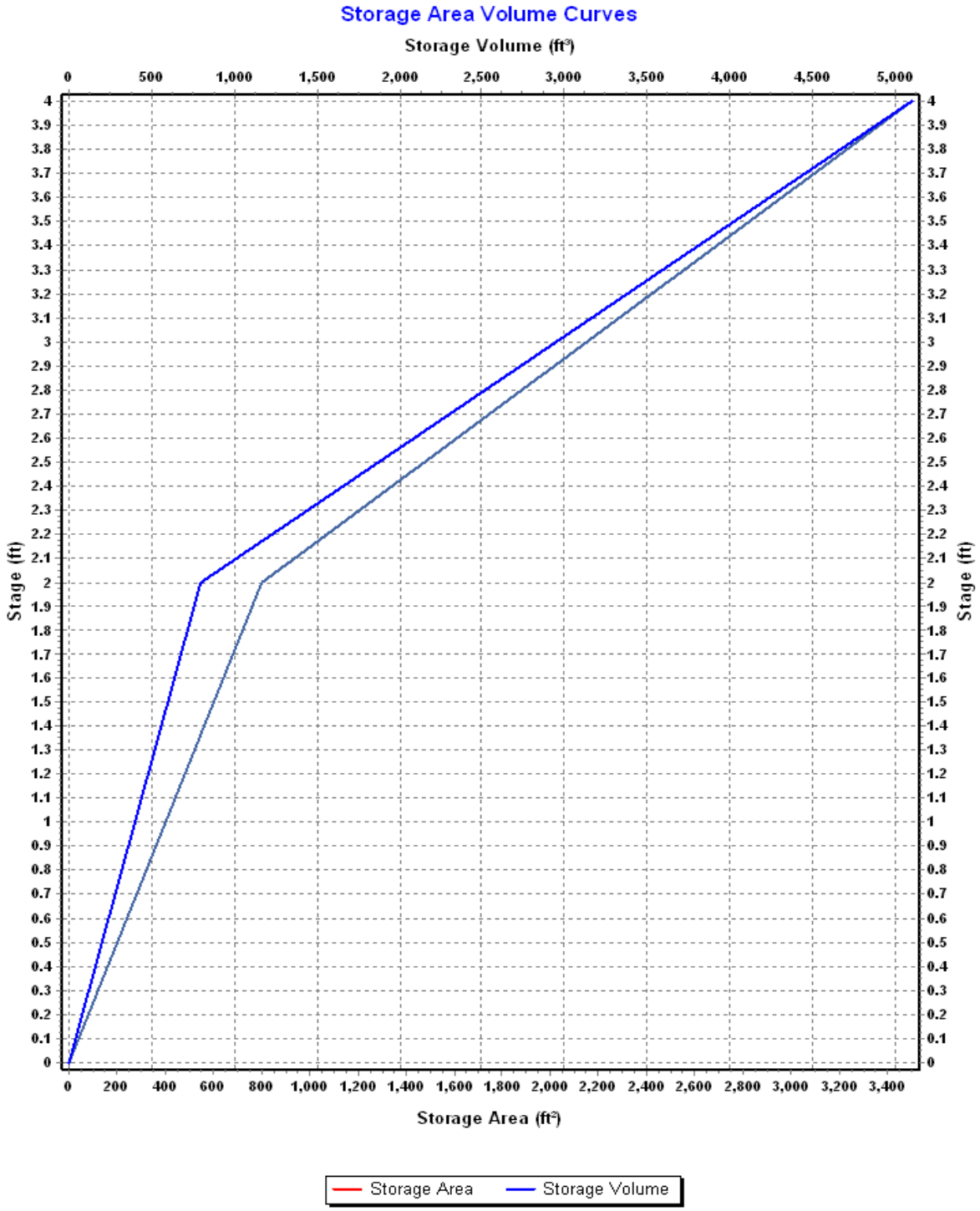
Input Data

Invert Elevation (ft)	1638.78
Max (Rim) Elevation (ft)	1642.00
Max (Rim) Offset (ft)	3.22
Initial Water Elevation (ft)	1638.78
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	3500.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Swale-SE-10

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	0	0.000
2	800	800.00
4	3500	5100.00


Storage Area Volume Curves
Storage Volume (ft³)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
Stage (ft)
Stage (ft)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3
3.1
3.2
3.3
3.4
3.5
3.6
3.7
3.8
3.9
4
0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200
2,400
2,600
2,800
3,000
3,200
3,400
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : HW-3 (continued)

Output Summary Results

Peak Inflow (cfs)	12.18
Peak Lateral Inflow (cfs)	12.18
Peak Outflow (cfs)	12.04
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	1640.63
Max HGL Depth Attained (ft)	1.85
Average HGL Elevation Attained (ft)	1638.97
Average HGL Depth Attained (ft)	0.19
Time of Max HGL Occurrence (days hh:mm)	0 12:00
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_NW2

Input Data

Invert Elevation (ft)	1642.00
Max (Rim) Elevation (ft)	1650.00
Max (Rim) Offset (ft)	8.00
Initial Water Elevation (ft)	1642.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	54786.20
Evaporation Loss	0.00

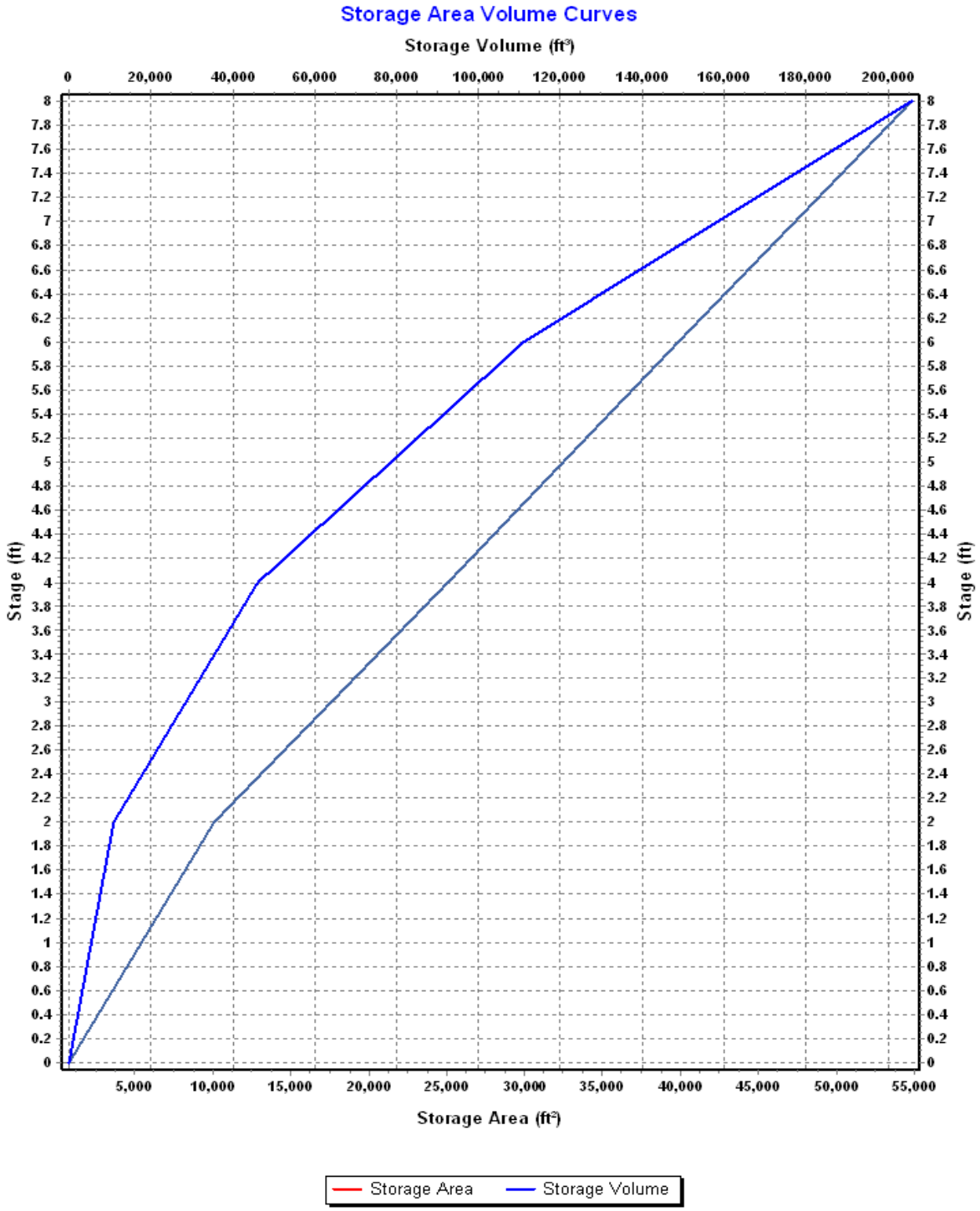
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.1000

Storage Area Volume Curves

Storage Curve : Storage-NW2

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	821.5183	0.000
2	10109.1334	10930.65
4	25079.2635	46119.05
6	39870.9340	111069.25
8	54786.20	205726.38


Storage Area Volume Curves
Storage Volume (ft³)
0
20,000
40,000
60,000
80,000
100,000
120,000
140,000
160,000
180,000
200,000
Stage (ft)
Stage (ft)
8
7.8
7.6
7.4
7.2
7
6.8
6.6
6.4
6.2
6
5.8
5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
45,000
50,000
55,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Pond_NW2 (continued)

Outflow Weirs

SN	Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1	Pond_NW2-Over	Trapezoidal	No	1649.00	7.00	10.00	1.00	3.33

Output Summary Results

Peak Inflow (cfs)	61.26
Peak Lateral Inflow (cfs)	14.99
Peak Outflow (cfs)	11.81
Peak Exfiltration Flow Rate (cfm)	4.26
Max HGL Elevation Attained (ft)	1646.75
Max HGL Depth Attained (ft)	4.75
Average HGL Elevation Attained (ft)	1643.70
Average HGL Depth Attained (ft)	1.7
Time of Max HGL Occurrence (days hh:mm)	0 12:38
Total Exfiltration Volume (1000-ft³)	2.032
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_NW-5

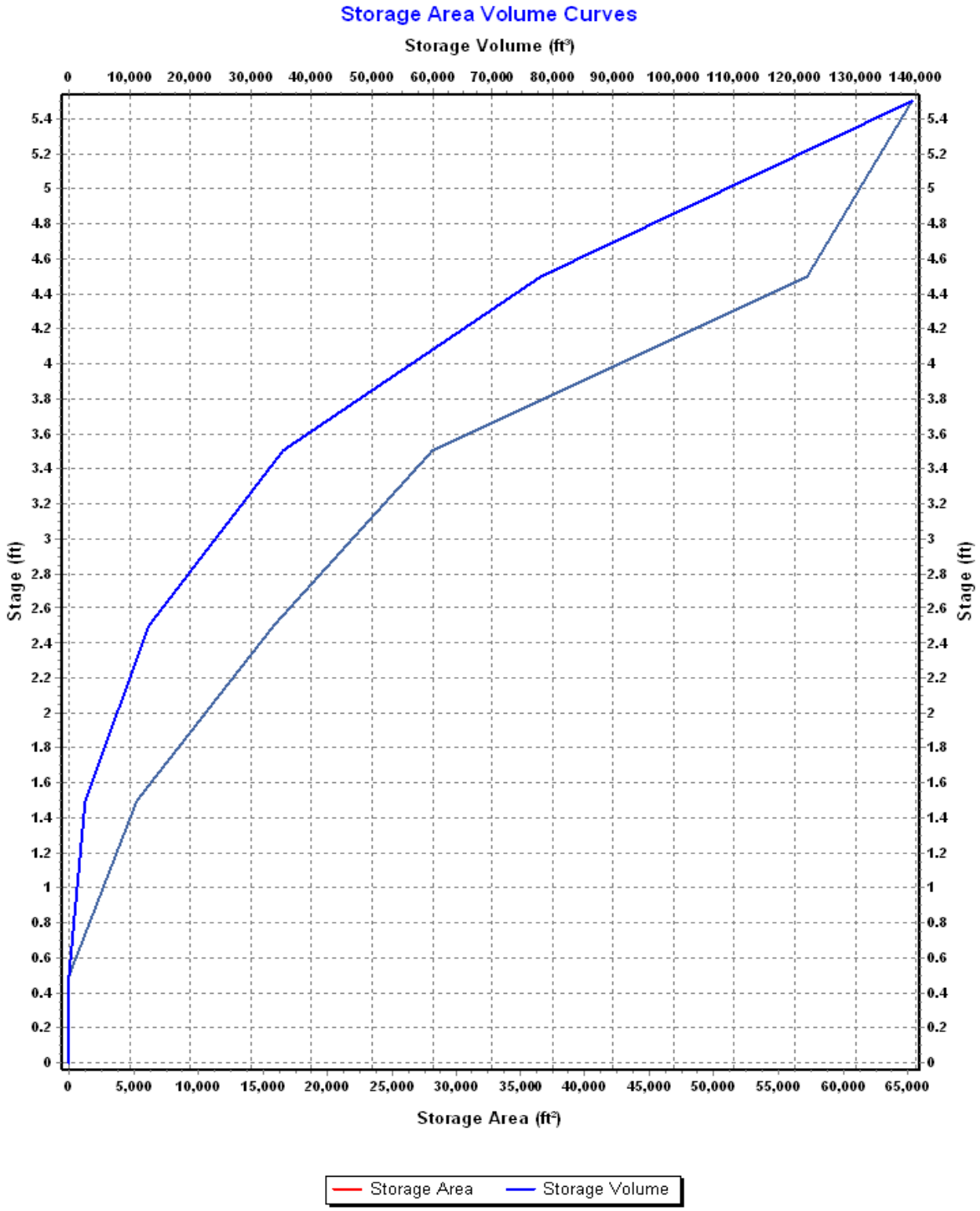
Input Data

Invert Elevation (ft)	1662.50
Max (Rim) Elevation (ft)	1670.00
Max (Rim) Offset (ft)	7.50
Initial Water Elevation (ft)	1663.00
Initial Water Depth (ft)	0.50
Ponded Area (ft²)	65300.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Pond_NW5

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	0	0.000
.5	45	11.25
1.5	5300	2683.75
2.5	15900	13283.75
3.5	28200	35333.75
4.5	57200	78033.75
5.5	65300	139283.75


Storage Area Volume Curves
Storage Volume (ft³)
0
10,000
20,000
30,000
40,000
50,000
60,000
70,000
80,000
90,000
100,000
110,000
120,000
130,000
140,000
Stage (ft)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
4.4
4.6
4.8
5
5.2
5.4
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
45,000
50,000
55,000
60,000
65,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Pond_NW-5 (continued)

Outflow Weirs

SN	Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1	Pond_NW-5-Weir-1	Trapezoidal	No	1669.33	6.83	10.00	1.00	2.67

Outflow Orifices

SN	Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1	Pond_NW-5-Dev 2	Bottom	CIRCULAR	No	30.00			1668.25	0.61
2	Pond_NW-5-orifice	Side	CIRCULAR	No	4.00			1663.50	0.61

Output Summary Results

Peak Inflow (cfs)	25.08
Peak Lateral Inflow (cfs)	6.94
Peak Outflow (cfs)	0.83
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	1667.41
Max HGL Depth Attained (ft)	4.91
Average HGL Elevation Attained (ft)	1665.12
Average HGL Depth Attained (ft)	2.62
Time of Max HGL Occurrence (days hh:mm)	1 00:00
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_S1

Input Data

Invert Elevation (ft)	1616.46
Max (Rim) Elevation (ft)	1622.46
Max (Rim) Offset (ft)	6.00
Initial Water Elevation (ft)	1616.46
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	10.00
Evaporation Loss	0.00

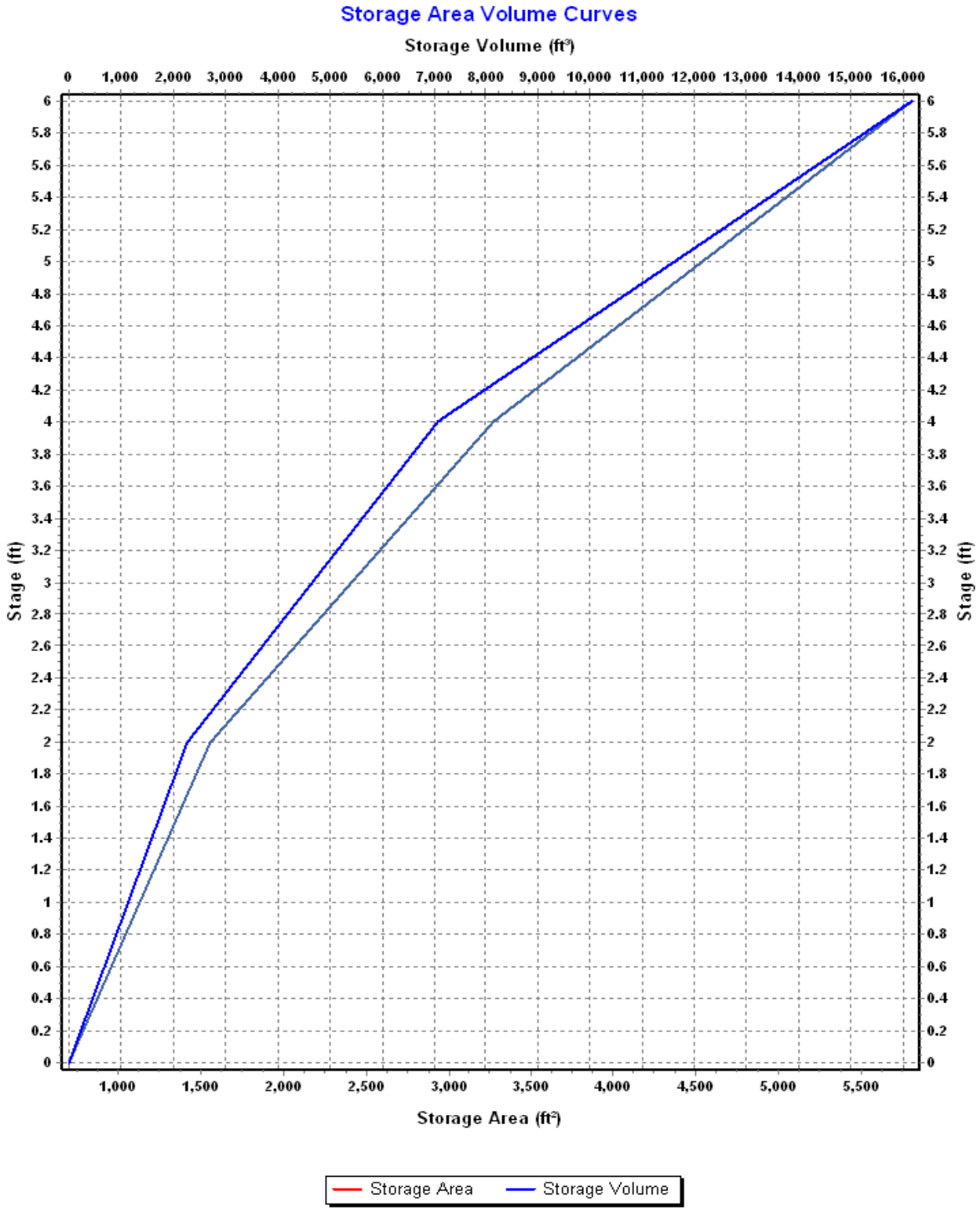
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.0850

Storage Area Volume Curves

Storage Curve : Pond-S1

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	700	0.000
2	1556	2256.00
4	3273	7085.00
6	5806	16164.00


Storage Area Volume Curves
Storage Volume (ft³)
0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000 11,000 12,000 13,000 14,000 15,000 16,000
Stage (ft)
0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4 2.6 2.8 3 3.2 3.4 3.6 3.8 4 4.2 4.4 4.6 4.8 5 5.2 5.4 5.6 5.8 6
1,000 1,500 2,000 2,500 3,000 3,500 4,000 4,500 5,000 5,500
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Pond_S1 (continued)

Output Summary Results

Peak Inflow (cfs)	7.75
Peak Lateral Inflow (cfs)	7.75
Peak Outflow (cfs)	7.46
Peak Exfiltration Flow Rate (cfm)	0.15
Max HGL Elevation Attained (ft)	1617.77
Max HGL Depth Attained (ft)	1.31
Average HGL Elevation Attained (ft)	1616.62
Average HGL Depth Attained (ft)	0.16
Time of Max HGL Occurrence (days hh:mm)	0 12:02
Total Exfiltration Volume (1000-ft³)	0.084
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_S2

Input Data

Invert Elevation (ft)	1619.20
Max (Rim) Elevation (ft)	1624.00
Max (Rim) Offset (ft)	4.80
Initial Water Elevation (ft)	1619.20
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	10.00
Evaporation Loss	0.00

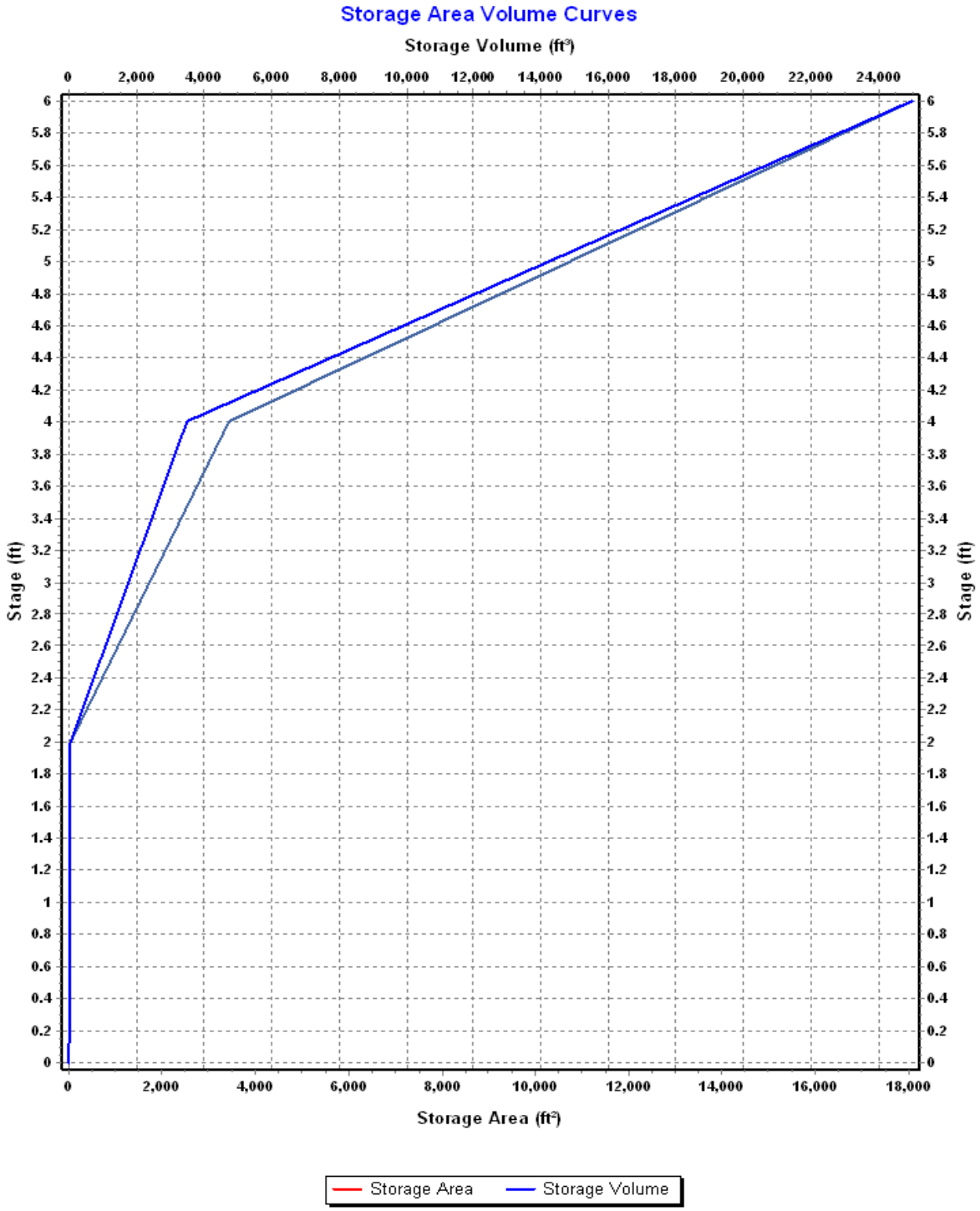
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.0850

Storage Area Volume Curves

Storage Curve : Pond-S2

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	10	0.000
2	27.9476	37.95
4	3428.8452	3494.74
6	18058.8080	24982.39


Storage Area Volume Curves
Storage Volume (ft³)
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
22,000
24,000
Stage (ft)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
4.4
4.6
4.8
5
5.2
5.4
5.6
5.8
6
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Pond_S2 (continued)

Output Summary Results

Peak Inflow (cfs)	27.56
Peak Lateral Inflow (cfs)	27.56
Peak Outflow (cfs)	26.77
Peak Exfiltration Flow Rate (cfm)	0.10
Max HGL Elevation Attained (ft)	1621.67
Max HGL Depth Attained (ft)	2.47
Average HGL Elevation Attained (ft)	1619.46
Average HGL Depth Attained (ft)	0.26
Time of Max HGL Occurrence (days hh:mm)	0 12:06
Total Exfiltration Volume (1000-ft³)	0.002
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_S3

Input Data

Invert Elevation (ft)	1615.31
Max (Rim) Elevation (ft)	1621.31
Max (Rim) Offset (ft)	6.00
Initial Water Elevation (ft)	1615.31
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	10.00
Evaporation Loss	0.00

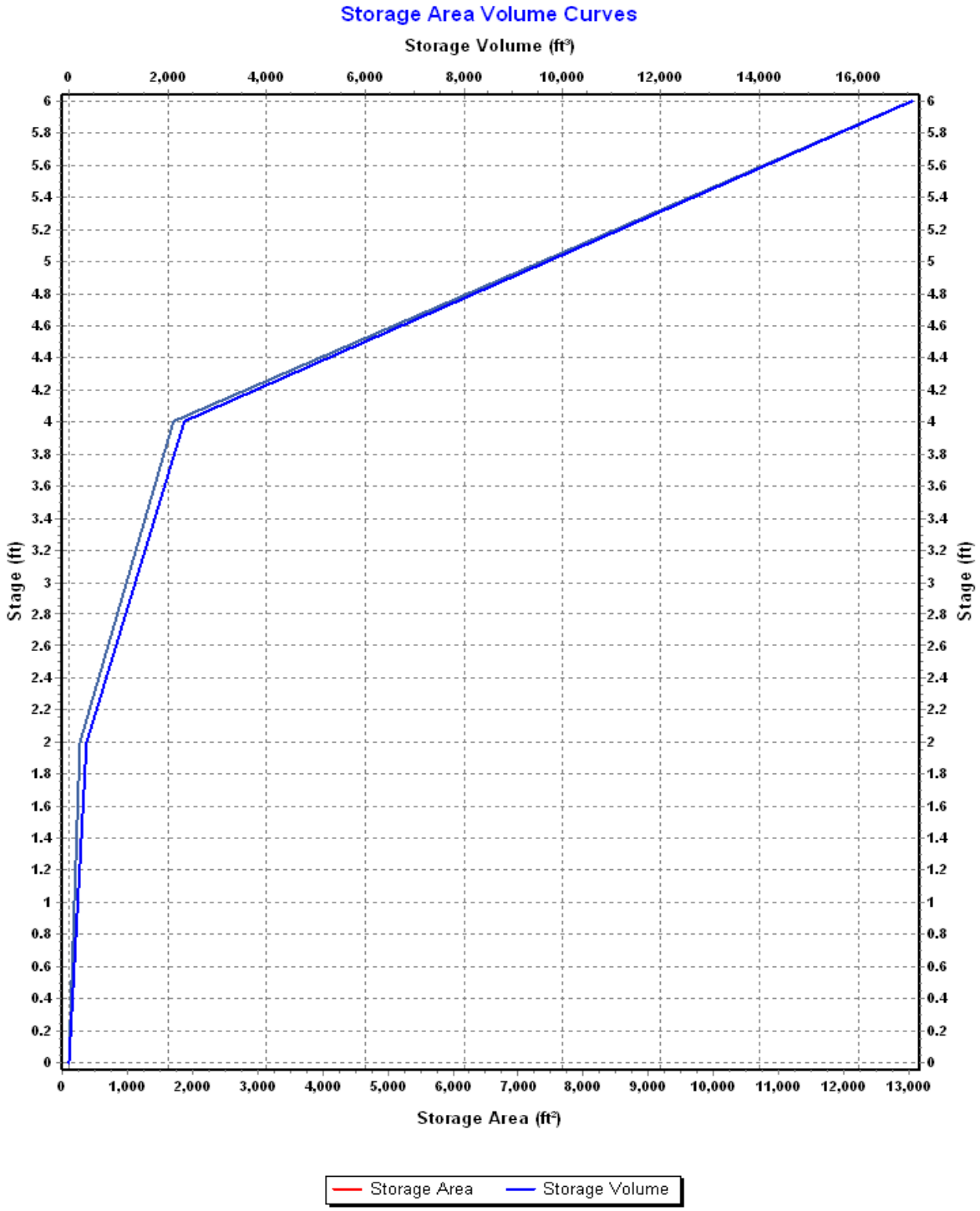
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.0850

Storage Area Volume Curves

Storage Curve : Pond-S3

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	100	0.000
2	267	367.00
4	1701	2335.00
6	13043	17079.00


Storage Area Volume Curves
Storage Volume (ft³)
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
Stage (ft)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
4.4
4.6
4.8
5
5.2
5.4
5.6
5.8
6
Storage Area (ft²)
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
11,000
12,000
13,000
Storage Area
Storage Volume

Storage Node : Pond_S3 (continued)

Output Summary Results

Peak Inflow (cfs)	20.56
Peak Lateral Inflow (cfs)	20.56
Peak Outflow (cfs)	20.52
Peak Exfiltration Flow Rate (cfm)	0.06
Max HGL Elevation Attained (ft)	1617.60
Max HGL Depth Attained (ft)	2.29
Average HGL Elevation Attained (ft)	1615.52
Average HGL Depth Attained (ft)	0.21
Time of Max HGL Occurrence (days hh:mm)	0 12:00
Total Exfiltration Volume (1000-ft³)	0.014
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_SE-1

Input Data

Invert Elevation (ft)	1628.00
Max (Rim) Elevation (ft)	1633.50
Max (Rim) Offset (ft)	5.50
Initial Water Elevation (ft)	1628.40
Initial Water Depth (ft)	0.40
Ponded Area (ft²)	26200.00
Evaporation Loss	0.00

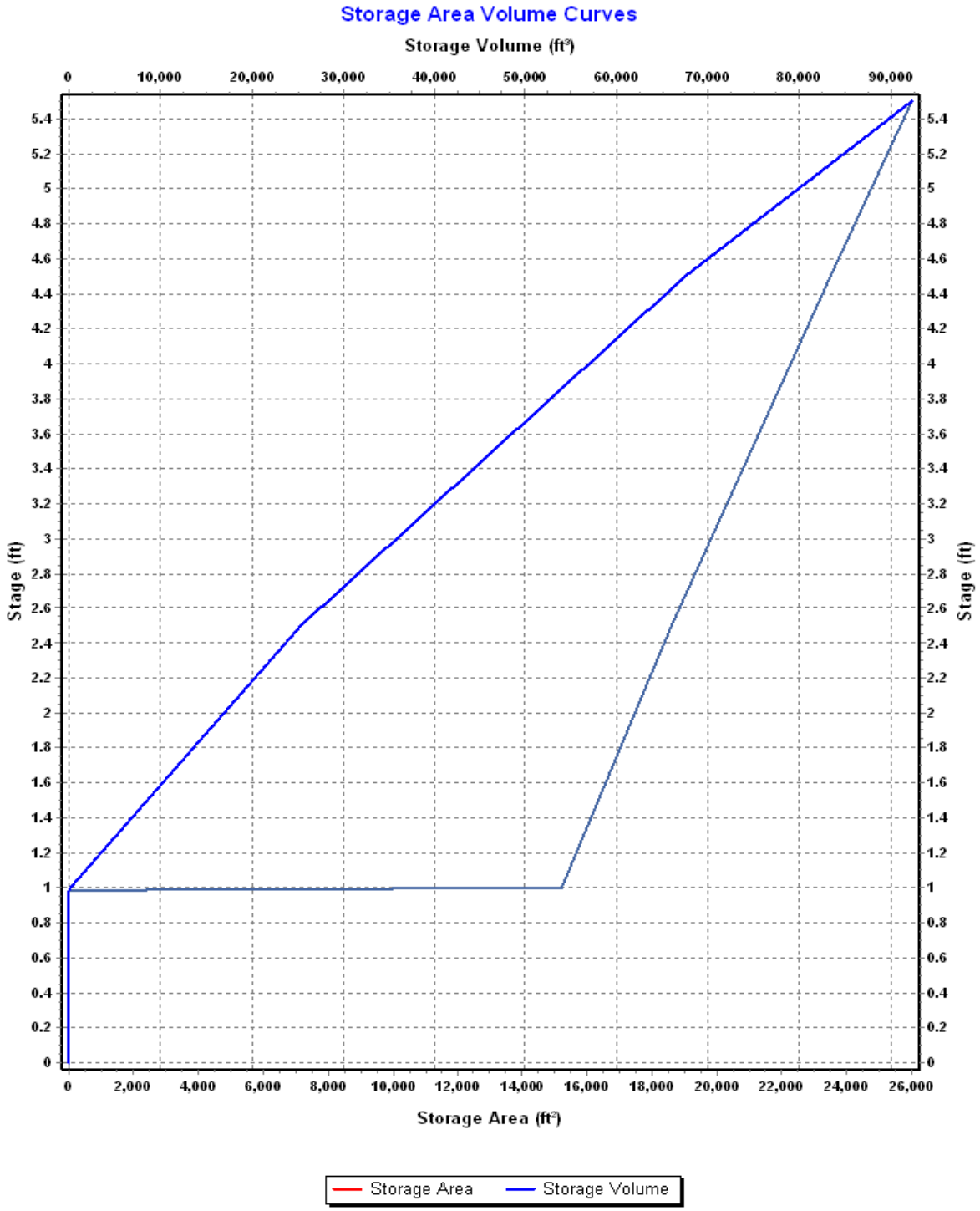
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.0000

Storage Area Volume Curves

Storage Curve : Pond_SE-1

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	16	0.000
0.99	16	15.84
1	15200	91.92
2.5	18600	25441.92
4.5	23500	67541.92
5.5	26000	92291.92


Storage Area Volume Curves
Storage Volume (ft³)
0
10,000
20,000
30,000
40,000
50,000
60,000
70,000
80,000
90,000
Stage (ft)
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Storage Area (ft²)
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
22,000
24,000
26,000
Storage Area
Storage Volume

Storage Node : Pond_SE-1 (continued)

Outflow Weirs

SN	Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1	Pond_SE-1-Weir-3	Trapezoidal	No	1633.00	5.00	10.00	0.50	2.67

Outflow Orifices

SN	Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1	Pond_SE-1-WQV	Side	CIRCULAR	No	3.50			1628.40	0.61
2	SE-1-OCS-2-2-Year	Bottom	CIRCULAR	No	15.00			1630.50	0.61

Output Summary Results

Peak Inflow (cfs)	27.87
Peak Lateral Inflow (cfs)	7.17
Peak Outflow (cfs)	4.04
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	1630.92
Max HGL Depth Attained (ft)	2.92
Average HGL Elevation Attained (ft)	1629.58
Average HGL Depth Attained (ft)	1.58
Time of Max HGL Occurrence (days hh:mm)	0 12:31
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_SE-1-FB

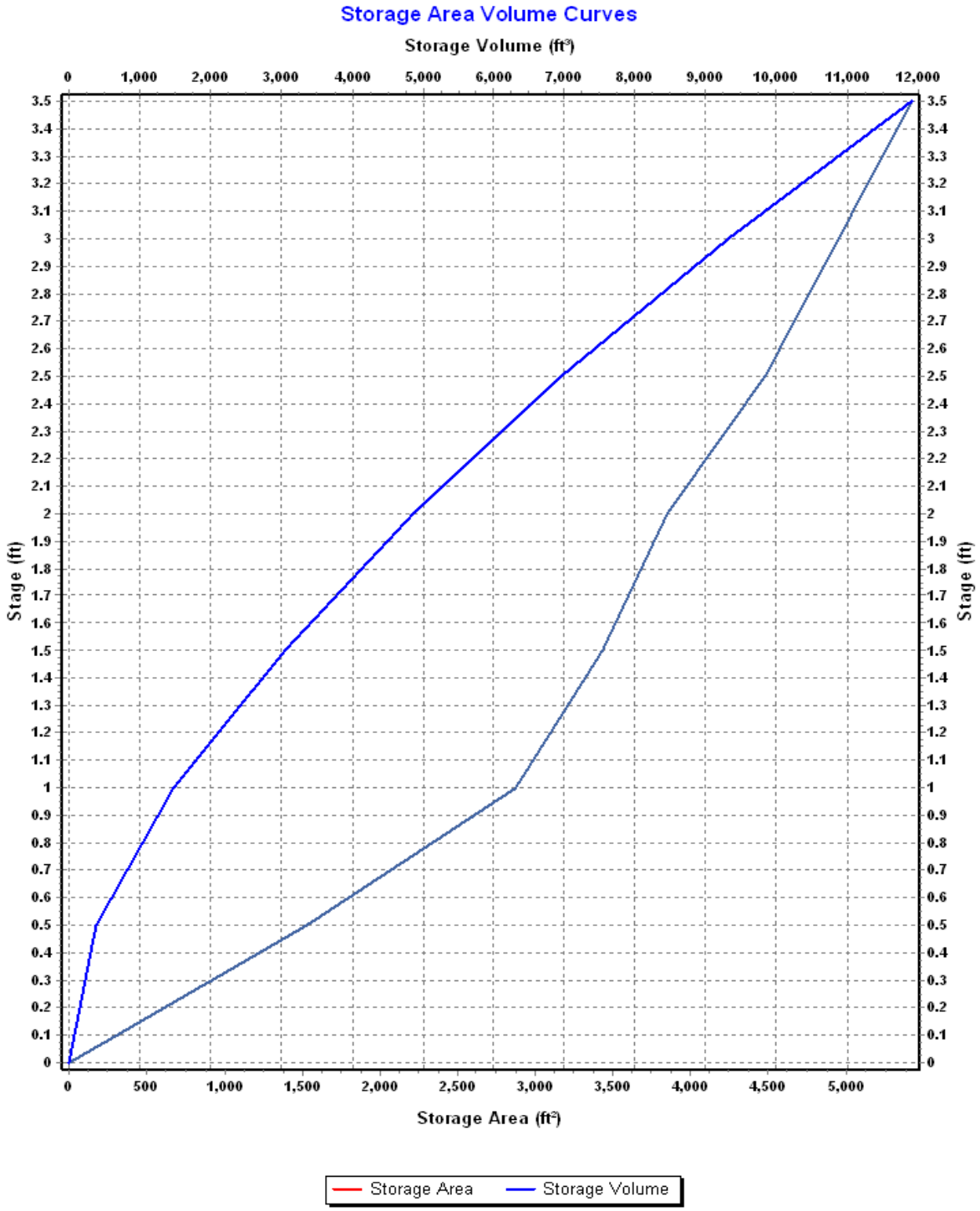
Input Data

Invert Elevation (ft)	1632.50
Max (Rim) Elevation (ft)	1636.00
Max (Rim) Offset (ft)	3.50
Initial Water Elevation (ft)	1632.50
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	5410.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Pond_SE1-FB

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	0	0.000
.5	1528.34	382.09
1	2870.16	1481.72
1.5	3431.80	3057.21
2	3850.25	4877.72
2.5	4477.89	6959.76
3	4946.93	9315.97
3.5	5421.68	11908.12


Storage Area Volume Curves
Storage Volume (ft³)
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
11,000
12,000
Stage (ft)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3
3.1
3.2
3.3
3.4
3.5
Storage Area (ft²)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
Storage Area
Storage Volume

Storage Node : Pond_SE-1-FB (continued)

Outflow Weirs

SN	Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1	Pond_SE-1-Weir-1	Trapezoidal	No	1634.50	2.00	15.00	1.50	2.67

Outflow Orifices

SN	Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1	Pond_SE-1-FB-Drawdown	Side	CIRCULAR	No	8.00			1632.50	0.61

Output Summary Results

Peak Inflow (cfs)	22.05
Peak Lateral Inflow (cfs)	0.00
Peak Outflow (cfs)	21.68
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	1635.08
Max HGL Depth Attained (ft)	2.58
Average HGL Elevation Attained (ft)	1632.91
Average HGL Depth Attained (ft)	0.41
Time of Max HGL Occurrence (days hh:mm)	0 12:04
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_SE-2

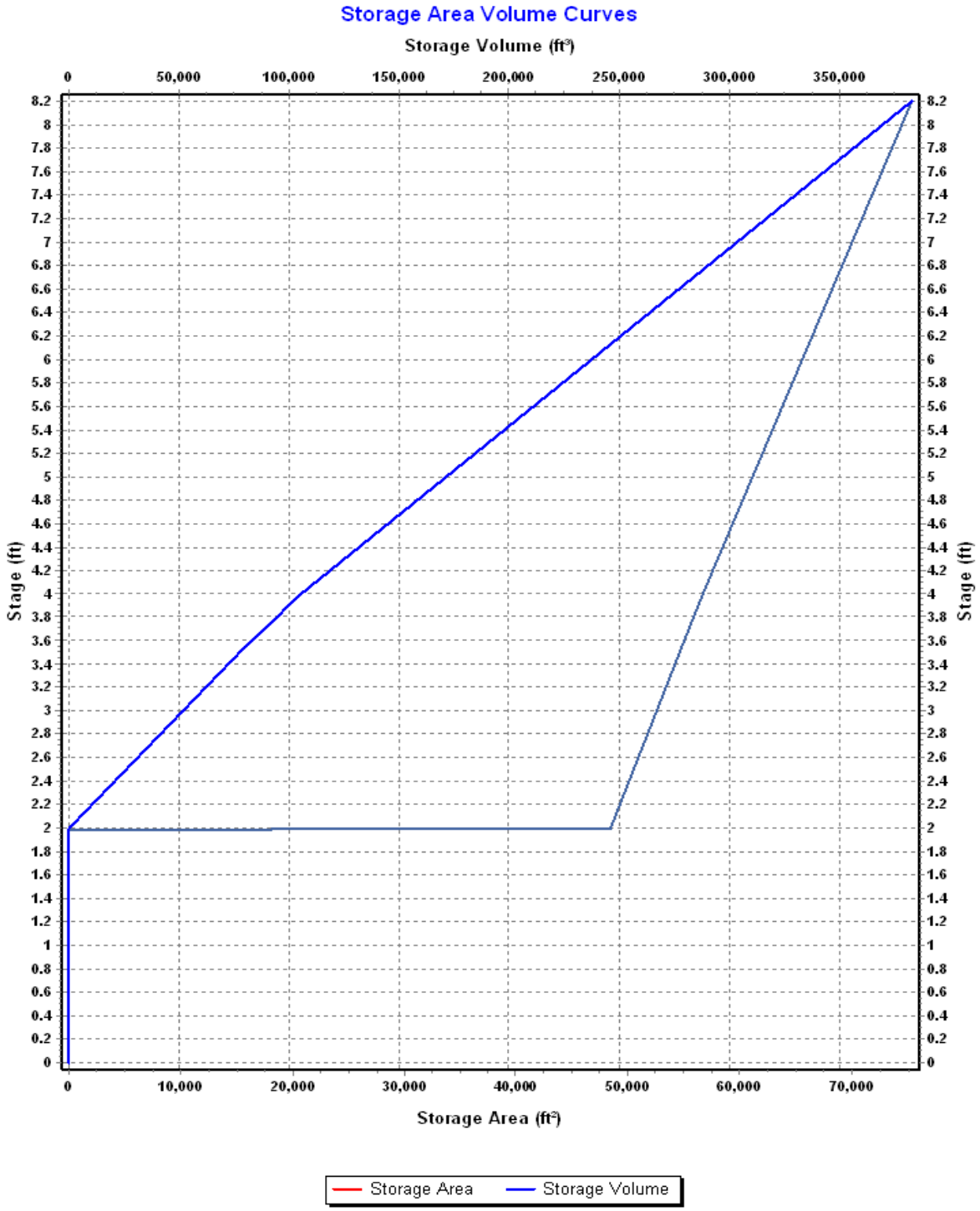
Input Data

Invert Elevation (ft)	1642.80
Max (Rim) Elevation (ft)	1651.00
Max (Rim) Offset (ft)	8.20
Initial Water Elevation (ft)	1644.20
Initial Water Depth (ft)	1.40
Ponded Area (ft²)	75400.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Pond_SE-2

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	18	0.000
1.99	18	35.82
2	48500	278.41
3.5	54600	77603.41
4	56700	105428.41
8.2	75400	382838.41


Storage Area Volume Curves
Storage Volume (ft³)
0
50,000
100,000
150,000
200,000
250,000
300,000
350,000
Stage (ft)
8.2
8
7.8
7.6
7.4
7.2
7
6.8
6.6
6.4
6.2
6
5.8
5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
10,000
20,000
30,000
40,000
50,000
60,000
70,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Pond_SE-2 (continued)

Outflow Weirs

SN	Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1	Pond_SE-2-Weir-3	Trapezoidal	No	1650.00	7.20	10.00	1.00	2.67

Outflow Orifices

SN	Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1	Pond_SE-2-2_YR	Side	Rectangular	No		6.00	24.00	1646.30	0.63
2	Pond_SE-2-25_YR	Bottom	Rectangular	No		48.00	21.00	1648.00	0.63
3	Pond_SE-2-WQV	Side	CIRCULAR	No	7.60			1644.20	0.61

Output Summary Results

Peak Inflow (cfs)	22.10
Peak Lateral Inflow (cfs)	0.00
Peak Outflow (cfs)	4.51
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	1646.76
Max HGL Depth Attained (ft)	3.96
Average HGL Elevation Attained (ft)	1645.41
Average HGL Depth Attained (ft)	2.61
Time of Max HGL Occurrence (days hh:mm)	0 15:35
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_SE-2-FB

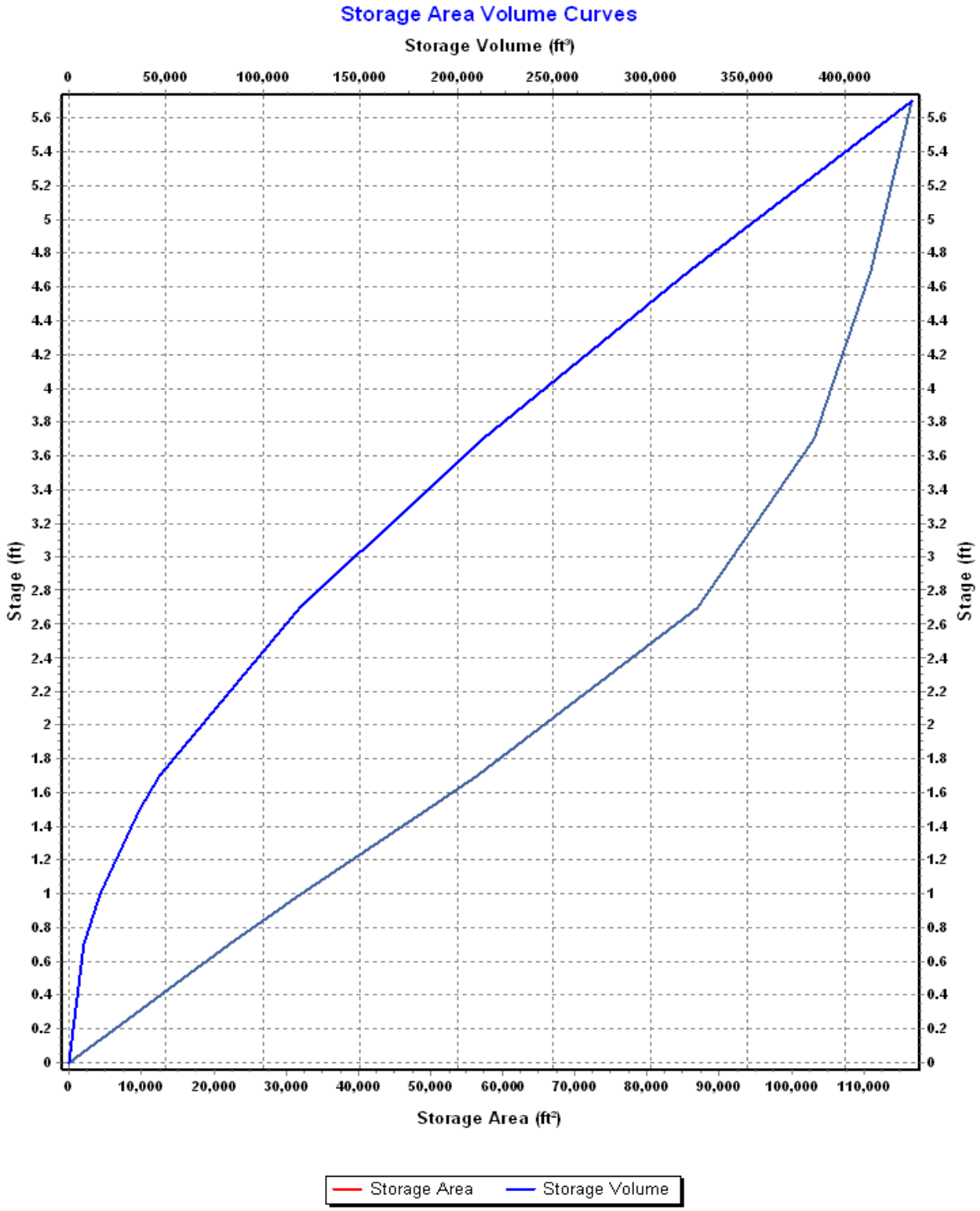
Input Data

Invert Elevation (ft)	1645.30
Max (Rim) Elevation (ft)	1651.00
Max (Rim) Offset (ft)	5.70
Initial Water Elevation (ft)	0.00
Initial Water Depth (ft)	-1645.30
Ponded Area (ft²)	116600.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Pond_SE-2-FB

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	0	0.000
.7	22100	7735.00
1	32100	15865.00
1.5	49600	36290.00
1.7	56600	46910.00
2.7	86900	118660.00
3.7	103000	213610.00
4.7	110900	320560.00
5.7	116600	434310.00


Storage Area Volume Curves
Storage Volume (ft³)
0
50,000
100,000
150,000
200,000
250,000
300,000
350,000
400,000
Stage (ft)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
4.4
4.6
4.8
5
5.2
5.4
5.6
Storage Area (ft²)
0
10,000
20,000
30,000
40,000
50,000
60,000
70,000
80,000
90,000
100,000
110,000
Storage Area
Storage Volume

Storage Node : Pond_SE-2-FB (continued)

Outflow Weirs

SN	Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1	Pond_SE-2-Weir-1	Trapezoidal	No	1647.30	2.00	10.00	3.70	2.67

Outflow Orifices

SN	Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1	Pond_SE-2-FB-Drawdown	Side	CIRCULAR	No	12.00			1645.30	0.61

Output Summary Results

Peak Inflow (cfs)	94.24
Peak Lateral Inflow (cfs)	19.95
Peak Outflow (cfs)	22.10
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	1647.95
Max HGL Depth Attained (ft)	2.65
Average HGL Elevation Attained (ft)	1646.37
Average HGL Depth Attained (ft)	1.07
Time of Max HGL Occurrence (days hh:mm)	0 12:24
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_SW1

Input Data

Invert Elevation (ft)	1629.16
Max (Rim) Elevation (ft)	1636.00
Max (Rim) Offset (ft)	6.84
Initial Water Elevation (ft)	1629.16
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	10.00
Evaporation Loss	0.00

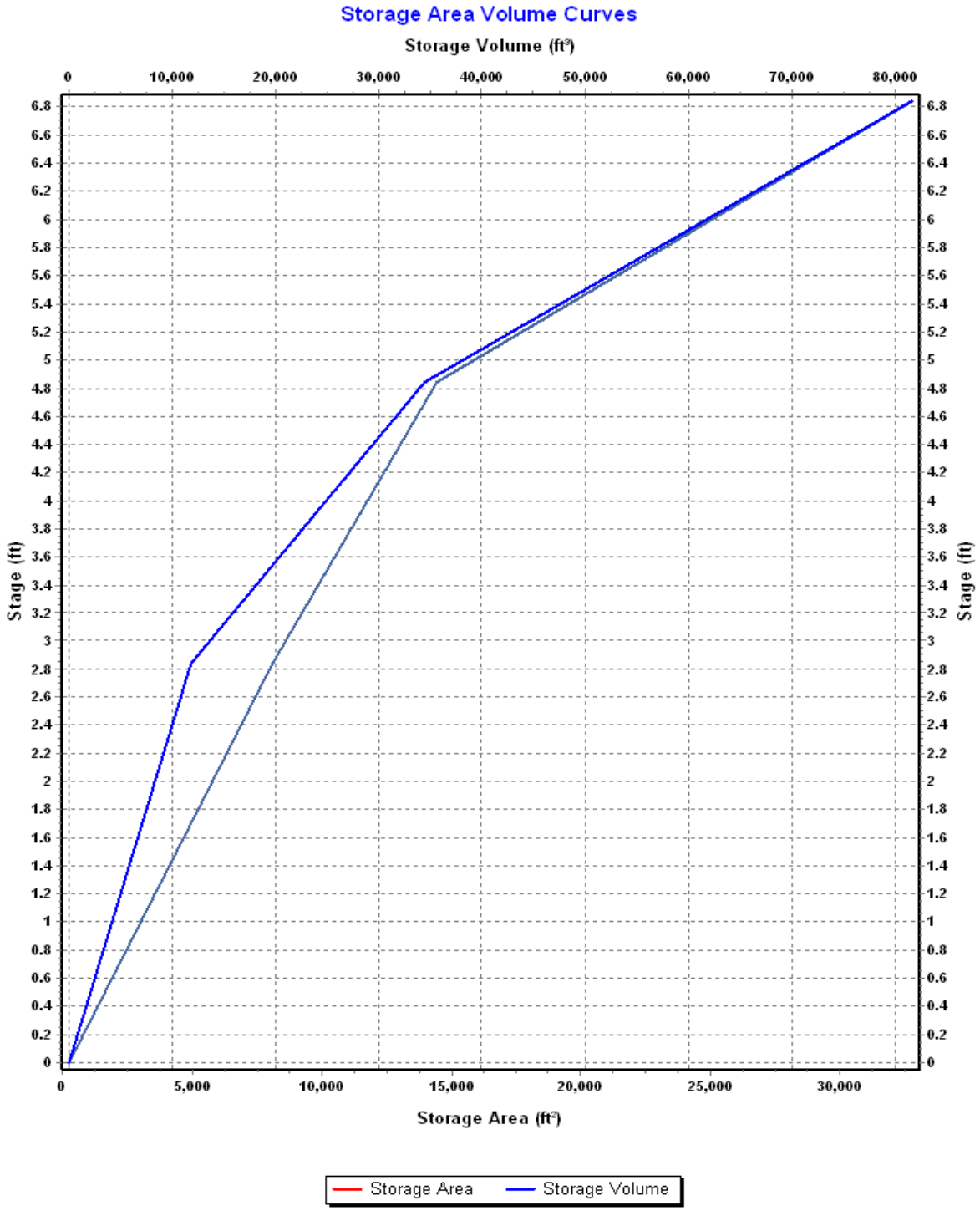
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.0850

Storage Area Volume Curves

Storage Curve : Pond-SW1

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	239	0.000
2.84	8089.7325	11826.80
4.84	14453.7561	34370.29
6.84	32772	81596.05


Storage Area Volume Curves
Storage Volume (ft³)
0
10,000
20,000
30,000
40,000
50,000
60,000
70,000
80,000
Stage (ft)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
4.4
4.6
4.8
5
5.2
5.4
5.6
5.8
6
6.2
6.4
6.6
6.8
0
5,000
10,000
15,000
20,000
25,000
30,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Pond_SW1 (continued)

Output Summary Results

Peak Inflow (cfs)	71.26
Peak Lateral Inflow (cfs)	9.92
Peak Outflow (cfs)	34.87
Peak Exfiltration Flow Rate (cfm)	2.58
Max HGL Elevation Attained (ft)	1634.81
Max HGL Depth Attained (ft)	5.65
Average HGL Elevation Attained (ft)	1630.48
Average HGL Depth Attained (ft)	1.32
Time of Max HGL Occurrence (days hh:mm)	0 12:17
Total Exfiltration Volume (1000-ft³)	0.666
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_SW2

Input Data

Invert Elevation (ft)	1634.25
Max (Rim) Elevation (ft)	1640.25
Max (Rim) Offset (ft)	6.00
Initial Water Elevation (ft)	1634.25
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	10.00
Evaporation Loss	0.00

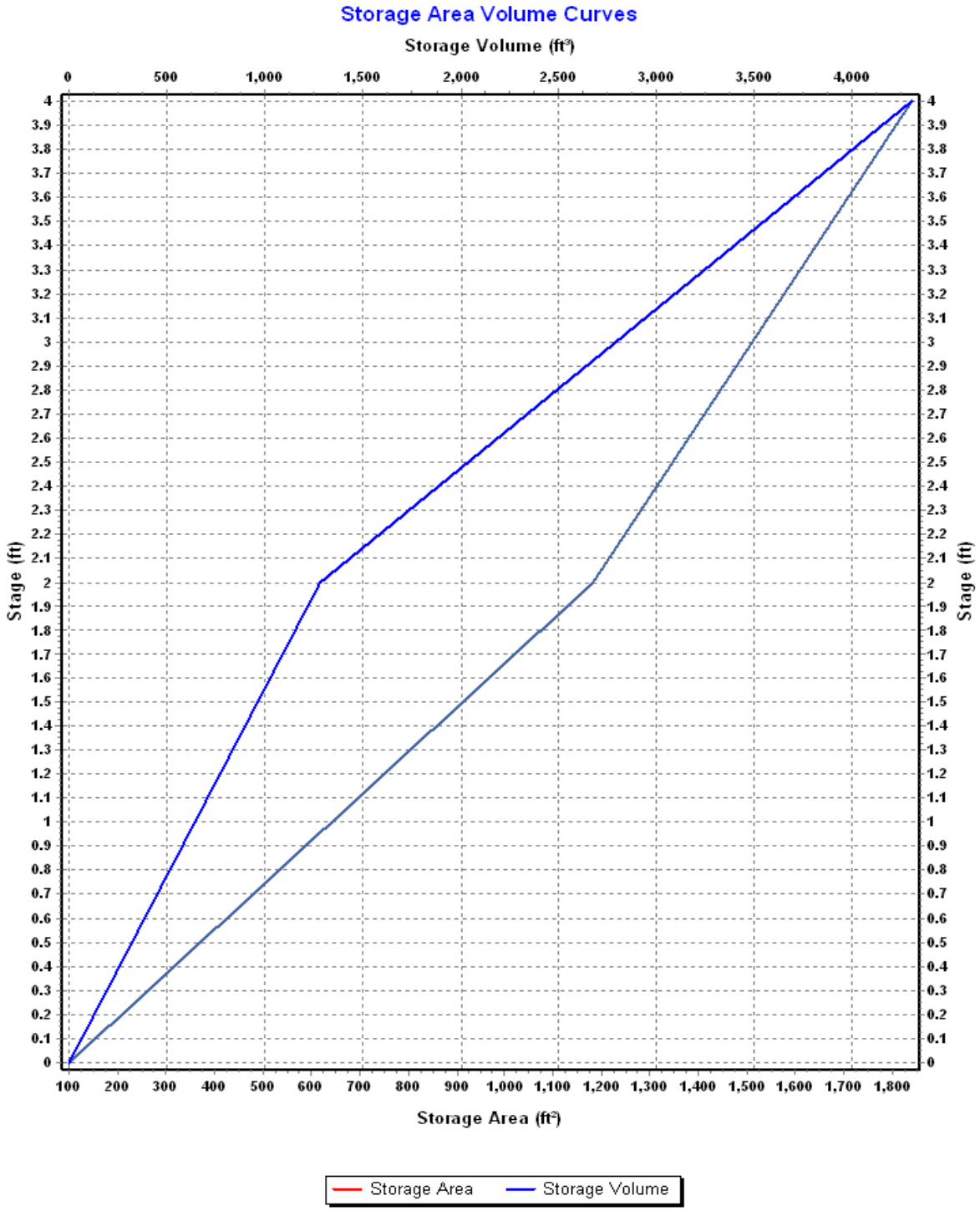
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.0850

Storage Area Volume Curves

Storage Curve : Pond-SW2

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	100	0.000
2	1181.3357	1281.34
4	1839.8713	4302.55


Storage Area Volume Curves
Storage Volume (ft³)
0 500 1,000 1,500 2,000 2,500 3,000 3,500 4,000
Stage (ft)
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3 3.1 3.2 3.3 3.4 3.5 3.6 3.7 3.8 3.9 4
100 200 300 400 500 600 700 800 900 1,000 1,100 1,200 1,300 1,400 1,500 1,600 1,700 1,800
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Pond_SW2 (continued)

Output Summary Results

Peak Inflow (cfs)	3.02
Peak Lateral Inflow (cfs)	3.02
Peak Outflow (cfs)	2.95
Peak Exfiltration Flow Rate (cfm)	0.07
Max HGL Elevation Attained (ft)	1635.10
Max HGL Depth Attained (ft)	0.85
Average HGL Elevation Attained (ft)	1634.33
Average HGL Depth Attained (ft)	0.08
Time of Max HGL Occurrence (days hh:mm)	0 12:02
Total Exfiltration Volume (1000-ft³)	0.017
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_SW3

Input Data

Invert Elevation (ft)	1578.00
Max (Rim) Elevation (ft)	1583.00
Max (Rim) Offset (ft)	5.00
Initial Water Elevation (ft)	1578.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	10.00
Evaporation Loss	0.00

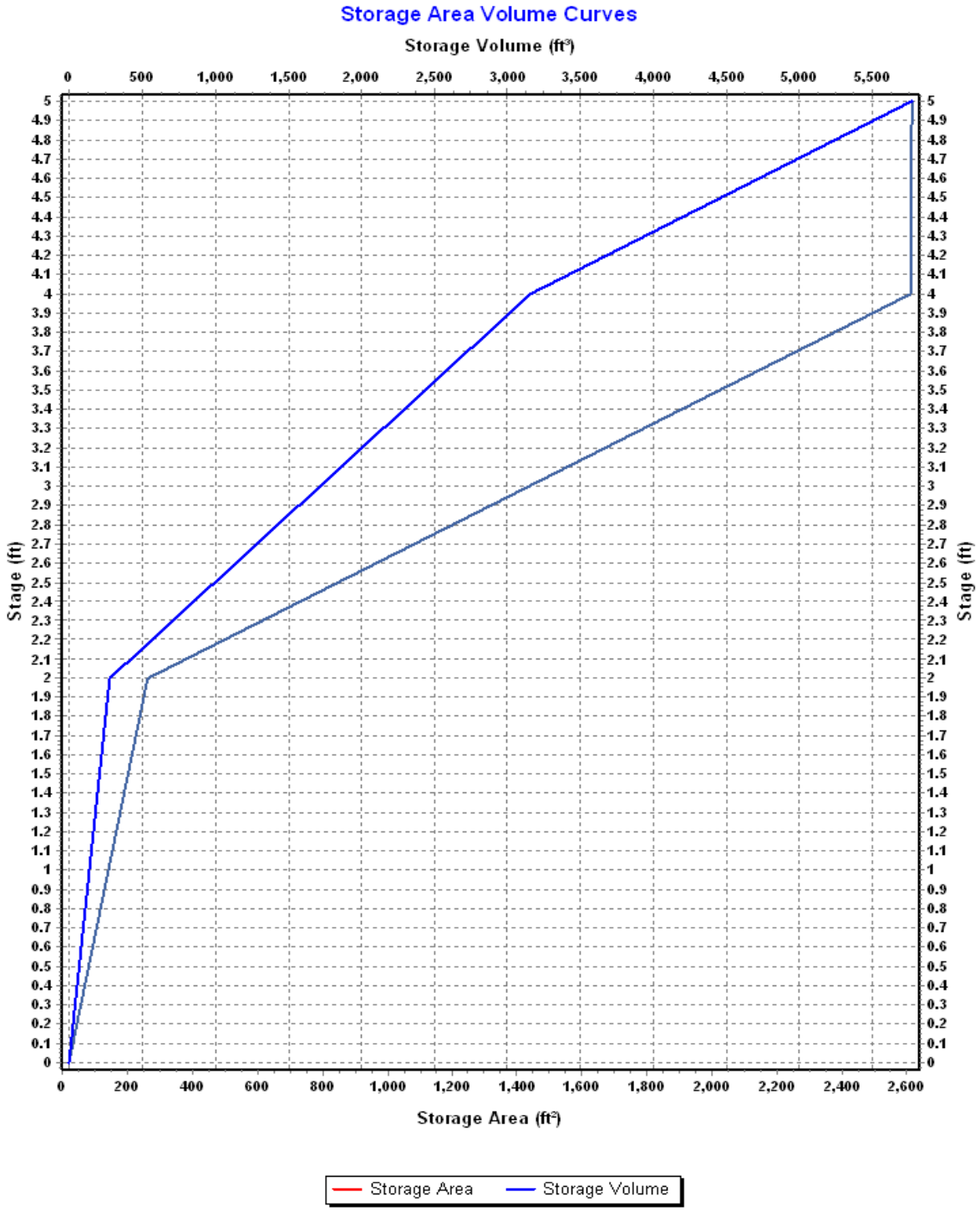
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.2600

Storage Area Volume Curves

Storage Curve : Storage-SW3

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	19.1651	0.000
2	261.3794	280.54
4	2611.6257	3153.55
5	2615	5766.86


Storage Area Volume Curves
Storage Volume (ft³)
0 500 1,000 1,500 2,000 2,500 3,000 3,500 4,000 4,500 5,000 5,500
Stage (ft)
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3 3.1 3.2 3.3 3.4 3.5 3.6 3.7 3.8 3.9 4 4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.8 4.9 5
0 200 400 600 800 1,000 1,200 1,400 1,600 1,800 2,000 2,200 2,400 2,600
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Pond_SW3 (continued)

Output Summary Results

Peak Inflow (cfs)	30.63
Peak Lateral Inflow (cfs)	30.63
Peak Outflow (cfs)	30.53
Peak Exfiltration Flow Rate (cfm)	0.50
Max HGL Elevation Attained (ft)	1580.96
Max HGL Depth Attained (ft)	2.96
Average HGL Elevation Attained (ft)	1578.51
Average HGL Depth Attained (ft)	0.51
Time of Max HGL Occurrence (days hh:mm)	0 12:41
Total Exfiltration Volume (1000-ft³)	0.052
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_SW4

Input Data

Invert Elevation (ft)	1602.72
Max (Rim) Elevation (ft)	1608.72
Max (Rim) Offset (ft)	6.00
Initial Water Elevation (ft)	1602.72
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	10.00
Evaporation Loss	0.00

Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.2600

Output Summary Results

Peak Inflow (cfs)	50.20
Peak Lateral Inflow (cfs)	0.00
Peak Outflow (cfs)	50.11
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	1606.98
Max HGL Depth Attained (ft)	4.26
Average HGL Elevation Attained (ft)	1603.30
Average HGL Depth Attained (ft)	0.58
Time of Max HGL Occurrence (days hh:mm)	0 12:35
Total Exfiltration Volume (1000-ft³)	0.003
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_SW5

Input Data

Invert Elevation (ft)	1647.36
Max (Rim) Elevation (ft)	1653.36
Max (Rim) Offset (ft)	6.00
Initial Water Elevation (ft)	1647.36
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	10.00
Evaporation Loss	0.00

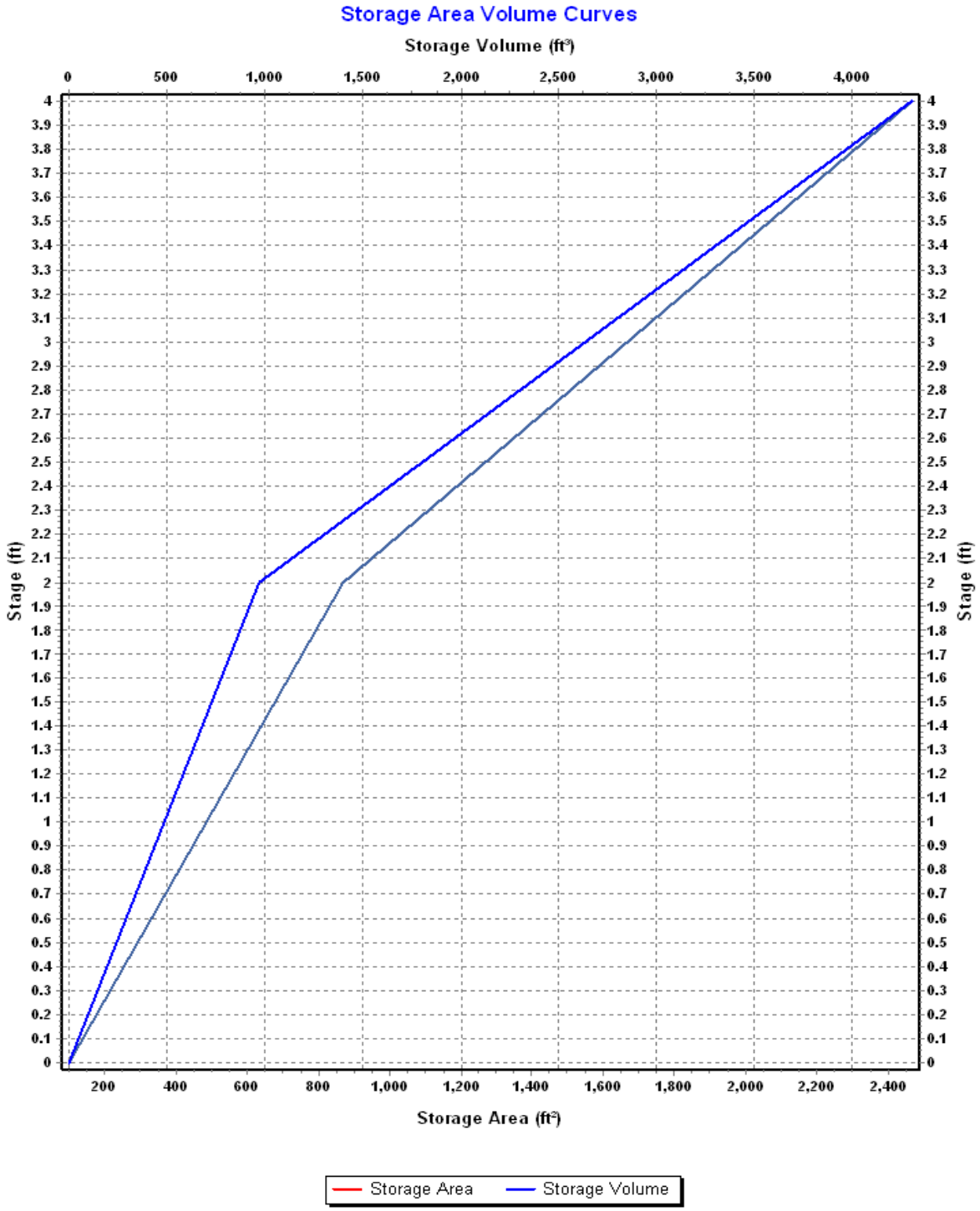
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.0850

Storage Area Volume Curves

Storage Curve : Storage-SW5

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	100	0.000
2	870	970.00
4	2465	4305.00


Storage Area Volume Curves
Storage Volume (ft³)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
Stage (ft)
Storage Area (ft²)
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200
2,400
Storage Area
Storage Volume

Storage Node : Pond_SW5 (continued)

Output Summary Results

Peak Inflow (cfs)	38.97
Peak Lateral Inflow (cfs)	38.97
Peak Outflow (cfs)	34.30
Peak Exfiltration Flow Rate (cfm)	0.32
Max HGL Elevation Attained (ft)	1651.68
Max HGL Depth Attained (ft)	4.32
Average HGL Elevation Attained (ft)	1647.70
Average HGL Depth Attained (ft)	0.34
Time of Max HGL Occurrence (days hh:mm)	0 12:06
Total Exfiltration Volume (1000-ft³)	0.034
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond_SW6

Input Data

Invert Elevation (ft)	1650.36
Max (Rim) Elevation (ft)	1656.36
Max (Rim) Offset (ft)	6.00
Initial Water Elevation (ft)	1650.36
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	10.00
Evaporation Loss	0.00

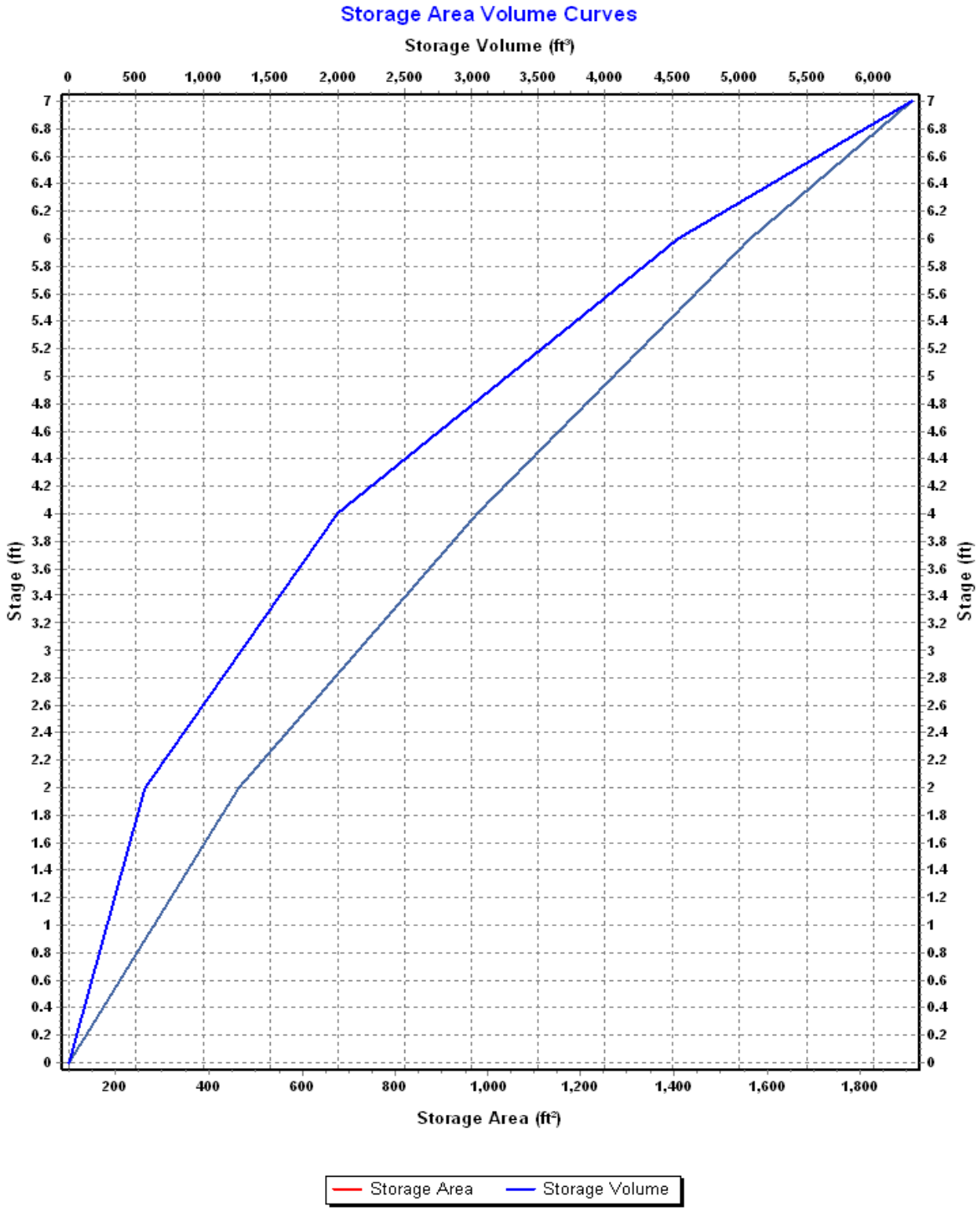
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.0850

Storage Area Volume Curves

Storage Curve : Pond-SW6

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	100	0.000
2	463	563.00
4	977	2003.00
6	1564	4544.00
7	1910	6281.00


Storage Area Volume Curves
Storage Volume (ft³)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
5,500
6,000
Stage (ft)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
4.4
4.6
4.8
5
5.2
5.4
5.6
5.8
6
6.2
6.4
6.6
6.8
7
Storage Area (ft²)
200
400
600
800
1,000
1,200
1,400
1,600
1,800
Storage Area
Storage Volume

Storage Node : Pond_SW6 (continued)

Output Summary Results

Peak Inflow (cfs)	31.12
Peak Lateral Inflow (cfs)	31.12
Peak Outflow (cfs)	30.93
Peak Exfiltration Flow Rate (cfm)	0.08
Max HGL Elevation Attained (ft)	1653.36
Max HGL Depth Attained (ft)	3
Average HGL Elevation Attained (ft)	1650.64
Average HGL Depth Attained (ft)	0.28
Time of Max HGL Occurrence (days hh:mm)	0 12:03
Total Exfiltration Volume (1000-ft³)	0.020
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond-NW3

Input Data

Invert Elevation (ft)	1647.91
Max (Rim) Elevation (ft)	1653.91
Max (Rim) Offset (ft)	6.00
Initial Water Elevation (ft)	1647.91
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	10.00
Evaporation Loss	0.00

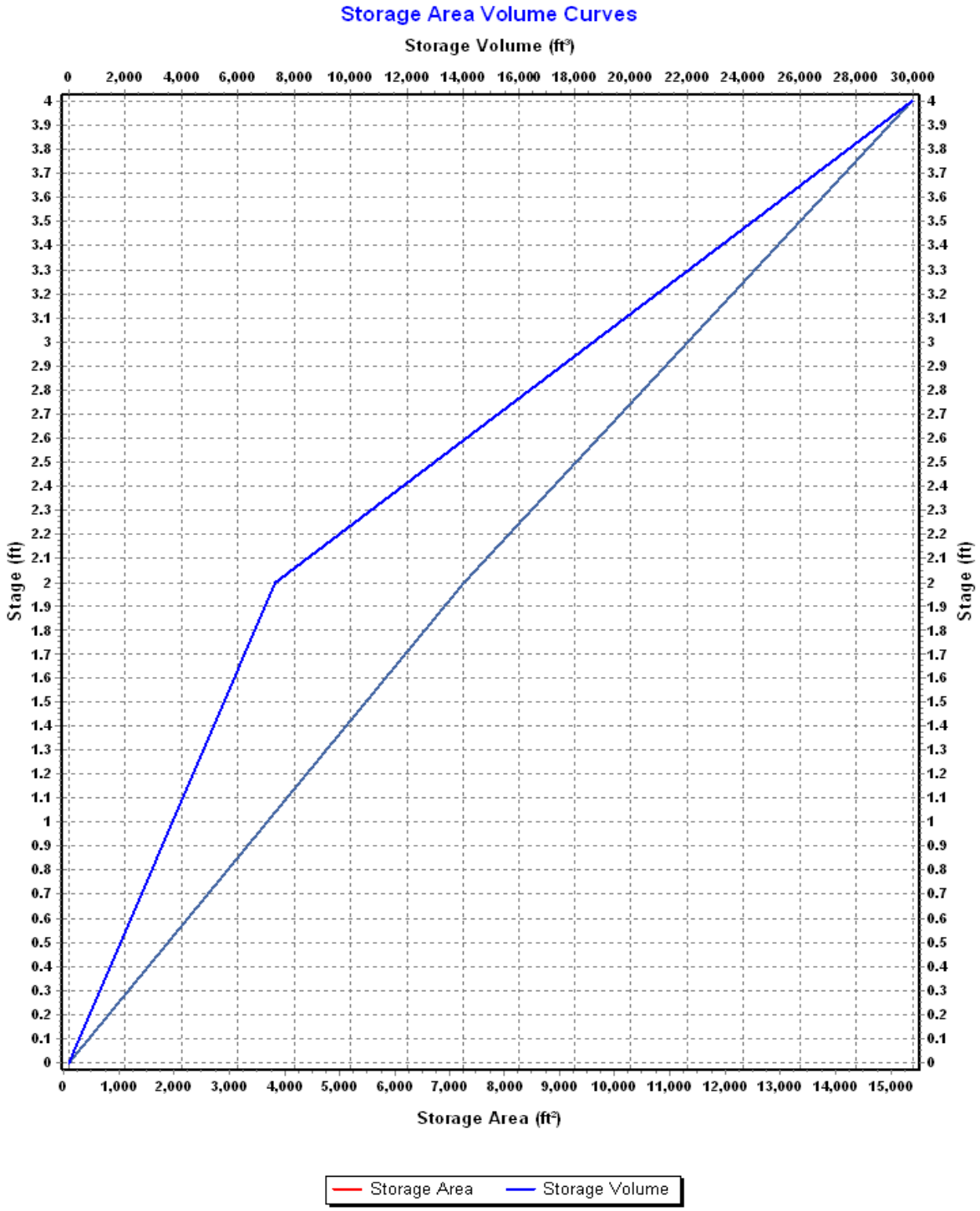
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.2600

Storage Area Volume Curves

Storage Curve : Pond-NW3

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	100	0.000
2	7247	7347.00
4	15378	29972.00


Storage Area Volume Curves
Storage Volume (ft³)
0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000 18,000 20,000 22,000 24,000 26,000 28,000 30,000
Stage (ft)
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3 3.1 3.2 3.3 3.4 3.5 3.6 3.7 3.8 3.9 4
0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000 11,000 12,000 13,000 14,000 15,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Pond-NW3 (continued)

Output Summary Results

Peak Inflow (cfs)	28.51
Peak Lateral Inflow (cfs)	0.00
Peak Outflow (cfs)	23.07
Peak Exfiltration Flow Rate (cfm)	2.04
Max HGL Elevation Attained (ft)	1649.46
Max HGL Depth Attained (ft)	1.55
Average HGL Elevation Attained (ft)	1648.05
Average HGL Depth Attained (ft)	0.14
Time of Max HGL Occurrence (days hh:mm)	0 12:08
Total Exfiltration Volume (1000-ft³)	0.294
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond-NW4

Input Data

Invert Elevation (ft)	1651.04
Max (Rim) Elevation (ft)	1654.00
Max (Rim) Offset (ft)	2.96
Initial Water Elevation (ft)	1651.04
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	10.00
Evaporation Loss	0.00

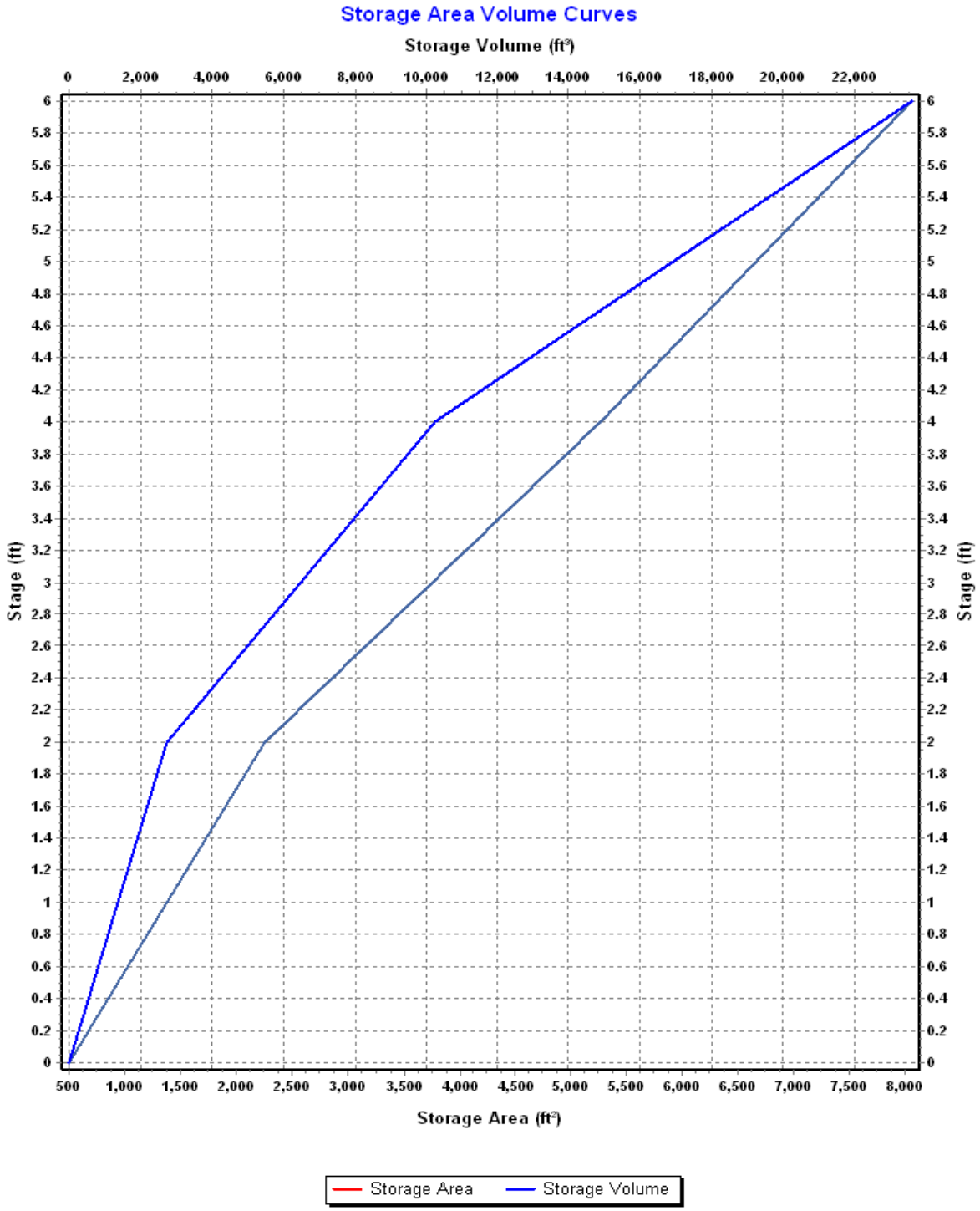
Infiltration/Exfiltration

Exfiltration Rate (in/hr)	0.0850

Storage Area Volume Curves

Storage Curve : Storage-NW4

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	500	0.000
2	2246.2497	2746.25
4	5274.7688	10267.27
6	8056	23598.04


Storage Area Volume Curves
Storage Volume (ft³)
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
22,000
Stage (ft)
6
5.8
5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
5,500
6,000
6,500
7,000
7,500
8,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Pond-NW4 (continued)

Output Summary Results

Peak Inflow (cfs)	33.47
Peak Lateral Inflow (cfs)	33.47
Peak Outflow (cfs)	33.27
Peak Exfiltration Flow Rate (cfm)	0.24
Max HGL Elevation Attained (ft)	1652.77
Max HGL Depth Attained (ft)	1.73
Average HGL Elevation Attained (ft)	1651.28
Average HGL Depth Attained (ft)	0.24
Time of Max HGL Occurrence (days hh:mm)	0 12:02
Total Exfiltration Volume (1000-ft³)	0.088
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

POST-DEVELOPMENT
2, 10, 25, & 50-YEAR, 24 HOUR STORM EVENT
ANALYSIS & CALCULATIONS SUMMARIES

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PROJECT: AVRRDD Phase IIIA Expansion

PROJECT NO: 777
DATE: April 1, 2020
CALC. BY: JHK

Table 5: Pre-Development vs Post Development Peak Flow Summary Table for 2-year 24-hour Storm

Discharge Area	Sub-basin	Area	Peak Runoff	Offsite Discharge	Sub-basin	Area	Peak Runoff	Pond Flow In	Pond Flow Out	Offsite Discharge	Comments
		(acre)	(cfs)			(acre)	(cfs)	(cfs)	(cfs)	(cfs)	
					NW2	6.62	4.18	15.75	2.40		Pond-NW2 accepts stormwater from subbasins NW3, NW4, and NW5. Pond-NW4 accepts stormwater from both subbasins NW4 and NW5. Pond-NW5 accepts stormwater from NW7. Other ponds only receive stormwater from their respective subbasins.
	Northeast	63.00	12.84		NW3	8.50	5.76	6.97	4.94		
North	Northwest	249.98	53.85	**63.94**	NW4	6.39	4.42	9.60	9.44	**55.17**	
	Subtotal	312.98			NW5	6.48	5.40	5.63	0.57		
					NW6	248.50	43.27				
					NW7	3.02	1.90				
					SE1	20.91	5.16	4.13	0.39		
					N1	57.90	14.16				
					Subtotal	358.32					
					SW1	5.70	2.64	23.15	14.82		Pond-SW1 accepts stormwater from subbasins SW1, SW2, and SW6. Pond-SW4 accepts stormwater from subbasins SW1, SW2, SW4, SW5, and SW6. Pond-SE2 accepts stormwater from subbasins SE5, SE6, SE7, SE8, SE9, SE9S, and SE12. Pond-SE1 accepts stormwater from subbasins SE10, SE11, and SE14. Other ponds only receive stormwater from their respective subbasins.
					SW2	1.16	0.83	0.82	0.80		
					SW3	58.50	3.65	3.65	3.65		
	Southeast	115.72	20.74		SW4	17.30	3.86	7.86	7.85		
South	East	49.63	10.02		SW5	15.25	11.19	11.18	11.38		
	West	88.34	20.59	**53.29**	SW6	10.08	10.59	10.58	10.54	**16.86**	
	Southwest	22.18	4.25		S1	2.83	2.22	2.21	2.03		
	Subtotal	275.87			S2	11.17	8.19	8.19	7.91		
					S3	7.51	5.88	5.88	5.86		
					SE2	19.47	4.53	3.89	1.61		
					SE3	26.27	9.34				
					SE4	4.93	0.45				
					SE5	3.03	2.61				
					SE6	2.68	3.74				
					SE7	4.34	4.20				
					SE8	4.86	4.78				
					SE9	4.45	3.98				
					SE9S	9.65	7.13				
					SE10	3.44	4.41				
					SE11	3.60	3.58				
					SE12	4.97	7.34				
					SE13	2.03	1.57				
					SE14	2.20	2.33				
					SE15	10.09	5.17				
					Subtotal	235.51					
	Total	**588.85**			**Total**	**593.83**					

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DATE: April 1, 2020
CALC. BY: JHK

Table 6: Pre-Development vs Post Development Peak Flow Summary Table for 10-year 24-hour Storm

Discharge Area	Sub-basin	Area	Peak Runoff	Offsite Discharge	Sub-basin	Area	Peak Runoff	Pond Flow In	Pond Flow Out	Offsite Discharge	Comments
		(acre)	(cfs)			(acre)	(cfs)	(cfs)	(cfs)	(cfs)	
					NW2	6.62	9.98	40.35	8.23		Pond-NW2 accepts stormwater from subbasins NW3, NW4, and NW5. Pond-NW4 accepts stormwater from both subbasins NW4 and NW5. Pond-NW5 accepts stormwater from NW7. Other ponds only receive stormwater from their respective subbasins.
	Northeast	63.00	39.36		NW3	8.50	13.80	18.31	14.50		
North	Northwest	249.98	141.81	**173.03**	NW4	6.39	10.54	22.41	22.23	**161.55**	
	Subtotal	312.98			NW5	6.48	12.46	15.75	0.75		
					NW6	248.50	123.76				
					NW7	3.02	4.59				
					SE1	20.91	14.60	18.75	1.61		
					N1	57.90	40.99				
					Subtotal	358.32					
					SW1	5.70	6.53	51.77	28.60		Pond-SW1 accepts stormwater from subbasins SW1, SW2, and SW6. Pond-SW4 accepts stormwater from subbasins SW1, SW2, SW4, SW5, and SW6. Pond-SE2 accepts stormwater from subbasins SE5, SE6, SE7, SE8, SE9, SE9S, and SE12. Pond-SE1 accepts stormwater from subbasins SE10, SE11, and SE14. Other ponds only receive stormwater from their respective subbasins.
					SW2	1.16	1.99	1.99	1.95		
					SW3	58.50	16.44	16.44	16.43		
	Southeast	115.72	53.03		SW4	17.30	10.91	34.32	34.28		
South	East	49.63	25.91		SW5	15.25	26.11	26.11	25.91		
	West	88.34	53.19	**137.52**	SW6	10.08	21.81	21.79	21.72	**66.98**	
	Southwest	22.18	10.97		S1	2.83	5.17	5.17	4.96		
	Subtotal	275.87			S2	11.17	18.66	18.65	18.22		
					S3	7.51	13.74	13.74	13.72		
					SE2	19.47	13.35	9.44	2.39		
					SE3	26.27	26.33				
					SE4	4.93	2.51				
					SE5	3.03	5.84				
					SE6	2.68	7.17				
					SE7	4.34	8.96				
					SE8	4.86	10.22				
					SE9	4.45	8.83				
					SE9S	9.65	15.67				
					SE10	3.44	8.68				
					SE11	3.60	7.61				
					SE12	4.97	14.30				
					SE13	2.03	3.86				
					SE14	2.20	4.96				
					SE15	10.09	12.98				
					Subtotal	235.51					
	Total	**588.85**			**Total**	**593.83**					

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DATE: April 1, 2020
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Table 7: Pre-Development vs Post Development Peak Flow Summary Table for 25-year 24-hour Storm

Discharge Area	Sub-basin	Area	Peak Runoff	Offsite Discharge	Sub-basin	Area	Peak Runoff	Pond Flow In	Pond Flow Out	Offsite Discharge	Comments
		(acre)	(cfs)			(acre)	(cfs)	(cfs)	(cfs)	(cfs)	
North	Northeast	63.00	64.50	**272.75**	NW2	6.62	15.01	61.26	11.81	**259.06**	Pond-NW2 accepts stormwater from subbasins NW3, NW4, and NW5. Pond-NW4 accepts stormwater from both subbasins NW4 and NW5. Pond-NW5 accepts stormwater from NW7. Other ponds only receive stormwater from their respective subbasins.
	Northwest	249.98	221.48		NW3	8.50	20.78	28.51	23.07		
	Subtotal	312.98			NW4	6.39	15.86	33.47	33.27		
					NW5	6.48	18.67	25.08	0.83		
					NW6	248.50	199.20				
					NW7	3.02	6.94				
					SE1	20.91	23.29	27.87	4.04		
					N1	57.90	65.62				
					Subtotal	358.32					
South	Southeast	115.72	81.88	**213.18**	SW1	5.70	9.92	71.26	34.87	**107.52**	Pond-SW1 accepts stormwater from subbasins SW1, SW2, and SW6. Pond-SW4 accepts stormwater from subbasins SW1, SW2, SW4, SW5, and SW6. Pond-SE2 accepts stormwater from subbasins SE5, SE6, SE7, SE8, SE9, SE9S, and SE12. Pond-SE1 accepts stormwater from subbasins SE10, SE11, and SE14. Other ponds only receive stormwater from their respective subbasins.
	East	49.63	40.22		SW2	1.16	3.02	3.02	2.95		
	West	88.34	82.44		SW3	58.50	30.63	30.63	30.53		
	Southwest	22.18	17.06		SW4	17.30	17.42	50.20	50.11		
	Subtotal	275.87			SW5	15.25	38.99	38.97	34.30		
					SW6	10.08	31.12	31.12	30.93		
					S1	2.83	7.75	7.75	7.46		
					S2	11.17	27.56	27.56	26.77		
					S3	7.51	20.57	20.56	20.52		
					SE2	19.47	21.57	22.10	4.51		
					SE3	26.27	41.72				
					SE4	4.93	4.81				
					SE5	3.03	8.59				
					SE6	2.68	9.95				
					SE7	4.34	12.98				
					SE8	4.86	14.81				
					SE9	4.45	12.99				
					SE9S	9.65	22.82				
					SE10	3.44	12.18				
					SE11	3.60	10.99				
					SE12	4.97	19.97				
					SE13	2.03	5.89				
					SE14	2.20	7.18				
					SE15	10.09	19.92				
					Subtotal	235.51					
	Total	**588.85**			**Total**	**593.83**					

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CALC. BY: JHK

Table 8: Pre-Development vs Post Development Peak Flow Summary Table for 50-year 24-hour Storm

Discharge Area	Sub-basin	Area (acre)	Peak Runoff (cfs)	Offsite Discharge	Sub-basin	Area (acre)	Peak Runoff (cfs)	Pond Flow In (cfs)	Pond Flow Out (cfs)	Offsite Discharge (cfs)	Comments
North	Northeast	63.00	89.72	**370.81**	NW2	6.62	19.91	81.56	13.64	**355.21**	Pond-NW2 accepts stormwater from subbasins NW3, NW4, and NW5. Pond-NW4 accepts stormwater from both subbasins NW4 and NW5. Pond-NW5 accepts stormwater from NW7. Other ponds only receive stormwater from their respective subbasins.
	Northwest	249.98	299.44		NW3	8.50	27.60	38.63	31.60		
	Subtotal	312.98			NW4	6.39	21.07	44.30	44.02		
					NW5	6.48	24.72	34.41	0.90		
					NW6	248.50	274.23				
					NW7	3.02	9.23				
					SE1	20.91	31.97	35.46	6.22		
					N1	57.90	90.45				
					Subtotal	358.32					
South	Southeast	115.72	110.77	**288.41**	SW1	5.70	13.25	89.72	38.40	**140.42**	Pond-SW1 accepts stormwater from subbasins SW1, SW2, and SW6. Pond-SW4 accepts stormwater from subbasins SW1, SW2, SW4, SW5, and SW6. Pond-SE2 accepts stormwater from subbasins SE5, SE6, SE7, SE8, SE9, SE9S, and SE12. Pond-SE1 accepts stormwater from subbasins SE10, SE11, and SE14. Other ponds only receive stormwater from their respective subbasins.
	East	49.63	54.37		SW2	1.16	4.03	4.02	3.94		
	West	88.34	111.25		SW3	58.50	45.81	45.80	45.49		
	Southwest	22.18	23.12		SW4	17.30	23.93	61.40	61.25		
	Subtotal	275.87			SW5	15.25	51.56	51.48	41.13		
					SW6	10.08	40.02	39.97	39.71		
					S1	2.83	10.27	10.27	9.91		
					S2	11.17	36.25	36.25	34.95		
					S3	7.51	27.25	27.24	27.05		
					SE2	19.47	29.90	37.20	6.92		
					SE3	26.27	57.09				
					SE4	4.93	7.25				
					SE5	3.03	11.25				
					SE6	2.68	12.56				
					SE7	4.34	16.84				
					SE8	4.86	19.22				
					SE9	4.45	17.01				
					SE9S	9.65	29.74				
					SE10	3.44	15.49				
					SE11	3.60	14.23				
					SE12	4.97	25.26				
					SE13	2.03	7.86				
					SE14	2.20	9.31				
					SE15	10.09	26.62				
					Subtotal	235.51					
	Total	**588.85**			**Total**	**593.83**					

APPENDIX G

FEMA FLOOD INSURANCE RATE MAP



Notes:

1. Flood Hazard shape files taken from FEMA.
2. AVRRDD property line from York Land Services, LLC. of Berlin, NH.

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Androscoggin Valley Regional Refuse Disposal District
Mt. Carberry Secure Landfill
Phase III Landfill Expansion

FEMA 100 Year Flood Plain

Figure 2

National Flood Hazard Layer FIRMette



Legend

- Cross-Sections
- Base Flood Elevations

Flood Hazard Zones

- 1% Annual Chance Flood
- Regulatory Floodway
- Special Floodway
- Area of Undetermined Flood Hazard
- 0.2% Annual Chance Flood
- Future Conditions 1% Annual Chance Flood Hazard
- Area with Reduced Risk Due to Levee

LOMRs

- Effective

Map Panels

- Digital Data
- Unmodernized Maps
- Unmapped

This map complies with FEMA's standards for the use of digital flood maps. The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. The base map shown complies with FEMA's base map accuracy standards.

The NFHL is a living database, updated daily, and this map represents a snapshot of information at a specific time.

Flood risks are dynamic and can change frequently due to a variety of factors, including weather patterns, erosion, and new development. FEMA flood maps are continually updated through a variety of processes. Users should always verify through the Map Service Center (http://msc.fema.gov) or the Community Map Repository that they have the current effective information.

NFHL maps should not be created for unmapped or unmodernized areas.

FEMA

Date: 7/6/2017 Time: 3:50:06 PM

Part IX

Landfill Stability Evaluation and Calculations

LANDFILL STABILITY ANALYSES
MT. CARBERRY LANDFILL, PHASE IIIA
SUCCESS, NEW HAMPSHIRE

This report presents the results of stability analyses of the Mt. Carberry Phase IIIA Landfill expansion in Success, New Hampshire. The objective of this work is to assess the stability of the landfill waste, lining system, and capping system under static and seismic loads, in support of the development of the Phase IIIA Landfill. The proposed landfill development will expand the landfill footprint by 23 acres to the northeast. Stage 1 through 4 of Phase I and Stage 7 through 9 of Phase II comprise the base grades for the existing landfill. Stages 1 through 12 comprise the Phase I and II Landfill.

The Phase IIIA area will be contiguous with Phase II, and Phase IIIA waste will in part be placed over the existing Phase I and II waste and lining systems. In addition, landfill final grades will be raised 16 feet, extending the Phase IIIA waste over existing waste in Stage 12. Stage 12 overlays Phase I Stage 5 and 6, and Phase II Stage 10 and 11. The landfill is currently operating in Stages 5 and 6, located above the Stage I base area. Landfill operations will transition to Phase 12 at the end of 2022. Stage 12 will operate through at least April 2025.

Reference the closure plan drawings included in this permit application for proposed Phase IIIA landfill final grades. Please refer to Phase 1 through 4 and 7 through 9 construction record documents on file at NHDES for soil and geosynthetic materials used in construction of those landfill phases. Appendices to the application contains boring and well installation logs, and a boring location plan relevant to the design and stability of the key portions of the landfill. These include borings drilled in the natural soils beneath the landfill prior to construction of the landfill. Borings drilled through the Phase 1 through 4 waste above the landfill lining system are included in the 2012 Geotechnical Report in Attachment 3 completed for the Stage 5 & 6 development.

Background

The composition of the waste landfilled in the Mt. Carberry Landfill has changed over time. A graphical summary of the changes in waste composition is provided as Figure 1. A plan showing proposed landfill base and final grades, as well as critical sections is included in Figure 2A through 2C in this report. As described below, a critical stability section is through the proposed peak of landfill in a general north to south orientation. This section is critical as it has the longest and highest waste slope, and base grades slope downward in a general north to south direction. This section also crosses through Stages 1 and 2 at a location that contains a sludge-based waste mass and a lining system unique to those stages in that they have lower shear strengths than the remainder of the landfill. A discussion of the sludge and other wastes and liner system components follows.

The wastes disposed at the landfill can be characterized by three general waste compositions. During the initial four years of operation of the landfill the waste consisted of 50 percent or greater sludge residuals mostly from the former pulp mill wastewater treatment plant, with lesser amounts of sludge from the paper mill and municipal wastewater treatment plants. The other constituents of the waste included sand and gravel used to stabilize the waste, and miscellaneous wastes including grit screenings, lime mud (from the pulping process) and incinerator ash. This composition of waste, referred to herein as sludge waste, was disposed in Stage 1 and 2 from 1989 through 1994. The sludge waste is relatively fine grained and was difficult to place and compact when wet, due its inherent high moisture content or when exposed to rainfall. The limits of the sludge waste are shown on Figure 4 in Attachment 3, a cross-section through Stage 1 and 2.

During operation of Stage 1 and 2, the active disposal area would on occasion become overly wet and difficult to operate, with instances of equipment sinking into the waste. These early operational problems related to storm water management. Active areas had been controlled by berms on the outside slopes to contain any contaminated storm water runoff in the landfill. This caused the storm water to collect in the active disposal area, pond and saturate the waste. On one occasion of heavy rain, storm water breached the containment berms and contaminated surface water escaped the landfill along with waste eroded from the waste side slope. After that incident in 1994 the sludge waste was further bulked up with large amounts of sand and gravel, as shown on Figure 1, and storm water was directed away from active areas. This failure of waste containment is attributed to storm water management and not instability of the waste itself.

The percentage of sludge in the waste dropped from the high 30s in 1995 to the low 20s in 2002. The proportional drop of sludge percentage in the waste was due to lower actual sludge volumes, a rough doubling of the sand and gravel component added to bulk up the sludge for handling and compaction purposes, and the addition of municipal solid waste (MSW) constituting roughly 10 percent of the waste. This type of waste, referred to herein as sludge and gravel, was landfilled in Stage 3 and the first half of Stage 4.

From 2002 through the present, the sludge component has declined to less than 10 percent of the waste composition. Since 2002 the waste has consisted mostly of construction and demolition debris (C&D); auto fluff consisting of plastics, foam, textiles, rubber and glass residuals from automobile recycling operations; and lesser quantities of municipal solid waste. Other minor waste constituents include sand and gravel and miscellaneous mill wastes. Since 2016 the portion of MSW has increased and C&D waste decreased correspondingly. This composition of waste is referred to herein as C&D/Auto Fluff/MSW waste. At present, it is expected that the Phase IIIA waste composition will be similar to the current C&D/Auto Fluff/MSW waste composition.

Explorations and Laboratory Testing

CMA Engineers conducted a subsurface waste exploration program in the Stage 1 through 4 landfill in October 2011. The objectives of the explorations were to characterize the in-place nature of the waste materials, with a focus on the extent and characteristics of the sludge waste material. The sludge waste was disposed in Stage 1 and 2. This waste has the potential to have lower shear strength than the other waste types due to its relatively high moisture and organic content, and lesser amounts of strength reinforcing materials such as building debris, cloth and municipal solid waste.

New Hampshire Boring (NHB) of Londonderry, New Hampshire drilled the waste borings, under the full-time observation of a CMA Engineers geotechnical engineer. NHB drilled a total of six borings to depths ranging from 32 to 52 feet. The boring locations are shown in Attachment 3. York Land Services of Berlin, New Hampshire surveyed the waste surface elevation at each boring location. CMA Engineers reviewed as-built liner grades to ensure the borings would extend no closer than 7 to 10 feet above the landfill lining system. The boring logs are provided in Attachment 3.

NHB advanced the borings with drive and wash drilling techniques, using 4-inch diameter casing, a polymer drilling fluid, and a tri-cone roller drilling bit. NHB used 3-inch diameter split spoon sampler to increase the likelihood and volume of sample recovery, rather than a conventional 2-inch diameter sampler. Standard Penetration Tests were typically conducted at 5-foot intervals to aid in assessing the in-place shear strength of the waste and to collect samples for laboratory analyses.

Subsurface conditions beneath the Stage 1 through 4 landfill consist of a thin layer of engineered fill underlain by glacial till deposits. Sevee & Maher Engineers of Cumberland, Maine conducted hydrogeologic studies of the Phase I landfill prior to its construction over the period between 1988 and 1999. The borings and well installation logs, boring locations, the Sevee & Maher interpretation of the bedrock surface, and overall subsurface conditions are included in Attachment 1 to the Hydrogeologic Evaluation in this application.

CMA Engineers submitted a total of 19 samples from the 2011 borings to Thielsch Engineering in Hopkinton, Massachusetts for laboratory testing. The samples were tested for water content, Atterberg limits, grain size distribution, organic content and pH. Two samples were also tested for shear strength in a triaxial cell. The samples were sheared in an undrained condition after being consolidated isotropically in the triaxial cell, with pore pressures measured throughout the duration of the test. Summary tables and laboratory test results are included in Attachment 3.

Waste Characteristics and Conditions

Sludge Waste

The thickness of the sludge waste ranges from about 28 to 36 feet across Stages 1 and 2. Historical waste records indicate approximately 585,000 tons of sludge waste was disposed in Stages 1 and 2. This volume corresponds to 22 percent of 2,645,000 tons of Phase I waste disposed through 2003. Additional C&D/Auto Fluff/MSW waste was placed after 2003 over the Stage I landfill as part of operations in Stage I Phase 5 & 6 and Stage II operations over internal Stage I sideslopes. Future filling associated with Stage 12 will raise final landfill grades over Phase I and II. A cross section through Phase I that depicts the approximate limits of the sludge waste is provided on Figure 4 in Attachment 3.

The color of the sludge varies from dark brown or gray to black. The sludge consistency ranges from clayey silt to sand and gravel, mixed occasionally with refuse and debris. The SPT N values, adjusted for the larger than standard 3-inch diameter split spoon, ranged from 3 to 31 blows per foot, and averaged 11 blows per foot indicating the waste overall is medium dense. Arranged in increasing sequential order, the 1/3 median SPT N value is 6. Isolated pockets of white or black pasty sludge were encountered sporadically in the borings. The landfill operator identified this material as lime mud from the former pulp mill. Similar quantities of dark gray to black incinerator ash were encountered as well. A triaxial compression test on an ash sample indicated a shear strength equal to an internal angle of friction of 35.4 degrees for the ash deposit.

The water content of the sludge had a low of 11 percent and a high of 213 percent but was generally in the range from 50 to 80 percent. Organic content ranged from 1 to 34 percent, with pH values in the 8 to 9-unit range. One incinerator ash sample had a pH of 12.25. The sludge waste was generally determined to be non-plastic or slightly plastic, although two samples of the lime mud had Atterberg limit values corresponding to a high plasticity clay.

Sludge and Gravel

The sludge and gravel deposit was encountered in Stage 3 and overlapping the interior slope of Stage 2 sludge waste. The sludge and gravel appeared to be similar to the sludge waste except it contained much more sand and gravel and municipal solid waste. The SPT N values for the sludge and gravel ranged from medium dense (16 blows per foot) to very dense (50 blows per 1”).

C&D/Auto Fluff

The C&D/Auto Fluff waste was difficult to drill and sample as the building rubble component of the waste (wood, concrete, brick, etc.) provided an obstruction to the drilling and sampling tools. SPT N values ranged from medium dense to very dense.

Subsurface Conditions

The natural glacial till deposits underlying the landfill consist of a well sorted mixture of gravel, sand, silt and clay. These deposits are dense to very dense with SPT N values ranging from 35 to refusal. The depth to bedrock ranges from about 16 feet in the upper northern portions of the landfill, to about 200 feet in the lower southern and western portions. The groundwater table is artificially depressed beneath the Phase I and II landfill by a series of underdrains intended to maintain a 6-foot separation between the bottom of the landfill lining system and the water table. Proposed Phase IIIA base grades are established to be at least 6 feet above the seasonally high groundwater table without the need to install underdrains.

Slope Stability

CMA Engineers used the GeoStudio 2020 Slope Stability software from the GeoSlope Company for the stability analyses. The selection of material input parameters is discussed below.

C&D/Auto Fluff/MSW

The C&D/Auto Fluff/MSW waste materials consist predominantly of construction and demolition debris, auto shredder fluff, and MSW with lesser amounts of wastewater treatment plant sludge, gravel and miscellaneous wastes. The strength characteristics of this waste mix is expected to be equal to or greater than the shear strength of conventional MSW. The waste stream prior to 2016 included more C&D and less MSW. The pre-2016 waste mix likely exhibits higher shear strengths due to the strong interlocking nature of the C&D waste. CMA Engineers conservatively used published MSW shear strength values for the C&D/Auto Fluff/MSW waste. Published values include an internal angle of friction (phi) of 33 to 35 degrees, and a cohesion intercept of 0 to 500 pounds per square foot (psf). We selected mid-range values of 33 degrees phi and a cohesion of 300 psf. We assigned a unit weight of 80 pounds per cubic foot to the C&D/Auto Fluff/MSW waste based on site waste density data and experience with similar waste materials.

Sludge and Gravel

As shown below, the potentially critical failure surface location is through the sludge wastes at the southern end of Phase I through Stages 1 and 2. All of the sludge and gravel wastes are further to the north in Stages 3 and 4 and outside of the limits of critical failure surfaces, and are therefore not situated to effect minimum slope stability factors of safety. We expect the shear strength of this waste to be similar to that assigned to the C&D/Auto Fluff/MSW material. For simplicity of modeling the landfill, we combined these two waste types into one deposit for the purposes of our stability analyses.

Sludge Waste

Using correlations between SPT N values and shear strength and the 1/3 median N value of 6 (corrected for the 3" split spoon) yields a phi of 28 degrees for the sludge waste. Considering the heterogeneous nature of the waste and the compositional and depositional differences between this waste and granular soil for which the correlations are based, the sludge waste shear strength was reduced to a design phi of 22 degrees for these analyses. We assigned a unit weight of 80 pounds per cubic foot to the sludge waste based on our experience and observations of the material, and moisture and density measurements taken for the laboratory triaxial compression tests.

Lining System

The Phase I lining system consists of a sequence of layers of engineered soil, smooth high density polyethylene (HDPE) geomembrane, HDPE drainage net, non-woven geotextile fabric (not bonded to the drainage net) and drainage sand. The lowest strength interface in the lining system is the interface between the smooth geomembrane and the drainage net in the north-south critical section. Based on interface test data on file for older projects with similar materials, we assigned an interface shear strength of 40 pounds per square foot cohesion and a phi of 16 degrees for this interface. We assigned a unit weight of 120 pounds per cubic foot to the liner to represent the soil components of the lining system. The Phase II lining systems includes textured geomembrane and drainage geocomposite consisting of drainage net bonded to non-woven geotextile fabric. The interface shear strength of the Phase II lining system is much higher than Phase I based on a large body of laboratory testing conducted over the past 20 years on similar lining system configurations. We assume a phi of 26 degrees for the Phase II lining systems. The Phase IIIA lining system will include a GCL layer beneath the primary lining system. Test results on file indicate interfaces with the GCL will have a phi of 22 degrees. This interface will represent the critical interface for the Phase IIIA liner.

Glacial Till

The shear strength of the glacial till soils at the site was determined using correlations to SPT N values and data from soil borings conducted at and adjacent to Stage I. We assigned an internal angle of friction of 36 degrees and a unit weight of 135 pounds per cubic foot to the glacial till soils.

Critical Failure Locations

We selected a critical failure location through the long axis of Phase I and II, in a north-south orientation. This section constitutes the longest and highest waste slopes in Phase I through III, intersects the landfill peak, coincides with the down sloping base grades, incorporates the lower interface shear strength of the Phase I liner and includes a failure surface through the low strength sludge waste. The final waste slope grades along the southern and western Phase I slopes are about 4H:1V. Our analysis conservatively neglects the three-dimensional shape of the waste grades. As a check, we also evaluated a failure section through the proposed landfill peak in a general east to west direction through Phase IIIA. This waste in section is not as high above surrounding ground as the

north-south section, and the base grades are flat. Final waste grades, however, are steeper at 3H:1V.

We did not evaluate the stability of perimeter berms as the landfill perimeter berms are generally less than 10 feet above surrounding grades, and base grades are shallow relative to surrounding ground. Interior berms are generally 6 feet or less high and are of no consequence with respect to stability.

STATIC STABILITY

Stability analyses were conducted in 2012 for Stage 5 & 6 permitting. Stage 5 & 6 are located over the lower strength Stage 1 and 2 waste, and below Stage 12 and the Phase IIIA rise in vertical height. Given the unconventional nature of the sludge waste from a geotechnical properties' perspective, we conducted a sensitivity analysis of the sludge waste strength at that time. As these analyses are relevant to the overlying Phase III-A expansion, the prior stability analyses are summarized below.

2012 Stage 5 & 6 Waste Stability/Sensitivity Analyses

The existing Stage 1 through 4 landfill has been filled to capacity since the year 2000, and has remained stable. To evaluate a lower bound threshold for the sludge waste shear strength, this value was varied to achieve a factor of safety of 1.0, i.e., the lower limit of a stable waste mass. Calculations and stability analyses results are included in Attachment 3.

Attached calculations indicate reducing the sludge waste shear strength to a phi of 12.5 degrees results in a minimum factor of safety of 1.0 for a shallow surface sloughing failure. This represents a lower bound value as the sludge waste slope has been stable since it was constructed in the early 1990s. Using this lower bound value, a deeper rotational failure through the sludge waste and the overlying Stage 5 & 6 C&D/Auto Fluff indicated a factor of safety of 1.7. Evaluating a waste mass failure along the lining system interface using the lower bound value indicates a minimum factor of safety of 1.4. Factors of safety in excess of 1.5 are generally considered to be acceptable for long term static conditions at landfill sites.

The potential for instability in the waste with Stage 5 and 6 filled to capacity was investigated using the design value of 22 degrees phi and checked against the calculated lower bound shear strength value of 12.5 degrees phi for the sludge waste. Calculations and stability analyses results are included in Appendix C.2 and are summarized below.

Failure Mode	22^{o} Sludge Shear Strength	12.5^{o} Sludge Shear Strength
Shallow Sloughing	2.1 min FS	1.0 min FS
Rotational Waste Failure	2.0 min FS	1.7 min FS
Waste/Liner Interface	2.0 min FS	1.4 min FS

Calculations indicated acceptable factors of safety against Stage 5 & 6 slope failure when using the design shear strength value for the sludge waste. Calculations also indicated the landfill is stable even when conservatively assigning lower bound strength values to the waste.

Proposed Phase IIIA Static Waste Mass Stability Analyses

The potential for instability in the waste mass with Phase IIIA filled to capacity was investigated for two potentially critical sections referred to as a north-south Section A-A', and an east-west Section B-B'. Calculations and static stability analyses results are included in Attachment 1. A factor of safety of 1.5 is considered acceptable for the long-term static condition.

North-South Failure Plane: Calculations indicated factors of safety against Phase IIIA rotational waste failure of 2.2 and 1.9 against waste/liner interface failure when using the design shear strength value for the sludge waste of 22 degrees and liner interfaces having a shear strength of 16 degrees phi and 40 psf cohesion.

East-West Failure Plane: Calculations indicated factors of safety against Phase IIIA rotational waste failure of 2.2 and 2.4 against waste/liner interface failure when using the design shear strength value for liner interface of 22 degrees phi representative of the GCL.

Deep Rotational Foundation Failure

Subsurface conditions consist of glacial till deposits and structural fill materials comprised of compacted glacial till or granular deposits and underdrain granular soils. The glacial till is underlain by bedrock at depths ranging from about 16 feet to 200 feet below landfill subgrade in the sections analyzed. The glacial till is dense as a result of the weight and movement of the ice sheet that deposited the soil directly over bedrock, and fill materials are compacted to 95% of maximum density using Modified Proctor testing techniques. The depth to groundwater below the landfill subgrade was assumed to be 6 feet as it is either controlled by the underdrain or base grades will be raised to create the required separation.

Given the very dense nature of the glacial till, by inspection the potential for a deep rotational failure through the foundation soils does not reasonably exist. Calculations indicate a minimum factor of safety of 3.4 and 3.1 against a deep rotational failure through the landfill foundation soils in the north-south and east-west sections, respectively. Calculations and stability analyses results are included in Attachment 1.

Cap Stability

A preliminary cap design is provided on the drawings and the closure plan included in this permit application. The design consists of two feet of cover soil overlying a drainage geocomposite (bonded geotextile and drainage net) and textured geomembrane. The geomembrane is underlain by screened glacial till, a gas transmission layer of granular soil and intermediate cover soil. The final capping system is proposed to be installed after the landfill is filled to capacity many years in the future. The final design is likely to vary from this preliminary design to account for regulatory requirements and materials available at that time.

We assumed a minimum interface friction value of 28 degrees for the capping system components. We evaluated the steeper 3H:1V final grades proposed for the northern and eastern Phase III slopes. For an infinitely long slope (ignoring the stabilizing toe buttressing effects and benches), the factor of safety is defined by the following equation:

Factor of safety = $\tan\varphi/\tan\beta$, where

φ = 28 degrees, the interface friction angle

B = 18.4 degrees, the maximum slope angle

Factor of safety = .53/.33 = 1.6

SEISMIC STABILITY

CMA Engineers completed seismic stability analyses of the secure landfill in accordance with Env-Wm 2503.04 and 40 CFR 258.14. Seismic stability calculations are included in Attachment 2. Seismic stability was evaluated considering a design earthquake with a 10 percent probability of exceedance in 250 years. A U. S. Geologic Survey (USGS) Hazard Map dated 2014 indicates the design earthquake has a probable ground acceleration (pga) of 0.14 of gravity. A Copy of the USGS Hazard Map is attached.

For foundation soils failure, two types of analyses are typically considered to demonstrate conformance with the above-referenced regulations. One analysis addresses the stability of the foundation soils relative to a deep rotational failure. The second analysis includes an evaluation of the liquefaction potential of the granular foundation soils. The glacial till soils are not subject to liquefaction because of their very dense nature.

Each critical section from the static analysis, including rotational failures through the waste mass and foundation soils as well as the critical liner interfaces were evaluated for seismic stability. Attached calculation indicate the probable ground acceleration of 0.14g would result in a seismic coefficient at the top of the waste of 0.24g (cap condition) following procedures outlined by Singh and Sun and 0.08g at the lining system (sliding

along liner interfaces) following procedures outlined by Makdisi and Seed. An average seismic coefficient of 0.16g was used for the waste mass when evaluating waste and foundation stability. Pseudo-static seismic stability analyses were conducted for the waste mass, foundation and liner sliding stability evaluations. A factor of safety of 1.1 is considered acceptable for stability of the waste mass and foundation conditions. Liner stability is evaluated relative to earthquake-induced displacements as described below.

North-South Failure Plane: Calculations using pseudo-static seismic loading indicated factors of safety against Phase IIIA rotational waste failure of 1.2, 1.3 against waste/liner interface failure, and 1.9 against foundation failure.

East-West Failure Plane: Calculations using pseudo-static seismic loading indicated factors of safety against Phase III rotational waste failure of 1.4, 1.8 against waste/liner interface failure, and 1.7 against foundation failure.

The analyses for computing earthquake-induced displacements for failure planes along lining system components used the following procedures:

- Determine the seismic coefficient, i.e., the average maximum earthquake-induced acceleration in the refuse mass immediately above the sliding surface. This involves assessment of any attenuation or amplification of the earthquake accelerations within the waste. In this instance, the analysis conservatively neglects any attenuation of earthquake acceleration in the very dense soil between bedrock and the lining system. For these analyses, calculations indicate a seismic coefficient acceleration of 0.08g for the lining system.
- Determine the yield acceleration for potential sliding surfaces. The yield acceleration is the earthquake acceleration that corresponds to a factor of safety of 1.0, or an earthquake sufficiently large enough to cause movement or displacement. Each critical failure surface was evaluated by varying the earthquake acceleration until a factor of safety of 1.0 was achieved. The calculations indicate a factor of safety of 1.00 with a minimum yield acceleration of 0.17g for the critical interface located within the lining system in the north-south section, and 0.35g for the critical interface located within the lining system in the east-west section.
- Compare the yield and induced accelerations. If the induced accelerations exceed the yield accelerations, assess the magnitude of permanent displacement. In this instance, the results of pseudo-static stability analyses indicate minimum yield accelerations of 0.17g and 0.35g, which are larger than the seismic coefficient (induced acceleration) of 0.08g.
- Assess the effects on containment systems from the estimated permanent displacements. Since the induced acceleration is less than the yield acceleration, the analyses indicate that the design earthquake would not be expected to cause any permanent deformations in the lining system. Permanent displacements on the order of 6 inches are typically considered acceptable for lining systems.

Cap Stability

Similar analyses were performed for cap stability as described above for liner stability. For the cap analyses, calculations indicate a seismic coefficient (induced acceleration) of 0.24g at the capping system. Calculations indicate a yield acceleration of 0.17g, and a permanent displacement of about one inch. Permanent displacements on the order of 6 inches to a foot are typically considered acceptable for capping systems.

CONCLUSIONS AND RECOMMENDATIONS

The analyses completed as part of this work indicate that the proposed landfill configuration and construction materials provide adequate factors of safety against foundation failure and sliding among liner and cap system components under the expected static loading conditions. Under seismic loads, the landfill is stable relative to a deep rotational failure, permanent deformation of the liner is not expected, and the cap system deformations are small and acceptable.



Robert J. Grillo, P.E.
Project Geotechnical Engineer

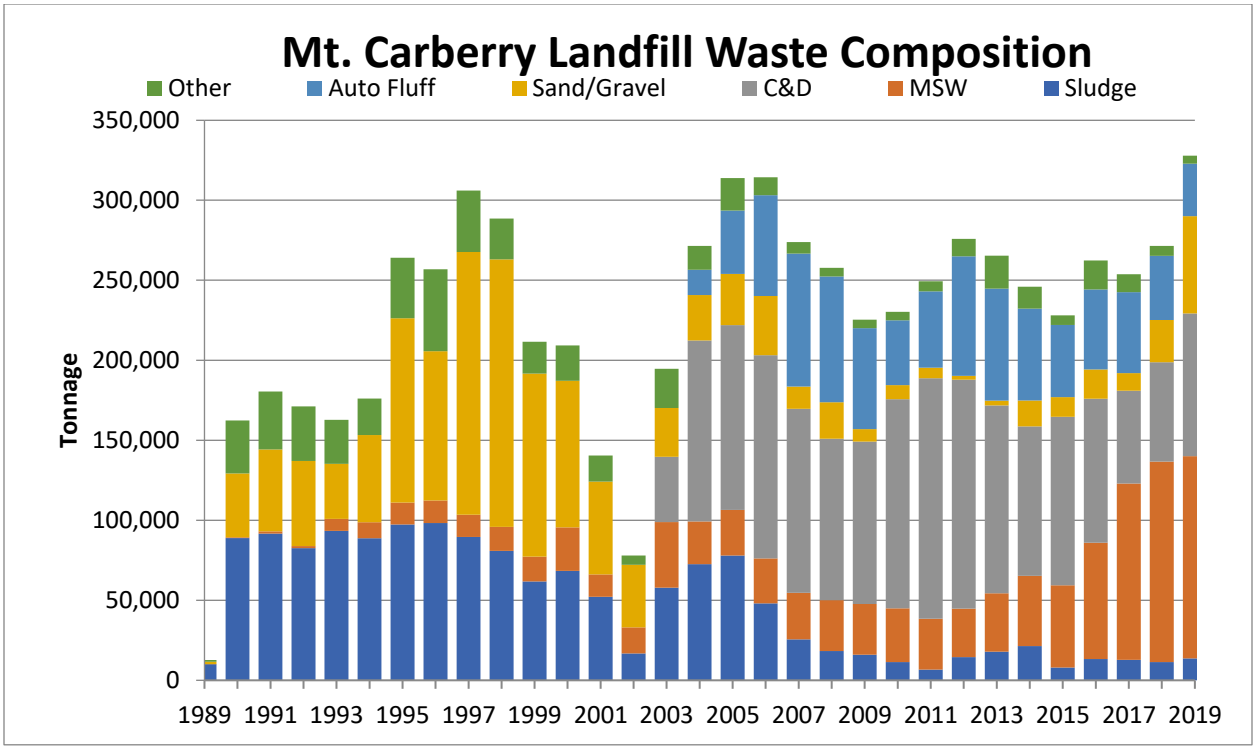

Mt. Carberry Landfill Waste Composition
Other
Auto Fluff
Sand/Gravel
C&D
MSW
Sludge
Tonnage
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019

FIGURE 1

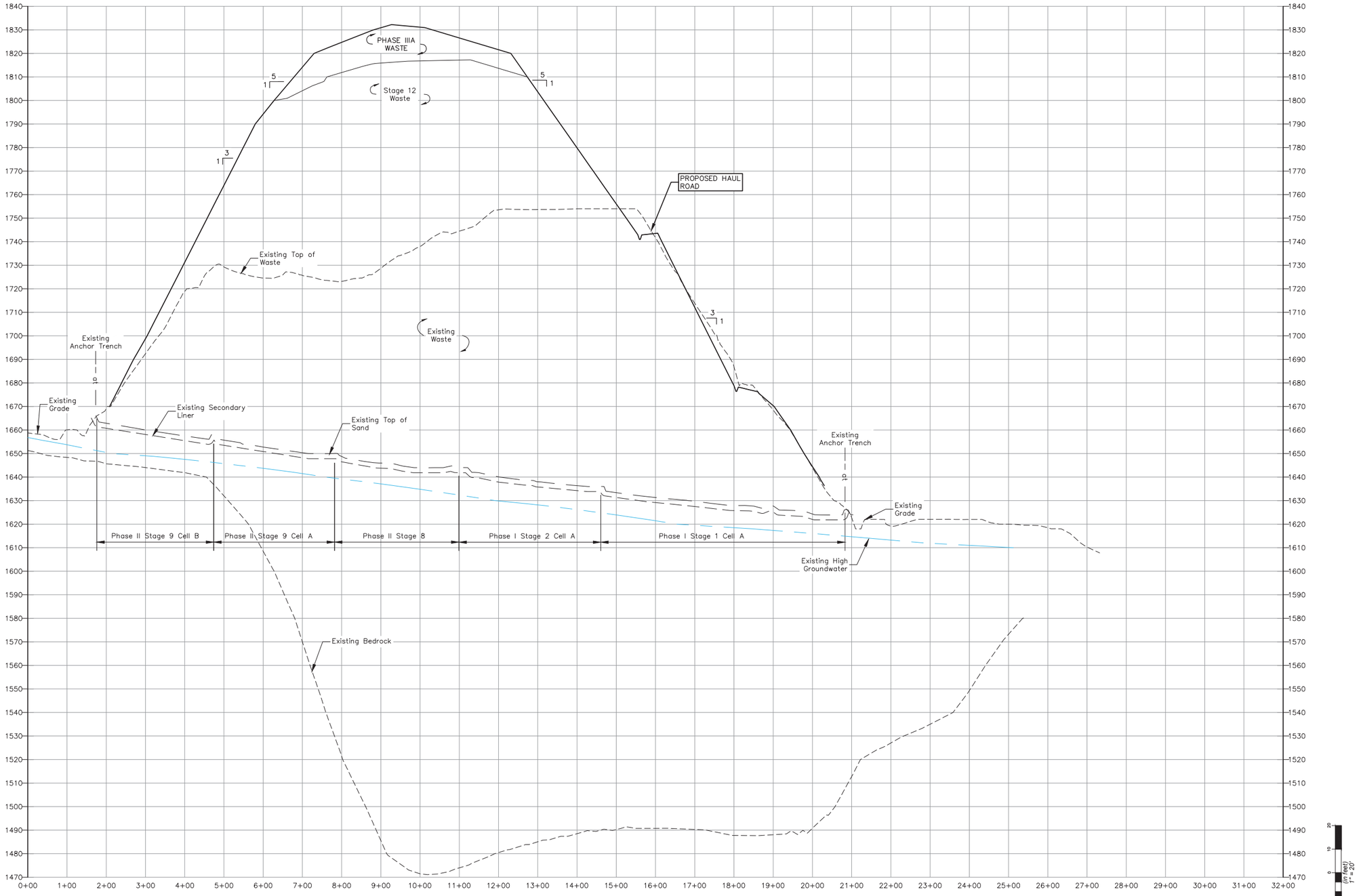


sheet: 1 of 3	drawing no. Figure 2A	Androscoggin Valley Regional Refuse Disposal District Mt. Carberry Secure Landfill Phase IIIA Geotechnical Figures Cross Section Alignments	date: April 2020 project no: 777 file name: scale: 0 120' 240' Scale: 1" = 120'	designed by: PDS/SJE drawn by: SJE approved by: PDS

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Landfill Cross Section A-A'

(See Figure 2A for Section Alignment)

Scale: 1" = 120' (Horiz.)
1" = 20' (Vert.)

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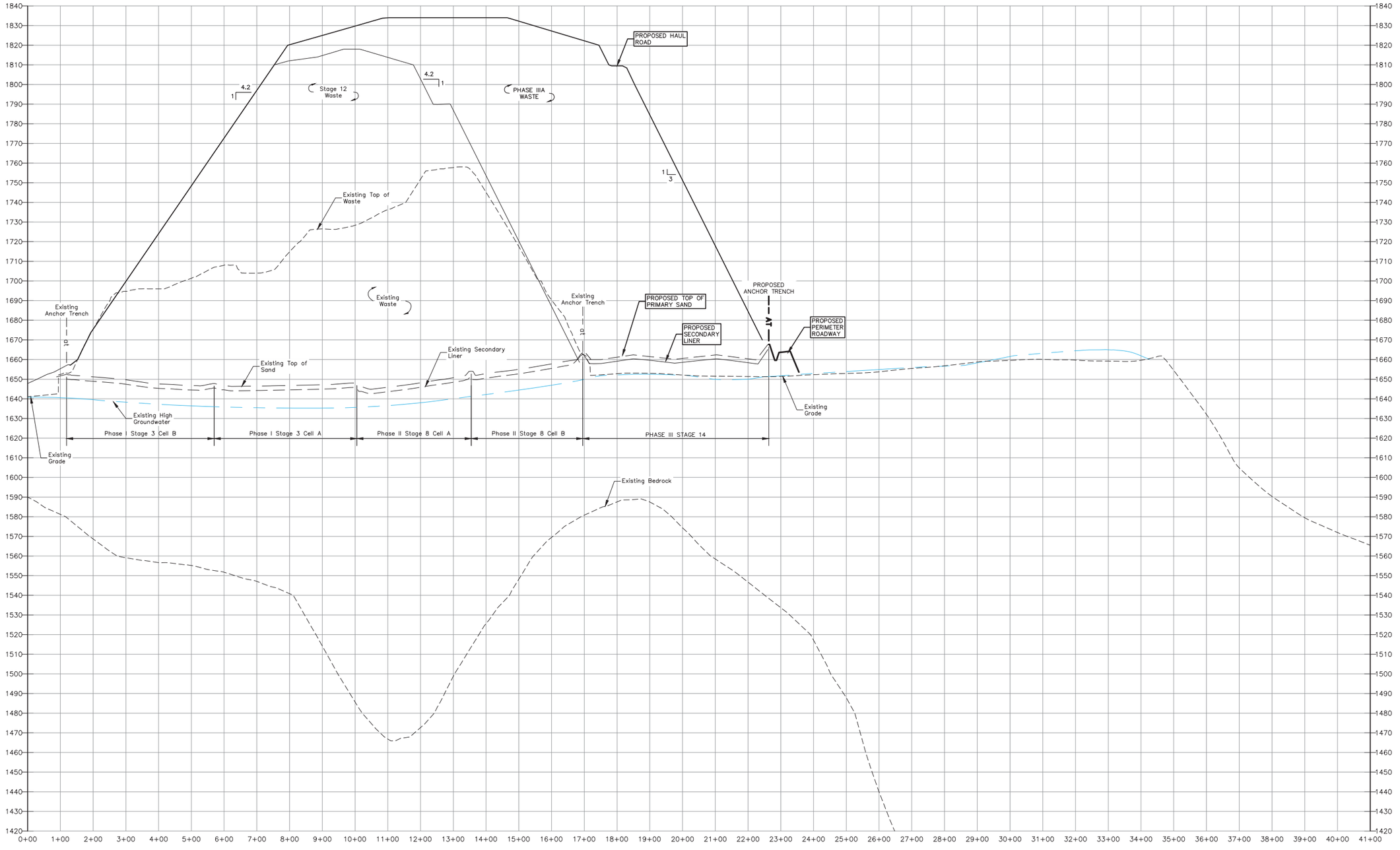
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drawn by: SJE
approved by: PDS
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date: April 2020
project no: 777
file name:

Androscoggin Valley Regional Refuse Disposal District
Mt. Carberry Secure Landfill Phase IIIA Development
Geotechnical Figures Section A-A'

drawing no.
Figure 2B

sheet: 2 of 3

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Landfill Cross Section B-B'

(See Figure 2A for Section Alignment)

Scale: 1" = 140' (Horiz.)
1" = 20' (Vert.)

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drawn by: SJE
approved by: PDS
date: April 2020
project no: 777
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scale:

Androscoggin Valley Regional Refuse Disposal District
Mt. Carberry Secure Landfill Phase IIIA Development
Geotechnical Figures Section B-B'

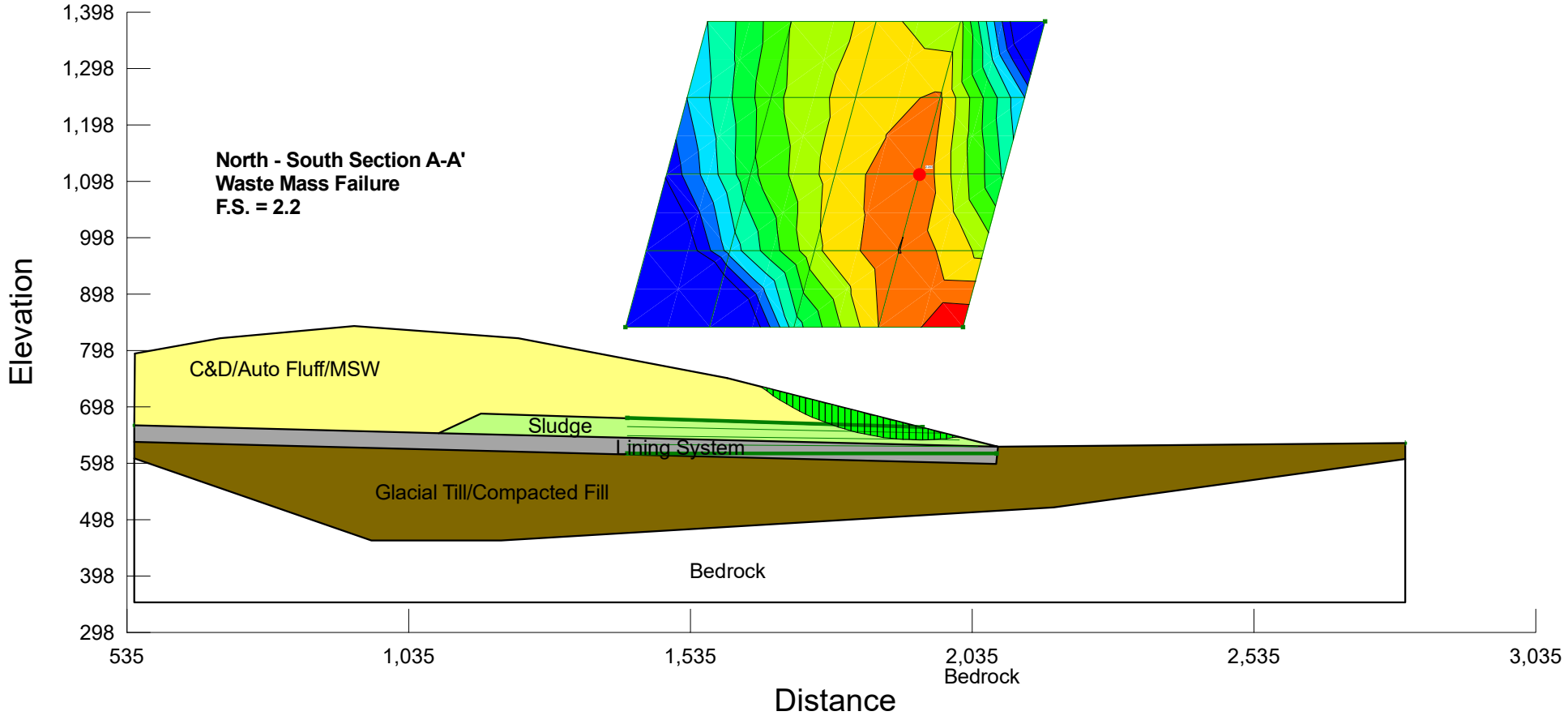
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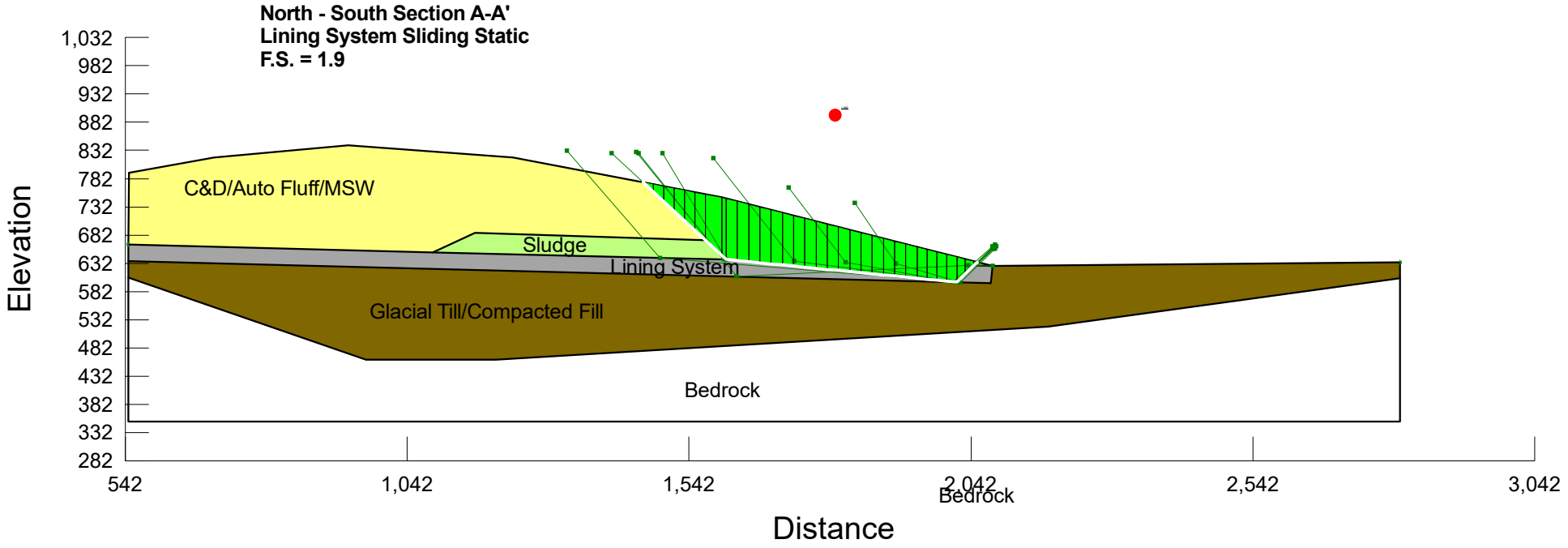
sheet: 3 of 3

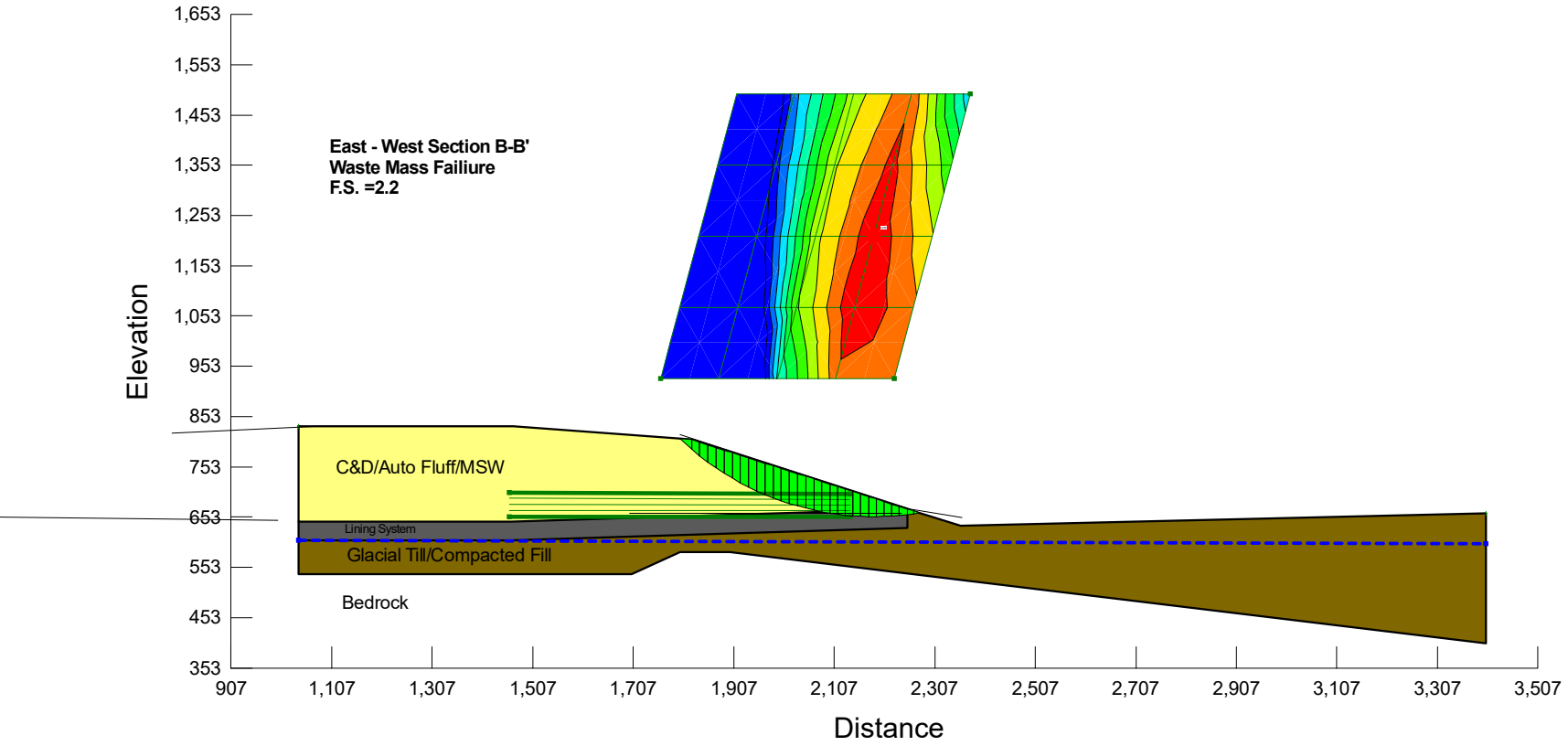
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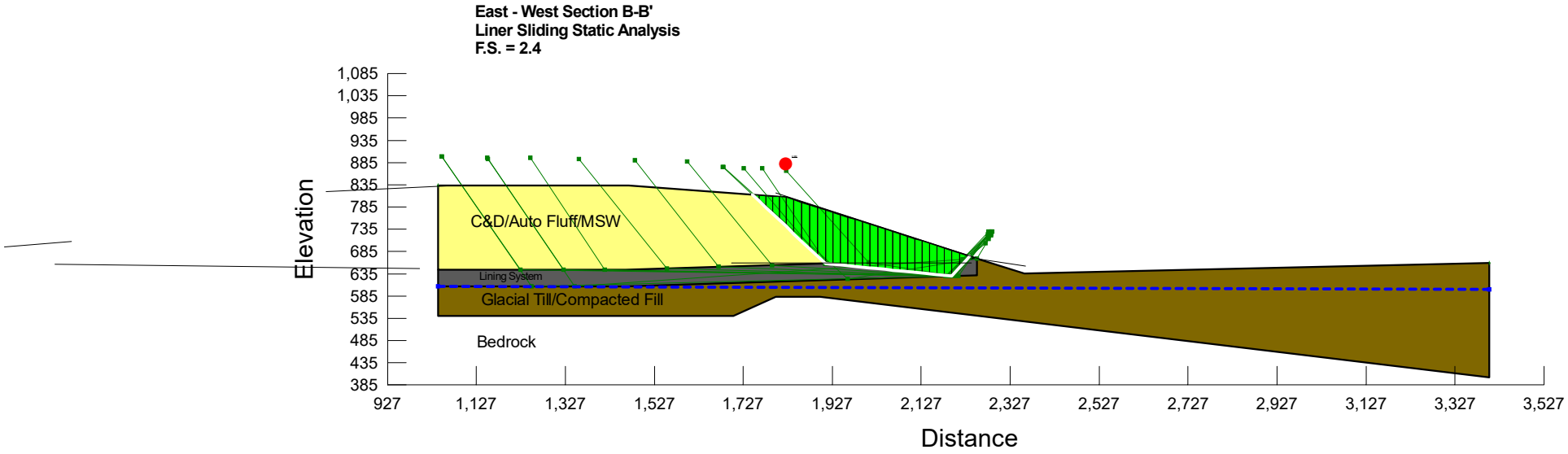
Attachment 1

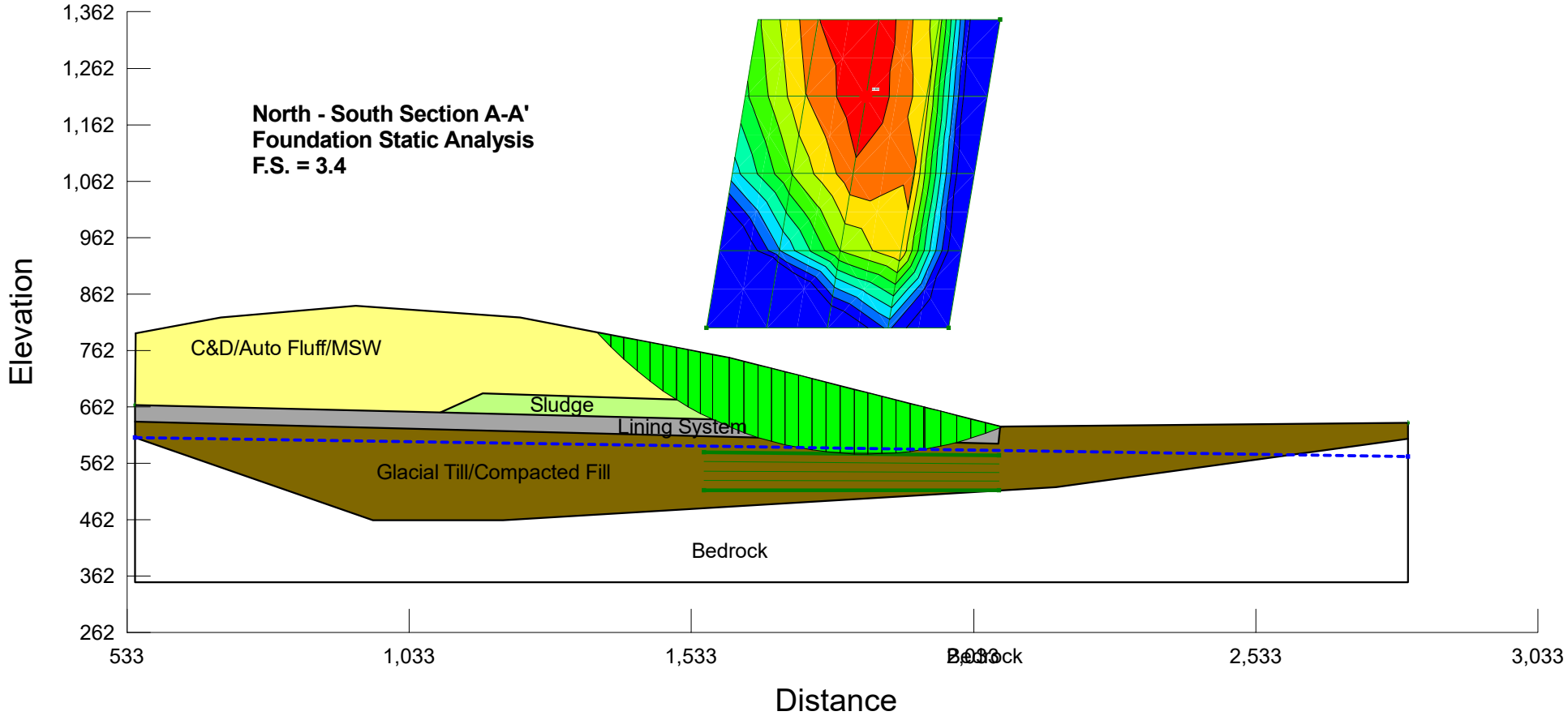
Phase III-A Static Stability Evaluations

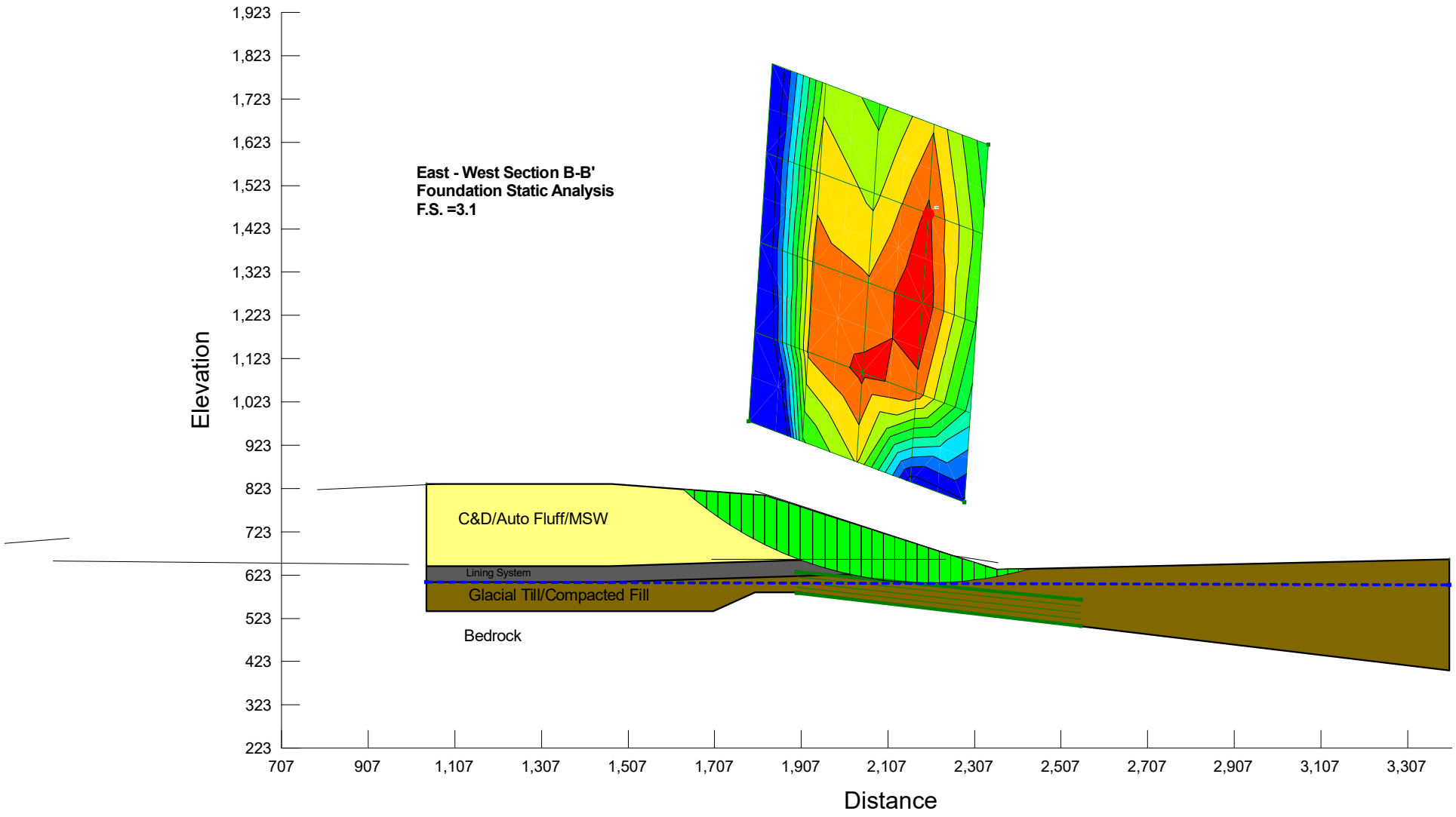

North - South Section A-A'
Waste Mass Failure
F.S. = 2.2
C&D/Auto Fluff/MSW
Sludge
Lining System
Glacial Till/Compacted Fill
Bedrock
Elevation
1,398
1,298
1,198
1,098
998
898
798
698
598
498
398
298
535
1,035
1,535
2,035
Bedrock
2,535
3,035
Distance


North - South Section A-A'
Lining System Sliding Static
F.S. = 1.9
1,032
982
932
882
832
782
732
682
632
582
532
482
432
382
332
282
Elevation
C&D/Auto Fluff/MSW
Sludge
Lining System
Glacial Till/Compacted Fill
Bedrock
542
1,042
1,542
2,042
Bedrock
2,542
3,042
Distance


East - West Section B-B'
Waste Mass Failiure
F.S. =2.2
C&D/Auto Fluff/MSW
Lining System
Glacial Till/Compacted Fill
Bedrock
Elevation
1,653
1,553
1,453
1,353
1,253
1,153
1,053
953
853
753
653
553
453
353
907
1,107
1,307
1,507
1,707
1,907
2,107
2,307
2,507
2,707
2,907
3,107
3,307
3,507
Distance

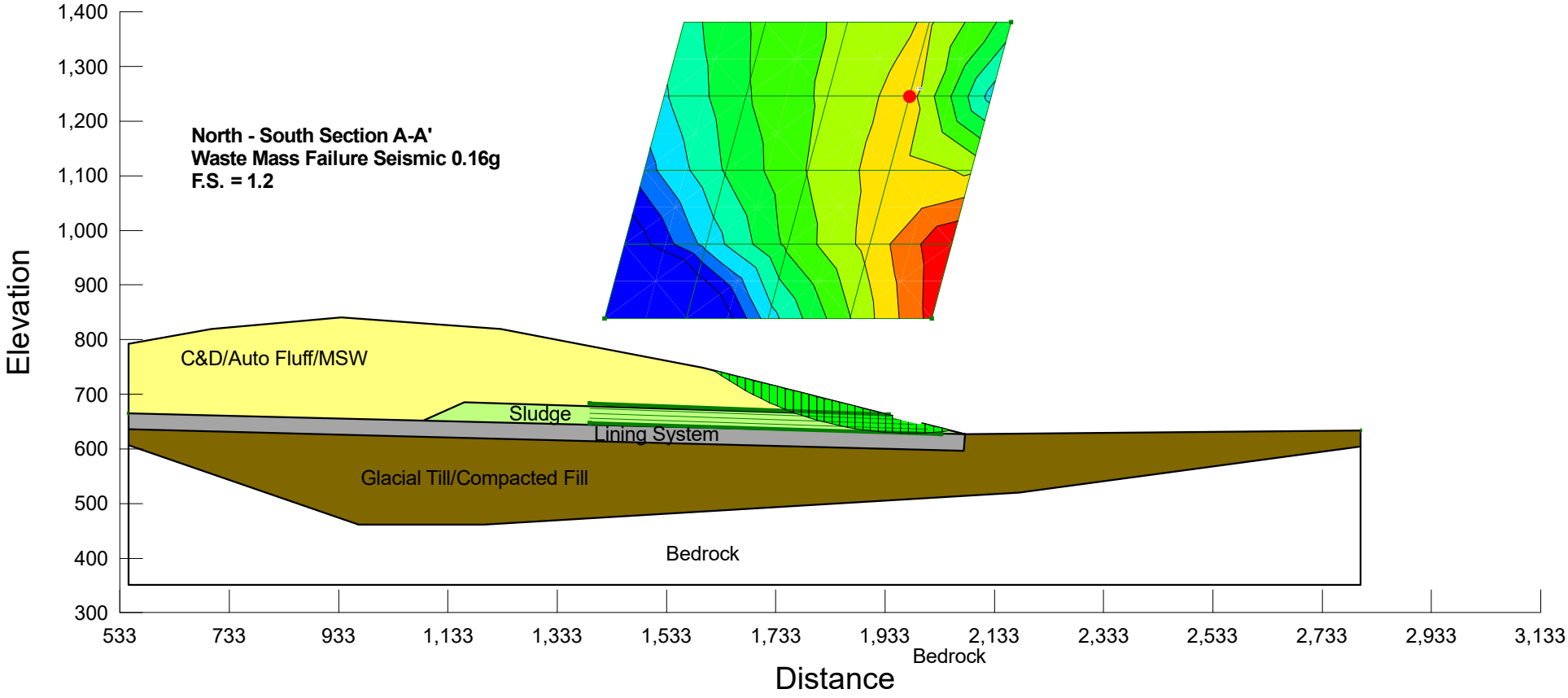

East - West Section B-B'
Liner Sliding Static Analysis
F.S. = 2.4
Elevation
1,085
1,035
985
935
885
835
785
735
685
635
585
535
485
435
385
C&D/Auto Fluff/MSW
Lining System
Glacial Till/Compacted Fill
Bedrock
927
1,127
1,327
1,527
1,727
1,927
2,127
2,327
2,527
2,727
2,927
3,127
3,327
3,527
Distance

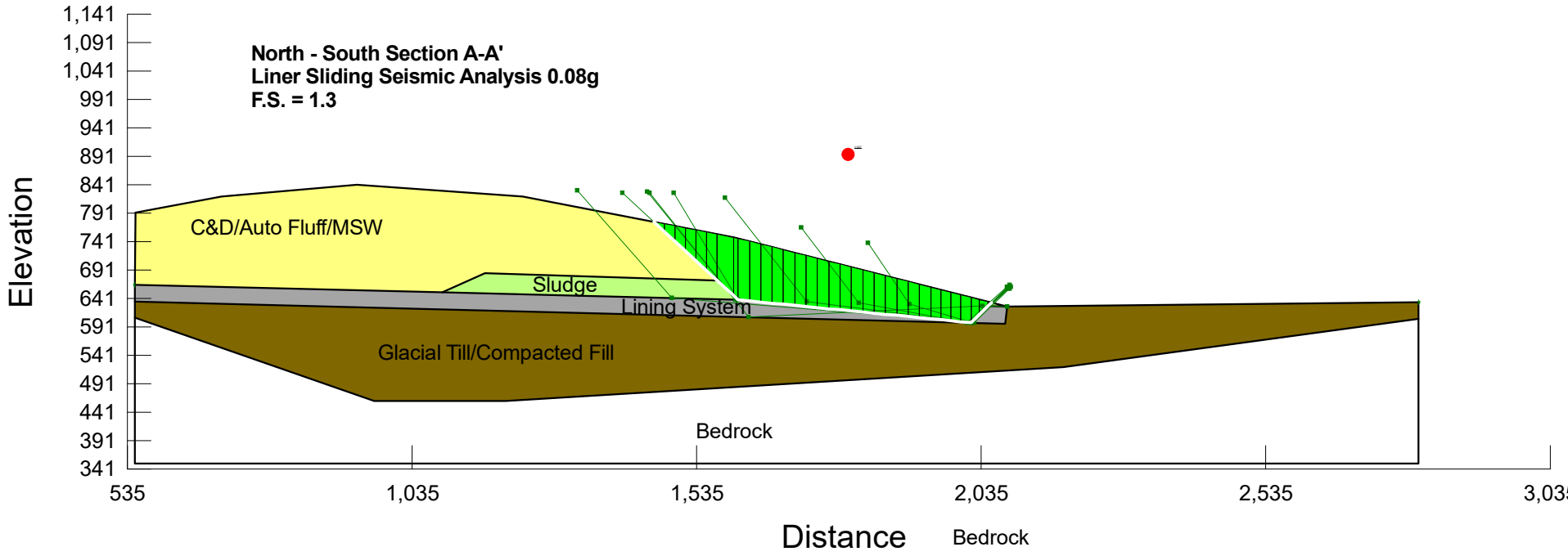

North - South Section A-A'
Foundation Static Analysis
F.S. = 3.4
C&D/Auto Fluff/MSW
Sludge
Lining System
Glacial Till/Compacted Fill
Bedrock
Elevation
1,362
1,262
1,162
1,062
962
862
762
662
562
462
362
262
533
1,033
1,533
2,033
2,533
3,033
Distance

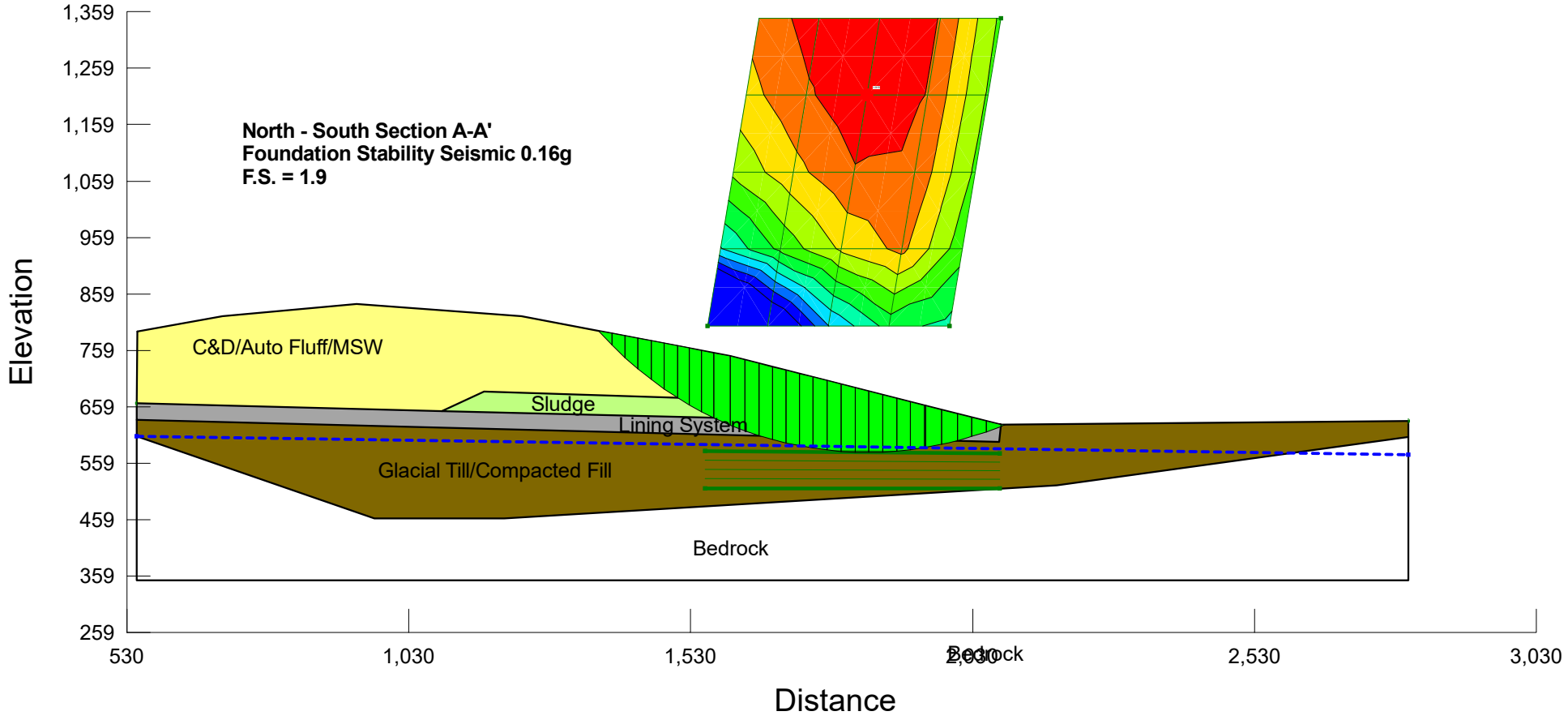

East - West Section B-B'
Foundation Static Analysis
F.S. =3.1
C&D/Auto Fluff/MSW
Lining System
Glacial Till/Compacted Fill
Bedrock
Elevation
1,923
1,823
1,723
1,623
1,523
1,423
1,323
1,223
1,123
1,023
923
823
723
623
523
423
323
223
707
907
1,107
1,307
1,507
1,707
1,907
2,107
2,307
2,507
2,707
2,907
3,107
3,307
Distance

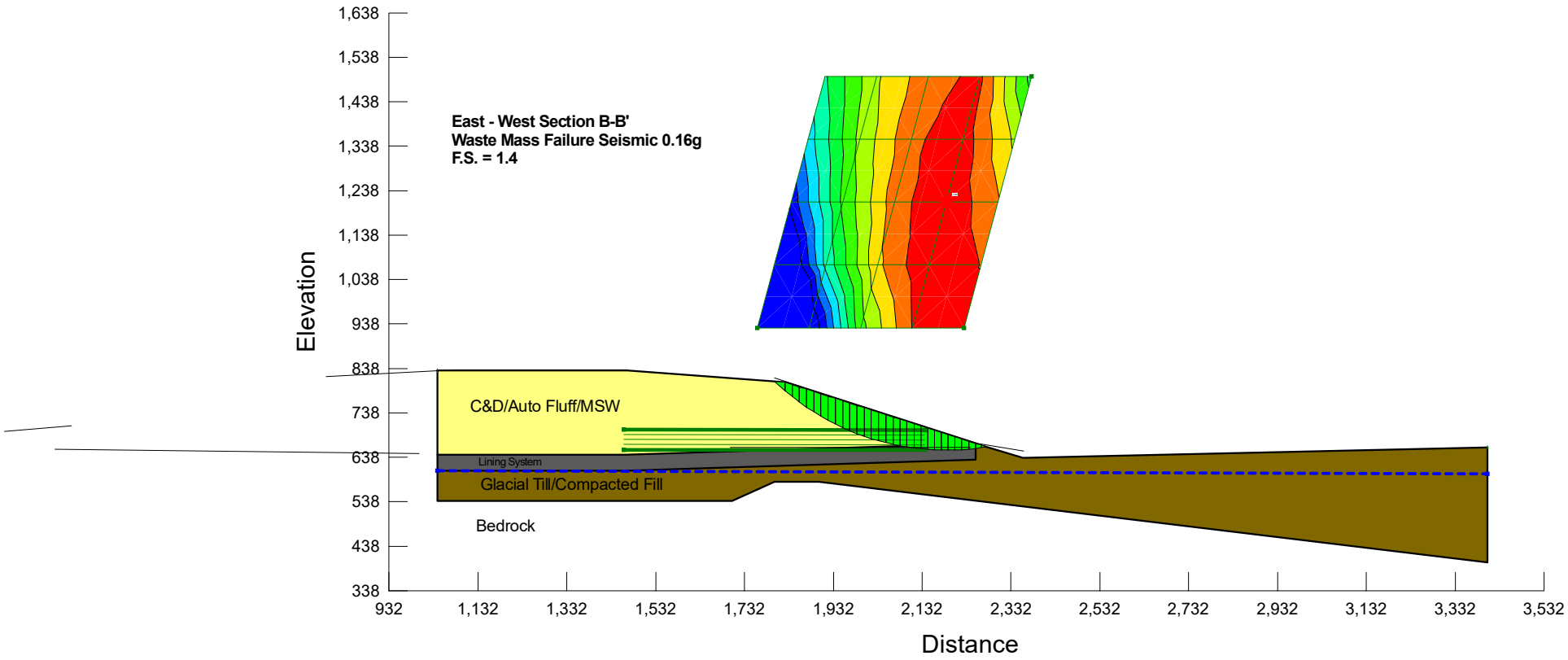
Attachment 2

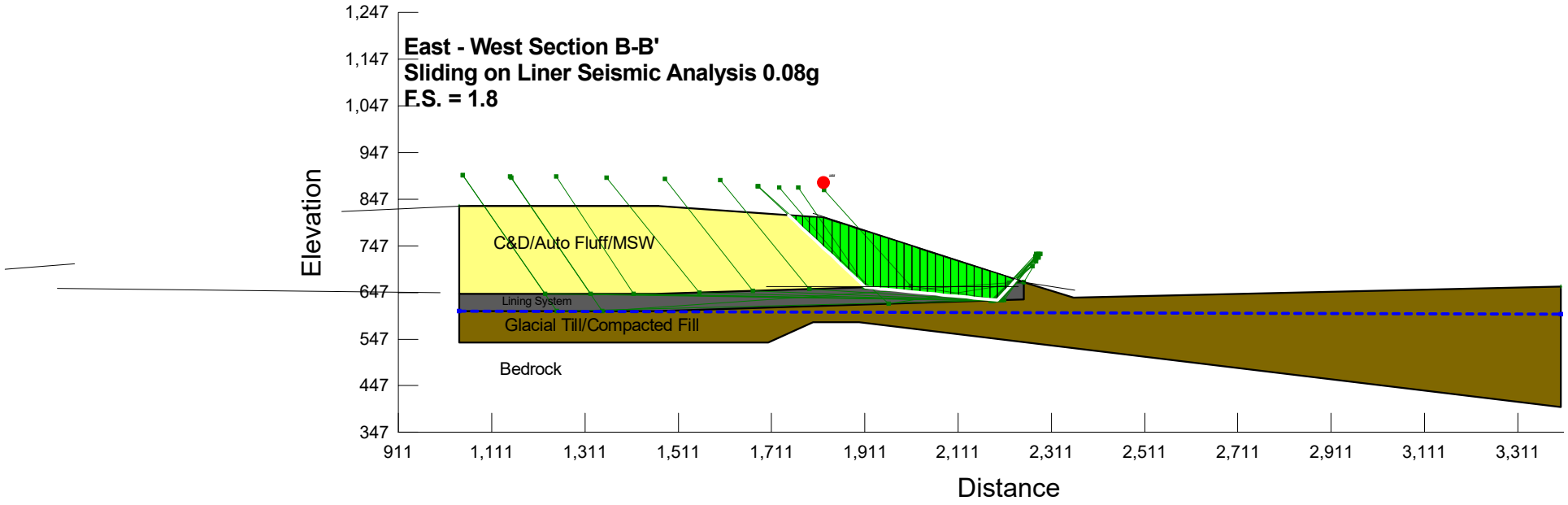
Phase III-A Seismic Stability Evaluations

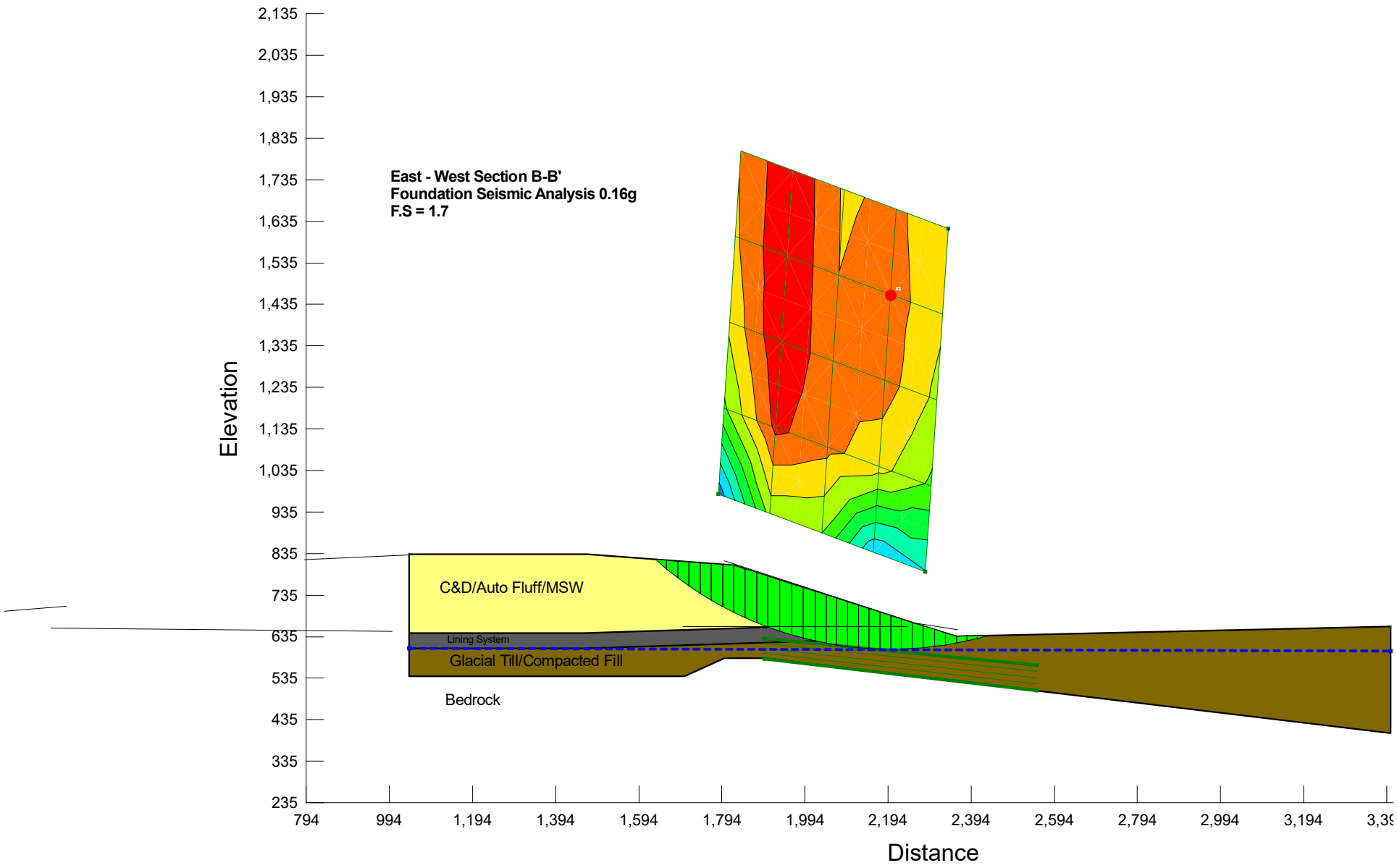

North - South Section A-A'
Waste Mass Failure Seismic 0.16g
F.S. = 1.2
C&D/Auto Fluff/MSW
Sludge
Lining System
Glacial Till/Compacted Fill
Bedrock
Bedrock
Elevation
Distance
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
533
733
933
1,133
1,333
1,533
1,733
1,933
2,133
2,333
2,533
2,733
2,933
3,133

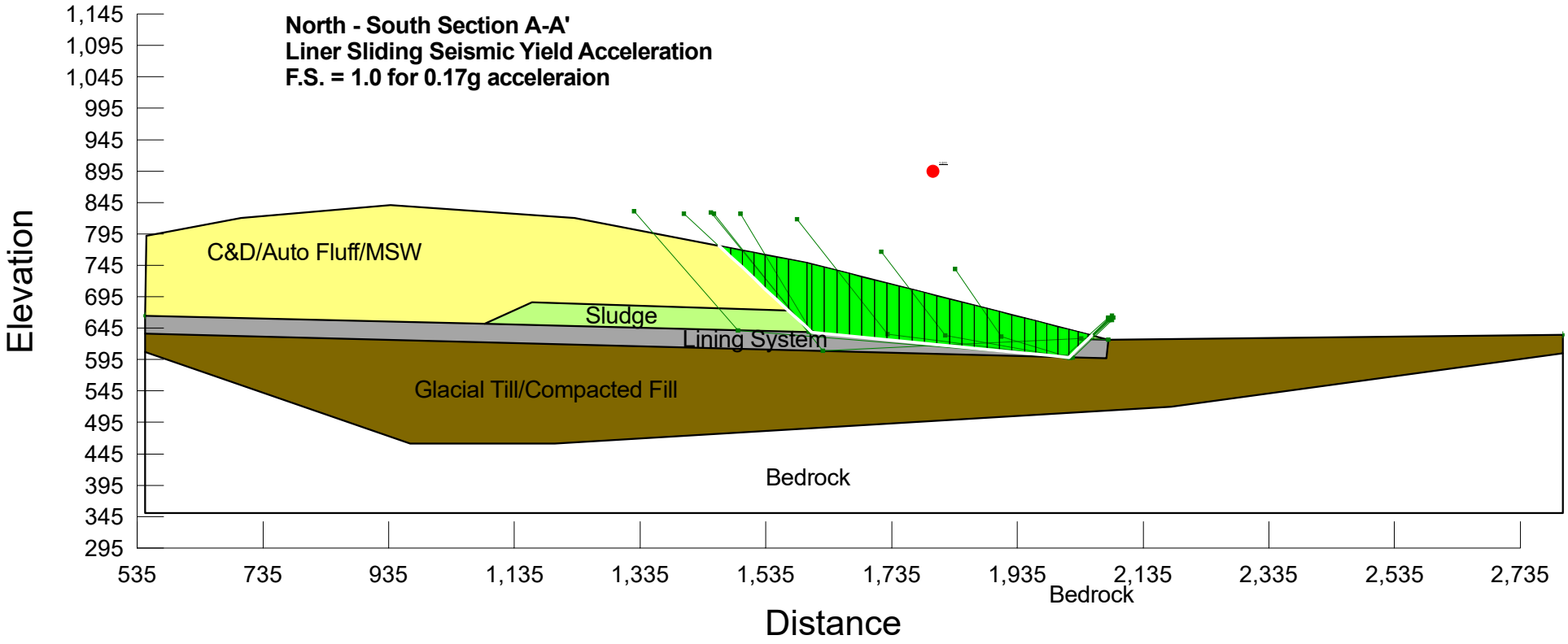

North - South Section A-A'
Liner Sliding Seismic Analysis 0.08g
F.S. = 1.3
C&D/Auto Fluff/MSW
Sludge
Lining System
Glacial Till/Compacted Fill
Bedrock
Bedrock
Elevation
Distance
1,141
1,091
1,041
991
941
891
841
791
741
691
641
591
541
491
441
391
341
535
1,035
1,535
2,035
2,535
3,035


North - South Section A-A'
Foundation Stability Seismic 0.16g
F.S. = 1.9
C&D/Auto Fluff/MSW
Sludge
Lining System
Glacial Till/Compacted Fill
Bedrock
Bedrock
Elevation
1,359
1,259
1,159
1,059
959
859
759
659
559
459
359
259
530
1,030
1,530
2,030
2,530
3,030
Distance

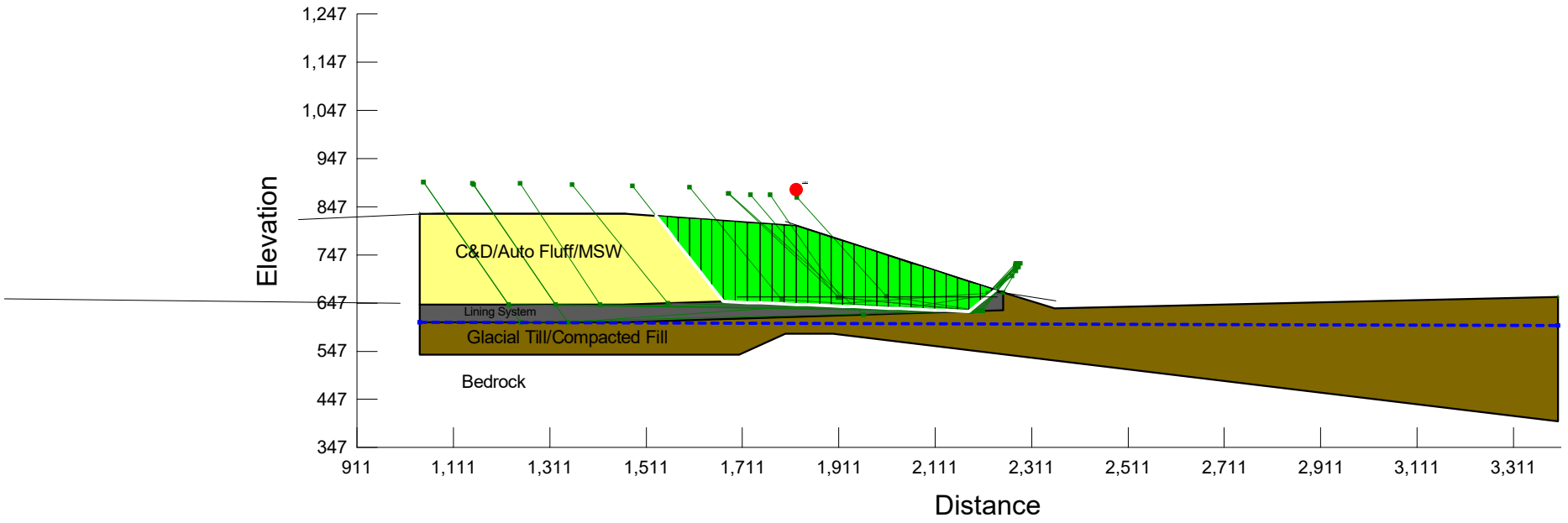

East - West Section B-B'
Waste Mass Failure Seismic 0.16g
F.S. = 1.4
C&D/Auto Fluff/MSW
Lining System
Glacial Till/Compacted Fill
Bedrock
Elevation
1,638
1,538
1,438
1,338
1,238
1,138
1,038
938
838
738
638
538
438
338
932
1,132
1,332
1,532
1,732
1,932
2,132
2,332
2,532
2,732
2,932
3,132
3,332
3,532
Distance


East - West Section B-B'
Sliding on Liner Seismic Analysis 0.08g
F.S. = 1.8
Elevation
1,247
1,147
1,047
947
847
747
647
547
447
347
C&D/Auto Fluff/MSW
Lining System
Glacial Till/Compacted Fill
Bedrock
911
1,111
1,311
1,511
1,711
1,911
2,111
2,311
2,511
2,711
2,911
3,111
3,311
Distance


East - West Section B-B'
Foundation Seismic Analysis 0.16g
F.S = 1.7
Elevation
2,135
2,035
1,935
1,835
1,735
1,635
1,535
1,435
1,335
1,235
1,135
1,035
935
835
735
635
535
435
335
235
C&D/Auto Fluff/MSW
Lining System
Glacial Till/Compacted Fill
Bedrock
794
994
1,194
1,394
1,594
1,794
1,994
2,194
2,394
2,594
2,794
2,994
3,194
Distance


North - South Section A-A'
Liner Sliding Seismic Yield Acceleration
F.S. = 1.0 for 0.17g acceleraion
Elevation
1,145
1,095
1,045
995
945
895
845
795
745
695
645
595
545
495
445
395
345
295
C&D/Auto Fluff/MSW
Sludge
Lining System
Glacial Till/Compacted Fill
Bedrock
535
735
935
1,135
1,335
1,535
1,735
1,935
2,135
2,335
2,535
2,735
Bedrock
Distance

East - West Section B-B'
Sliding on Liner Seismic Yield Acceleration
F.S. 1.0 for 0.35g Acceleration



CMA ENGINEERS, Inc.
Civil/Environmental Engineers

35 Bow Street
Portsmouth, NH 03801

Project:	AVRRDD Phase III-A
	Success, New Hampshire
Project No:	777
Date:	March 26, 2020
Calc. By:	RJG
Chkd. By:	BMD

OBJECTIVE: To evaluate the factor of safety against failure through components of the cap section under seismic loading conditions.

GIVEN: Final Grading Plan prepared by CMA Engineers: maximum slope angle of 3H:1V
Cover Section per Preliminary Closure Plan Drawings.

ASSUMPTION: Closure construction to occur in future years. Available materials and methods will be those in use at the time and in accordance with regulations in place at the time

METHOD - SEISMIC: Refer to method and references for liner stability in previous static stability calculation.

REFERENCE: Matasovic, "Selection of Method for Seismic Slope Stability Analysis," Proceedings, Second International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics, St. Louis, MO, 1991

Determine Seismic Cofficient

From relationships developed by Singh and Sun (attached), maximum acceleration at refuse surface equals 0.24g.

Determine Yield Acceleration (a_y)

factor of Safety (F.S.) =	1.0
Θ =	28 degrees
β=	18.3 degrees

Equation per Matasovic

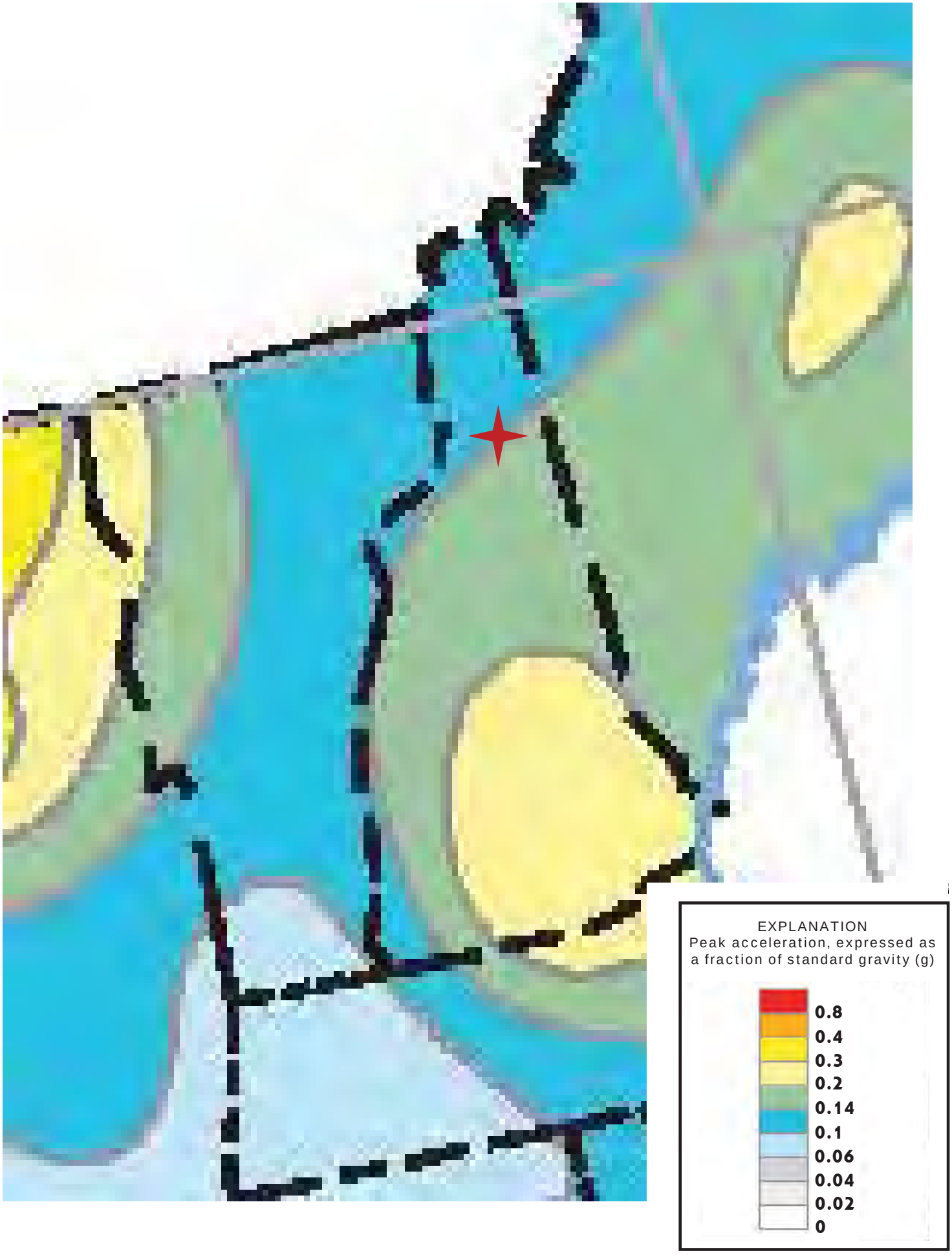
$$a_y = \frac{\tan\Theta - \tan\beta}{1 + \tan\beta * \tan\Theta}$$

a_y = 0.169

Determine Cap Displacement

From Makdisi and Seed (attached), and yield acceleration divided by maximum acceleration equaling 0.70 displacement equals 52.5 centimeters or about one inch.

RESULTS Cap displacement resulting from the design earthquake will be one inch, which is less than the generally considered acceptable range of 6 inches to a foot.


EXPLANATION
Peak acceleration, expressed as a fraction of standard gravity (g)
0.8
0.4
0.3
0.2
0.14
0.1
0.06
0.04
0.02
0

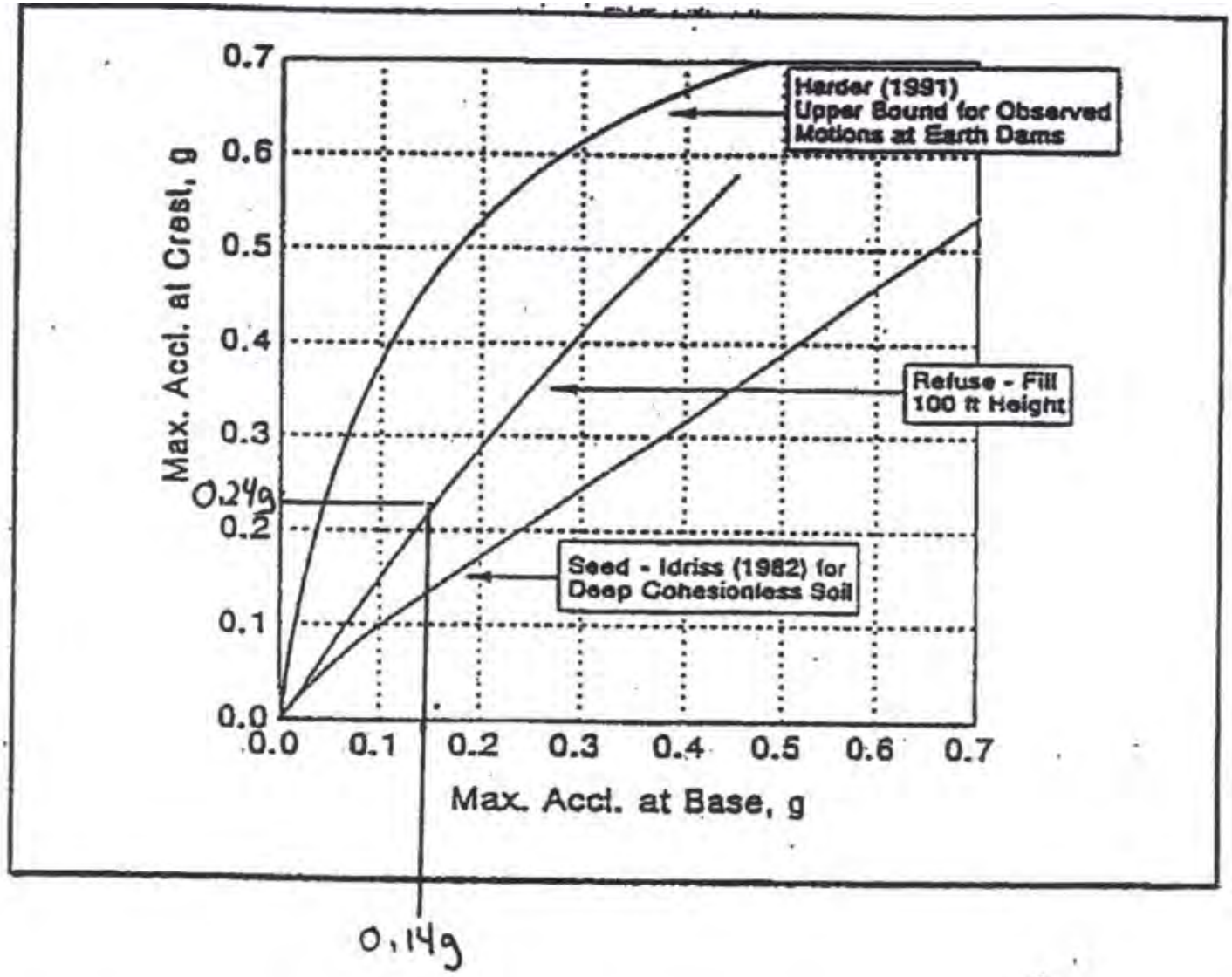


Figure 4.6 Approximate Relationship Between Maximum Accelerations at the Bas and Crest for Various Ground Conditions (Singh and Sun, 1995)

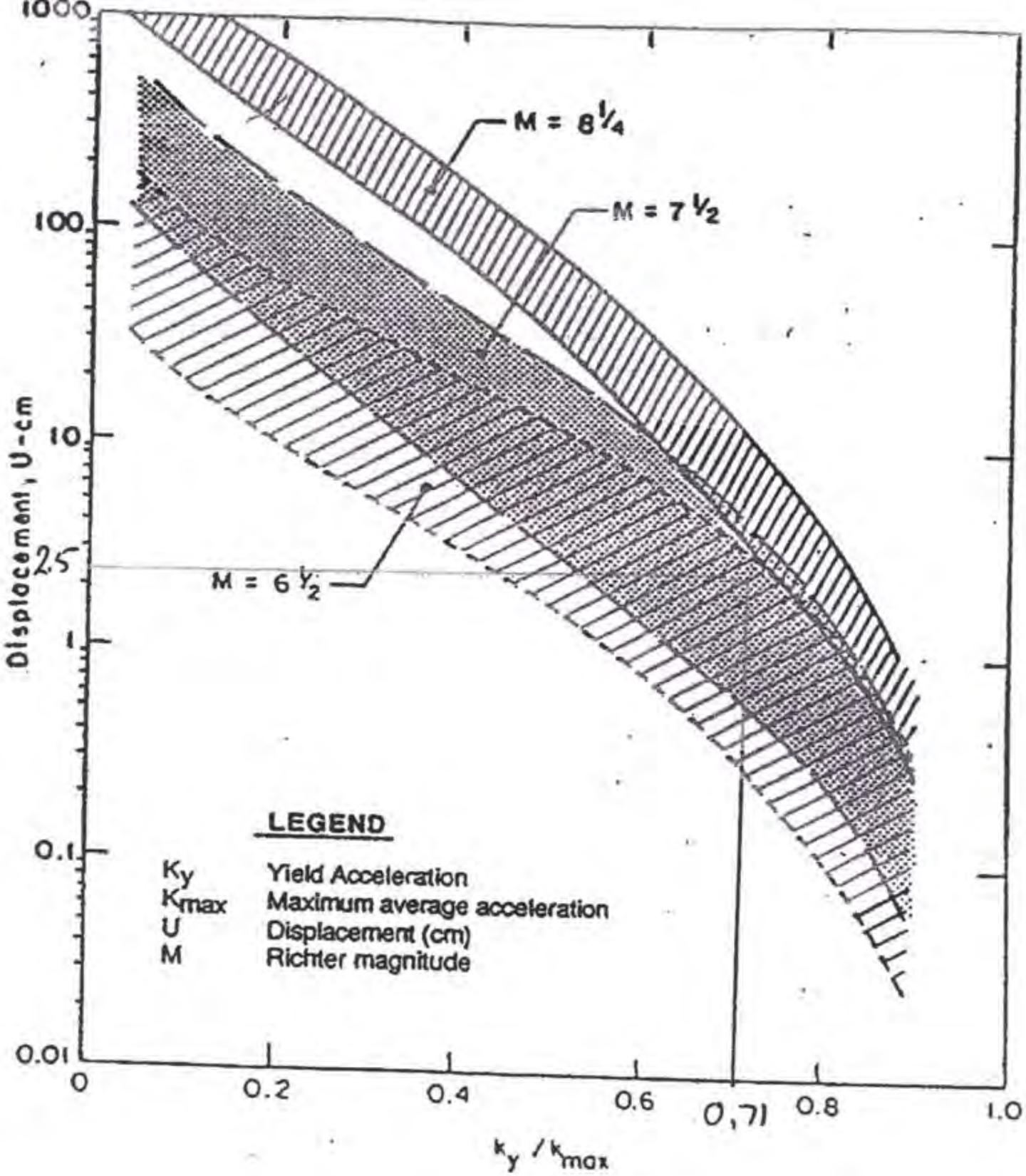


Figure 6.6 Makdisi and Seed Permanent Displacement Chart (Makdisi and Seed 1978).

Attachment 3

2012 Stage 5 & 6 Stability Evaluations

LANDFILL STABILITY ANALYSES
MT. CARBERRY LANDFILL, STAGE 5 & 6
SUCCESS, NEW HAMPSHIRE

This report presents the results of stability analyses of the Mt. Carberry Stage 5 & 6 Landfill in Success, New Hampshire. The objective of this work is to assess the stability of the landfill waste, lining system, and capping system under static and seismic loads, in support of the development of the Stage 5 & 6 Landfill. The proposed landfill development will be situated over existing waste in Stages 1 through 4, and does not involve construction of new lined landfill area. Stages 1 through 6 comprise the Phase I Landfill. A portion of the Stage 5 & 6 landfill will overlap existing waste in the adjacent Stage II landfill (Phases 7 through 11). The landfill is currently operating in Stages 10 and 11, located above the Stage 7, 8 and 9 base area.

Reference the construction design drawings and technical specifications included in this permit application for landfill final grades. Please refer to Phase 1 through 4 construction record documents on file at NHDES for soil and geosynthetic materials used in construction of those landfill phases. Attached are boring logs and a boring location plan relevant to the design and stability of the modified portion of the landfill. These include borings drilled in the natural soils beneath the landfill prior to construction of the landfill, and borings drilled through the Phase 1 through 4 waste above the landfill lining system.

Background

The composition of the waste landfilled at the Mt. Carberry Landfill has changed over time. A graphical summary of the changes in waste composition is provided as Figure 1. A detailed tabulation of waste tonnages by category that served as the basis for Figure 1 is provided in Attachment A. Plans showing proposed landfill final grades and existing waste grades are included in Figure 2 in this report.

The wastes disposed in Stages 1 through 4 can be characterized by three general waste compositions. During the initial four years of operation of the landfill the waste consisted of 50 percent or greater sludge residuals mostly from the former pulp mill waste water treatment plant, with lesser amounts of sludge from the paper mill and municipal waste water treatment plants. The other constituents of the waste included sand and gravel used to stabilize the waste, and miscellaneous wastes including grit screenings, lime mud (from the pulping process) and incinerator ash. This composition of waste, referred to herein as sludge waste, was disposed in Stages 1 and 2 from 1989 through 1994. The sludge waste is relatively fine grained and was difficult to place and compact when wet, due its inherent high moisture content or when subjected to rainfall.

During operation of Stage 1 and 2, the active disposal area would on occasion become overly wet and difficult to operate, with instances of equipment sinking into the waste. These early operational problems related to storm water management. Active areas had been controlled by berms on the outside slopes to contain any contaminated storm water

runoff in the landfill. This caused the storm water to collect in the active disposal area, pond and saturate the waste. On one occasion of heavy rain, the containment berms were breached and contaminated surface water escaped the landfill along with waste eroded from the waste side slope. Since that incident in 1994 the sludge waste was further bulked up with large amounts of sand and gravel, as shown on Figure 1, and storm water has been directed away from active areas. This release of waste and failure of containment is attributed to storm water management and not instability of the waste itself.

The percentage of sludge in the waste dropped from the high 30s in 1995 to the low 20s in 2002. The proportional drop of sludge percentage in the waste was due to lower actual sludge volumes, a rough doubling of the sand and gravel component added to bulk up the sludge for handling and compaction purposes, and the addition of municipal solid waste (MSW) constituting roughly 10 percent of the waste. This type of waste, referred to herein as sludge and gravel, was landfilled in Stage 3 and the first half of Stage 4.

From 2002 through the present, the sludge component has declined to less than 10 percent of the waste composition. The waste now consists of mostly construction and demolition debris (C&D); auto fluff used as daily cover consisting of plastics, foam, textiles, rubber and glass residuals from automobile recycling operations; and lesser quantities of municipal solid waste. Other minor waste constituents include sand and gravel and miscellaneous mill wastes. This composition of waste, referred to herein as C&D/Auto Fluff waste, was disposed in the second half of Stage 4. C&D/Auto Fluff was also subsequently disposed in a 15- to 20-foot layer over Stages 1 and 2, and a 24- to 30-foot layer over Stage 3. Further, C&D/Auto Fluff waste was disposed in the adjacent cells of Stages 7 through 9 and overlying the internal Stage 1 through 4 waste slopes that face the Stage 7 and 8 areas. The Stage 7 through 9 base area was constructed sequentially from 2004 through 2009. At present, it is expected that the Stage 5 and 6 waste composition will be similar to the current and former C&D/Auto Fluff waste composition.

Explorations and Laboratory Testing

CMA Engineers conducted a subsurface waste exploration program in the Stage 1 through 4 landfill in October 2011. The objectives of the explorations were to characterize the in-place nature of the waste materials, with a focus on the extent and characteristics of the sludge waste material. The sludge waste was disposed in Stage 1 and 2. This waste has the potential to have lower shear strength than the other waste types due to its relatively high moisture and organic content, and lesser amounts of strength reinforcing materials such as building debris, cloth and municipal solid waste.

New Hampshire Boring (NHB) of Londonderry, New Hampshire drilled the waste borings, under the full time observation of a CMA Engineers geotechnical engineer. NHB drilled a total of six borings to depths ranging from 32 to 52 feet. The boring locations are shown on Figure 2. York Land Services of Berlin, New Hampshire surveyed the waste surface elevation at each boring location. CMA Engineers reviewed

as-built liner grades to ensure the borings would extend no closer than 7 to 10 above the landfill lining system. The boring logs are provided in Attachment B.

NHB advanced the borings with drive and wash drilling techniques, using 4-inch diameter casing, a polymer drilling fluid, and a tricone roller drilling bit. NHB used 3-inch diameter split spoon sampler to increase the likelihood and volume of sample recovery. Standard Penetration Tests were usually conducted at 5-foot intervals to aid in assessing the in-place shear strength of the waste and to collect samples for laboratory analyses.

Subsurface conditions beneath the Stage 1 through 4 landfill consist of small volumes of engineered fill, underlain by glacial till deposits. Sevee & Maher Engineers of Cumberland, Maine conducted hydrogeologic studies of the Phase I landfill prior to its construction over the period between 1988 and 1999. Soil borings documenting subsurface conditions beneath the landfill are also included in Attachment B. The boring locations, the Sevee & Maher interpretation of the bedrock surface, and with landfill base grades are shown on Figure 3.

CMA Engineers submitted a total of 19 samples from the 2011 borings to Thielsch Engineering in Hopkinton, Massachusetts for laboratory testing. The samples were tested for water content, Atterberg limits, grain size distribution, organic content and pH. Two samples were also tested for shear strength in a triaxial cell. The samples were sheared undrained after being consolidated isotropically, with pore pressures measured throughout the duration of the test. Summary tables and laboratory test results are included in Attachment C.

Waste Characteristics and Conditions

Sludge Waste

The thickness of the sludge waste ranges from about 28 to 36 feet across Stages 1 and 2. Historical waste records indicate approximately 585,000 tons of sludge waste was disposed in Stages 1 and 2. This volume corresponds to about 22 percent of the 2,645,000 tons of Phase I waste disposed through 2003. We believe additional C&D/Auto Fluff waste was placed after 2003 over the Stage I landfill as part of Stage II operations. Figure 4 is a cross section through Phase I that depicts the approximate limits of the sludge waste.

The color of the sludge varies from dark brown or gray to black. The sludge consistency ranges from clayey silt to sand and gravel, mixed occasionally with refuse and debris. The SPT N values, adjusted for the larger 3 inch split spoon diameter, ranged from 3 to 31 blows per foot, and averaged 11 blows per foot indicating the waste overall is medium dense. Arranged in increasing sequential order, the 1/3 median SPT N value is 6. Isolated pockets of white or black pasty sludge were encountered sporadically in the borings. The landfill operator identified this material as lime mud from the former pulp mill. Similar quantities of dark gray to black incinerator ash were encountered as well.

A triaxial compression test on an ash sample indicated a shear strength equal to an internal angle of friction of 35.4 degrees for the ash deposit.

The water content of the sludge ranged from 11 to 213 percent, but was generally in the range from 50 to 80 percent. Organic content ranged from 1 to 34 percent, with pH values in the 8 to 9 unit range. One incinerator ash sample had a pH of 12.25. The sludge waste was generally determined to be non-plastic or slightly plastic, although two samples of the lime mud had Atterberg limit values corresponding to a high plasticity clay.

Sludge and Gravel

The sludge and gravel was encountered in Stage 3 and overlapping the interior slope of Stage 2 sludge waste. The sludge and gravel appeared to be similar to the sludge waste except it contained much more sand and gravel and municipal solid waste. The SPT N values for the sludge and gravel ranged from very dense (50 blows per 1") to medium dense (16 blows per foot).

C&D/Auto Fluff

The C&D/Auto Fluff waste was difficult to drill and sample as the building rubble component of the waste (wood, concrete, brick, etc.) provided an obstruction to the drilling and sampling tools. SPT N values ranged from medium dense to very dense.

Subsurface Conditions

The natural glacial till deposits underlying the landfill consist of a well sorted mixture of gravel, sand, silt and clay. These deposits are dense to very dense with SPT N values ranging from 35 to refusal. The depth to bedrock ranges from about 30 in the upper northern portion of Phase I, to more than 130 feet in the lower southern portion of Phase I. The groundwater table is artificially depressed beneath the landfill by a series of under drains intended to maintain a 6 foot separation between the bottom of the landfill lining system and the water table.

Slope Stability

CMA Engineers used the Slope/W Version 5 slope stability software from Geo-Slope International for the stability analyses. The selection of material input parameters is discussed below.

C&D/Auto Fluff

The C&D/Auto Fluff waste materials consist predominantly of construction and demolition debris waste and auto shredder fluff, with moderate amounts of municipal solid waste (MSW) and lesser amounts of wastewater treatment plant sludge, gravel and miscellaneous wastes. The C&D wastes are expected to control the behavior of the waste relative to stability, and to exhibit high shear strengths relative to municipal solid waste due to the interlocking nature of the building debris. CMA Engineers conservatively used published MSW shear strength values for the C&D/Auto Fluff waste. These values

include an internal angle of friction of 33 degrees, and a cohesion intercept of 500 pounds per square foot. We assigned a unit weight of 90 pounds per cubic foot to the C&D/Auto Fluff waste based on experience with similar waste materials.

Sludge and Gravel

As shown below, all of the potentially critical failure surfaces are through the sludge wastes at the southern end of Phase I through Stages 1 and 2. All of the sludge and gravel wastes are further to the north in Stages 3 and 4, and are therefore not situated to effect minimum slope stability factors of safety. We expect the shear strength of this waste to be similar to that assigned to the C&D/Auto Fluff material. For simplicity of modeling the landfill, we combined these two waste types into one deposit for the purposes of our stability analyses.

Sludge Waste

Using correlations between SPT N values and shear strength, and the 1/3 median N value of 6 (corrected for the 3" split spoon) yields an angle of internal friction of 28 degrees for the sludge waste. Considering the heterogeneous nature of the waste and the compositional and depositional differences between this waste and granular soil for which the correlations are based, the sludge waste shear strength was reduced to a design internal friction angle of 22 degrees for these analyses. We assigned a unit weight of 80 pounds per cubic foot to the sludge waste based on our experience and observations of the material, and moisture and density measurements taken for the laboratory triaxial compression tests.

Lining System

The Phase I lining system consists of a sequence of layers of engineered soil, smooth high density polyethylene (HDPE) geomembrane, HDPE drainage net, and drainage sand. The lowest strength interface in the lining system is clearly the interface between the smooth geomembrane and the drainage net. Based on interface test data on file for older projects with similar materials, we assigned an interface shear strength of 40 pounds per square foot cohesion and an internal friction angle of 16 degrees for this interface. We assigned a unit weight of 120 pounds per cubic foot to the liner to represent the soil components of the lining system.

Glacial Till

The shear strength of the glacial till soils at the site was determined using correlations to SPT N values and data from soil borings conducted at and adjacent to Stage I. We assigned an internal angle of friction of 36 degrees and a unit weight of 135 pounds per cubic foot to the glacial till soils.

Critical Failure Location

We selected a critical failure location through the long axis of Phase I, in a north-south orientation. This section constitutes the longest and steepest waste slopes in Phase I, and also coincides with the down sloping base grades. Our analysis conservatively neglects the three dimensional shape of the waste grades. Factors of safety in excess of 1.5 are generally considered to be acceptable for long term static conditions at landfill sites.

STATIC STABILITY

Existing Conditions Waste Stability/Sensitivity Analyses

The existing Stage 1 through 4 landfill has been filled to capacity since the year 2000, and has remained stable. To evaluate a lower bound threshold for the sludge waste shear strength, this value was varied to achieve a factor of safety of 1.0. Calculations and stability analyses results are included in Attachment D.1.

Attached calculations indicate reducing the sludge waste shear strength to an internal friction angle of 12.5 degrees results in a minimum factor of safety of 1.0 for a shallow sloughing failure. Evaluating a deeper rotational failure through the sludge waste and the overlying C&D/Auto Fluff indicates a factor of safety of 1.5. Evaluating a waste mass failure along the lining system interface indicates a minimum factor of safety of 2.0.

Stage 5 and 6 Waste Material Stability

The potential for instability in the waste when Stage 5 and 6 are filled to capacity was investigated using the design value, and checked against the calculated lower bound shear strength value for the sludge waste. Calculations and stability analyses results are included in Attachment D.2, and are summarized below.

Failure Mode	22^o Sludge Shear Strength	12.5^o Sludge Shear Strength
Shallow Sloughing	2.1 min FS	1.0 min FS
Rotational Waste Failure	2.1 min FS	1.7 min FS
Waste/Liner Interface	2.0 min FS	1.9 min FS

Calculations indicate acceptable factors of safety against slope failure when using the design shear strength value for the sludge waste. Calculations also indicate the landfill is stable even when conservatively assigning lower bound strength values to the waste.

Deep Rotational Foundation Failure

Subsurface conditions consist of glacial till deposits and structural fill materials consisting of compacted glacial till and underdrain granular soils. The glacial till is underlain by bedrock at depths ranging from about 30 feet to 130 feet below landfill subgrade in the section analyzed. The glacial till is dense as a result of the weight and movement of the ice sheet that deposited the soil directly over bedrock. The depth to groundwater below the landfill subgrade was assumed to be controlled by the underdrain and be 6 feet below liner subgrade elevations.

The landfill base is excavated below natural grade into the glacial till deposits. Given the very dense nature of the glacial till, by inspection the potential for a deep rotational failure through the foundation soils does not reasonably exist. Calculations indicate a minimum factor of safety of 3.1 against a deep rotational failure through the landfill

foundation soils. Calculations and stability analyses results are included in Attachment D.3.

Cap Stability

A preliminary cap design is provided in the drawings and the closure plan included in this permit application. The design consists of two feet of cover soil overlying a drainage geocomposite (bonded geotextile and drainage net) and texture geomembrane. The geomembrane is underlain by screened glacial till, a gas transmission layer of granular soil and intermediate cover soil. The final capping system is proposed to be installed after the landfill is filled to capacity many years in the future. The final design is likely to vary from this preliminary design to account for regulatory requirements and available materials at that time.

We assumed a minimum interface friction value of 28 degrees for the capping system components. For an infinitely long slope (ignoring the stabilizing toe buttressing effects), the factor of safety is defined by the following equation:

Factor of safety = tan /tanβ
where = 28 degrees, the interface friction angle
B = 18.4 degrees, the maximum slope angle
Factor of safety = .53/.33 = 1.6

SEISMIC STABILITY

CMA Engineers completed seismic stability analyses of the secure landfill in accordance with Env-Wm 2503.04 and 40 CFR 258.14. Seismic stability calculations are included in Attachment D.4. Seismic stability was evaluated considering a design earthquake with a 10 percent probability of excedance in 250 years. A U. S. Geologic Survey (USGS) Hazard Map dated 2008 indicates the design earthquake has a probable ground acceleration (pga) of 0.14 of gravity. A Copy of the USGS Hazard Map is attached.

For foundation soils failure, two types of analyses are typically considered to demonstrate conformance with the above-referenced regulations. One analysis addresses the stability of the foundations soils relative to a deep rotational failure. The second analysis includes an evaluation of the liquefaction potential of the granular foundation soils. The glacial till soils are not subject to liquefaction because of their very dense nature.

Each critical section from the static analysis, including rotational failure and the critical liner interfaces, were evaluated for seismic stability. This analysis involves computing earthquake-induced displacements, using the following procedures:

- Determine the seismic coefficient, i.e., the average maximum earthquake-induced acceleration in the refuse mass immediately above the sliding surface. This involves assessment of any attenuation or amplification of the earthquake

accelerations within the waste. In this instance, the analysis conservatively neglects any attenuation of earthquake acceleration in the very dense soil between bedrock and the lining system. For these analyses, calculations indicate a seismic coefficient of 0.08g.

- Determine the yield acceleration for potential sliding surfaces. The yield acceleration is the earthquake acceleration that corresponds to a factor of safety of 1.0, or an earthquake sufficiently large enough to cause movement or displacement. Each critical failure surface was evaluated by varying the earthquake acceleration until a factor of safety of 1.0 was achieved. The calculations indicate a factor of safety of 1.00, along with calculated minimum yield accelerations of 0.18g for the critical interface located within the lining system.
- Compare the yield and induced accelerations. If the induced accelerations exceed the yield accelerations, assess the magnitude of permanent displacement. In this instance, the results of pseudo-static stability analyses indicate a minimum yield acceleration of 0.18g, which is larger than seismic coefficient (induced acceleration) of 0.08g.
- Assess the effects on containment systems from the estimated permanent displacements. Since the induced acceleration is less than the yield acceleration, the analyses indicate that the design earthquake would not be expected to cause any permanent deformations in the lining system.

Cap Stability

Similar analyses were performed for cap stability as described above for liner stability. For the cap analyses, calculations indicate a seismic coefficient (induced acceleration) of 0.24g. Calculations indicate a yield acceleration of 0.17g, and a permanent displacement of about one inch. Permanent displacements on the order of 6 inches to a foot are typically considered acceptable for lining systems. For capping systems, larger deformations may be acceptable because the cap system components can be readily repaired.

CONCLUSIONS AND RECOMMENDATIONS

The analyses completed as part of this work indicate that the proposed landfill configuration and construction materials provide adequate factors of safety against foundation failure and sliding among liner and cap system components under the expected static loading conditions. Under seismic loads, the landfill is stable relative to a deep rotational failure, permanent deformation of the liner is not expected, and the cap system deformations are small and acceptable.

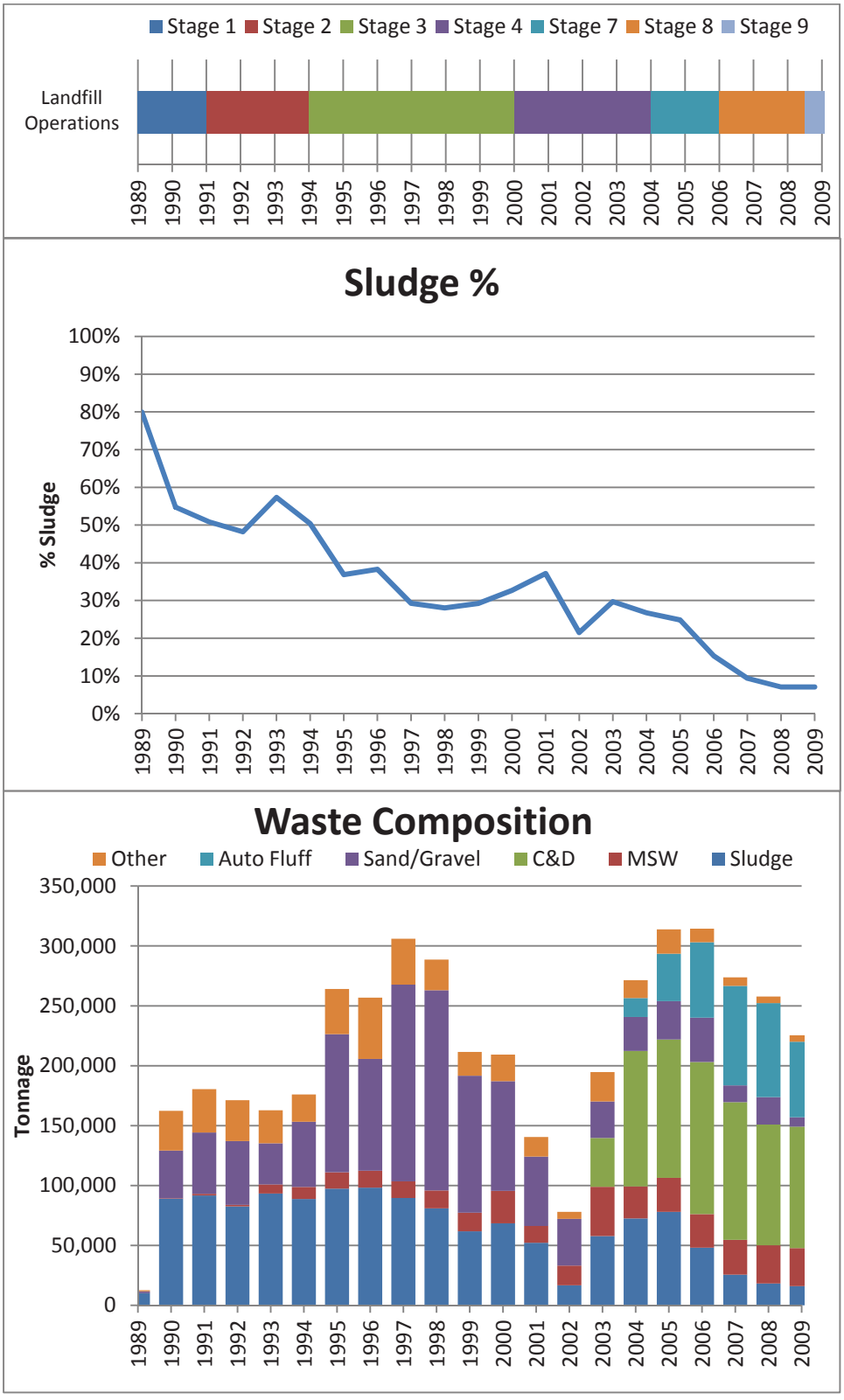
We recommend extending the existing waste slopes on the southern and western portions of Stage 5 and 6 at their existing slope angle. Consistent with this recommendation, proposed final grades shown on Figure 2 depict 4.2 horizontal to 1 vertical (4.2H:1V) slopes on the south side of Stage 6, and 3.8H:1V slopes on the west side of Stage 5 & 6.

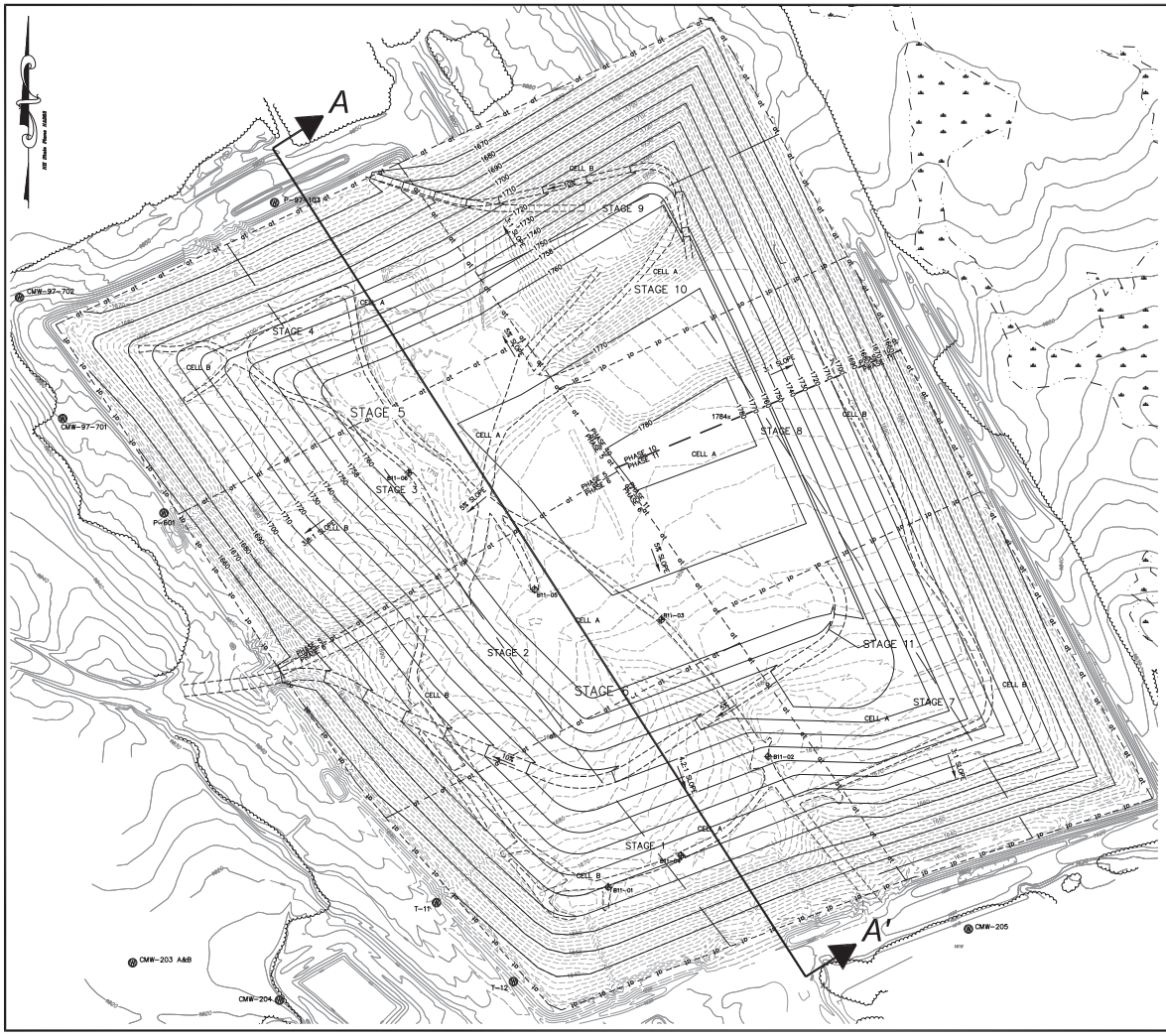
The northern slope of Stage 5 consists entirely of C&D/Auto Fluff waste and can be graded at a 3H:1V slope. Operationally, the waste should be placed in lifts working in a north to south direction, with waste in Stage 6 never being higher than the waste in Stage 5. Additional stability analyses are required for any proposed steepening of slopes, increases in final grades, or operating sequences not consistent with the recommendations outlined above.

Robert J. Grillo, P.E.
Project Geotechnical Engineer

FIGURES

Figure 1


Stage 1
Stage 2
Stage 3
Stage 4
Stage 7
Stage 8
Stage 9
Landfill Operations
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
Sludge %
% Sludge
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Waste Composition
Other
Auto Fluff
Sand/Gravel
C&D
MSW
Sludge
Tonnage
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0



Notes:

1. Existing topography is a compilation of field survey of the active filling area performed on April 19, 2012 and the remaining landfill footprint performed on October 4, 2011, by York Land Services, LLC, of Berlin, NH. Topography is based on NGVD85. Final Stage 10 & 11 Grades represent top of waste.
2. Topography outside of the Phase I & II anchor trench is approximate and was provided Sewall & Associates Engineers.
3. Stage 5 & 6 capacity is approximately 2,102,000 CY beyond the Stage 10 & 11 final waste grades. The Stage 5 & 6 combined capacity is approximately 3,354,000 CY from the existing April 19, 2012 topography shown.
4. Section A on Figure 4 depicts the proposed Stage 5&6 Final Waste Grades in section view along with interpreted bedrock surface.

Legend:

- Existing 2' Contour
- 1700 — Existing 10' Contour
- Existing Edge of Gravel Road
- at — at — at — Anchor Trench
- Cell Division
- MW-202 — Existing Groundwater Monitoring Well
- 1700 — Stage 5 & 6 Top of Waste 10 'Contou
- Proposed Gravel Access Road

no.	revision	date	by

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designed by	PDS/BWS
drawn by	PDS
approved by	PDS
date	June 2012
project no.	774
file name	F:\cg-dat\dwg\Stg 5&6\774-Stg 5&6-PSP-May 2012.dwg
scale	1" = 100'

Androscoggin Valley Regional Refuse Disposal District

Mt. Carberry Landfill

Stage 5 & 6 Landfill Stability Analysis

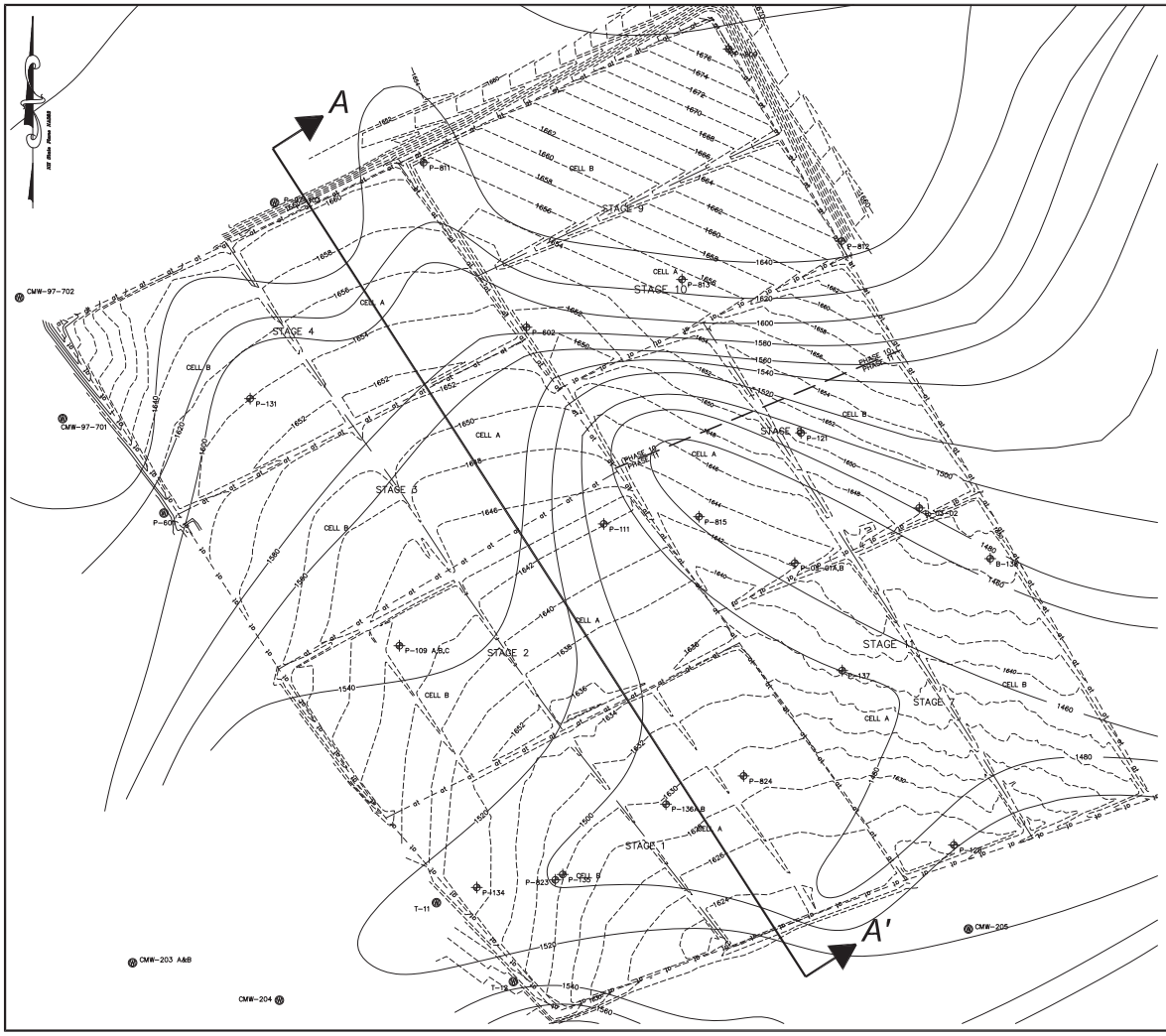
Proposed Final Waste Grades

drawing no.

Figure 2

sheet - of -

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Notes:

1. Bedrock contours are from Figure 2-4 from the Phase III-North Type I-A Permit Application submitted by Sevee & Maher Engineers.
2. Bedrock contours are interpreted based on boring data, seismic refraction survey, and outcrop observations. Actual configuration of bedrock surface may vary from that shown. The bedrock surface map should be used only for indicating general trends in the bedrock surface.
3. Section A on Figure 4 depicts interpreted bedrock surface in section view along with proposed Stage 5&6 Final Waste Grades.

Legend:

- 1700 — Bedrock 10' Contour
- at — at — at — Anchor Trench
- Cell Division
- CMW-202 — Existing Groundwater Monitoring Well
- P-602 — Boring Location

no.	revision	by	date

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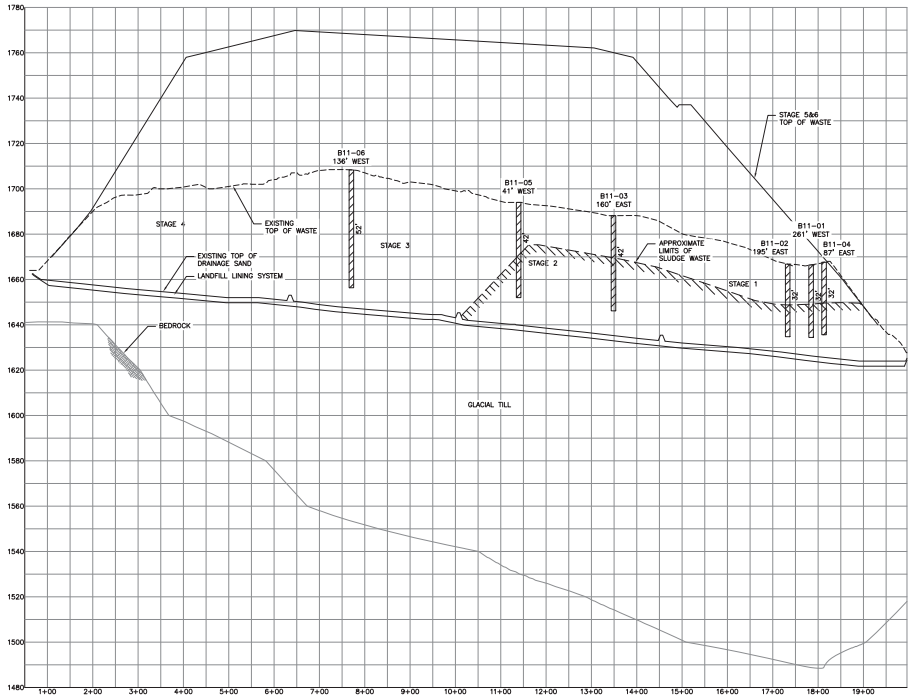
designed by: PDS/BWS
drawn by: BWS
approved by: PDS
scale: 1" = 1000'
date: June 2012
project no.: P774
file name: P:\cg-sbp\dwg\Stg 5&6-PSP-May 2012.dwg

Androscoggin Valley Regional Refuse Disposal District
Mt. Carberry Landfill
Stage 5 & 6 Landfill Stability Analysis
Bedrock Contour Plan

drawing no.
Figure 3

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Section A
Horizontal: 1" = 100'
Vertical: 1" = 20'

no.	revision	date	by

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drawn by: BWS
checked by: PDS
approved by: PDS

date: June 2012
project no.: 774
file name: 774-Stage 5&6 Xsections.dwg
scale:

Androscoggin Valley Regional Refuse Disposal District
Mt. Carberry Landfill
Stage 5 & 6 Landfill Stability Analysis
Cross Section A

drawing no.
Figure 4

sheet - of -

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ATTACHMENTS

ATTACHMENT A – TABULATED WASTE SUMMARY

MT. CARBERRY LANDFILL LLC						0		
TONS DELIVERED BY CATEGORY								
QUARTER:	SLUDGE	ASH	LIME	GRIT	GRAVEL	MISC.	PAPER/MSW	TOTALS:
Q489	10,110	748	248	17	1,501	0	21	12,645
1989 TOTAL:	10,110	748	248	17	1,501	0	21	12,645
Q190	21,197	3,839	1,552	509	2,805	810	115	30,829
Q290	17,316	3,778	1,856	2,915	11,612	812	113	38,404
Q390	23,008	3,860	1,662	2,822	15,994	897	63	48,306
Q490	27,353	3,388	1,785	1,999	9,426	615	219	44,785
1990 TOTAL:	88,874	14,867	6,855	8,245	39,837	3,135	510	162,324
Q191	21,571	2,671	2,209	1,064	3,941	311	272	32,038
Q291	23,036	2,022	2,944	5,087	13,090	474	309	46,960
Q391	23,282	2,752	1,688	2,867	19,376	922	352	51,238
Q491	23,825	5,500	1,910	2,022	14,785	1,750	401	50,194
1991 TOTAL:	91,714	12,944	8,751	11,040	51,192	3,456	1,334	180,430
Q192	20,349	4,330	1,482	883	2,473	92	360	29,970
Q292	21,733	3,002	2,518	3,020	6,376	344	318	37,313
Q392	20,453	2,189	2,266	3,428	21,950	659	316	51,261
Q492	20,022	4,252	1,995	2,614	22,403	1,004	354	52,644
1992 TOTAL:	82,556	13,774	8,262	9,945	53,202	2,100	1,349	171,187
Q193	21,704	2,687	2,343	375	2,549	328	1,662	31,649
Q293	24,457	1,470	1,350	3,308	14,002	2,181	1,838	48,607
Q393	21,520	1,668	1,036	2,698	4,028	994	2,091	34,035
Q493	25,663	2,502	1,328	2,959	13,770	355	1,939	48,516
1993 TOTAL:	93,344	8,327	6,058	9,341	34,349	3,859	7,531	162,808
Q194	24,780	2,385	1,490	674	0	352	1,881	31,562
Q294	27,115	1,664	2,093	1,678	15,090	658	2,339	50,637
Q394	18,817	800	1,748	1,636	18,111	1,343	2,627	45,083
Q494	18,021	773	2,164	1,833	21,301	1,459	3,198	48,750
1994 TOTAL:	88,734	5,622	7,496	5,822	54,503	3,813	10,045	176,033
Q195	21,929	3,750	1,921	688	12,306	476	3,193	44,263
Q295	23,782	2,870	6,439	821	26,830	1,010	3,209	64,962
Q395	22,525	1,518	4,639	1,928	31,733	1,179	3,744	67,266
Q495	29,129	3,242	2,256	2,385	44,339	2,670	3,577	87,598
1995 TOTAL:	97,366	11,380	15,255	5,822	115,208	5,336	13,723	264,088
Q196	24,115	4,526	3,325	2,041	21,189	1,126	3,199	59,521
Q296	26,227	4,170	4,044	5,128	20,022	1,582	3,504	64,677
Q396	22,782	3,021	2,436	3,610	22,692	1,090	3,727	59,358
Q496	25,155	5,104	3,050	5,399	29,361	1,487	3,681	73,237

MT. CARBERRY LANDFILL LLC						0		
TONS DELIVERED BY CATEGORY								
QUARTER:	SLUDGE	ASH	LIME	GRIT	GRAVEL	MISC.	PAPER/MSW	TOTALS:
1996 TOTAL:	98,279	16,821	12,855	16,178	93,264	5,285	14,111	256,793
Q197	23,679	4,191	2,687	1,142	40,536	1,101	3,242	76,578
Q297	22,986	3,333	2,336	2,302	37,983	2,901	3,585	75,426
Q397	20,691	2,145	4,825	992	42,344	1,721	3,663	76,381
Q497	22,197	3,649	1,983	956	43,323	2,087	3,441	77,636
1997 TOTAL:	89,553	13,318	11,831	5,392	164,186	7,810	13,931	306,021
Q198	22467	2990	2885	317	47877	1077	3414	81,027
Q298	21066	1685	1758	749	50958	2540	3742	82,498
Q398	19700	1537	2698	321	34590	1515	4040	64,401
Q498	17677	2050	2788	0	33804	609	3731	60,659
1998 TOTAL:	80,910	8,262	10,129	1,387	167,229	5,741	14,927	288,585
Q199	22367	1578	3164	14	29354	495	3600	60,573
Q299	16933	1693	3186	25	30450	674	3810	56,771
Q399	12337	1628	2655	8	26459	225	4530	47,842
Q499	10153	1869	1813	96	28079	786	3582	46,378
1999 TOTAL:	61,790	6,768	10,817	144	114,342	2,180	15,522	211,564
Q100	8962	2109	2052	142	20913	1160	3532	38,870
Q200	9647	711	2026	346	23598	999	7708	45,035
Q300	12740	880	1734	62	27641	1108	10912	55,077
Q400	37050	3164	4303	103	19420	1230	5031	70,300
2000 TOTAL:	68,399	6,863	10,115	653	91,571	4,497	27,183	209,282
Q101	14,986	3,652	2,710	175	14,650	1,083	3,271	40,527
Q201	18,831	0	1,849	93	19,209	1,002	3,709	44,693
Q301	13,913	1,819	1,730	302	16,227	1,271	3,661	38,923
Q401	4,440	0	0	0	7,886	640	3,364	16,330
2001 TOTAL:	52,170	5,471	6,289	570	57,972	3,996	14,005	140,473
Q102	0	0	0	43	11,950	522	3,067	15,582
Q202	1,829	93	0	50	10,858	1,502	3,676	18,008
Q302	7,405	0	156	0	10,383	1,159	4,629	23,732
Q402	7,530	802	15	0	5,892	1,440	4,993	20,672
2002 TOTAL:	16,764	895	171	93	39,083	4,623	16,364	77,994

AVRRDD - MT. CARBERRY LANDFILL 2003

TONS DELIVERED BY CATEGORY

QUARTER:	SLUDGE	ASBESTOS	ASH	LIME	MILL GRIT	CONTAMINATED EXCAVATION DEBRIS	SAND/ GRAVEL	SAWDUST CONTAINING ABSRBD CHEM	PAPER/CORES FELTS	MSW-C&D BULKY	SUB TOTAL
Q103	7,135		2,115	6	61		147	27	129	222	9,842
Q203	12,847	9	3,053	1,317	972	6,645	1,968	171	193	345	27,519
Q303	16,155	4	2,634	1,860	21		1,582	542	149	225	23,172
Q403	14,776	1	3,926	1,723	3	24	449	481	191	201	21,774
2003 TOTAL:	50,914	13	11,729	4,906	1,056	6,669	4,146	1,222	662	993	82,308

AVRRDD-MT CARBERRY LANDFILL
TONS DELIVERED BY CATEGORY
TOWNS & COMMERCIAL

QUARTER:	SLUDGE	MISC.	ASBESTOS	PAPER/ CORES	MSW	C&D	BULKY	CONTAMINATED SOIL	SUB TOTAL
Q103	554			153	3,282	855	21		4,865
Q203	539	35	1	140	6,312	7,901	175	75	15,178
Q303	429	198	16	113	15,467	17,465	91	79	33,859
Q403	500	109		148	16,009	13,583	120	2	30,470
2003 TOTAL:	**2,021**	**341**	**18**	**555**	**41,070**	**39,804**	**407**	**156**	**84,372**

NOTE-
This includes corrections based on changes in supplier numbers

Q103 Misc None
Q203 Misc Grit/Sand
Q303 Misc Grit/Sand
Q403 Misc Grit/Sand

AVRRDD-MT CARBERRY LANDFILL
TONS DELIVERED BY CATEGORY
REUSABLE

QUARTER:	GLASS	BIOMASS	SAND/GRAVEL	SUB TOTAL	Grand Total
Q103	124	368	6269	6,761	21,469
Q203	127		8742	8,869	51,566
Q303	138	393	4968	5,499	62,530
Q403	131	355	6356	6,842	59,086
2003 TOTAL:	**519**	**1,116**	**26,335**	**27,971**	**194,651**

AVRRDD - MT. CARBERRY LANDFILL - 2004

TONS DELIVERED BY CATEGORY

QUARTER:	MILL SLUDGE	ASBESTOS	ASH	LIME	GRIT	CONTAMINATED EXCAVATION DEBRIS	SAND/ GRAVEL	SAWDUST CONTAINING ABSRBD CHEM	PAPER/CORES FELTS	MSW	C&D BULKY	SUB TOTAL
Jan	5,244		798	475	11		101	135	52	12	22	6,849
Feb	5,317		556	713			132	109	68	9	15	6,918
Mar	6,073		440	678	3	2	205	89	74	8	29	7,600
Q104	16,633	0	1,794	1,866	14	2	437	333	193	28	65	21,367
Apr	5,200		722	672			338	156	67	20	16	7,191
May	5,196		876	591		40	83	143	84	14	1	7,027
Jun	4,982		585	754			14	119	66	9	13	6,542
Q204	15,378	0	2,183	2,017	0	40	435	419	217	43	30	20,760
Jul	4,372		105	772	35			152	78	15	2	5,529
Aug	5,584		519	675	23			104	97	20	3	7,025
Sept	5,311		556	690				149	65	20	2	6,793
Q304	15,267	0	1,180	2,137	58	0	0	406	240	54	7	19,348
Oct	4,191		735	568	14	108	26	103	58	20	3	5,825
Nov	5,105		670	841		140		196	64	11	2	7,029
Dec	5,698		1,332	747	1	25		147	95	10	6	8,060
Q404	14,994	0	2,737	2,156	15	273	26	446	216	42	11	20,914
2004 TOTAL:	62,272	0	7,893	8,176	86	314	898	1,603	866	168	113	82,390

AVRRDD-MT CARBERRY LANDFILL - 2004

TONS DELIVERED BY CATEGORY

TOWNS & COMMERCIAL

QUARTER:	SLUDGE	MISC.	Ash	ASBESTOS	PAPER/ CORES	In-State MSW	Out of State MSW	C&D	BULKY	CONTAMINATED SOIL	SUB TOTAL
Jan	190	20	33		43	1,698	106	6,296	45		8,431
Feb	142	14			38	1,610	117	5,918	30	5	7,875
Mar	226	8		4	40	1,708	81	6,616	59	30	8,774
Q104	558	42	33	4	121	5,017	304	18,830	134	35	25,079
Apr	180	17			43	1,685	108	7,425	102		9,560
May	166	9			53	1,607	129	11,114	129	34	13,242
Jun	177			14	46	2,120	104	12,886	88	4	15,439
Q204	524	26	0	14	142	5,412	341	31,425	319	38	38,242
Jul	181		36	3	39	2,675	128	13,537	76		16,676
Aug	164			27	48	2,643	118	12,702	118		15,821
Sep	158			29	46	2,469	116	11,516	75		14,409
Q304	503	0	36	59	133	7,787	362	37,755	269	0	46,905
Oct	172	79	14	10	57	2,351	102	10,486	149	102	13,522
Nov	169	40		5	37	2,383	102	10,777	67	18	13,597
Dec	186		150		42	2,219	116	3,780	63	122	6,678
Q404	527	119	163	15	136	6,953	320	25,043	279	242	33,797
2004 TOTAL:	2,112	188	233	92	532	25,169	1,328	113,052	1,001	315	144,022

Q104 Misc	Grit/Sand
Q204 Misc	Grit/Sand
Q304 Misc	None
Q404 Misc	Grit/Sand

AVRRDD-MT CARBERRY LANDFILL - 2004

TONS DELIVERED BY CATEGORY

REUSABLE

QUARTER:	GLASS	AUTO FLUFF	BIOMASS	SAND/GRAVEL	SUB TOTAL	Grand Total
Jan	50			1,988	2,038	17,317
Feb	21			2,478	2,499	17,292
Mar	37			2,464	2,501	18,874
Q104	108	0	0	6,930	7,038	53,483
Apr	56			2,675	2,731	19,482
May	37		253	2,529	2,819	23,088
Jun	44		332	2,760	3,136	25,118
Q204	137	0	585	7,965	8,686	67,688
Jul	52	950		2,892	3,894	26,099
Aug	40	2,388		1,645	4,073	26,919
Sept	49	2196	468	3,178	5,892	27,094
Q304	141	5,535	468	7,715	13,859	80,112
Oct	55	1,951		1,612	3,618	22,965
Nov	28	1,884	190	1,739	3,840	24,466
Dec	35	6,425	73	1,484	8,017	22,755
Q404	118	10,260	263	4,835	15,476	70,187
2004 TOTAL:	504	15,794	1,316	27,444	45,058	271,470

AVRRDD - MT. CARBERRY LANDFILL - 2005

TONS DELIVERED BY CATEGORY

MILL

QUARTER:	SLUDGE	ASBESTOS	ASH	LIME	GRIT	CONTAMINATED EXCAVATION DEBRIS	SAND/ GRAVEL	SAWDUST CONTAINING ABSRBD CHEM	PAPER/CORES FELTS/STARCH	MSW	C&D BULKY	SUB TOTAL
Jan	5,692		1,008	1,777				178	62	7	11	8,734
Feb	4,607	1	604	739		6		145	71	10	2	6,185
Mar	5,300		1,073	857				207	79	18	2	7,536
Q105	15,599	1	2,685	3,373	0	6	0	530	211	35	15	22,454
Apr	5,382		1,424	772				167	80	16	5	7,846
May	5,010		1,134	1,031				154	78	22		7,428
Jun	4,323		690	588				106	57	13	52	5,829
Q205	14,715	0	3,247	2,391	0	0	0	428	214	51	57	21,102
Jul	5,547		871	1,387			9	186	91	20	6	8,117
Aug	5,571		998	1,078			65	187	88	20	16	8,022
Sept	5,634		860	1,145			254	152	68	33	298	8,444
Q305	16,752	0	2,728	3,610	0	0	328	525	247	73	320	24,583
Oct	6,163		1,634	823			781	158	92	18	7	9,677
Nov	5,636		1,310	715			366	57	77	20	5	8,187
Dec	5,405	0	1,543	789		19	433	76	80	15		8,360
Q405	17,204	0	4,487	2,327	0	19	1,580	291	249	53	12	26,224
2005 TOTAL:	64,270	1	13,147	11,701	0	25	1,908	1,774	922	212	404	94,364

AVRRDD-MT CARBERRY LANDFILL - 2005
TONS DELIVERED BY CATEGORY
TOWNS & COMMERCIAL

QUARTER:	SLUDGE	MISC.	Ash	ASBESTOS	PAPER/ CORES	In-State MSW	Out of State MSW	C&D	BULKY	CONTAMINATED SOIL	SUB TOTAL
Jan	191			7	45	1,926	120	7,849	52		10,191
Feb	157		14		39	1,859	94	6,772	27		8,963
Mar	195	14	16	3	50	1,986	94	7,216	43		9,616
Q105	543	14	29	10	134	5,771	308	21,837	122	0	28,769
Apr	160				43	2,072	103	9,093	219		11,689
May	181	32	15	1	54	2,145	110	10,518	373		13,429
Jun	172	23		9	33	2,464	127	11,299	336		14,462
Q205	512	55	15	10	129	6,681	340	30,910	927	0	39,580
Jul	149		49	16	34	2,353	118	10,025	229	60	13,033
Aug	172			4	55	2,762	111	10,604	189		13,897
Sep	161	17	14		40	2,579	139	10,324	175		13,450
Q305	482	17	63	20	129	7,694	368	30,953	593	60	40,380
Oct	159		19	19	31	2,404	123	11,297	75		14,126
Nov	150	22		1	52	2,358	88	11,432	94		14,197
Dec	164	6	25	2	35	2,002	122	8,655	55		11,066
Q405	473	27	44	21	119	6,765	332	31,384	224	0	39,388
2005 TOTAL:	2,010	113	151	62	512	26,911	1,349	115,084	1,867	60	148,118

AVRRDD-MT CARBERRY LANDFILL - 2005
TONS DELIVERED BY CATEGORY
REUSABLE

QUARTER:	GLASS	AUTO FLUFF	BIOMASS	SAND/GRAVEL	SUB TOTAL	Grand Total
Jan	41	2,356		2,072	4,470	23,394
Feb	37	2,930		882	3,850	18,997
Mar	29	3,080		2,094	5,203	22,355
Q105	108	8,366	0	5,048	13,522	64,746
Apr	39	2,219		3,016	5,274	24,809
May	39	2,473		4,593	7,105	27,962
Jun	55	3,985	523	3,519	8,082	28,372
Q205	134	8,677	523	11,128	20,462	81,144
Jul	44	3,722		3,265	7,031	28,182
Aug	40	5,440		2,783	8,263	30,182
Sept	42	5,722	387	2,170	8,321	30,215
Q305	125	14,884	387	8,218	23,615	88,579
Oct	31	2,823		2,425	5,279	29,081
Nov	39	2,934		2,306	5,279	27,663
Dec	30	1,913	298	930	3,172	22,598
Q405	101	7,669	298	5,661	13,730	79,342
2005 TOTAL:	468	39,596	1,209	30,055	71,328	313,810

AVRRDD - MT. CARBERRY LANDFILL - 2006

TONS DELIVERED BY CATEGORY

MILL

QUARTER:	SLUDGE	ASBESTOS	ASH	LIME	GRIT	CONTAMINATED EXCAVATION DEBRIS	SAND/ GRAVEL	SAWDUST CONTAINING ABSRBD CHEM	PAPER/CORES FELTS/STARCH	MSW	C&D BULKY	SUB TOTAL
Jan	6,145		1,386	734			335	81	80	19	4	8,783
Feb	5,609		702	523			200	74	61	11	4	7,184
Mar	6,097		728	867			247	92	79	15	65	8,188
Q106	17,850	0	2,816	2,123	0	0	783	247	220	45	72	24,155
Apr	5,465		848	1,781			486	156	64	14	2	8,814
May	2,710		53	265			8	872	71	10	8	3,998
Jun	2,116			243				549	74	12	3	2,997
Q206	10,291	0	901	2,289	0	0	493	1,577	209	36	13	15,809
Jul	2,049		4					55	62	4		2,174
Aug	2,073			5				19	69	3	5	2,174
Sept	2,343		7						75	1	7	2,433
Q306	6,466	0	10	5	0	0	0	74	206	8	11	6,780
Oct	2,485								87	1	59	2,632
Nov	2,394								81		52	2,527
Dec	2,357								71	0		2,428
Q406	7,237	0	0	0	0	0	0	0	239	1	110	7,587
2006 TOTAL:	41,844	0	3,728	4,416	0	0	1,276	1,898	874	90	207	54,332

AVRRDD-MT CARBERRY LANDFILL - 2006

TONS DELIVERED BY CATEGORY

TOWNS & COMMERCIAL

QUARTER:	SLUDGE	MISC.	Ash	ASBESTOS	PAPER/ CORES	In-State MSW	Out of State MSW	C&D	BULKY	CONTAMINATED SOIL	SUB TOTAL
Jan	171		18		40	2,056	95	6,963	32		9,376
Feb	116		16	9	36	1,707	134	6,404	39		8,462
Mar	195			0	35	2,044	105	9,227	57	11	11,673
Q106	482	0	35	9	111	5,807	334	22,594	128	11	29,512
Apr	137		14	103	34	1,970	95	9,837	74	1	12,265
May	184	16		36	31	2,367	89	12,761	140	48	15,671
Jun	158	63	18	3	34	2,473	120	13,424	141		16,433
Q206	478	79	32	142	99	6,810	304	36,022	355	48	44,369
Jul	144		14		23	2,544	141	11,187	87		14,141
Aug	181				30	2,773	133	13,223	126		16,466
Sep	123		15	6	24	2,124	108	10,969	108		13,476
Q306	448	0	29	6	77	7,441	382	35,380	321	0	44,083
Oct	180			1	32	2,268	114	12,971	96		15,661
Nov	145		17	124	36	2,319	97	11,175	88	9	14,009
Dec	118			100	33	1,967	107	8,636	50		11,011
Q406	442	0	17	224	100	6,553	318	32,782	234	9	40,680
2006 TOTAL:	1,851	79	112	381	387	26,611	1,338	126,778	1,038	69	158,644
Q106 Misc											
Q206 Misc	Dirt/Grvl										
Q306 Misc											
Q406 Misc											

AVRRDD-MT CARBERRY LANDFILL - 2006

TONS DELIVERED BY CATEGORY

REUSABLE

QUARTER:	GLASS	AUTO FLUFF	BIOMASS	SAND/GRAVEL	SUB TOTAL	Grand Total
Jan	39	1,977		1,792	3,808	21,967
Feb	24	1,793	79	3,165	5,061	20,707
Mar	39	2,546		3,012	5,598	25,459
Q106	103	6,316	79	7,970	14,467	68,134
Apr	34	2,491		6,689	9,215	30,294
May	47	5,011	159	4,022	9,239	28,908
Jun	34	6,235	77	2,970	9,316	28,746
Q206	115	13,737	236	13,682	27,770	87,948
Jul	50	6,903	170	2,270	9,392	25,707
Aug	28	8,594	238	1,065	9,926	28,566
Sept	30	6,810	439	2,462	9,742	25,651
Q306	108	22,308	847	5,797	29,060	79,923
Oct	57	8,240	805	3,402	12,504	30,797
Nov	32	7,031	261	2,867	10,191	26,727
Dec	30	5,382		3,198	8,610	22,049
Q406	118	20,654	1066	9,467	31,305	79,573
2006 TOTAL:	444	63,015	2,228	36,916	102,602	315,578
Adj from Apr-May-Jun				-1,204		
				35,712	101,398	314,374

AVRRDD - MT. CARBERRY LANDFILL - 2007

TONS DELIVERED BY CATEGORY

MILL

QUARTER:	SLUDGE	ASBESTOS	ASH	LIME	GRIT	CONTAMINATED EXCAVATION DEBRIS	SAND/ GRAVEL	SAWDUST CONTAINING ABSRBD CHEM	PAPER/CORES FELTS/STARCH	MSW	C&D BULKY	SUB TOTAL
Jan	2,255								69		2	2,326
Feb	1,758								60		1	1,820
Mar	2,146					28			81			2,256
Q107	6,159	0	0	0	0	28	0	0	211	0	3	6,401
Apr	2,251							10	81			2,342
May	1,931								77			2,008
Jun	2,161								57			2,219
Q207	6,343	0	0	0	0	0	0	10	215	0	0	6,568
Jul	2,061								50			2,111
Aug	2,170								63			2,232
Sept	1,713		0						52			1,765
Q307	5,943	0	0	0	0	0	0	0	165	0	0	6,109
Oct	2,022	17				65			66		29	2,199
Nov	1,779								76			1,855
Dec	1,585									70	2	1,656
Q407	5,386	17	0	0	0	65	0	0	141	70	31	5,710
2007 TOTAL:	23,832	17	0	0	0	92	0	10	732	70	34	24,787

AVRRDD-MT CARBERRY LANDFILL - 2007
TONS DELIVERED BY CATEGORY
TOWNS & COMMERCIAL

QUARTER:	SLUDGE	MISC.	Ash	ASBESTOS	PAPER/ CORES	In-State MSW	Out of State MSW	C&D	BULKY	CONTAMINATED SOIL	SUB TOTAL
Jan	148		16	10	39	2,241	146	7,945	32	3	10,581
Feb	143			66	30	1,680	168	5,919	48		8,055
Mar	193		14	108	35	1,778	95	7,564	43		9,829
Q107	484	0	30	184	104	5,699	408	21,429	123	3	28,464
Apr	140		16	126	31	1,869	95	8,040	79		10,396
May	138			60	31	2,119	121	10,120	148		12,737
Jun	160		15	278	32	1,973	118	10,987	116		13,678
Q207	438	0	32	464	95	5,960	334	29,147	342	0	36,811
Jul	147			255	25	2,794	117	11,121	81	73	14,612
Aug	143		14	888	36	2,918	144	10,851	116	1	15,112
Sep	132			286	28	2,348	159	10,885	91		13,930
Q307	423	0	14	1,429	90	8,060	421	32,856	288	73	43,654
Oct	164		15		28	2,870	413	12,341	120	21	15,972
Nov	150		17		39	2,366	230	10,359	106		13,266
Dec	123				35	2,054	213	8,749	24		11,198
Q407	437	0	32	0	102	7,289	856	31,449	250	21	40,437
2007 TOTAL:	1,782	0	108	2,076	390	27,009	2,018	114,881	1,003	97	149,366
Q107 Misc						Adjustment					
Q207 Misc											
Q307 Misc											
Q407 Misc											

AVRRDD-MT CARBERRY LANDFILL - 2007
TONS DELIVERED BY CATEGORY
REUSABLE

QUARTER:	GLASS	AUTO FLUFF	BIOMASS	SAND/GRAVEL	SUB TOTAL	Grand Total
Jan	44	2,170		8,866	11,080	23,986
Feb	23	7,406		120	7,549	17,423
Mar	34	8,254		0	8,289	20,373
Q107	101	17,830	0	8,986	26,917	61,783
Apr	40	8,309		36	8,385	21,123
May	35	10,057	391	390	10,873	25,618
Jun	45	9,730		253	10,027	25,924
Q207	121	28,095	391	678	29,285	72,664
Jul	42	8,659		114	8,815	25,538
Aug	42	6,692	396	72	7,202	24,546
Sept	37	4,746	89	186	5,057	20,752
Q307	121	20,096	484	372	21,073	70,836
Oct	38	5,266		1,596	6,900	25,071
Nov	37	6,852	1,312	1,608	9,810	24,931
Dec	26	4,967		686	5,679	18,533
Q407	101	17,085	1,312	3,890	22,389	68,535
2007 TOTAL:	444	83,106	2,188	13,926	99,664	273,817

AVRRDD - MT. CARBERRY LANDFILL - 2008

TONS DELIVERED BY CATEGORY

QUARTER:	MILL SLUDGE	ASBESTOS	ASH	LIME	GRIT	CONTAMINATED EXCAVATION DEBRIS	SAND/ GRAVEL	SAWDUST CONTAINING ABSRBD CHEM	PAPER/CORES FELTS/STARCH	MSW	C&D BULKY	SUB TOTAL
Jan	1,977						5		110			2,092
Feb	1,437						12		70		5	1,524
Mar	1,605								47		3	1,655
Q108	5,019	0	0	0	0	0	17	0	227	0	8	5,271
Apr	1,851	9							45		12	1,917
May	1,251	4							46		3	1,303
Jun	1,231								62	4		1,297
Q208	4,333	13	0	0	0	0	0	0	152	4	15	4,517
Jul	1,130								36			1,166
Aug	1,093								60			1,153
Sept	1,052						70		56			1,178
Q308	3,275	0	0	0	0	0	70	0	152	0	0	3,497
Oct	1,499	12							63		9	1,583
Nov	1,108	5							42		8	1,163
Dec	1,217								47			1,264
Q408	3,823	17	0	0	0	0	0	0	152	0	17	4,009
2008 TOTAL:	16,450	30	0	0	0	0	87	0	683	4	39	17,294

AVRRDD-MT CARBERRY LANDFILL - 2008
TONS DELIVERED BY CATEGORY
TOWNS & COMMERCIAL

QUARTER:	SLUDGE	MISC.	Ash	ASBESTOS	PAPER/ CORES	In-State MSW	Out of State MSW	C&D	BULKY	CONTAMINATED SOIL	SUB TOTAL
Jan	162		15		15	2,304	237	8,685	44		11,462
Feb	160				10	2,027	201	6,337	33		8,769
Mar	143				7	2,027	184	8,025	34	17	10,436
Q108	465	0	15	0	32	6,358	622	23,048	111	17	30,667
Apr	180	15	19		7	2,338	249	7,787	115	233	10,941
May	144			116		2,313	230	8,067	159	73	11,103
Jun	165		33	3		2,312	241	8,181	125		11,060
Q208	489	15	52	119	7	6,963	720	24,035	398	305	33,103
Jul	163		14	8		2,863	341	8,639	123		12,152
Aug	136			58		2,737	262	8,490	183	8	11,875
Sep	131		16	5		2,688	286	9,920	131		13,176
Q308	430	0	30	70	0	8,288	889	27,050	438	8	37,203
Oct	166			13		2,647	359	10,808	130		14,123
Nov	106		27	0		2,078	215	8,230	123	10	10,790
Dec	167		12			2,382	311	7,618	55		10,545
Q408	439	0	40	14	0	7,107	885	26,656	307	10	35,458
2008 TOTAL:	1,823	15	136	203	39	28,716	3,117	100,788	1,254	341	136,431
Q108 Misc											
Q208 Misc	Starch										
Q308 Misc											
Q408 Misc											

AVRRDD-MT CARBERRY LANDFILL - 2008

TONS DELIVERED BY CATEGORY

REUSABLE

QUARTER:	GLASS	AUTO FLUFF	BIOMASS	SAND/GRAVEL	SUB TOTAL	Grand Total
Jan	31	8,375		1,834	10,240	23,794
Feb	39	5,515			5,554	15,847
Mar	28	5,834		994	6,856	18,947
Q108	98	19,725	0	2,828	22,651	58,589
Apr	34	7,263		2,279	9,576	22,433
May	44	6,939		3,563	10,545	22,951
Jun	51	3,585	421	3,004	7,061	19,417
Q208	129	17,786	421	8,846	27,182	64,802
Jul	36	4,973	37	3,087	8,133	21,451
Aug	45	6,008		2,086	8,139	21,167
Sept	63	10,237	71	5,073	15,443	29,797
Q308	143	21,218	108	10,246	31,716	72,415
Oct	78	10,192	758	109	11,138	26,844
Nov	25	5,800	862	288	6,975	18,928
Dec	82	3,840		440	4,363	16,171
Q408	186	19,833	1,620	837	22,476	61,942
2008 TOTAL:	556	78,562	2,149	22,757	104,024	257,748

AVRRDD - MT. CARBERRY LANDFILL - 2009

TONS DELIVERED BY CATEGORY

QUARTER:	MILL SLUDGE	ASBESTOS	ASH	LIME	GRIT	CONTAMINATED EXCAVATION DEBRIS	SAND/ GRAVEL	SAWDUST CONTAINING ABSRBD CHEM	PAPER/CORES FELTS/STARCH	MSW	C&D BULKY	SUB TOTAL
Jan	1,036								49			1,085
Feb	1,153								57			1,209
Mar	1,204								36			1,240
Q109	3,393	0	0	0	0	0	0	0	141	0	0	3,534
Apr	1,018								38			1,057
May	1,237								50			1,288
Jun	1,062								28		4	1,094
Q209	3,317	0	0	0	0	0	0	0	117	0	4	3,438
Jul	1,279	9							44		18	1,350
Aug	1,022		3						47			1,072
Sept	1,111								37		9	1,156
Q309	3,412	9	3	0	0	0	0	0	128	0	27	3,578
Oct	1,412	9	3				11		49		11	1,495
Nov	1,187								37			1,224
Dec	1,442								58			1,500
Q409	4,040	9	3	0	0	0	11	0	144	0	11	4,219
2009 TOTAL:	14,162	18	6	0	0	0	11	0	530	0	41	14,769

AVRRDD-MT CARBERRY LANDFILL - 2009
TONS DELIVERED BY CATEGORY
TOWNS & COMMERCIAL

QUARTER:	SLUDGE	MISC.	C&D FINES	Ash	ASBESTOS	PAPER/ CORES	In-State MSW	Out of State MSW	C&D	BULKY	CONTAMINATED SOIL	SUB TOTAL
Jan	135			13		8	2,056	242	6,569	43	35	9,101
Feb	139						1,912	167	6,440	54		8,712
Mar	178			15			2,162	195	6,903	80		9,534
Q109	452	0		28	0	8	6,129	604	19,913	177	35	27,346
Apr	178				13		2,242	206	9,232	111	37	12,018
May	154			12	5		2,311	195	8,952	138	4	11,771
Jun	183				1		2,526	242	9,425	140		12,516
Q209	515	0		12	19	0	7,079	643	27,608	389	40	36,305
Jul	128	17		18	1		2,932	323	9,790	155	40	13,403
Aug	148			42			2,820	330	8,915	111		12,365
Sep	127				255		2,719	287	8,782	158	55	12,383
Q309	403	17		61	256	0	8,471	939	27,486	423	95	38,151
Oct	143				552		2,496	399	10,070	121		13,782
Nov	130				22		2,189	251	8,871	93	49	11,605
Dec	159		568		18		2,330	231	6,924	53	4	10,288
Q409	431	0	568	0	592	0	7,015	881	25,866	268	53	35,675
2009 TOTAL:	1,802	17	568	101	867	8	28,695	3,067	100,872	1,257	223	137,477
Q109 Misc												
Q209 Misc												
Q309 Misc	Sand/Dirt											
Q409 Misc												

AVRRDD-MT CARBERRY LANDFILL - 2009

TONS DELIVERED BY CATEGORY

REUSABLE

QUARTER:	GLASS	AUTO FLUFF	BIOMASS	SAND/GRAVEL	SUB TOTAL	Grand Total
Jan	59	4,641		798	5,498	15,683
Feb	44	5,371		532	5,947	15,869
Mar	78	6,425		598	7,102	17,875
Q109	182	16,437	0	1,928	18,547	49,427
Apr	52	8,479	494	892	9,917	22,992
May	63	5,164	49	791	6,067	19,126
Jun	75	5,041		479	5,596	19,206
Q209	190	18,684	543	2,162	21,580	61,323
Jul	77	3,307	488	867	4,739	19,492
Aug	69	3,974		2,116	6,158	19,596
Sept	72	4,104	339	644	5,159	18,698
Q309	218	11,384	826	3,627	16,056	57,786
Oct	77	5,574			5,651	20,927
Nov	49	5,859	155		6,063	18,892
Dec	50	5,183			5,233	17,021
Q409	176	16,615	155	0	16,947	56,840
2009 TOTAL:	767	63,120	1,525	7,718	73,130	225,376

ATTACHMENT B – BORING LOGS

TEST BORING LOG

CMA Engineers, Inc.
Civil/Environmental Engineers
35 Bow Street
Portsmouth, NH 03801
Phone: 603.431.6196
Fax: 603.431.5376

PROJECT
Description: AVRRDD Stage 5 & 6
Location: Success, NH

Test Boring Number
B.11-01

Sheet 1 of 2

Contractor: NH Boring
Date: 10/27/2011

CMA Engineer: Bob Grillo
Equipment: Mobile B59-Truck
Ground Elevation: 1666

File Number: 774
Operator: Ken Smith
Weather: Overcast, 35°F

Depth	Sample No. Depth (ft)	Blow Count	Sample Descriptions and Classifications	Well Const.	Remarks
1					3" S.S. Sampler 4" Casing Drive & Wash Drilling
2					
3					
4					
5	S-1 5' - 7'	31	Gray brown fine to coarse SAND, some fine to coarse Gravel, trace Silt. Wood and cloth debris in top of sample. Moist. 16" Rec.		
6		36			
7		35 25			C&D/Autofluff
8					
9					
10	S-2 10' - 12'	7	No Recovery other than woven fabric and stone in tip of sampler.		
11		17 25			
12		11			
13					
14					14.0'
15	S-3 15' - 17'	4	Black organic CLAY/Sludge and fine to medium SAND, little fine to coarse Gravel, trace Plastic. 5" Rec.		15' Casing in ground. Switched to liquid polymer drilling fluid from water.
16		2 3			
17		4			
18					Sludge Waste
19					
20	S-4 20' - 22'	3	Same. Wet.		
21		2 4			
22		5			
23					
24					
25					

TEST BORING LOG

CMA Engineers, Inc.
Civil/Environmental Engineers
35 Bow Street
Portsmouth, NH 03801
Phone: 603.431.6196
Fax: 603.431.5376

PROJECT
Description: AVRRDD Stage 5 & 6
Location: Success, NH

Test Boring Number
B.11-01

Sheet 2 of 2

Contractor: NH Boring

Date: 10/27/2011

CMA Engineer: Bob Grillo

Equipment: Mobile B59-Truck

Ground Elevation: 1666

File Number: 774

Operator: Ken Smith

Weather: Overcast, 35°F

Depth	Sample No. Depth (ft)	Blow Count	Sample Descriptions and Classifications	Well Const.	Remarks
26	S-5 25' - 27'	4 4 5 42	Same, with little fine to coarse Gravel. Drier. 24" Rec.		
27					
28					
29					
30					
31	S-6 30' - 32'	15 8 10 13	A: Gray brown organic SILT. Some fine to coarse Sand and fine Gravel. B: Same, more Sand, less organic. Rec 20".		
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					
47					
48					
49					
50					

TEST BORING LOG

CMA Engineers, Inc.
Civil/Environmental Engineers
35 Bow Street
Portsmouth, NH 03801
Phone: 603.431.6196
Fax: 603.431.5376

PROJECT
Description: AVRRDD Stage 5 & 6
Location: Success, NH

Test Boring Number
B.11-02

Sheet 1 of 2

Contractor: NH Boring
Date: 10/27/2011

CMA Engineer: Bob Grillo
Equipment: Mobile B59-Truck
Ground Elevation: 1672

File Number: 774
Operator: Ken Smith
Weather: Overcast, 35°F

Depth	Sample No. Depth (ft)	Blow Count	Sample Descriptions and Classifications	Well Const.	Remarks
1					
2					
3					
4					
5	S-1 5' - 5'-4"	50/4"	No Recovery. Trace Plastic in tip of spoon.		C&D/Autofluff
6					
7					
8					
9					
10	S-2 10' - 10'-3"	50/3"	Obstruction. Loss of drilling fluid. Difficult drilling.		Extended 4" Casing to 15'
11					
12					
13					
14					
15	S-3 15' - 17'	50/3"	Used 300 lb. Hammer. Only trace trash, wood, & rubble recovery.		Rubble refusal to 15'
16					
17					
18					18.0'
19					
20	S-4 20' - 22'	30	Black fine to coarse SAND, some fine Gravel, trace Silt and refuse/cloth. Rec 8".		Sludge Waste
21		25			
22		43 / 43			
23					
24					
25					

TEST BORING LOG

CMA Engineers, Inc.
Civil/Environmental Engineers
35 Bow Street
Portsmouth, NH 03801
Phone: 603.431.6196
Fax: 603.431.5376

PROJECT
Description: AVRRDD Stage 5 & 6
Location: Success, NH

Test Boring Number
B.11-02

Sheet 2 of 2

Contractor: NH Boring
Date: 10/27/2011

CMA Engineer: Bob Grillo
Equipment: Mobile B59-Truck
Ground Elevation: 1672

File Number: 774
Operator: Ken Smith
Weather: Overcast, 35°F

Depth	Sample No. Depth (ft)	Blow Count	Sample Descriptions and Classifications	Well Const.	Remarks
26	S-5 25' - 27'	4 4 5 7	Black and white SILT/Sludge, little fine to medium Sand. Moist. 24" Rec.		
27					
28					
29					
30	S-6 30' - 32'	6 8 8 8	Same, little Gravel, Black.		
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					
47					
48					
49					
50					

TEST BORING LOG

CMA Engineers, Inc.
Civil/Environmental Engineers
35 Bow Street
Portsmouth, NH 03801
Phone: 603.431.6196
Fax: 603.431.5376

PROJECT
Description: AVRRDD Stage 5 & 6
Location: Success, NH

Test Boring Number
B.11-03

Sheet 1 of 2

Contractor: NH Boring

Date: 10/28/2011

CMA Engineer: Bob Grillo

Equipment: Mobile B59-Truck

Ground Elevation: 1689

File Number: 774

Operator: Ken Smith

Weather: Clear, 29°F

Depth	Sample No. Depth (ft)	Blow Count	Sample Descriptions and Classifications	Well Const.	Remarks
1					Drill through C&D Waste to 15' without sampling. Difficult Drilling.
2					
3					
4					
5					
6					
7					
8					
9					C&D/Autofluff
10					
11					
12					
13					
14					
15	S-1 15' - 15'-3"	50/3"	No Recovery		
16					
17					
18					
19					
20					
21					
22					22.0'
23					
24					Sludge Waste
25					

TEST BORING LOG

CMA Engineers, Inc.
Civil/Environmental Engineers
35 Bow Street
Portsmouth, NH 03801
Phone: 603.431.6196
Fax: 603.431.5376

PROJECT
Description: AVRRDD Stage 5 & 6
Location: Success, NH

Test Boring Number
B.11-03

Sheet 2 of 2

Contractor: NH Boring
Date: 10/28/2011

CMA Engineer: Bob Grillo
Equipment: Mobile B59-Truck
Ground Elevation: 1689

File Number: 774
Operator: Ken Smith
Weather: Clear, 29°F

Depth	Sample No. Depth (ft)	Blow Count	Sample Descriptions and Classifications	Well Const.	Remarks
26	S-2 25' - 25'-11"	53 / 100/5"	Brown fine to coarse SAND, some fine to coarse Gravel, trace Silt. 6" Rec.		
30	S-3 30' - 32'	4 / 5 / 5 / 20	2" Recovery (Wash?) Rock fragment and Sand and Gravel.		
35	S-4 35' - 37'	21 / 25 / 22 / 20	Brown fine to coarse SAND and fine to coarse GRAVEL, trace Silt with cloth, rubbish. 8" Rec.		
40	S-5 40' - 42'	14 / 17 / 17 / 20	Same. Mixed with little Sludge, plastic. Wetter.		

TEST BORING LOG

CMA Engineers, Inc.
Civil/Environmental Engineers
35 Bow Street
Portsmouth, NH 03801
Phone: 603.431.6196
Fax: 603.431.5376

PROJECT
Description: AVRRDD Stage 5 & 6
Location: Success, NH

Test Boring Number
B.11-04

Sheet 1 of 2

Contractor: NH Boring

Date: 11/1/2011

CMA Engineer: Bob Grillo

Equipment: Mobile B59-Truck

Ground Elevation: 1666

File Number: 774

Operator: Ken Smith

Weather: Sunny, 29°F

Depth	Sample No. Depth (ft)	Blow Count	Sample Descriptions and Classifications	Well Const.	Remarks
1					Drill through C&D Waste to 10' without sampling. Difficult Drilling.
2					
3					
4					
5					
6					
7					
8					
9					C&D/Autofluff
10	S-1 10' - 12'	10	Wood fragments. Otherwise no recovery.		
11		7			
		32			
12		64			
13					
14					
15	S-2 15' - 17'	50	Wood and Rock. 3" Recovery.		
16		22			
		18			
17		15			
18					18.0'
19					
20	S-3 20' - 22'	20	No Recovery. Indication of trash.		
21		6			
		6			
22		6			Sludge Waste
23					
24					
25					

TEST BORING LOG

CMA Engineers, Inc.
Civil/Environmental Engineers
35 Bow Street
Portsmouth, NH 03801
Phone: 603.431.6196
Fax: 603.431.5376

PROJECT
Description: AVRRDD Stage 5 & 6
Location: Success, NH

Test Boring Number
B.11-04

Sheet 2 of 2

Contractor: NH Boring

Date: 11/1/2011

CMA Engineer: Bob Grillo

Equipment: Mobile B59-Truck

Ground Elevation: 1666

File Number: 774

Operator: Ken Smith

Weather: Sunny, 29°F

Depth	Sample No. Depth (ft)	Blow Count	Sample Descriptions and Classifications	Well Const.	Remarks
26	S-4 25' - 26'-8"	16 25 21 50/2"	No Recovery.		
30	S-5 30' - 32'	2 3 3 6	Gravel, rock, wood and plastic. 2" Recovery.		
50					

TEST BORING LOG

CMA Engineers, Inc.
Civil/Environmental Engineers
35 Bow Street
Portsmouth, NH 03801
Phone: 603.431.6196
Fax: 603.431.5376

PROJECT
Description: AVRRDD Stage 5 & 6
Location: Success, NH

Test Boring Number
B.11-05

Sheet 1 of 2

Contractor: NH Boring
Date: 10/28/2011

CMA Engineer: Bob Grillo
Equipment: Mobile B59-Truck
Ground Elevation: 1696

File Number: 774
Operator: Ken Smith
Weather: Sunny, 29°F

Depth	Sample No. Depth (ft)	Blow Count	Sample Descriptions and Classifications	Well Const.	Remarks
1					Drill through C&D Waste to 10' without sampling. Difficult Drilling.
2					
3					
4					
5					C&D/Autofluff
6					
7					
8					
9					
10	S-1 10' - 10'-3"	74/3"	Black SILT/Sludge with Refuse. 3" Recover.		10.0'
11					
12					
13					
14					Sludge and Gravel
15	S-2 14' - 14'-1"	50/1"	No Recovery.		
16					
17					
18					
19					Drilled through Rubble to 25'
20					
21					
22					
23					
24					
25					Sludge Waste

TEST BORING LOG

CMA Engineers, Inc.
Civil/Environmental Engineers
35 Bow Street
Portsmouth, NH 03801
Phone: 603.431.6196
Fax: 603.431.5376

PROJECT
Description: AVRRDD Stage 5 & 6
Location: Success, NH

Test Boring Number
B.11-05

Sheet 2 of 2

Contractor: NH Boring
Date: 10/28/2011

CMA Engineer: Bob Grillo
Equipment: Mobile B59-Truck
Ground Elevation: 1696

File Number: 774
Operator: Ken Smith
Weather: Sunny, 29°F

Depth	Sample No. Depth (ft)	Blow Count	Sample Descriptions and Classifications	Well Const.	Remarks
26	S-3 25' - 27'	11, 7, 12, 32	Dark brown fine to coarse SAND/Sludge, little fine Gravel and Silt, mixed with Rubbish.		
30	S-4 30' - 32'	1, 6, 18, 30	Same, with carpet, Rubbish.		
35	S-5 35' - 37'	14, 9, 7, 8	Same. 2" Recovery.		
40	S-6 40' - 42'	7, 13, 8, 12	Brown fine to coarse SAND and GRAVEL, little Silt with paper and plastic Rubbish.		

TEST BORING LOG

CMA Engineers, Inc.
Civil/Environmental Engineers
35 Bow Street
Portsmouth, NH 03801
Phone: 603.431.6196
Fax: 603.431.5376

PROJECT
Description: AVRRDD Stage 5 & 6
Location: Success, NH

Test Boring Number
B.11-06

Sheet 1 of 2

Contractor: NH Boring
Date: 10/31/2011

CMA Engineer: Bob Grillo
Equipment: Mobile B59-Truck
Ground Elevation: 1708

File Number: 774
Operator: Ken Smith
Weather: Sunny, 30°F

Depth	Sample No. Depth (ft)	Blow Count	Sample Descriptions and Classifications	Well Const.	Remarks
1					Drill through C&D Waste to 10' without sampling. Difficult Drilling.
2					
3					
4					
5					
6					
7					C&D/Autofluff
8					
9					
10	S-1 10' - 10'-2"	100/2"	No Recovery.		
11					
12					
13					
14					
15					Drilled through C&D Rubble to 20'. Difficult drilling.
16					
17					
18					
19					
20	S-2 20' - 22'	36	Brown organic fine to coarse SAND, little Silt and Gravel. Fibrous.		
21		16			
22		19 34			
23					
24					
25					Drilled to 30'. Mostly difficult drilling through C&D Rubble, with 2' to 3' layer of softer material.

TEST BORING LOG

CMA Engineers, Inc.
Civil/Environmental Engineers
35 Bow Street
Portsmouth, NH 03801
Phone: 603.431.6196
Fax: 603.431.5376

PROJECT
Description: AVRRDD Stage 5 & 6
Location: Success, NH

Test Boring Number
B.11-06

Sheet 2 of 2

Contractor: NH Boring
Date: 10/31/2011

CMA Engineer: Bob Grillo
Equipment: Mobile B59-Truck
Ground Elevation: 1708

File Number: 774
Operator: Ken Smith
Weather: Sunny, 30°F

Depth	Sample No. Depth (ft)	Blow Count	Sample Descriptions and Classifications	Well Const.	Remarks
26					
27					
28					
29					
30	S-3 30' - 32'	5	Dark gray to black CLAY/Sludge, some fine to medium Sand, trace Gravel.		30.0'
31		8			
		14			
32		22			Sludge and Gravel
33					
34					
35					
36					
37					
38					
39					
40	S-4 40' - 42'	9	Same, grading to SILT and SAND. 20" Recovery.		
41		8			
		10			
42		22			
43					
44					
45					
46					
47					
48					
49					
50	S-5 50' - 52'	5/8	Same, grading to black fine to coarse SAND and SILT.		
		10/12			

ATTACHMENT C – SOIL LABORATORY TEST RESULTS

GEOTECHNICAL LABORATORY TESTING DATA SHEET

Project Name AVRRDD Mt. Carberry Landfill | Project Location Berlin, NH | Reviewed By

Project No. CTS-74-11-0051.19 | Assigned By R. Grillo

Project Manager M. Polsky | Date 12/15/2011 | Date Reviewed 12/15/2011

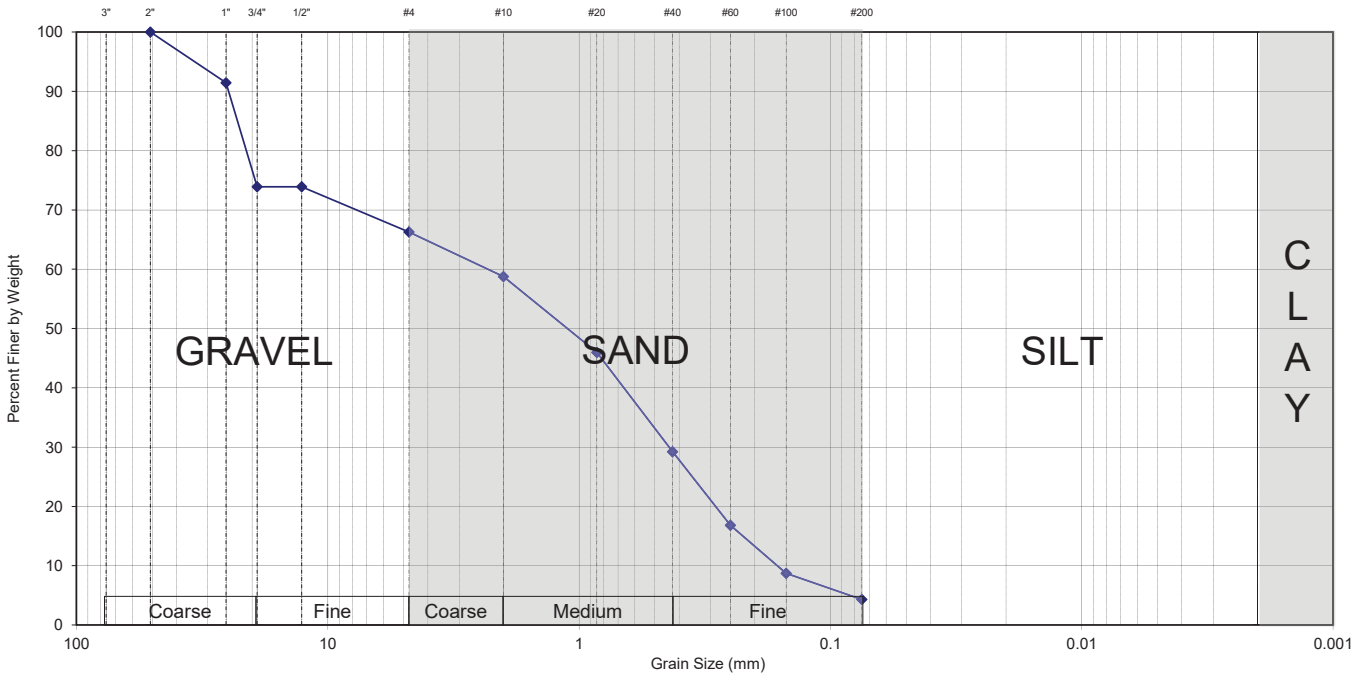
Boring/ Test Pit No.	Sample No.	Depth ft.	Lab No.	Identification Tests								Strength Tests					Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	pH	Dry unit wt. pcf	Torvane or Type Test	σ_c psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	
B.11-01	S-1	5-7	1	13.2			4		0.6								Gray-brown f-c SAND some f-c Gravel, trace Silt
B.11-01	S-3	15-17	2	213.0			58	11	30.3	8.38							Gray-brown SILT some f-c Sand, trace Gravel
B.11-01	S-5	25-27	3	119.7	101	57	43	7	19.7	8.43							Black CLAY and f-m SAND, little f-c Gravel
B.11-01	S-6A	30-32	4	106.4			48	7	32.7	8.48							Gray-brown SILT, some f-c Sand, some fine Gravel
B.11-01	S-6B	30-32	5	74.3	--	NP	44	7	15.6	8.52							Gray-brown f-c SAND and SILT, trace Gravel
B.11-02	S-4	20-22	6	12.7			5		0.8								Black f-c SAND some fine Gravel, trace Silt
B.11-02	S-5	25-27	7	69.4	--	NP	69	16	8.1	9.21							Black & White SILT little f-m Sand
B.11-03	S-2	25-27	9	11.0			12		1.3								Brown f-c SAND some f-c Gravel, little Silt
B.11-03	S-4	35-37	10	11.3			9		0.5								Brown f-c SAND and f-c GRAVEL, trace Silt
B.11-03	S-5	40-42	11	72.8			9	3	22.6								Dark Brown f-c SAND some f-c Gravel, trace Silt

Note: Material classifications are based on particle size and atterberg limit tests. These classifications do not reflect the sample composition, which includes material other than soil.

THIELSCH ENGINEERING

106 South Street
Hopkinton, MA 01748 508-435-9244

U.S. STANDARD SIEVE AND HYDROMETER



Gravel	Sand	Fines
33.7%	62.0%	4.3%

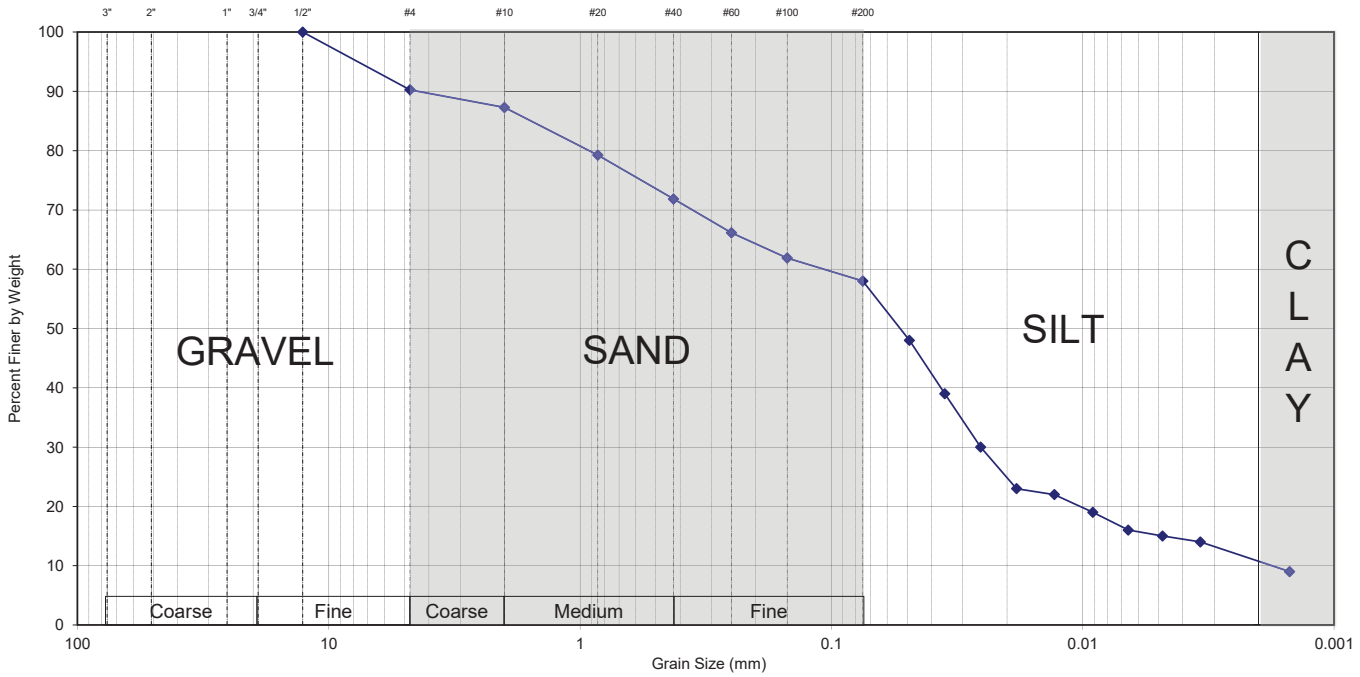
Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
1	B.11-01	S-1	5-7'	Gray-brown f-c SAND, some f-c Gravel, trace Silt	13.2			

THIELSCH ENGINEERING

AVRRDD Mt. Carberry Landfill
Berlin, NH
Thielsch CTS File # 74-11-0051.19

Tested by: PEC Date: 12/2/11
Reviewed by: MBP Date: 12/12/11

U.S. STANDARD SIEVE AND HYDROMETER



Gravel	Sand	Fines
9.7%	32.2%	58.0%

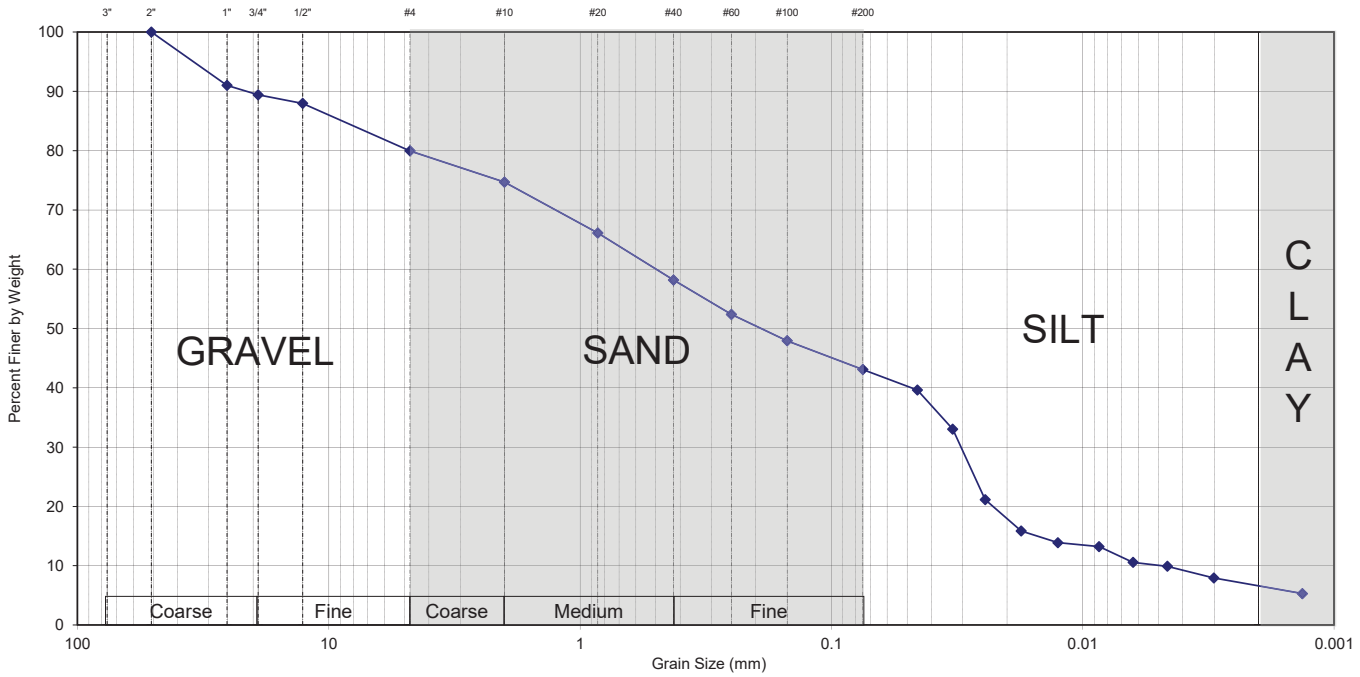
Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
2	B.11-01	S-3	15-17'	Gray-brown SILT, some f-c Sand, trace Gravel	213.0			

THIELSCH ENGINEERING

AVRRDD Mt. Carberry Landfill
Berlin, NH
Thielsch CTS File # 74-11-0051.19

Tested by: GG/PEC Date: 12/6/11
Reviewed by: MBP Date: 12/12/11

U.S. STANDARD SIEVE AND HYDROMETER



Gravel	Sand	Fines
20.0%	36.9%	43.1%

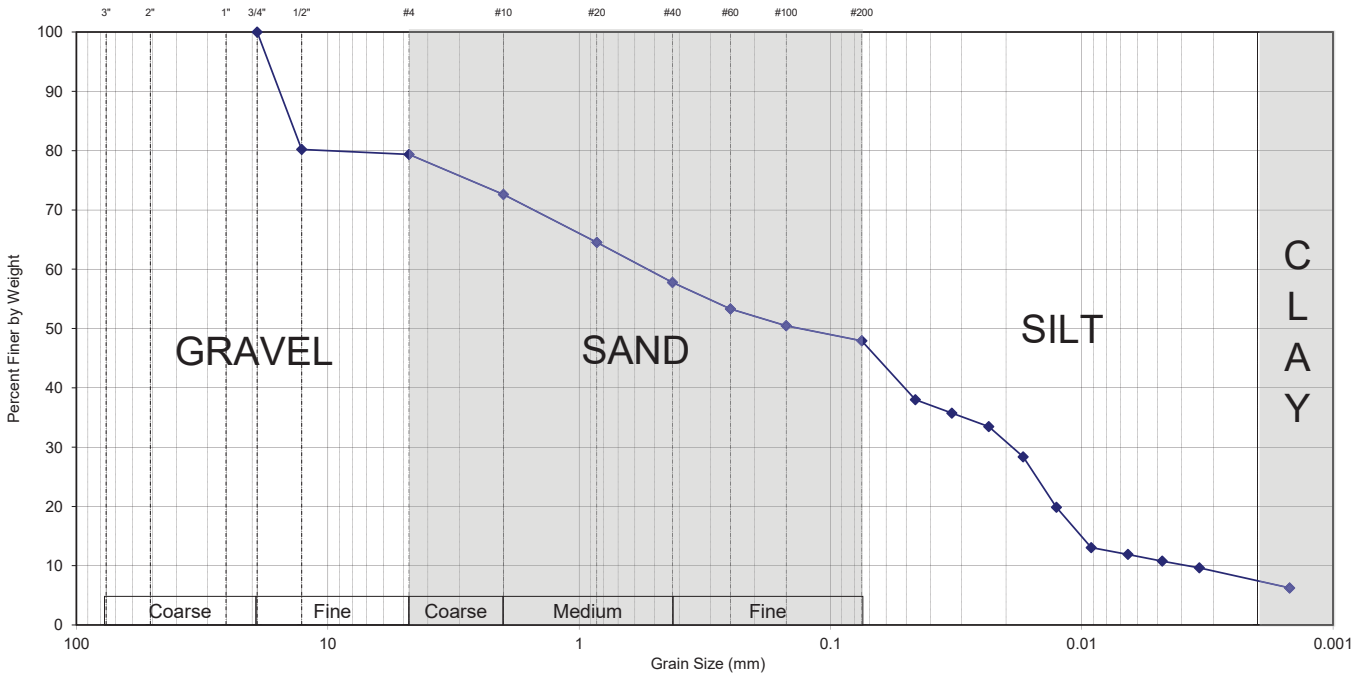
Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
3	B.11-01	S-5	25-27'	Black CLAY and f-m SAND, little f-c Gravel	119.7			

THIELSCH ENGINEERING

AVRRDD Mt. Carberry Landfill
Berlin, NH
Thielsch CTS File # 74-11-0051.19

Tested by: AS Date: 12/7/11
Reviewed by: MBP Date: 12/12/11

U.S. STANDARD SIEVE AND HYDROMETER



Gravel	Sand	Fines
20.6%	31.4%	47.9%

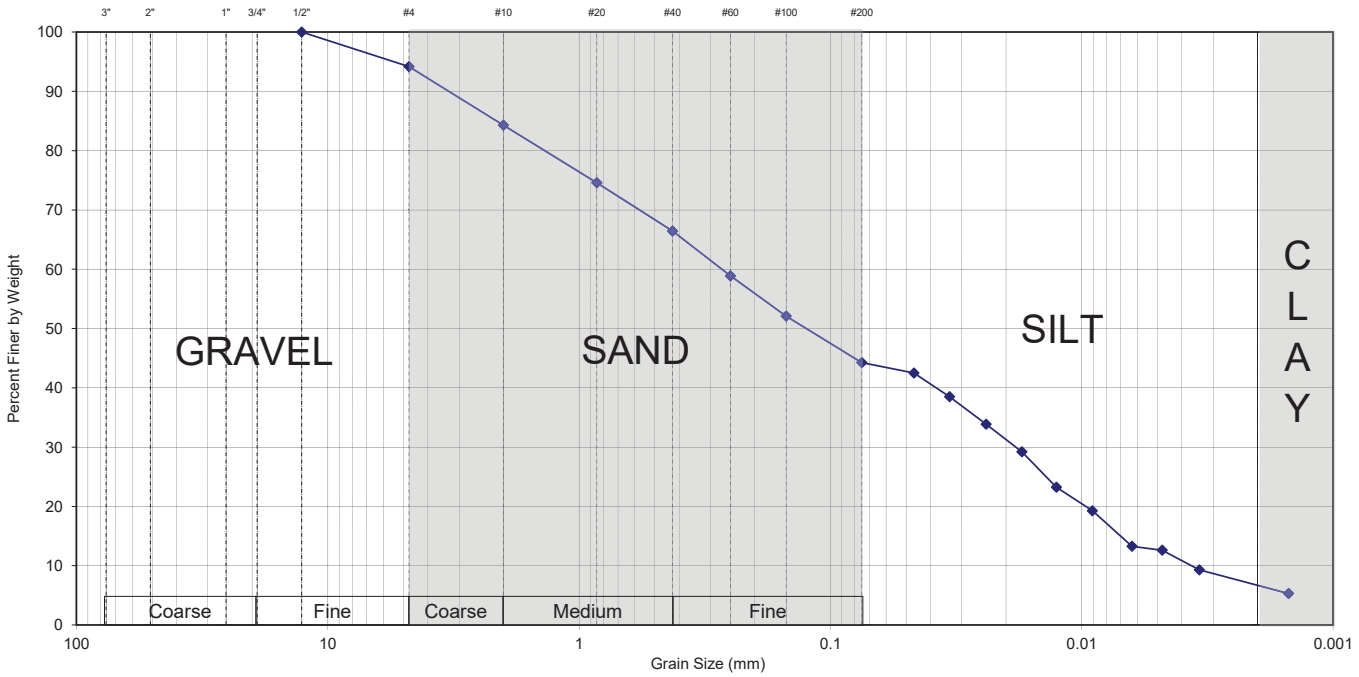
Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
4	B.11-01	S-6A	30-32'	Gray-brown SILT, some f-c Sand, some fine Gravel	106.4			

THIELSCH ENGINEERING

AVRRDD Mt. Carberry Landfill
Berlin, NH
Thielsch CTS File # 74-11-0051.19

Tested by: GG/PEC Date: 12/6/11
Reviewed by: MBP Date: 12/12/11

U.S. STANDARD SIEVE AND HYDROMETER



Gravel	Sand	Fines
5.8%	49.9%	44.3%

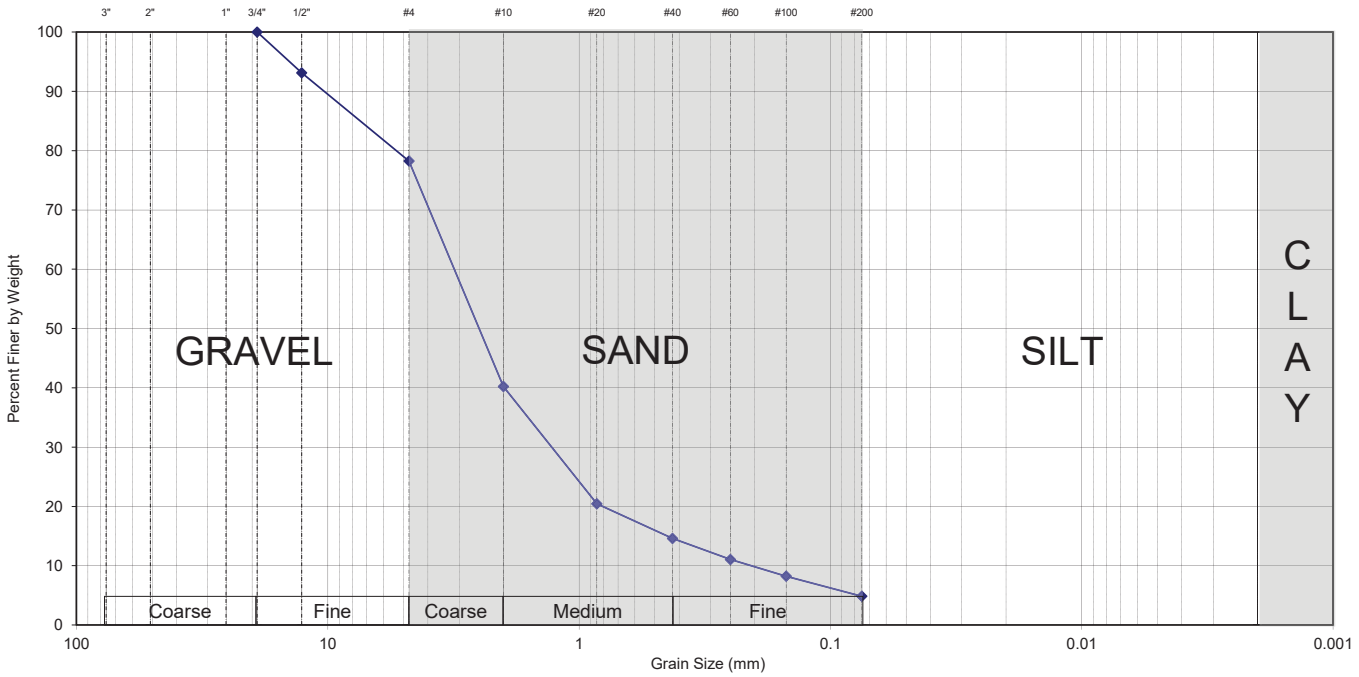
Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
5	B.11-01	S-6B	30-32'	Gray-brown f-c SAND and SILT, trace Gravel	74.3			

THIELSCH ENGINEERING

AVRRDD Mt. Carberry Landfill
Berlin, NH
Thielsch CTS File # 74-11-0051.19

Tested by: GG/PEC Date: 12/6/11
Reviewed by: MBP Date: 12/12/11

U.S. STANDARD SIEVE AND HYDROMETER



Gravel	Sand	Fines
21.8%	73.4%	4.8%

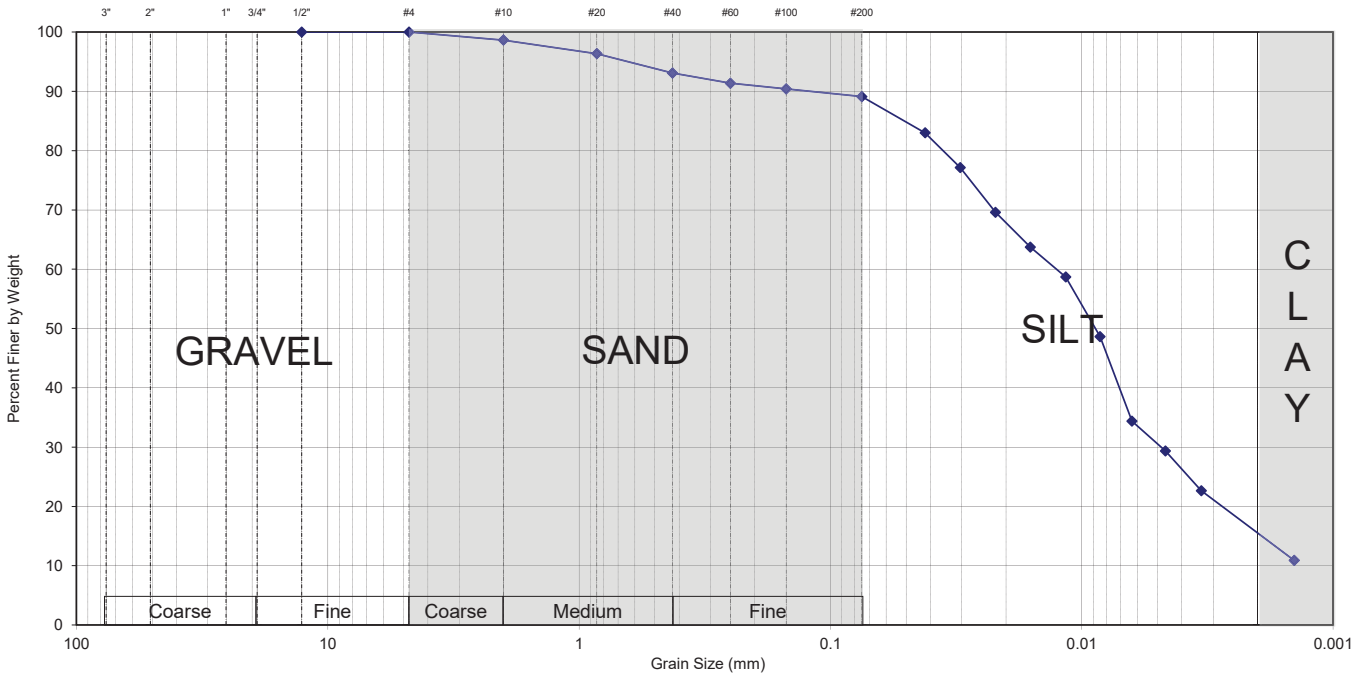
Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
6	B.11-02	S-4	20-22'	Black f-c SAND, some fine Gravel, trace Silt	12.7			

THIELSCH ENGINEERING

AVRRDD Mt. Carberry Landfill
Berlin, NH
Thielsch CTS File # 74-11-0051.19

Tested by: PEC Date: 12/2/11
Reviewed by: MBP Date: 12/12/11

U.S. STANDARD SIEVE AND HYDROMETER



Gravel	Sand	Fines
0.0%	10.9%	89.1%

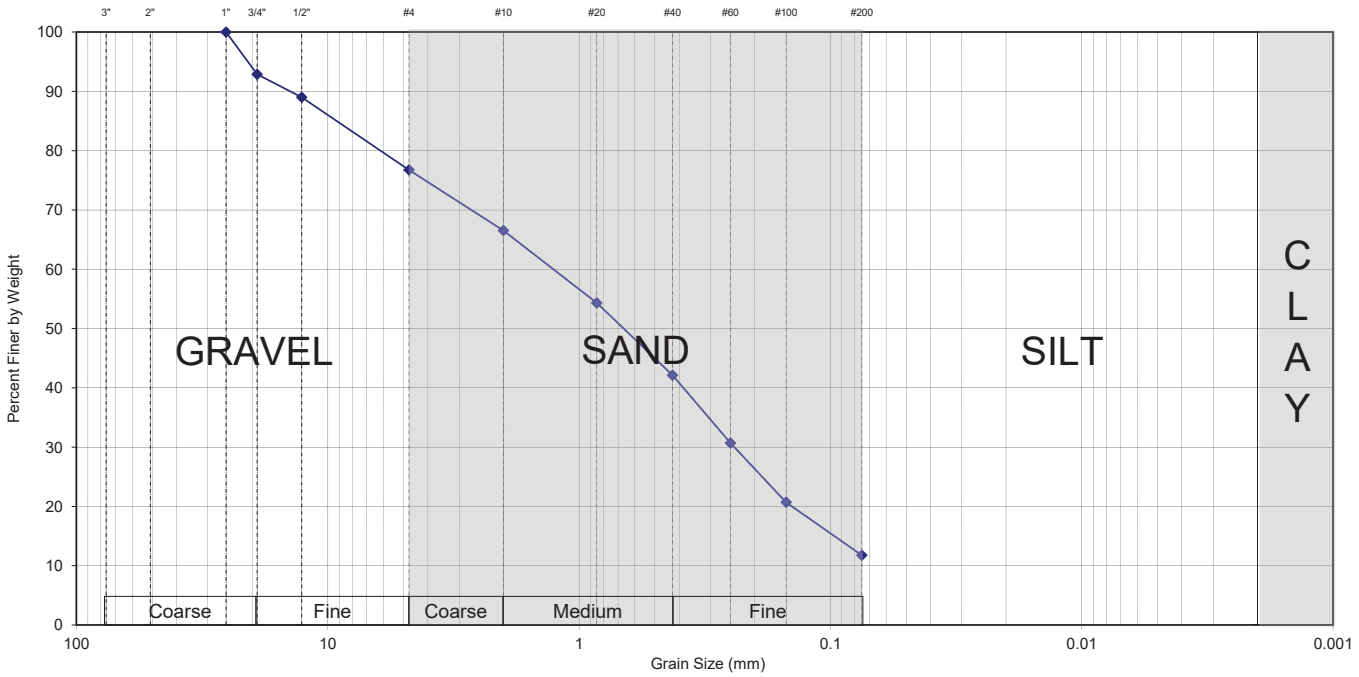
Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
7	B.11-02	S-5	25-27'	Black & White SILT, little f-m Sand	69.4			

THIELSCH ENGINEERING

AVRRDD Mt. Carberry Landfill
Berlin, NH
Thielsch CTS File # 74-11-0051.19

Tested by: AS Date: 12/7/11
Reviewed by: MBP Date: 12/12/11

U.S. STANDARD SIEVE AND HYDROMETER



Gravel	Sand	Fines
23.2%	65.0%	11.8%

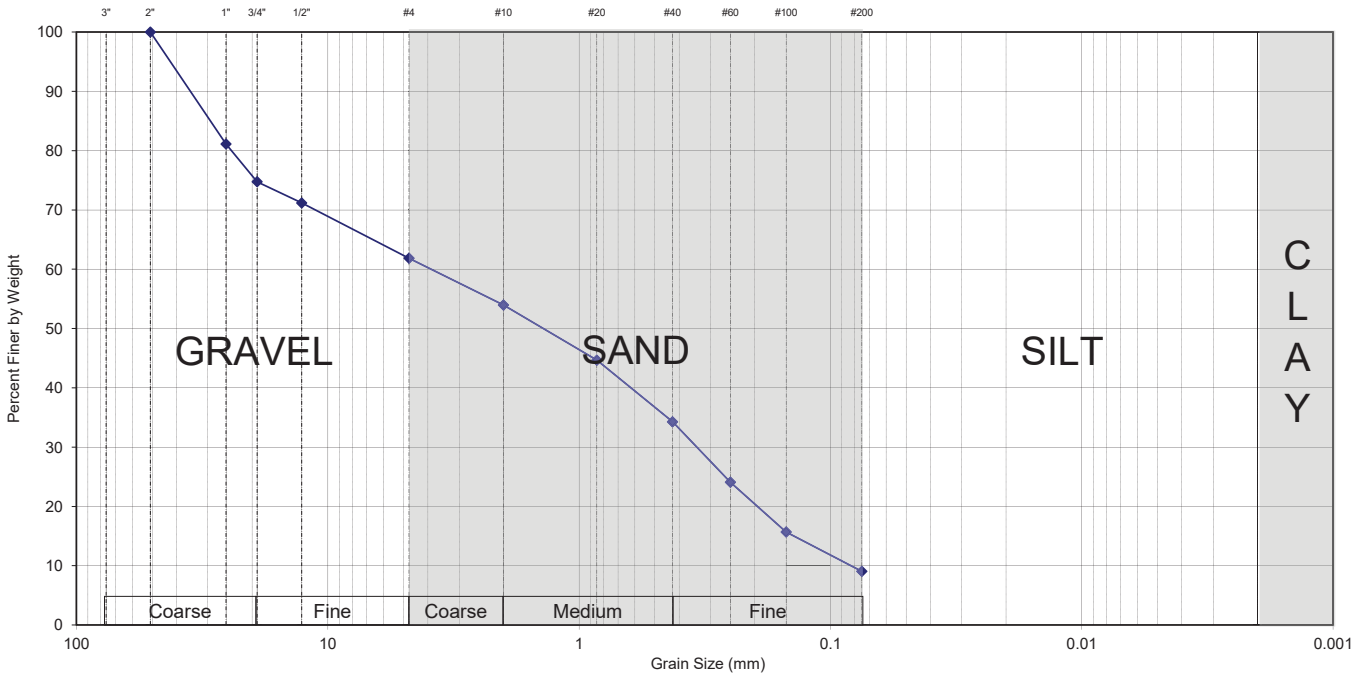
Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
9	B.11-03	S-2	25-27'	Brown f-c SAND, some f-c Gravel, little Silt	11.0			

THIELSCH ENGINEERING

AVRRDD Mt. Carberry Landfill
Berlin, NH
Thielsch CTS File # 74-11-0051.19

Tested by: PEC Date: 12/2/11
Reviewed by: MBP Date: 12/12/11

U.S. STANDARD SIEVE AND HYDROMETER



Gravel	Sand	Fines
38.1%	52.8%	9.0%

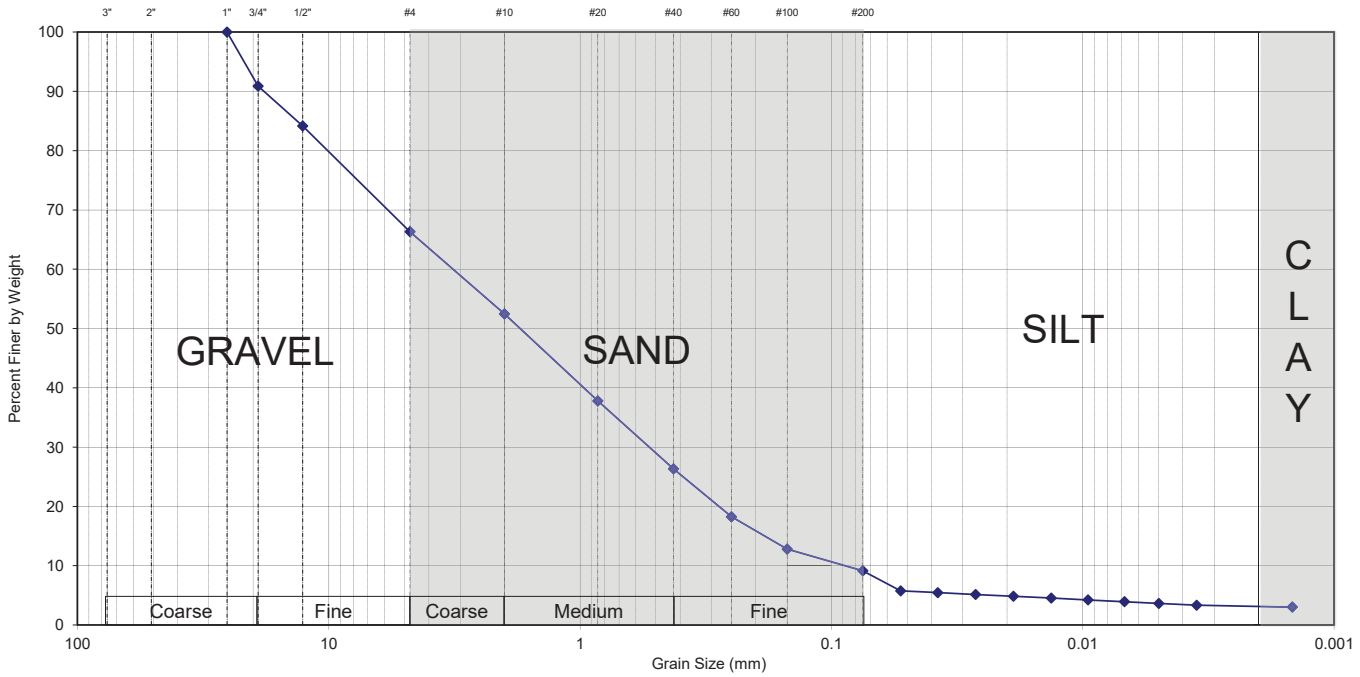
Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
10	B.11-03	S-4	35-37'	Brown f-c SAND and f-c GRAVEL, trace Silt	11.3			

THIELSCH ENGINEERING

AVRRDD Mt. Carberry Landfill
Berlin, NH
Thielsch CTS File # 74-11-0051.19

Tested by: PEC Date: 12/2/11
Reviewed by: MBP Date: 12/12/11

U.S. STANDARD SIEVE AND HYDROMETER



Gravel	Sand	Fines
33.7%	57.2%	9.1%

Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
11	B.11-03	S-5	40-42'	Dk. Brown f-c SAND, some f-c Gravel, trace Silt	72.8			

THIELSCH ENGINEERING

AVRRDD Mt. Carberry Landfill
Berlin, NH
Thielsch CTS File # 74-11-0051.19

Tested by: AS Date: 12/7/11
Reviewed by: MBP Date: 12/12/11

GEOTECHNICAL LABORATORY TESTING DATA SHEET

Project Name AVRRDD Mt. Carberry Landfill | Project Location Berlin, NH | Reviewed By

Project No. CTS-74-11-0051.19 | Assigned By R. Grillo

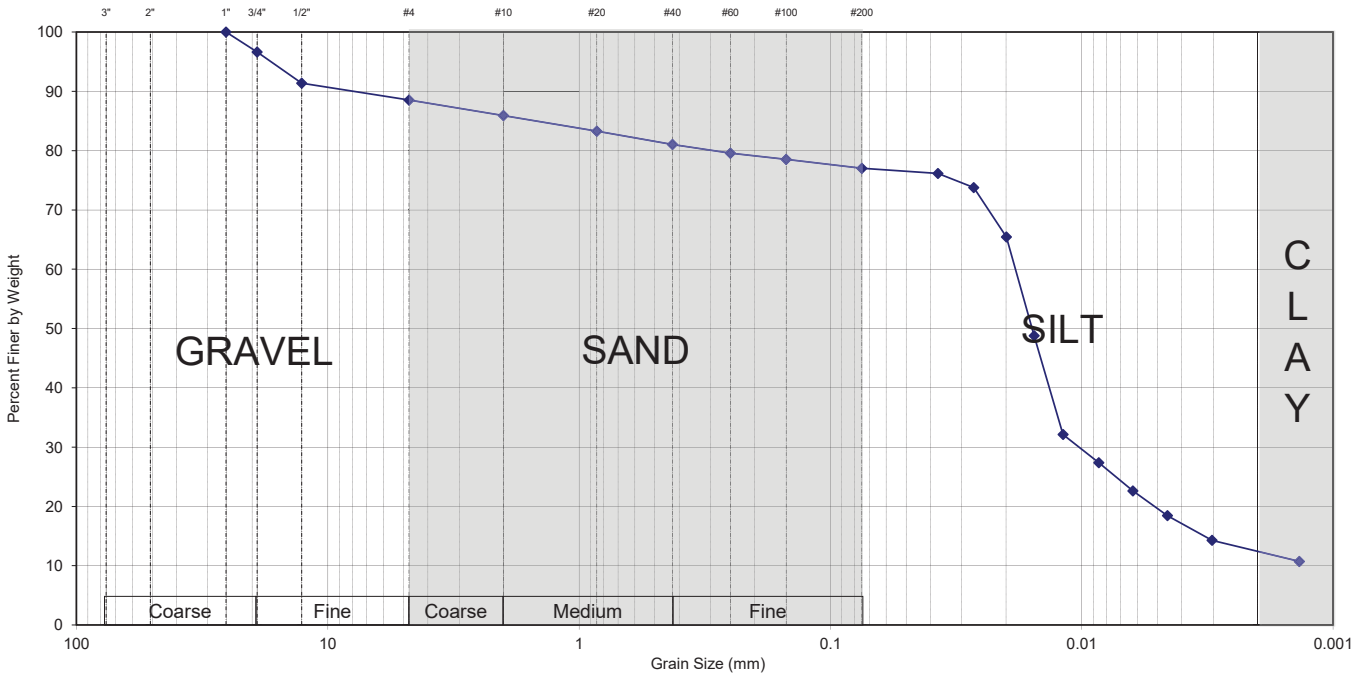
Project Manager M. Polsky | Date 12/15/2011 | Date Reviewed 12/15/2011

Boring/ Test Pit No.	Sample No.	Depth ft.	Lab No.	Identification Tests: Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	pH	Dry unit wt. pcf	Strength Tests: Torvane or Type Test	σ_c psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	Laboratory Log and Soil Description
B.11-02	S-6	30-32	8	70.2	--	NP	77	12	9.3	12.25							Black SILT, little f-m Sand, little f-c Gravel
				66.6							59.1	CIU	2510	σ_1/σ_3 Max	2404	3.1	
											63.6	CIU	5000	σ_1/σ_3 Max	6523	4.1	
											67.6	CIU	10000	σ_1/σ_3 Max	15464	10.1	

Note: Material classifications are based on particle size and atterberg limit tests. These classifications do not reflect the sample composition, which includes material other than soil.

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U.S. STANDARD SIEVE AND HYDROMETER



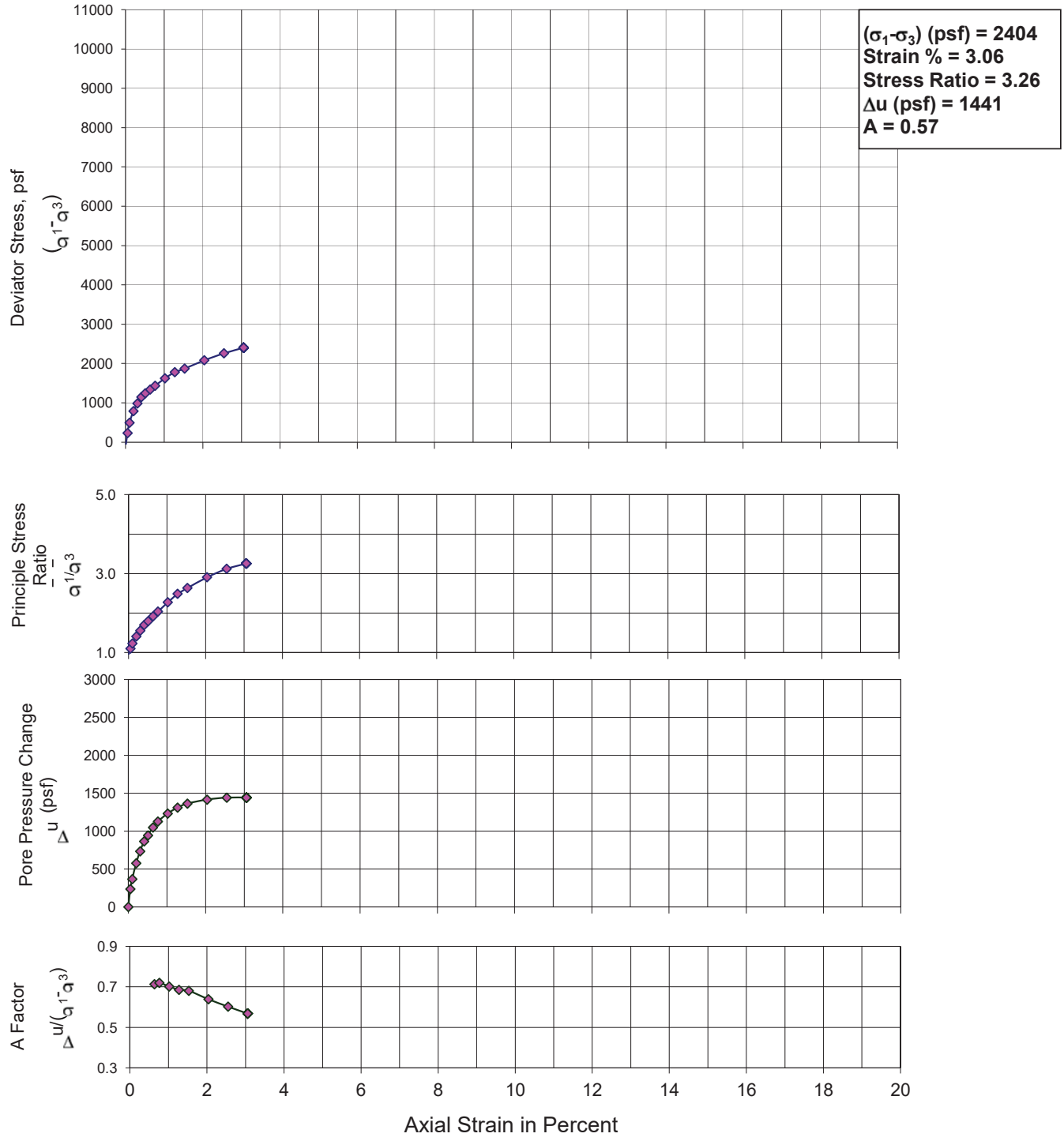
Gravel	Sand	Fines
11.5%	11.5%	77.0%

Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
8	B.11-02	S-6	30-32'	Black SILT, little f-m Sand, little f-c Gravel	70.2			

THIELSCH ENGINEERING

AVRRDD Mt. Carberry Landfill
Berlin, NH
Thielsch CTS File # 74-11-0051.19

Tested by: AS Date: 12/7/11
Reviewed by: MBP Date: 12/12/11



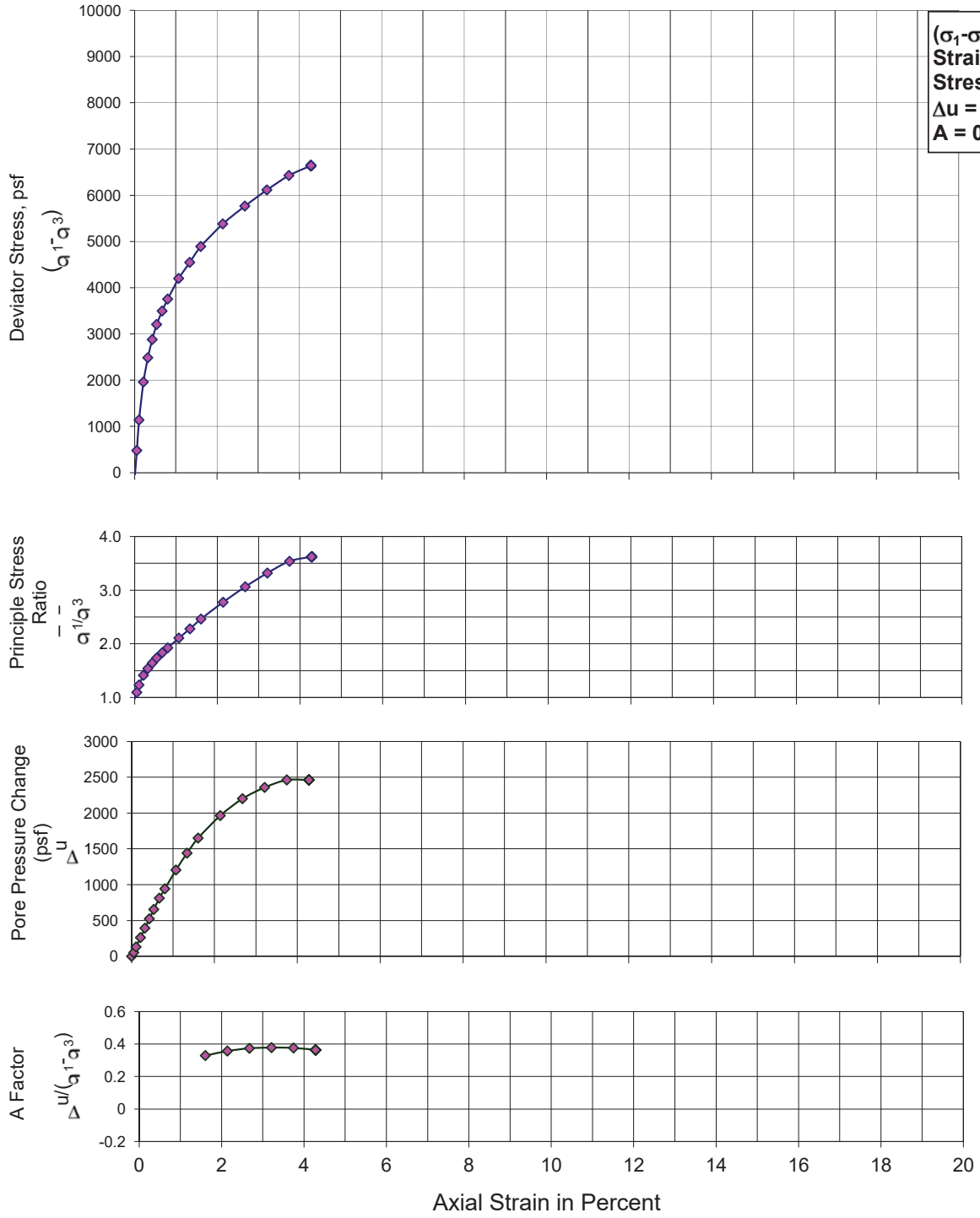
THIELSCH ENGINEERING

SOIL DESCRIPTION:	See Summary Sheet		
LIQUID LIMIT: --	PLASTIC LIMIT: NP	SPECIFIC GRAVITY:	NT

TEST NO. / SYMBOL	INITIAL CONDITIONS: INITIAL WATER CONTENT, %	INITIAL DRY UNIT WEIGHT, pcf	SAMPLE HEIGHT, IN.	SAMPLE DIAMETER, IN.	CONDITIONS BEFORE SHEAR: INITIAL STRESS, ksf (σ_3)	FINAL BACK PRESSURE, ksf	VOLUMETRIC STRAIN, %	PORE PRESSURE RESPONSE, %	FINAL CONDITIONS: FINAL WATER CONTENT, %	FINAL DRY UNIT WEIGHT, pcf	RATE OF STRAIN, PERCENT PER MINUTE
Tr 8.1.1	66.6	59.1	4.02	2.01	2.51	4.32	7.06	96.4	51.0	63.6	0.060

AVRRDD Mt. Carberry Landfill
Berlin, NH
TRIAXIAL COMPRESSION TESTS (CIU)

BORING: B.11-02	FILE NO: 74-11-0051.19
SAMPLE: S-6	Date: 12/9/11
DEPTH: 30-32'	Tech.: AS
TEST NO: Tr 8.1.1	Reviewer: MBP



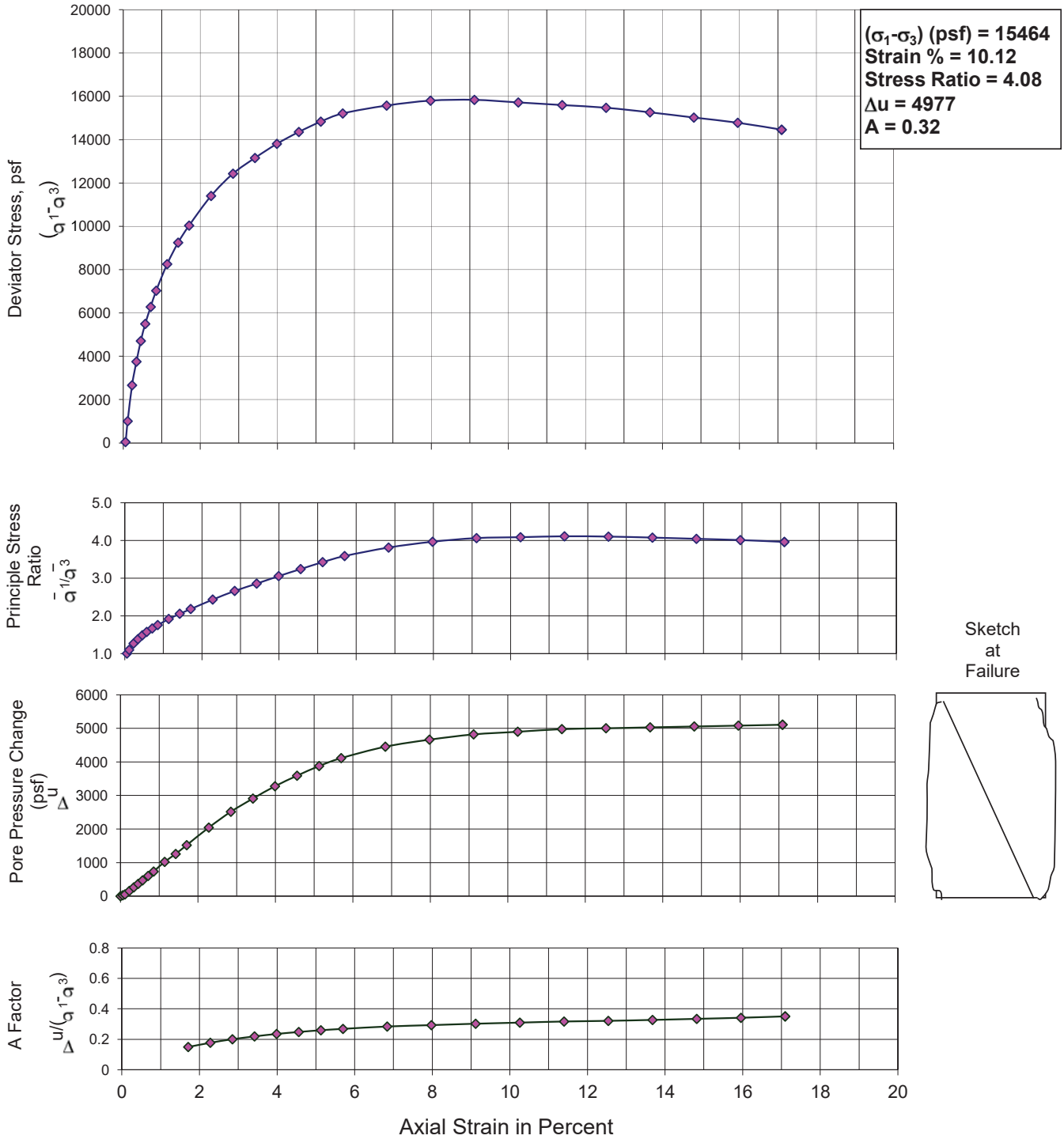
THIELSCH ENGINEERING

SOIL DESCRIPTION:	See Summary Sheet		
LIQUID LIMIT: --	PLASTI C LIMIT: NP	SPECIFIC GRAVITY:	NT

TEST NO. / SYMBOL	INITIAL CONDITIONS: INITIAL WATER CONTENT, %	INITIAL DRY UNIT WEIGHT, pcf	SAMPLE HEIGHT, IN.	SAMPLE DIAMETER, IN.	CONDITIONS BEFORE SHEAR: INITIAL STRESS, ksf σ_3	FINAL BACK PRESSURE, ksf u_b	VOLUMETRIC STRAIN, %	PORE PRESSURE RESPONSE, %	FINAL CONDITIONS: FINAL WATER CONTENT, %	FINAL DRY UNIT WEIGHT, %	RATE OF STRAIN, PERCENT PER MINUTE
T8.1.2	66.6	63.6	3.81	1.99	5.00	4.3	5.35	96.4	51	67.2	0.063

AVRRDD Mt. Carberry Landfill
Berlin, NH
TRIAXIAL COMPRESSION TESTS (CIU)

BORING: B.11-02	FILE NO: 74-11-0051.19
SAMPLE: S-6	Date: 12/12/11
DEPTH: 14.8-15.3'	Tech.: AS
TEST NO: T8.1.2	Reviewer: MBP



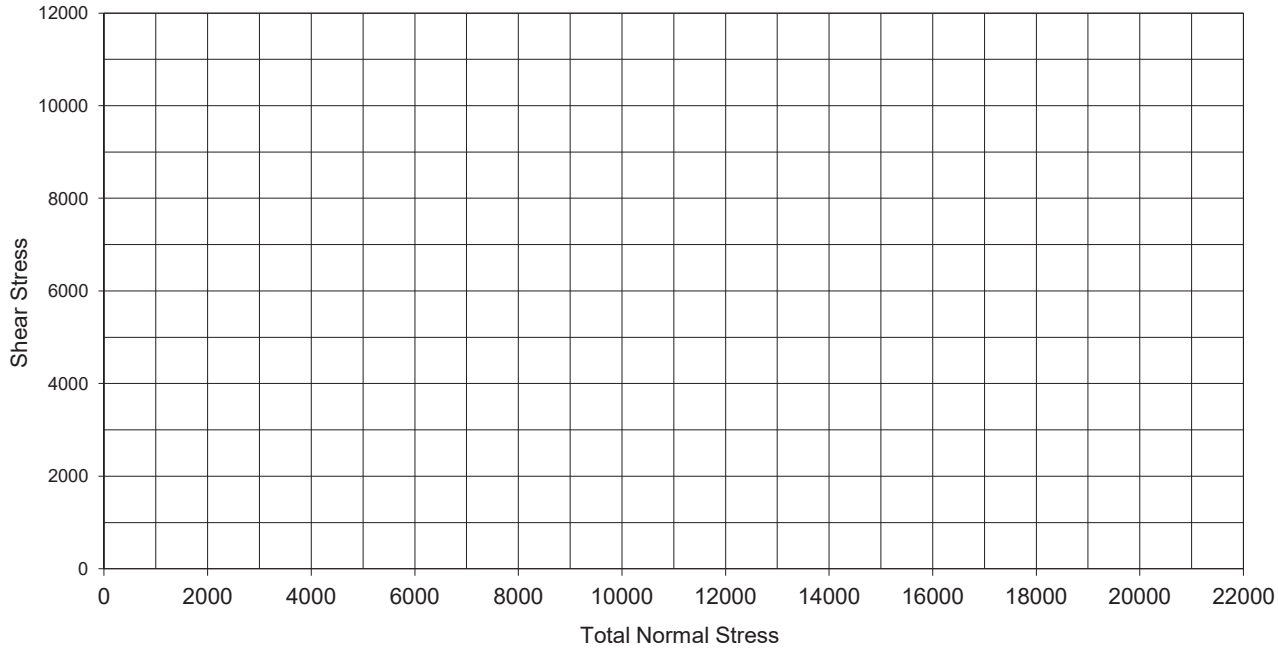
THIELSCH ENGINEERING

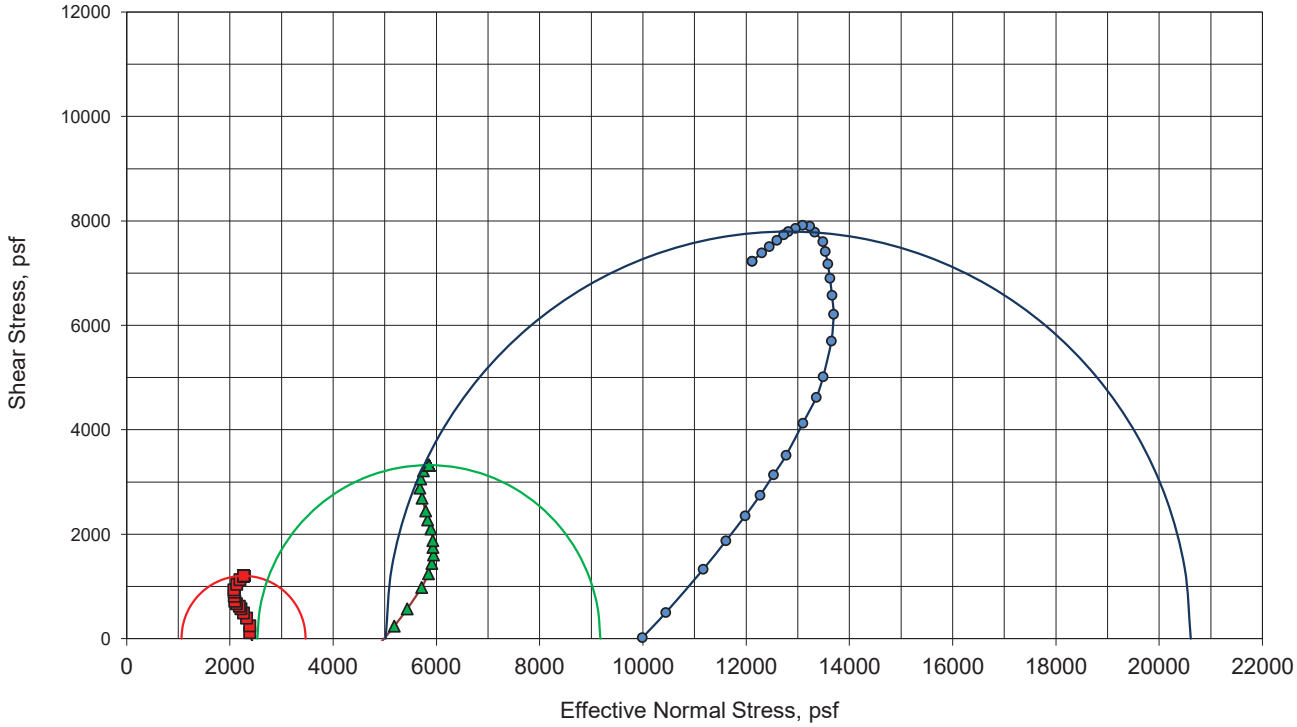
SOIL DESCRIPTION:	See Summary Sheet		
LIQUID LIMIT: --	PLASTI C LIMIT: NP	SPECIFIC GRAVITY:	NT

TEST NO. / SYMBOL	INITIAL CONDITIONS: INITIAL WATER CONTENT, %	INITIAL DRY UNIT WEIGHT, pcf	SAMPLE HEIGHT, IN.	SAMPLE DIAMETER, IN.	CONDITIONS BEFORE SHEAR: INITIAL STRESS, ksf σ_3	FINAL BACK PRESSURE, ksf	VOLUMETRIC STRAIN, %	PORE PRESSURE RESPONSE, %	FINAL CONDITIONS: FINAL WATER CONTENT, %	FINAL DRY UNIT WEIGHT, %	RATE OF STRAIN, PERCENT PER MINUTE
T2.1.3	66.6	67.6	3.58	1.99	9.99	4.3	5.69	96.4	51.0	71.7	0.067

AVRRDD Mt. Carberry Landfill
Berlin, NH
TRIAXIAL COMPRESSION TESTS (CIU)

BORING:	B.11-02	FILE NO:	74-11-0051.19
SAMPLE:	S-6	Date:	12/13/11
DEPTH:	15.4-15.8'	Tech.:	AS
TEST NO:	T8.1.2	Reviewer:	MBP





SOIL DESCRIPTION:	See Summary Sheet			
LIQUID LIMIT: --	PLASTI C LIMIT: NP		SPECIFIC GRAVITY:	NT

FAILURE CRITERIA: σ_1/σ_3 MAX

REMARKS:

THIELSCH ENGINEERING

AVRRDD Mt. Carberry Landfill
Berlin, NH
TRIAXIAL COMPRESSION TESTS (CIU)

BORING: B.11-02	FILE NO: 74-11-0051.19
SAMPLE: S-6	Date: 12/13/11
DEPTH: 30-32'	Tech.: AS
TEST SERIES: 8	Reviewer: MBP

GEOTECHNICAL LABORATORY TESTING DATA SHEET

Project Name AVRRDD Mt. Carberry Landfill | Project Location Berlin, NH | Reviewed By

Project No. CTS-74-11-0051.19 | Assigned By R. Grillo

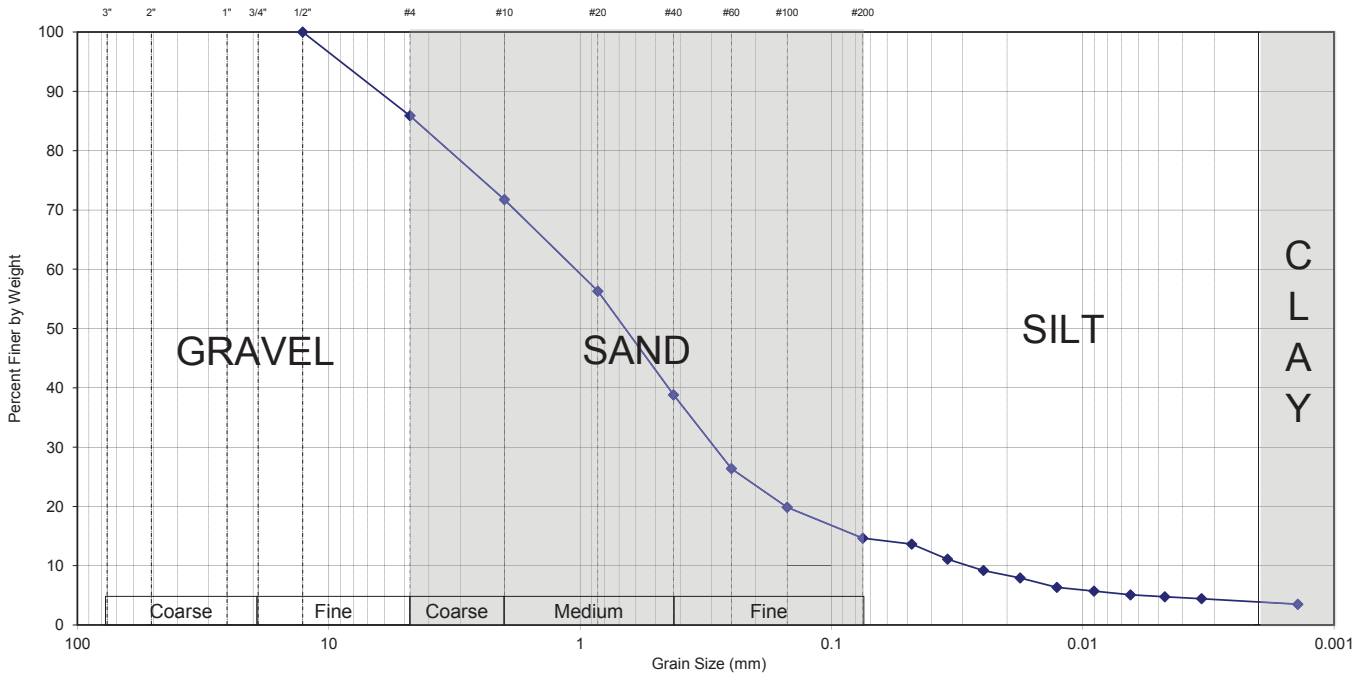
Project Manager M. Polsky | Date 12/15/2011 | Date Reviewed 12/15/2011

Boring/ Test Pit No.	Sample No.	Depth ft.	Lab No.	Identification Tests								Strength Tests					
				Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	pH	Dry unit wt. pcf	Torvane or Type Test	σ_c psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	Laboratory Log and Soil Description
B.11-05	S-3	25-27	12	29.4	--	NP	15	4	5.8	8.85							Dark Brown f-c SAND little Silt, little fine Gravel
B.11-05	S-6	40-42	13	67.3			11	2	9.7								Brown f-c SAND and f-c GRAVEL, little Silt
B.11-06	S-2	10-12	14	121.7			29	5	33.6	8.38							Brown f-c SAND some Silt, some fine Gravel
B.11-06	S-4A	40-42	16	51.3	--	NP	84	8	4.1	9.10							Dark Gray SILT little f-m Sand, trace Gravel
B.11-06	S-4B	40-42	17	48.1	--	NP	39	6	7.3	8.72							Black f-c SAND and SILT, little fine Gravel
B.11-06	S-5A	50-52	18	50.3	39	35	42	8	8.5	9.06							Gray Clayey SILT and f-c SAND, little fine Gravel
B.11-06	S-5B	50-52	19	51.1	--	NP	36	7	9.1	9.03							Black f-c SAND and SILT, little f-c Gravel

Note: Material classifications are based on particle size and atterberg limit tests. These classifications do not reflect the sample composition, which includes material other than soil.

THIELSCH ENGINEERING
106 South Street
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U.S. STANDARD SIEVE AND HYDROMETER



Gravel	Sand	Fines
14.1%	71.3%	14.6%

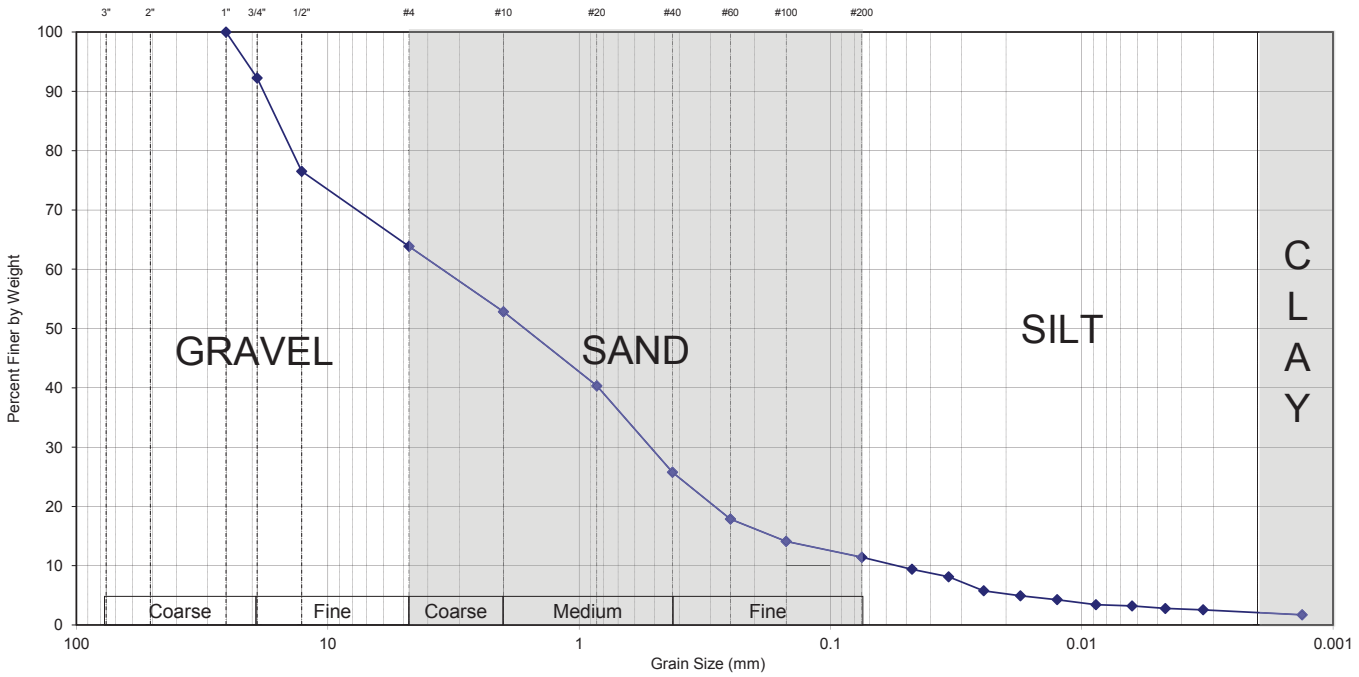
Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
12	B.11-05	S-3	25-27'	Dk. Brown f-c SAND, little Silt, little fine Gravel	29.4			

THIELSCH ENGINEERING

AVRRDD Mt. Carberry Landfill
Berlin, NH
Thielsch CTS File # 74-11-0051.19

Tested by: AS Date: 12/7/11
Reviewed by: MBP Date: 12/12/11

U.S. STANDARD SIEVE AND HYDROMETER



Gravel	Sand	Fines
36.1%	52.5%	11.4%

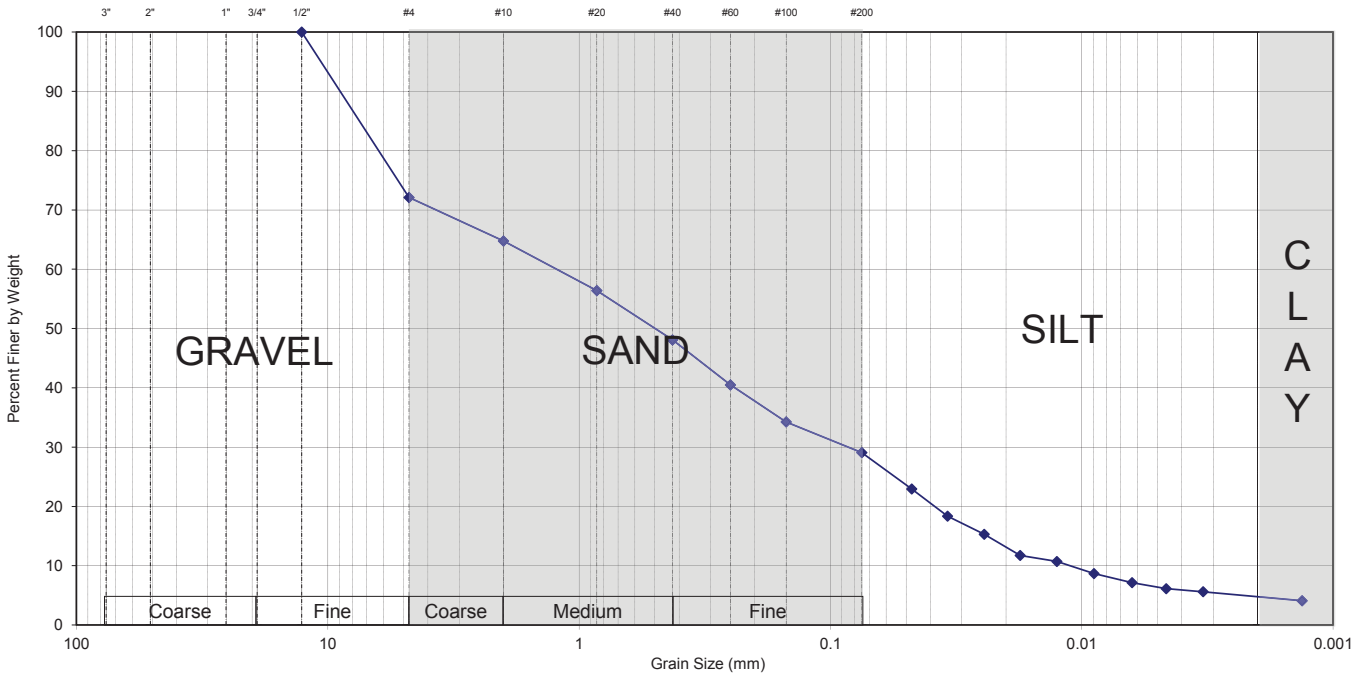
Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
13	B.11-05	S-6	40-42'	Brown f-c SAND and f-c GRAVEL, little Silt	67.3			

THIELSCH ENGINEERING

AVRRDD Mt. Carberry Landfill
Berlin, NH
Thielsch CTS File # 74-11-0051.19

Tested by: AS Date: 12/7/11
Reviewed by: MBP Date: 12/12/11

U.S. STANDARD SIEVE AND HYDROMETER



Gravel	Sand	Fines
27.9%	43.0%	29.1%

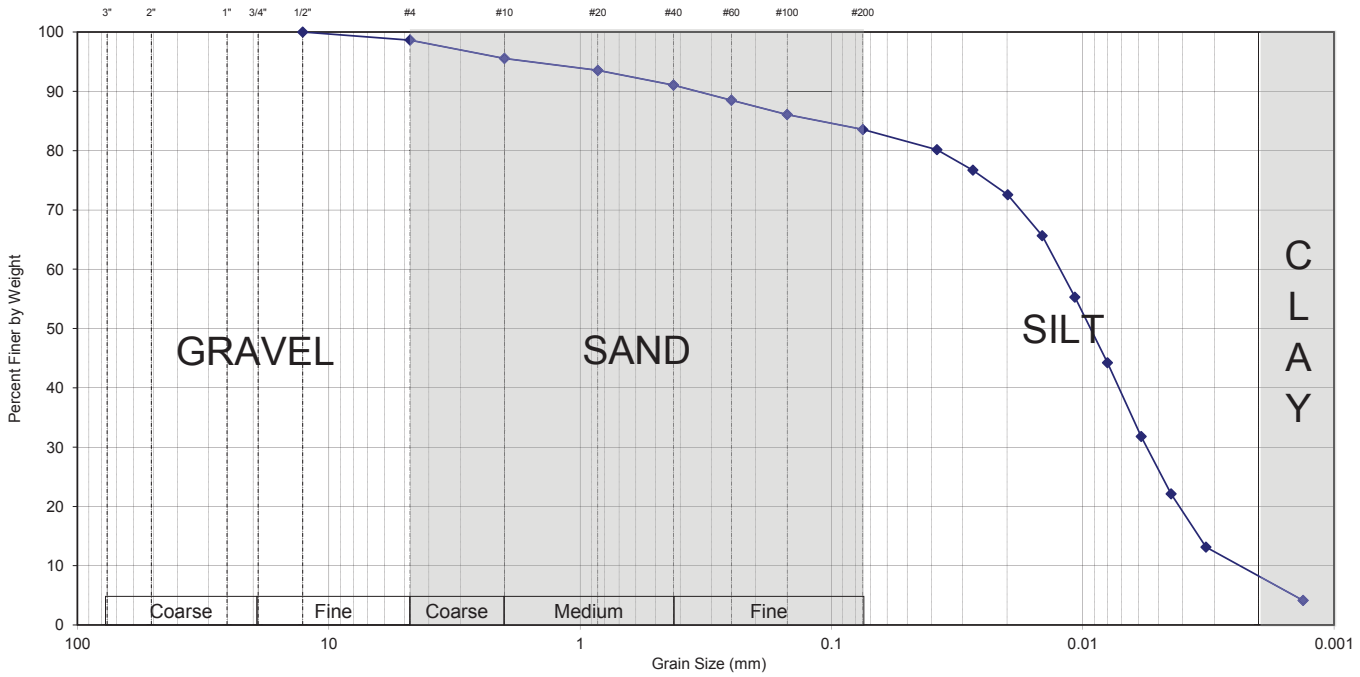
Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
14	B.11-06	S-2	10-12'	Brown f-c SAND, some Silt, some fine Gravel	121.7			

THIELSCH ENGINEERING

AVRRDD Mt. Carberry Landfill
Berlin, NH
Thielsch CTS File # 74-11-0051.19

Tested by: AS Date: 12/7/11
Reviewed by: MBP Date: 12/12/11

U.S. STANDARD SIEVE AND HYDROMETER



Gravel	Sand	Fines
1.3%	15.1%	83.6%

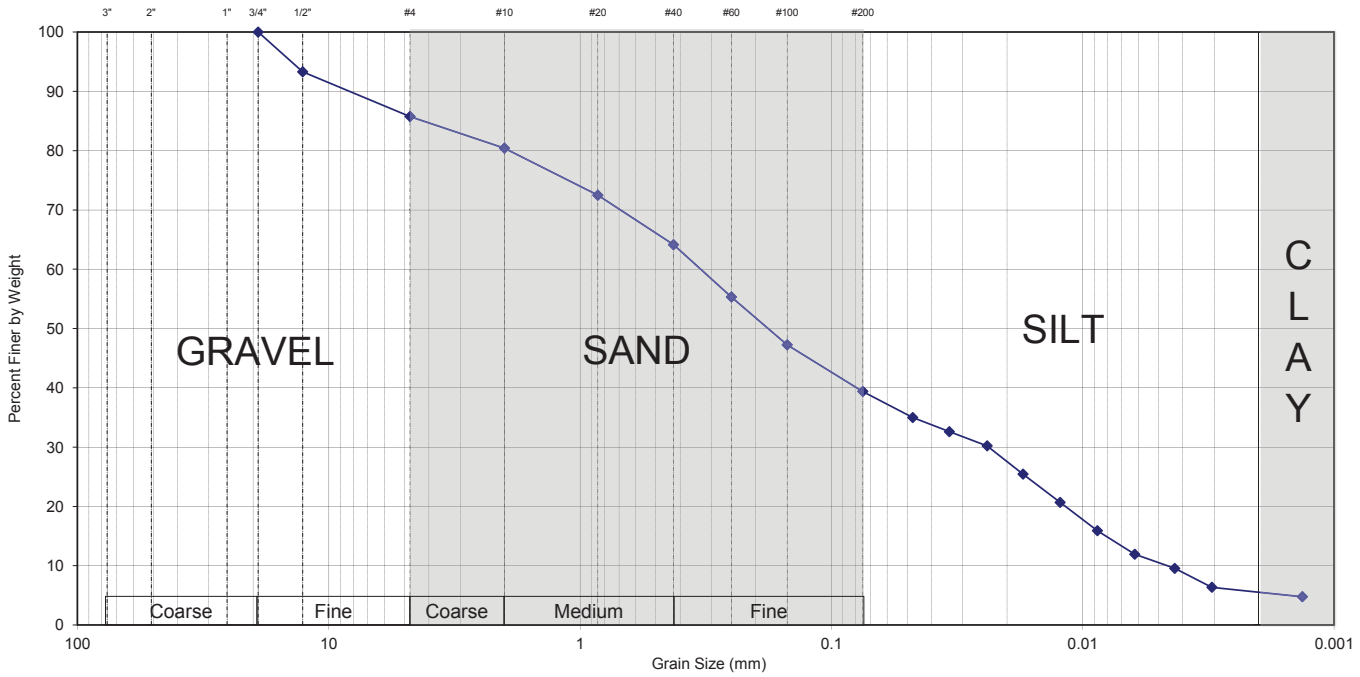
Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
16	B.11-06	S-4A	40-42'	Dark gray SILT, little f-m Sand, trace Gravel	51.3			

THIELSCH ENGINEERING

AVRRDD Mt. Carberry Landfill
Berlin, NH
Thielsch CTS File # 74-11-0051.19

Tested by: AS Date: 12/7/11
Reviewed by: MBP Date: 12/12/11

U.S. STANDARD SIEVE AND HYDROMETER



Gravel	Sand	Fines
14.2%	46.4%	39.4%

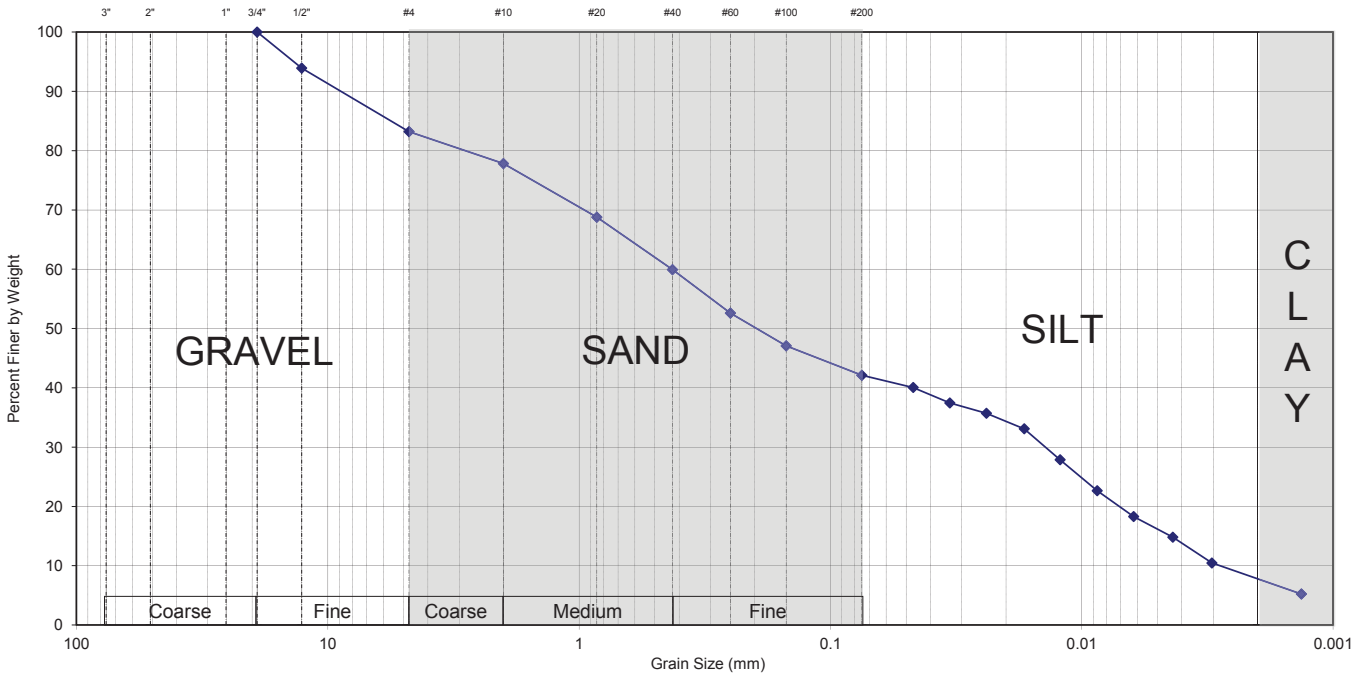
Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
17	B.11-06	S-4B	40-42'	Black f-c SAND and SILT, little fine Gravel	48.1			

THIELSCH ENGINEERING

AVRRDD Mt. Carberry Landfill
Berlin, NH
Thielsch CTS File # 74-11-0051.19

Tested by: AS Date: 12/7/11
Reviewed by: MBP Date: 12/12/11

U.S. STANDARD SIEVE AND HYDROMETER



Gravel	Sand	Fines
16.8%	41.1%	42.1%

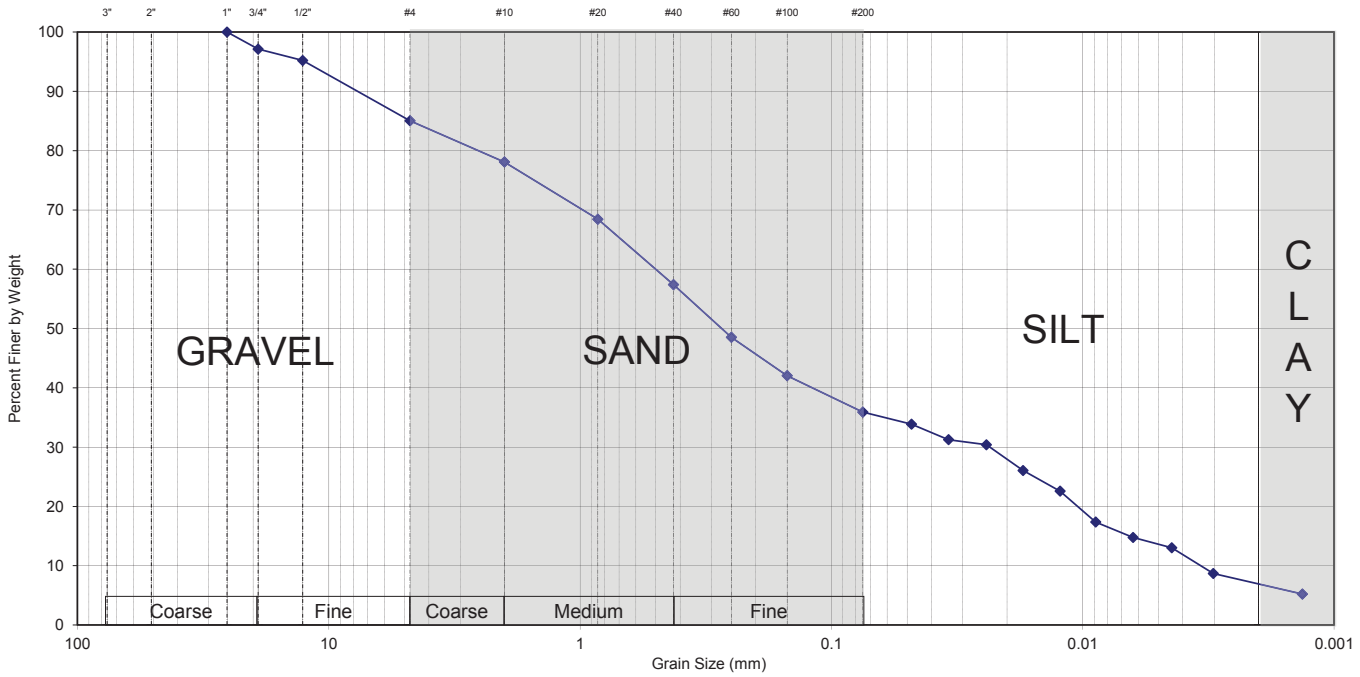
Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
18	B.11-06	S-5A	50-52'	Gray Clayey SILT and f-c SAND, little fine Gravel	50.3			

THIELSCH ENGINEERING

AVRRDD Mt. Carberry Landfill
Berlin, NH
Thielsch CTS File # 74-11-0051.19

Tested by: PEC Date: 12/12/11
Reviewed by: MBP Date: 12/13/11

U.S. STANDARD SIEVE AND HYDROMETER



Gravel	Sand	Fines
15.0%	49.1%	35.9%

Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
19	B.11-06	S-5B	50-52'	Black f-c SAND and SILT, little f-c Gravel	51.1			

THIELSCH ENGINEERING

AVRRDD Mt. Carberry Landfill
Berlin, NH
Thielsch CTS File # 74-11-0051.19
Tested by: PEC Date: 12/12/11
Reviewed by: MBP Date: 12/13/11

GEOTECHNICAL LABORATORY TESTING DATA SHEET

Project Name AVRRDD Mt. Carberry Landfill | Project Location Berlin, NH | Reviewed By

Project No. CTS-74-11-0051.19 | Assigned By R. Grillo

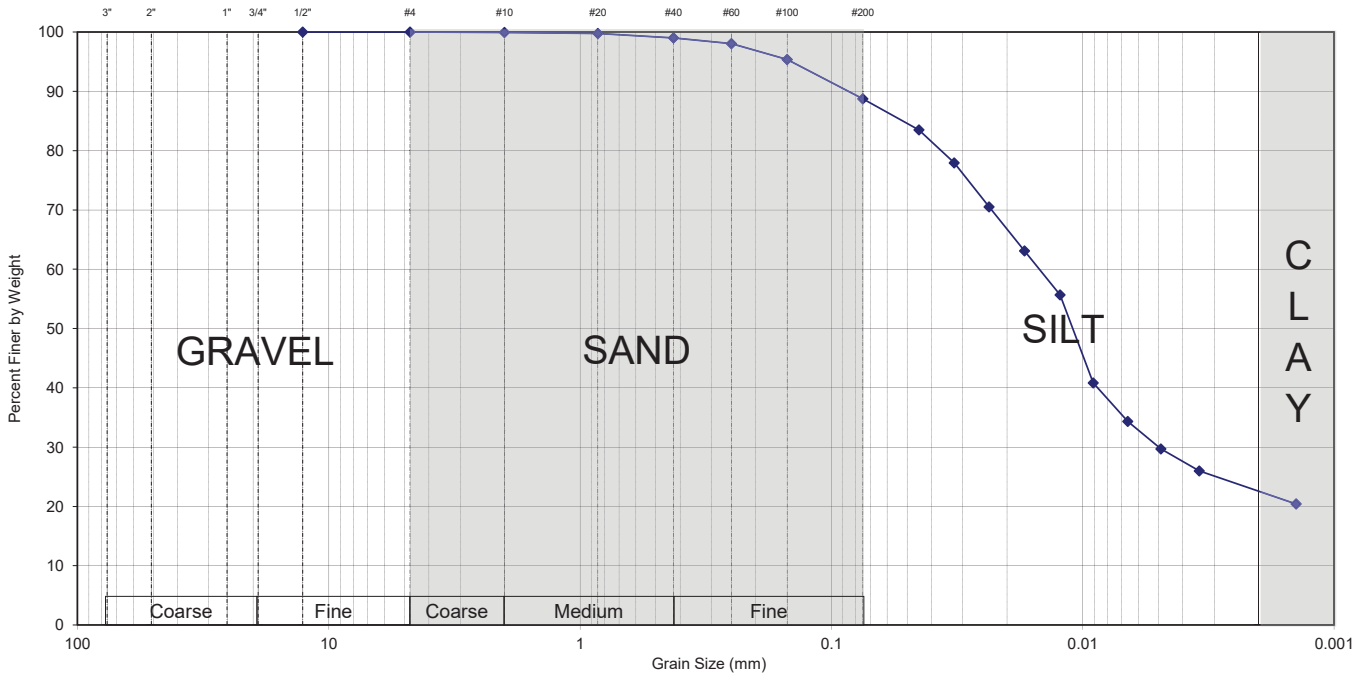
Project Manager M. Polsky | Date 12/16/2011 | Date Reviewed 12/16/2011

Boring/ Test Pit No.	Sample No.	Depth ft.	Lab No.	Identification Tests: Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	pH	Dry unit wt. pcf	Strength Tests: Torvane or Type Test	σ_c psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	Laboratory Log and Soil Description
B.11-06	S-3	30-32	15	58.0	188	53	88	23	1.3	8.97							Black CLAY little fine Sand
				84.9							44.1	CIU	2510	σ_1/σ_3 Max	925	3.5	
											48.7	CIU	5000	σ_1/σ_3 Max	1744	5.3	
											51.5	CIU	10000	σ_1/σ_3 Max	2393	15.9	

Note: Material classifications are based on particle size and atterberg limit tests. These classifications do not reflect the sample composition, which includes material other than soil.

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106 South Street
Hopkinton, MA 01748 508-435-9244

U.S. STANDARD SIEVE AND HYDROMETER



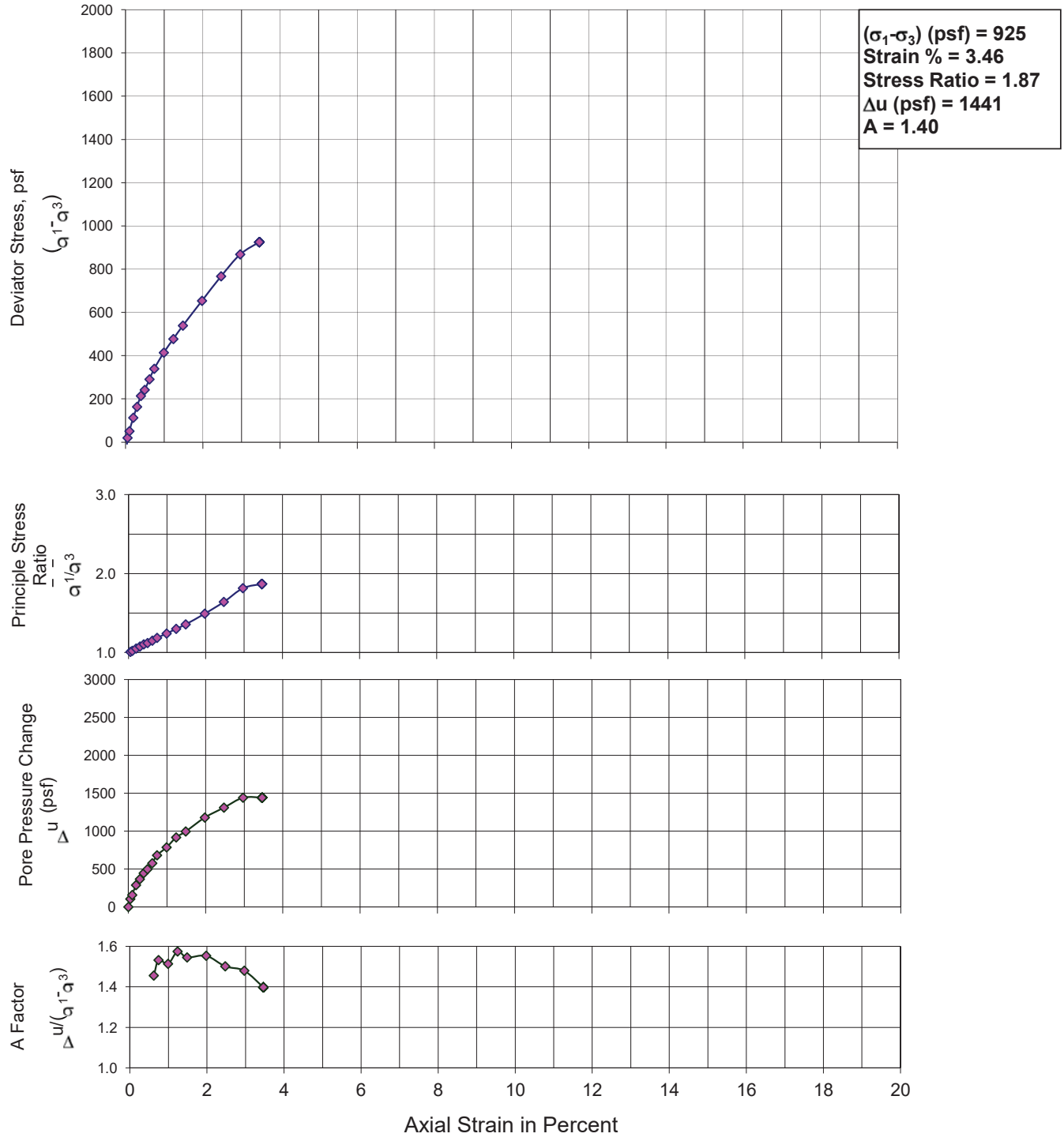
Gravel	Sand	Fines
0.0%	11.3%	88.7%

Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
15	B.11-06	S-3	30-32'	Black CLAY, little fine Sand	58.0			

THIELSCH ENGINEERING

AVRRDD Mt. Carberry Landfill
Berlin, NH
Thielsch CTS File # 74-11-0051.19

Tested by: AS Date: 12/13/11
Reviewed by: MBP Date: 12/15/11



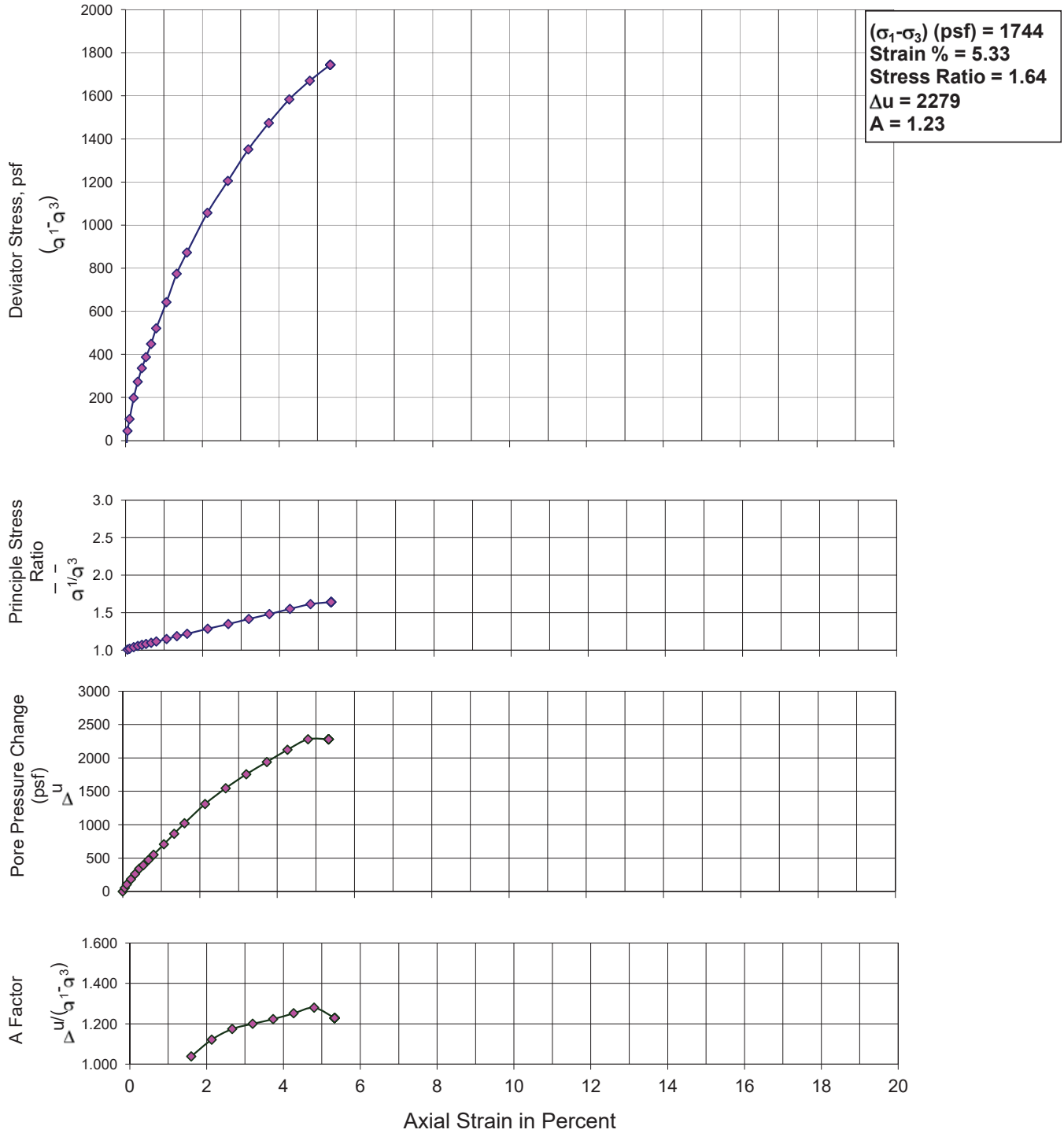
THIELSCH ENGINEERING

SOIL DESCRIPTION:	See Summary Sheet		
LIQUID LIMIT: 188	PLASTIC LIMIT: 53	SPECIFIC GRAVITY:	NT

TEST NO. / SYMBOL	INITIAL CONDITIONS				CONDITIONS BEFORE SHEAR				FINAL CONDITIONS		RATE OF STRAIN, PERCENT PER MINUTE
	INITIAL WATER CONTENT, %	INITIAL DRY UNIT WEIGHT, pcf	SAMPLE HEIGHT, IN.	SAMPLE DIAMETER, IN.	INITIAL STRESS, ksf $\sigma_1-\sigma_3$	FINAL BACK PRESSURE, ksf	VOLUMETRIC STRAIN, %	PORE PRESSURE RESPONSE, %	FINAL WATER CONTENT, %	FINAL DRY UNIT WEIGHT, pcf	
Tr 15.1.1	84.9	44.1	4.07	2.02	2.51	5.76	2.20	96.4	82.9	45.0	0.059

AVRRDD Mt. Carberry Landfill
Berlin, NH
TRIAXIAL COMPRESSION TESTS (CIU)

BORING: B.11-06	FILE NO: 74-11-0051.19
SAMPLE: S-3	Date: 12/13/11
DEPTH: 30-32'	Tech.: AS
TEST NO: Tr 15.1.1	Reviewer: MBP



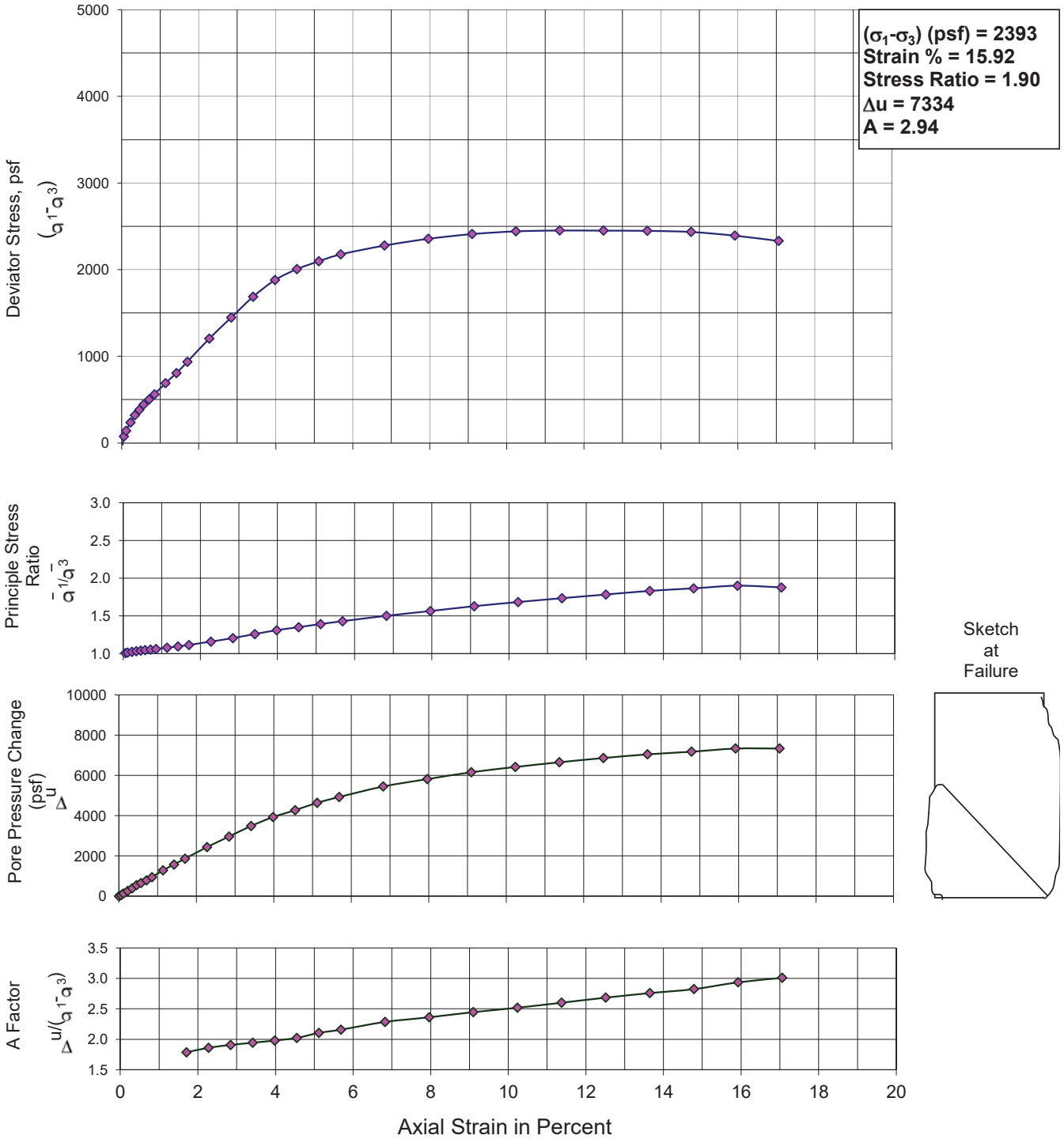
THIELSCH ENGINEERING

SOIL DESCRIPTION:	See Summary Sheet		
LIQUID LIMIT: 188	PLASTI C LIMIT: 53	SPECIFIC GRAVITY:	NT

TEST NO. / SYMBOL	INITIAL CONDITIONS: INITIAL WATER CONTENT, %	INITIAL DRY UNIT WEIGHT, pcf	SAMPLE HEIGHT, IN.	SAMPLE DIAMETER, IN.	CONDITIONS BEFORE SHEAR: INITIAL STRESS, ksf σ_3	FINAL BACK PRESSURE, ksf	VOLUMETRIC STRAIN, %	PORE PRESSURE RESPONSE, %	FINAL CONDITIONS: FINAL WATER CONTENT, %	FINAL DRY UNIT WEIGHT, %	RATE OF STRAIN, PERCENT PER MINUTE
T15.1.2	84.9	48.7	3.79	2	5.00	4.3	2.68	96.4	82.9	50.1	0.063

AVRRDD Mt. Carberry Landfill
Berlin, NH
TRIAXIAL COMPRESSION TESTS (CIU)

BORING: B.11-06	FILE NO: 74-11-0051.19
SAMPLE: S-3	Date: 12/12/11
DEPTH: 30-32'	Tech.: AS
TEST NO: T15.1.2	Reviewer: MBP



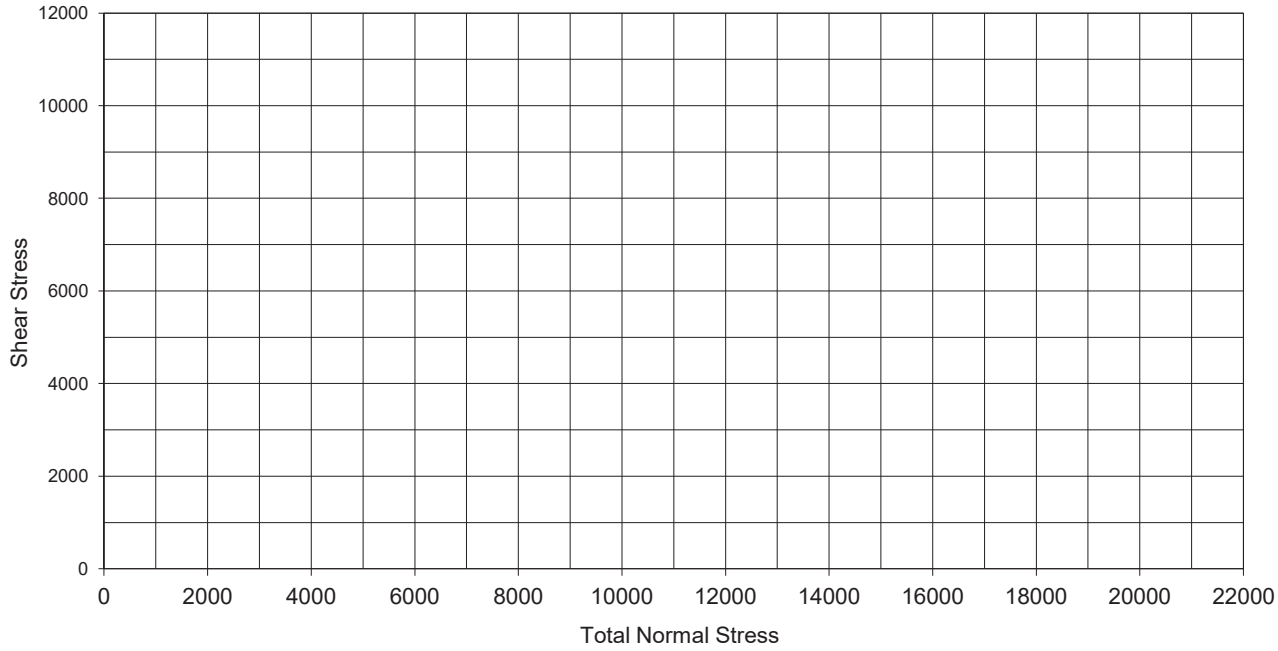
THIELSCH ENGINEERING

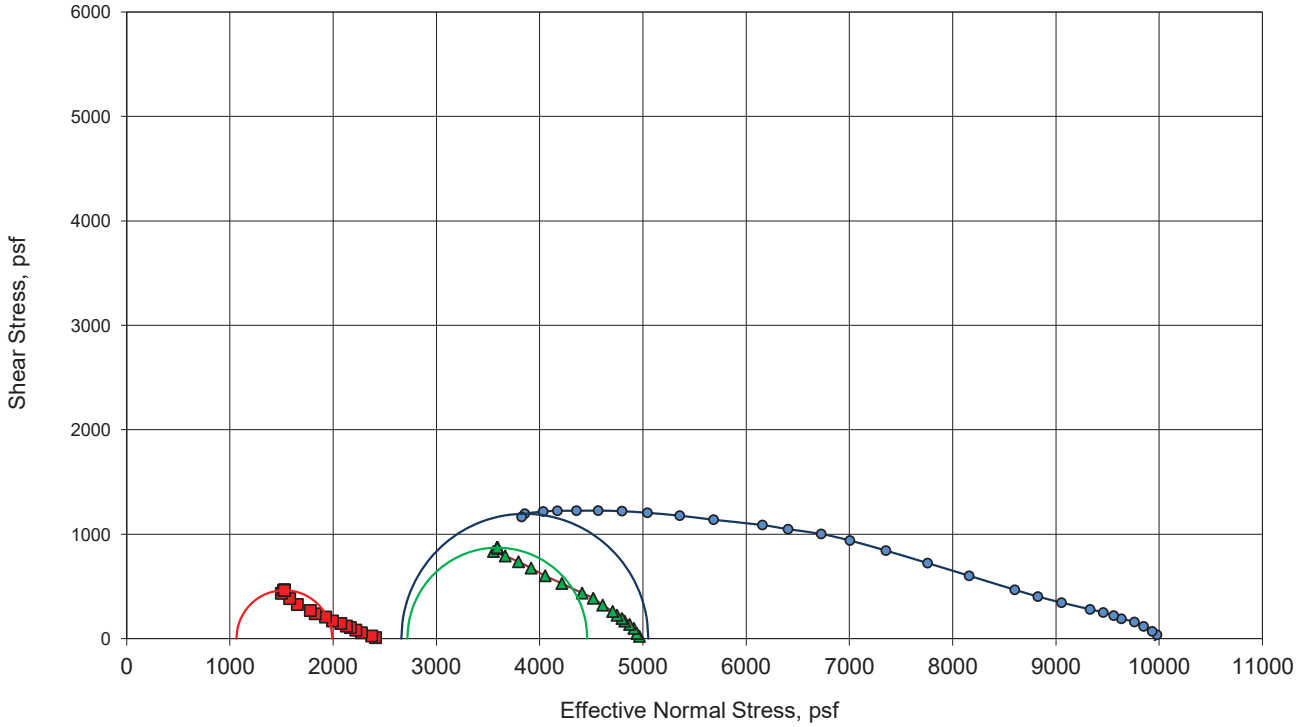
SOIL DESCRIPTION:	See Summary Sheet		
LIQUID LIMIT: 188	PLASTI C LIMIT: 53	SPECIFIC GRAVITY:	NT

TEST NO. / SYMBOL	INITIAL CONDITIONS: INITIAL WATER CONTENT, %	INITIAL DRY UNIT WEIGHT, pcf	SAMPLE HEIGHT, IN.	SAMPLE DIAMETER, IN.	CONDITIONS BEFORE SHEAR: INITIAL STRESS, ksf σ_3	FINAL BACK PRESSURE, ksf	VOLUMETRIC STRAIN, %	PORE PRESSURE RESPONSE, %	FINAL CONDITIONS: FINAL WATER CONTENT, %	FINAL DRY UNIT WEIGHT, %	RATE OF STRAIN, PERCENT PER MINUTE
T15.1.3	84.9	51.5	3.54	2.01	9.99	4.3	1.74	96.4	82.9	52.4	0.068

AVRRDD Mt. Carberry Landfill
Berlin, NH
TRIAXIAL COMPRESSION TESTS (CIU)

BORING: B.11-06	FILE NO: 74-11-0051.19
SAMPLE: S-3	Date: 12/14/11
DEPTH: 30-32'	Tech.: AS
TEST NO: T15.1.2	Reviewer: MBP





SOIL DESCRIPTION:	See Summary Sheet				
LIQUID LIMIT:	188	PLASTI C LIMIT:	53	SPECIFIC GRAVITY:	NT

FAILURE CRITERIA: σ_1/σ_3 MAX

REMARKS:

THIELSCH ENGINEERING

AVRRDD Mt. Carberry Landfill
Berlin, NH
TRIAXIAL COMPRESSION TESTS (CIU)

BORING: B.11-06	FILE NO: 74-11-0051.19
SAMPLE: S-3	Date: 12/14/11
DEPTH: 30-32'	Tech.: AS
TEST SERIES: 8	Reviewer: MBP

ATTACHMENT D – STABILITY ANALYSES

Attachment D.1- Existing Conditions Waste Stability/Sensitivity Analyses

CMA ENGINEERS, Inc. Civil/Environmental Engineers 35 Bow Street Portsmouth, NH 03801	Project: AVRRDD Mt. Carberry Landfill Phase 5&6 Success, New Hampshire Project No: 778 Date: February 2012 Calc. By: RJG Chkd. By:

OBJECTIVE: To evaluate the factor of safety against failure through the waste, foundation soils, and lining system.

GIVEN: Final waste grades prepared by CMA Engineers, and base grades per grading plans and liner system schematics prepared for Stages 1 through 4 prepared by SME in design/record drawings for previous stages.

METHOD: Slope/W Version 5 by Geo-Slope Inc. slope stability program

CRITICAL SECTION: A – A' north-south through Stages 1 – 4 per Figure 2.

Strength Properties

Interface/Material	φ degrees, c psf	Basis
Drainage sand/drainage geocomposite	28 degrees, 0 psf	file test data
Drainage geocomposite/smooth liner	16 degrees, 40 psf	file test data
Liner/glacial till	22 degrees, 0 psf	literature
ASSUMED LINER STRENGTH	**16 degrees, 40 psf**	
C&D/Auto Fluff WASTE	**33 degrees, 500 psf**	literature
SLUDGE WASTE DESIGN STRENGTH	**22 degrees**	blow counts
LOWER BOUND SLUDGE STRENGTH	**12.5 degrees, 0 psf**	analyses
GLACIAL TILL	**36 degrees, 0 psf**	blow counts

Note: A lower bound sludge waste shear strength was calculated by evaluating the stability of existing stable Stage 1 through 4 waste slopes and varying the sludge strength to produce a factor of safety of 1.0.

RESULTS for Section A – A':

Condition	Waste Strength	Min. Factor of Safety	Acceptable Factor of Safety
Existing Conditions	Lower Bound		
• Shallow sloughing		1.0	N/A
• Rotational waste failure		1.5	N/A
• Liner interface failure		2.0	N/A
Stage 5&6 Buildout	Design Values		
• Shallow sloughing		2.1	1.5
• Rotational waste failure		2.1	1.5
• Liner interface failure		2.0	1.5
• Foundation failure		3.1	1.5
	Lower Bound		
• Shallow sloughing		1.0	N/A
• Rotational waste failure		1.7	1.0
• Liner interface failure		1.9	1.0

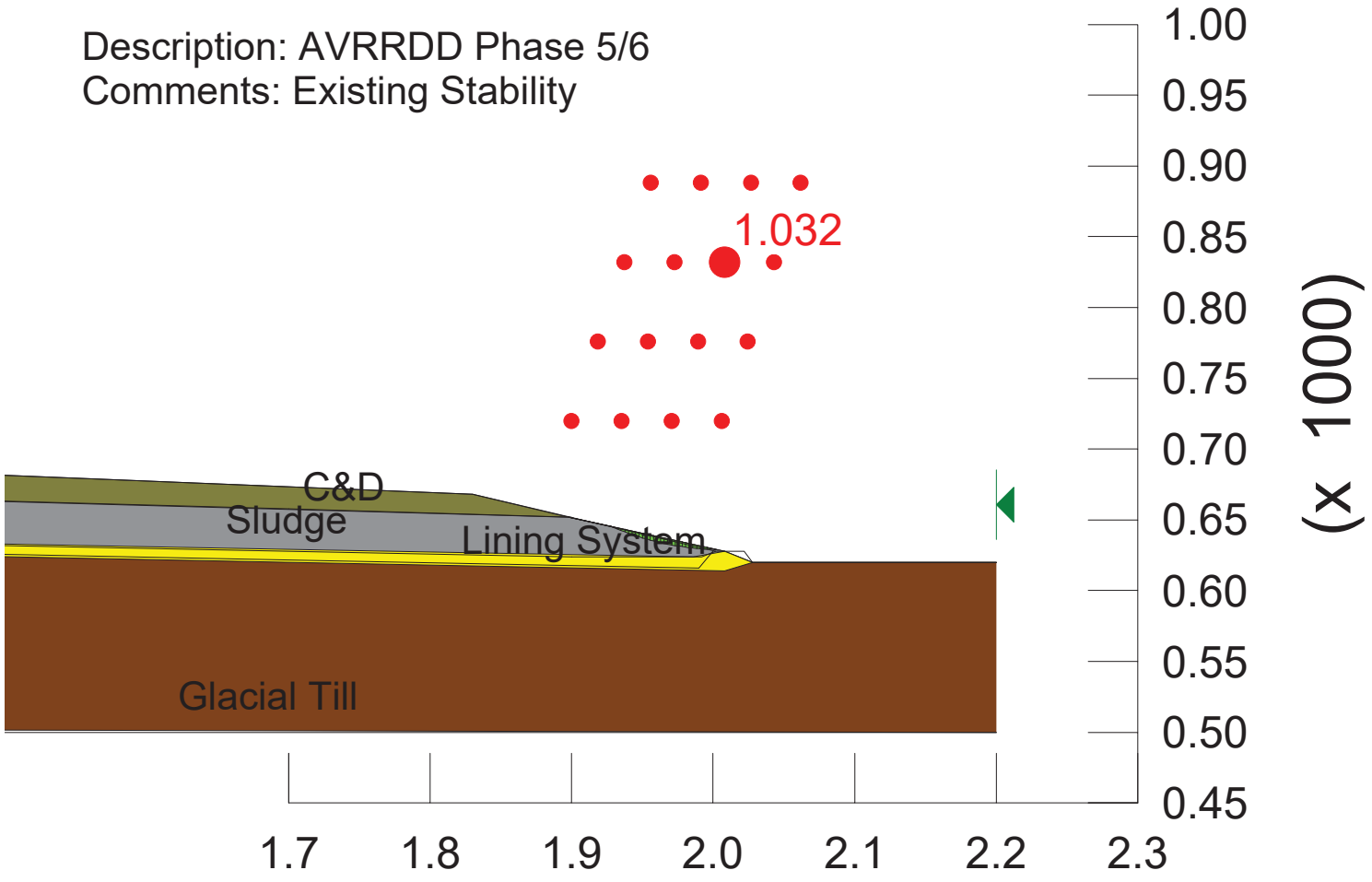
All Soils
Soil 1
C&D
Soil Model	Mohr-Coulomb
Unit Weight	90
Cohesion	500
Phi	33
Piezometric Line #	0
Ru	0
Pore-Air Pressure	0

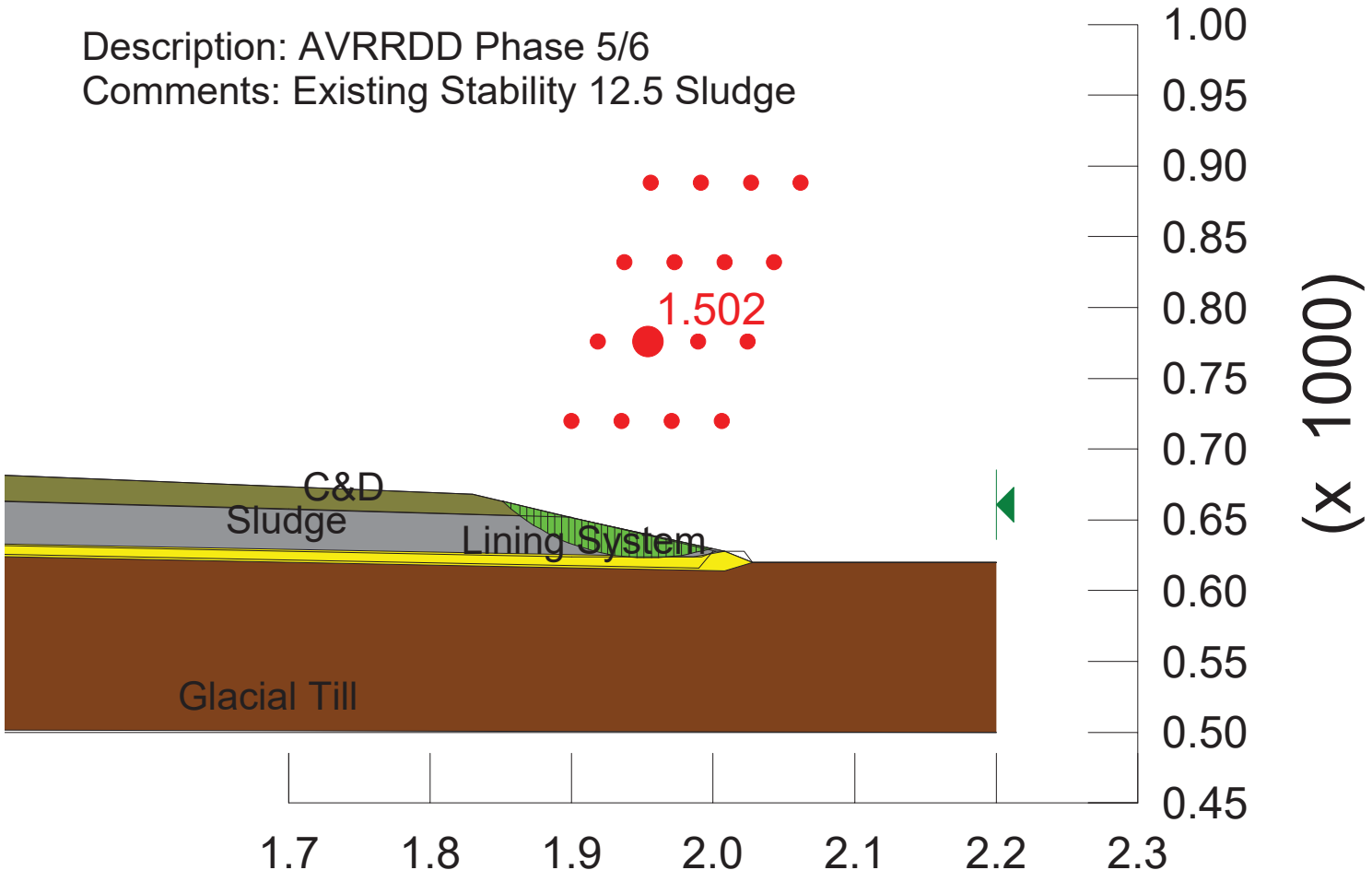
Soil 2
Sludge
Soil Model	Mohr-Coulomb
Unit Weight	80
Cohesion	0
Phi	12.5
Piezometric Line #	0
Ru	0
Pore-Air Pressure	0

Soil 3
Lining System
Soil Model	Mohr-Coulomb
Unit Weight	120
Cohesion	40
Phi	16
Piezometric Line #	0
Ru	0
Pore-Air Pressure	0

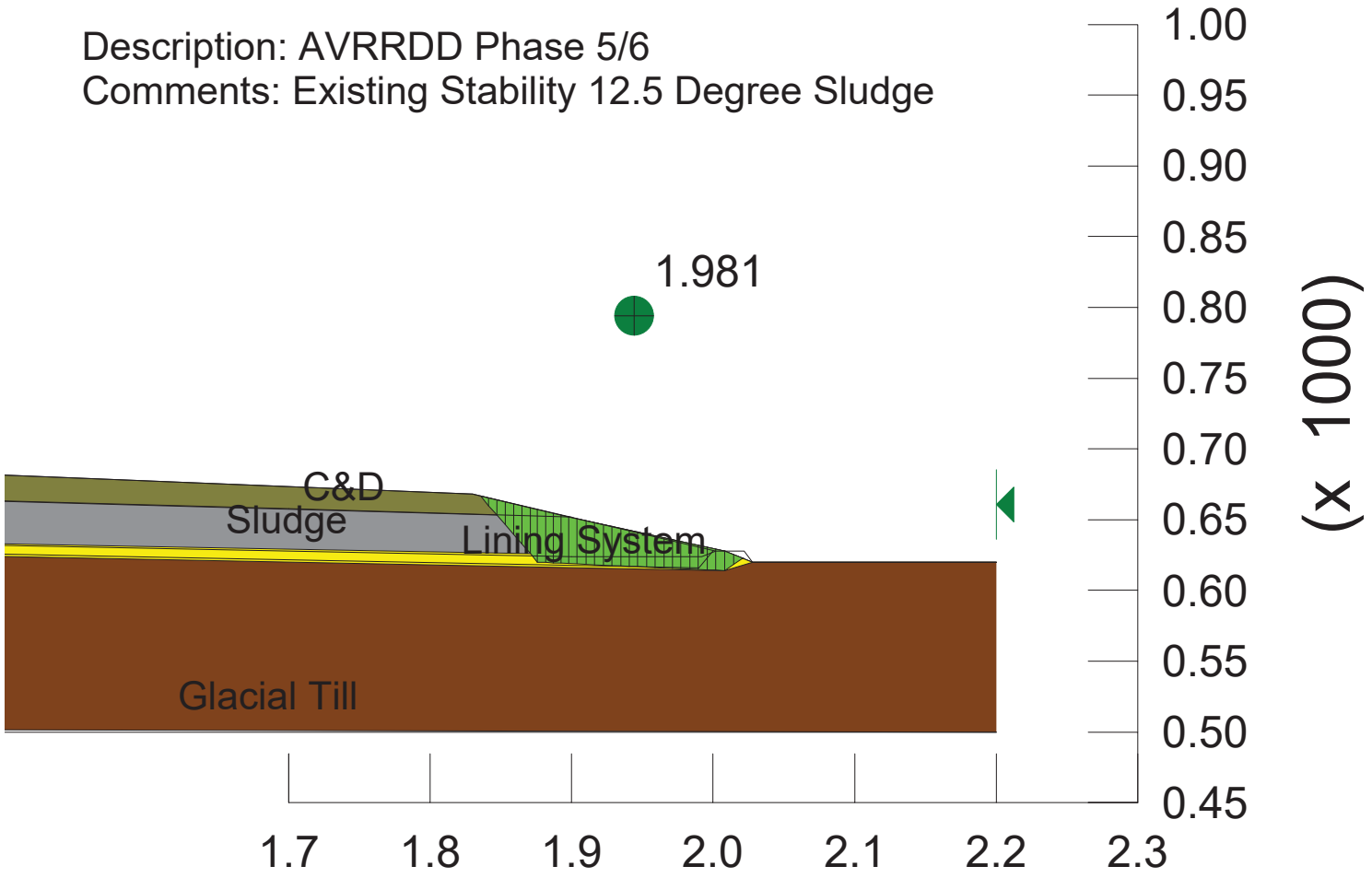
Soil 4
Glacial Till
Soil Model	Mohr-Coulomb
Unit Weight	135
Cohesion	0
Phi	36
Piezometric Line #	0
Ru	0
Pore-Air Pressure	0

Soil 5
Bedrock
Soil Model	Bedrock
Piezometric Line #	0
Ru	0
Pore-Air Pressure	0


Description: AVRRDD Phase 5/6
Comments: Existing Stability
1.032
C&D
Sludge
Lining System
Glacial Till
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
(x 1000)
1.7
1.8
1.9
2.0
2.1
2.2
2.3


Description: AVRRDD Phase 5/6
Comments: Existing Stability 12.5 Sludge
1.502
C&D
Sludge
Lining System
Glacial Till
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
(x 1000)
1.7
1.8
1.9
2.0
2.1
2.2
2.3

Description: AVRRDD Phase 5/6
Comments: Existing Stability 12.5 Degree Sludge



Attachment D.2 – Stage 5 & 6 Waste Stability

CMA ENGINEERS, Inc. Civil/Environmental Engineers 35 Bow Street Portsmouth, NH 03801	Project: AVRRDD Mt. Carberry Landfill Phase 5&6 Success, New Hampshire Project No: 778 Date: February 2012 Calc. By: RJG Chkd. By:

OBJECTIVE: To evaluate the factor of safety against failure through the waste, foundation soils, and lining system.

GIVEN: Final waste grades prepared by CMA Engineers, and base grades per grading plans and liner system schematics prepared for Stages 1 through 4 prepared by SME in design/record drawings for previous stages.

METHOD: Slope/W Version 5 by Geo-Slope Inc. slope stability program

CRITICAL SECTION: A – A' north-south through Stages 1 – 4 per Figure 2.

Strength Properties

Interface/Material	φ degrees, c psf	Basis
Drainage sand/drainage geocomposite	28 degrees, 0 psf	file test data
Drainage geocomposite/smooth liner	16 degrees, 40 psf	file test data
Liner/glacial till	22 degrees, 0 psf	literature
ASSUMED LINER STRENGTH	**16 degrees, 40 psf**	
C&D/Auto Fluff WASTE	**33 degrees, 500 psf**	literature
SLUDGE WASTE DESIGN STRENGTH	**22 degrees**	blow counts
LOWER BOUND SLUDGE STRENGTH	**12.5 degrees, 0 psf**	analyses
GLACIAL TILL	**36 degrees, 0 psf**	blow counts

Note: A lower bound sludge waste shear strength was calculated by evaluating the stability of existing stable Stage 1 through 4 waste slopes and varying the sludge strength to produce a factor of safety of 1.0.

RESULTS for Section A – A':

Condition	Waste Strength	Min. Factor of Safety	Acceptable Factor of Safety
Existing Conditions	Lower Bound		
• Shallow sloughing		1.0	N/A
• Rotational waste failure		1.5	N/A
• Liner interface failure		2.0	N/A
Stage 5&6 Buildout	Design Values		
• Shallow sloughing		2.1	1.5
• Rotational waste failure		2.1	1.5
• Liner interface failure		2.0	1.5
• Foundation failure		3.1	1.5
	Lower Bound		
• Shallow sloughing		1.0	N/A
• Rotational waste failure		1.7	1.0
• Liner interface failure		1.9	1.0

All Soils
Soil 1
C&D
Soil Model	Mohr-Coulomb
Unit Weight	90
Cohesion	500
Phi	33
Piezometric Line #	0
Ru	0
Pore-Air Pressure	0

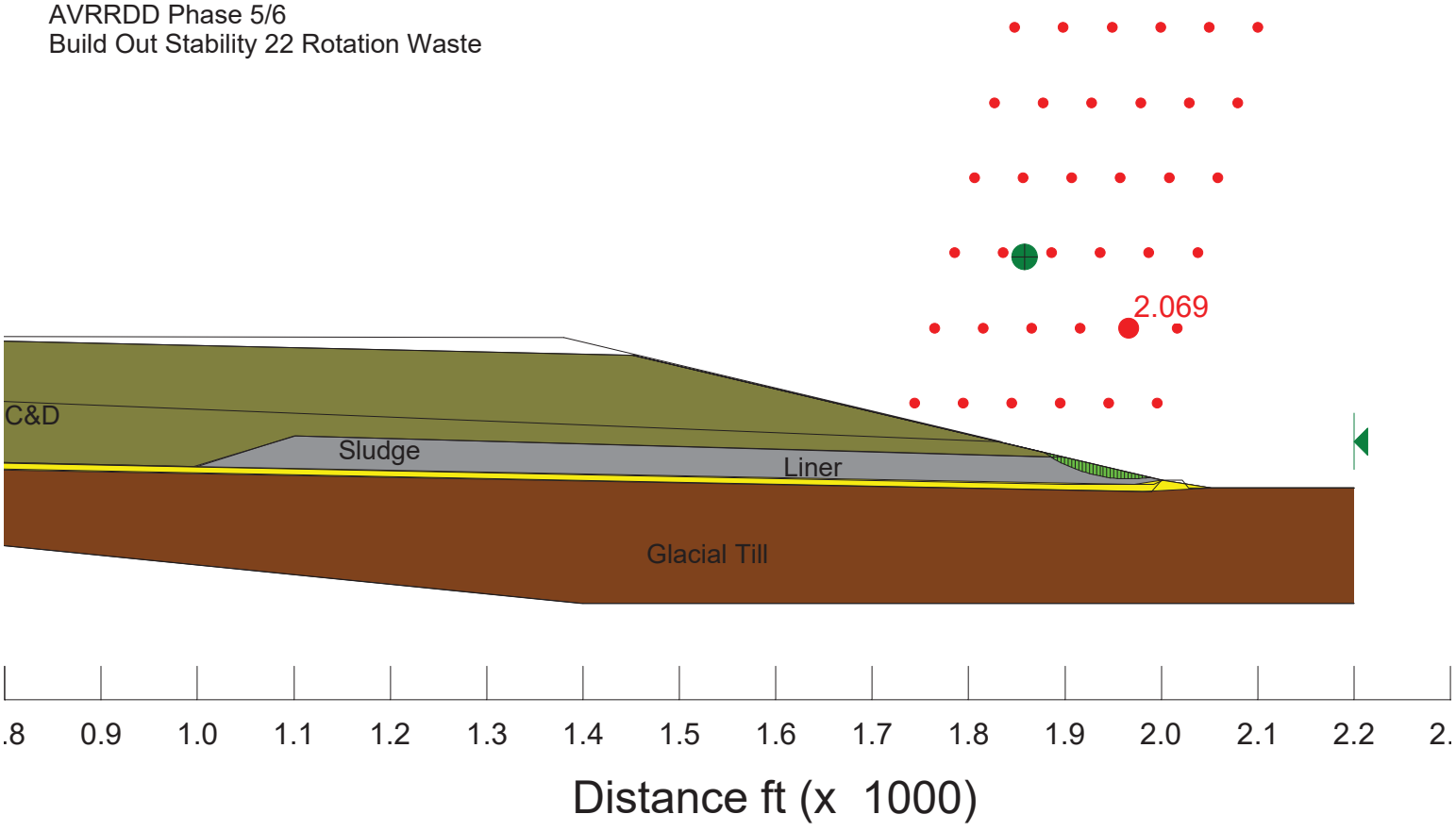
Soil 2
Sludge
Soil Model	Mohr-Coulomb
Unit Weight	80
Cohesion	0
Phi	22
Piezometric Line #	0
Ru	0
Pore-Air Pressure	0

Soil 3
Lining System
Soil Model	Mohr-Coulomb
Unit Weight	120
Cohesion	40
Phi	16
Piezometric Line #	0
Ru	0
Pore-Air Pressure	0

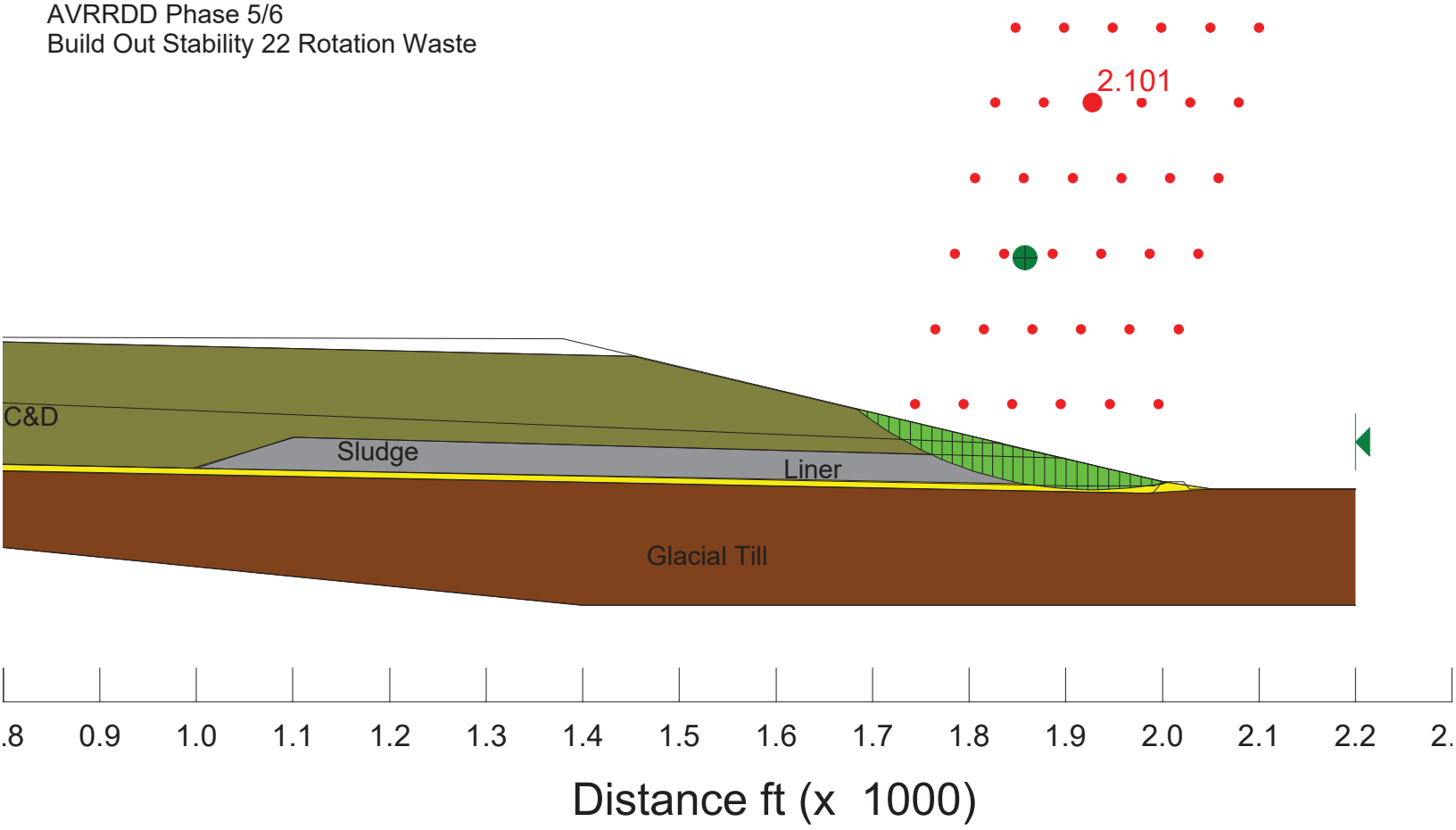
Soil 4
Glacial Till
Soil Model	Mohr-Coulomb
Unit Weight	135
Cohesion	0
Phi	36
Piezometric Line #	0
Ru	0
Pore-Air Pressure	0

Soil 5
Bedrock
Soil Model	Bedrock
Piezometric Line #	0
Ru	0
Pore-Air Pressure	0

AVRRDD Phase 5/6
Build Out Stability 22 Rotation Waste



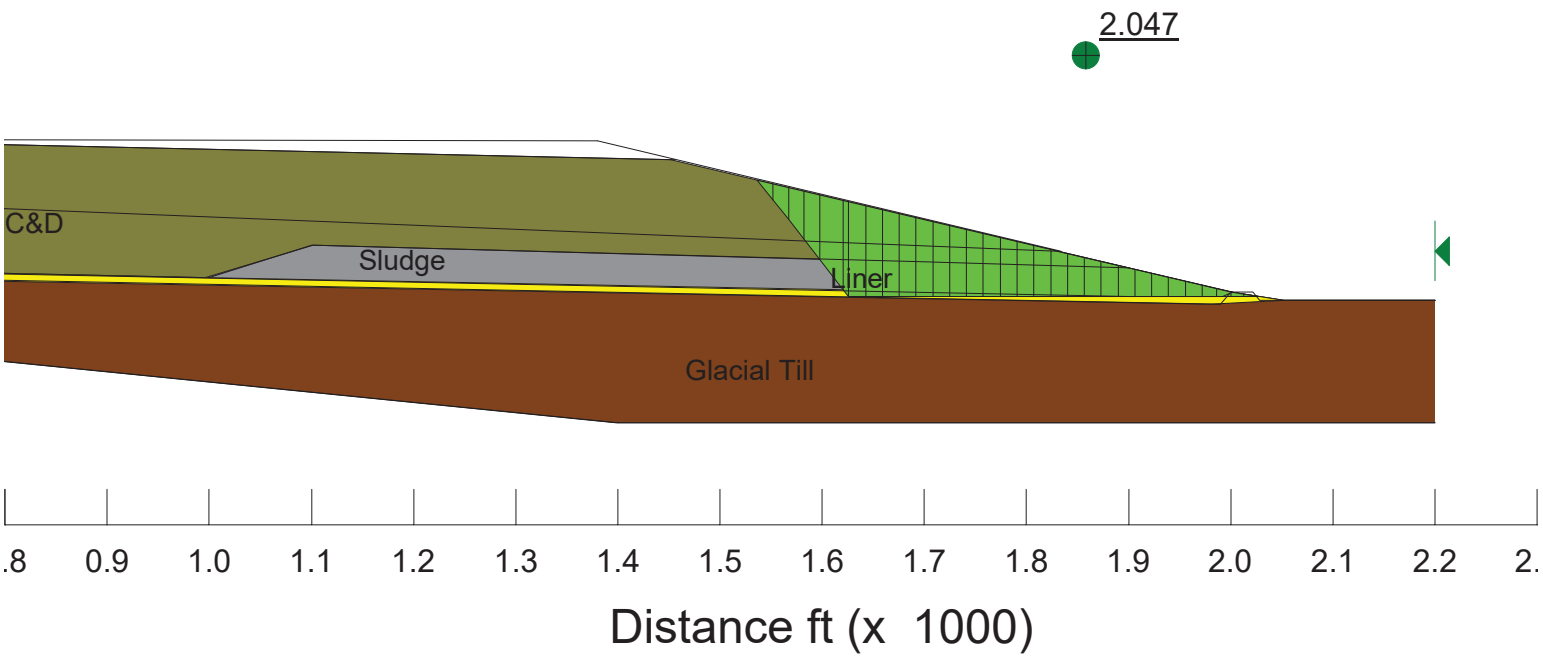
AVRRDD Phase 5/6
Build Out Stability 22 Rotation Waste



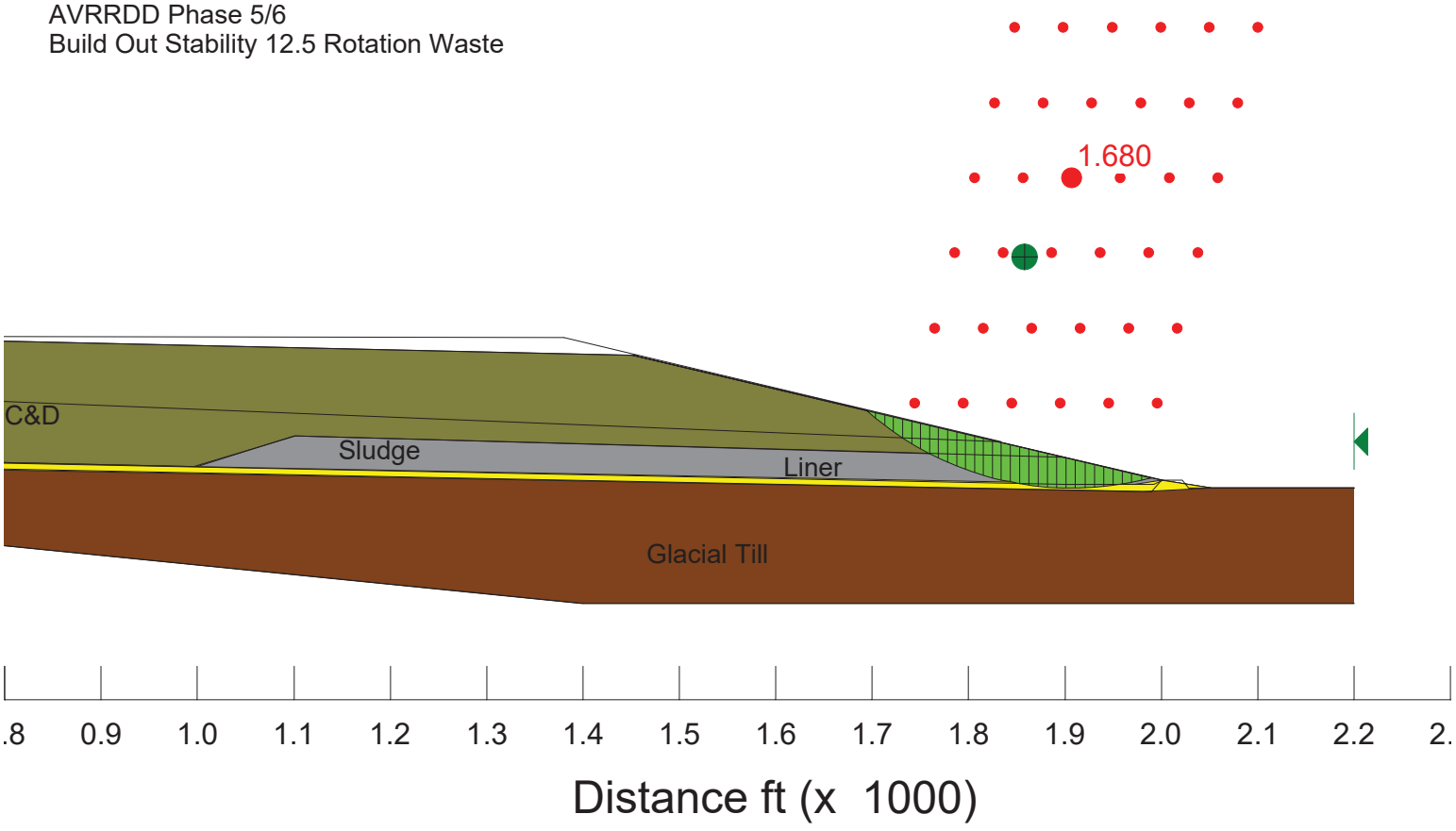
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Distance ft (x 1000)

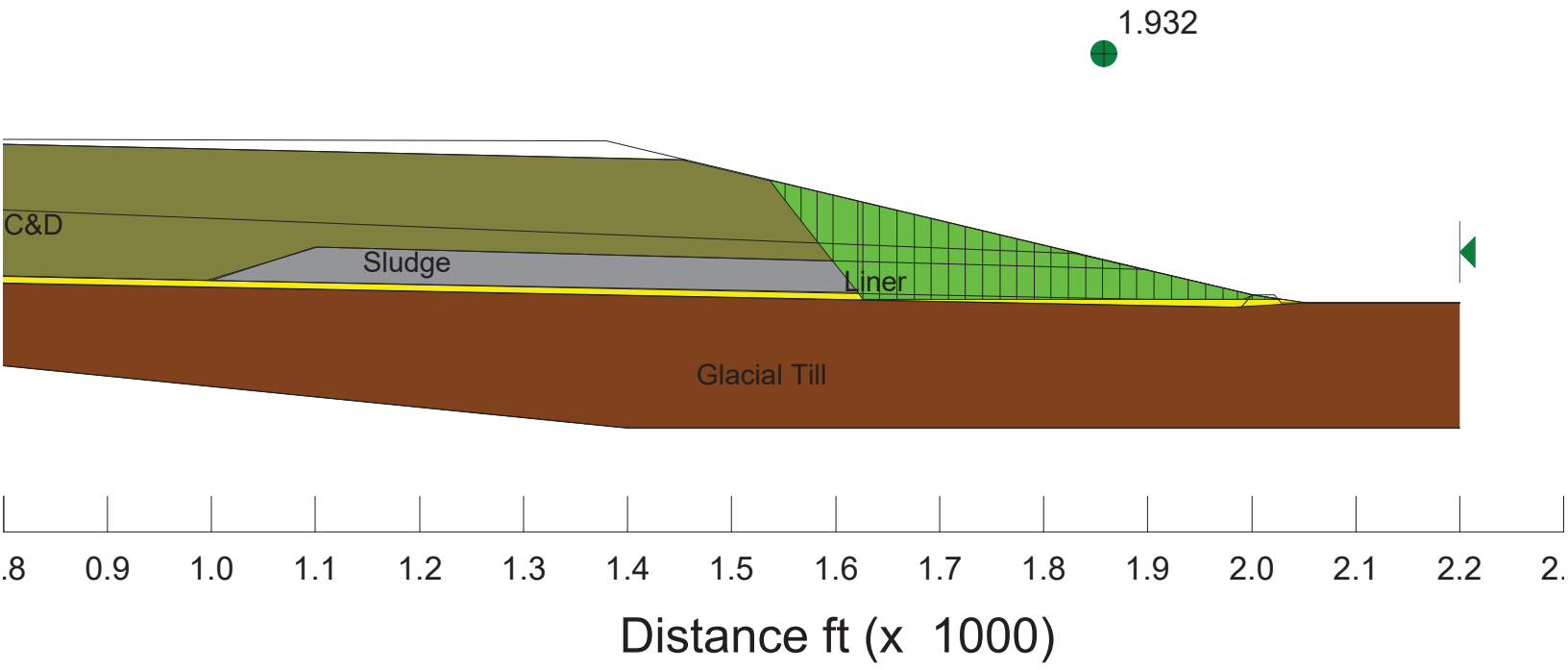
AVRRDD Phase 5/6
Build Out Stability 22 Liner



AVRRDD Phase 5/6
Build Out Stability 12.5 Rotation Waste



AVRRDD Phase 5/6
Build Out Stability 12.5



Attachment D.3 – Deep Rotational Foundation Stability

CMA ENGINEERS, Inc. Civil/Environmental Engineers 35 Bow Street Portsmouth, NH 03801	Project: AVRRDD Mt. Carberry Landfill Phase 5&6 Success, New Hampshire Project No: 778 Date: February 2012 Calc. By: RJG Chkd. By:

OBJECTIVE: To evaluate the factor of safety against failure through the waste, foundation soils, and lining system.

GIVEN: Final waste grades prepared by CMA Engineers, and base grades per grading plans and liner system schematics prepared for Stages 1 through 4 prepared by SME in design/record drawings for previous stages.

METHOD: Slope/W Version 5 by Geo-Slope Inc. slope stability program

CRITICAL SECTION: A – A' north-south through Stages 1 – 4 per Figure 2.

Strength Properties

Interface/Material	φ degrees, c psf	Basis
Drainage sand/drainage geocomposite	28 degrees, 0 psf	file test data
Drainage geocomposite/smooth liner	16 degrees, 40 psf	file test data
Liner/glacial till	22 degrees, 0 psf	literature
ASSUMED LINER STRENGTH	**16 degrees, 40 psf**	
C&D/Auto Fluff WASTE	**33 degrees, 500 psf**	literature
SLUDGE WASTE DESIGN STRENGTH	**22 degrees**	blow counts
LOWER BOUND SLUDGE STRENGTH	**12.5 degrees, 0 psf**	analyses
GLACIAL TILL	**36 degrees, 0 psf**	blow counts

Note: A lower bound sludge waste shear strength was calculated by evaluating the stability of existing stable Stage 1 through 4 waste slopes and varying the sludge strength to produce a factor of safety of 1.0.

RESULTS for Section A – A':

Condition	Waste Strength	Min. Factor of Safety	Acceptable Factor of Safety
Existing Conditions	Lower Bound		
• Shallow sloughing		1.0	N/A
• Rotational waste failure		1.5	N/A
• Liner interface failure		2.0	N/A
Stage 5&6 Buildout	Design Values		
• Shallow sloughing		2.1	1.5
• Rotational waste failure		2.1	1.5
• Liner interface failure		2.0	1.5
• Foundation failure		3.1	1.5
	Lower Bound		
• Shallow sloughing		1.0	N/A
• Rotational waste failure		1.7	1.0
• Liner interface failure		1.9	1.0

All Soils
Soil 1
C&D
Soil Model	Mohr-Coulomb
Unit Weight	90
Cohesion	500
Phi	33
Piezometric Line #	0
Ru	0
Pore-Air Pressure	0

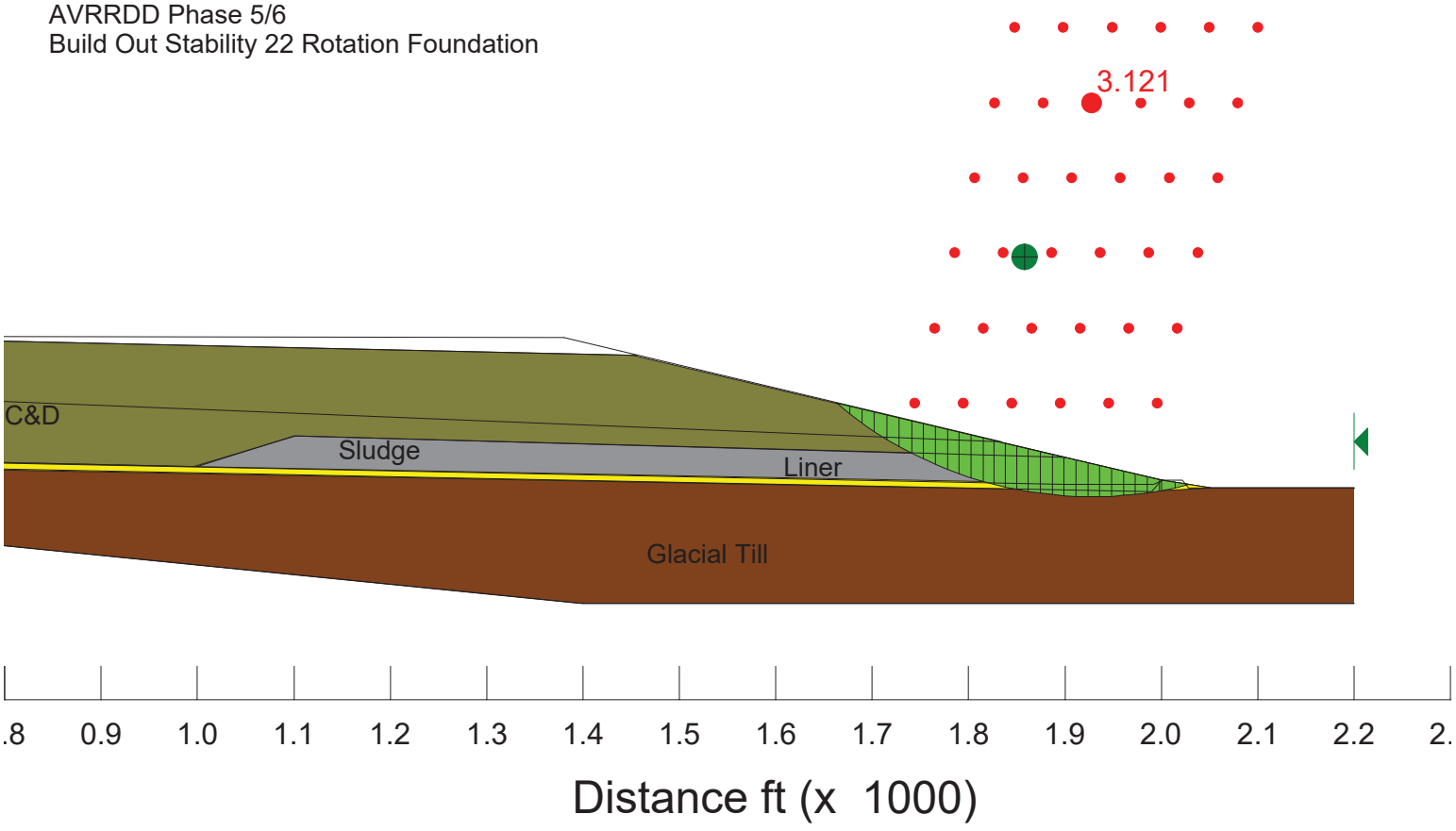
Soil 2
Sludge
Soil Model	Mohr-Coulomb
Unit Weight	80
Cohesion	0
Phi	22
Piezometric Line #	0
Ru	0
Pore-Air Pressure	0

Soil 3
Lining System
Soil Model	Mohr-Coulomb
Unit Weight	120
Cohesion	40
Phi	16
Piezometric Line #	0
Ru	0
Pore-Air Pressure	0

Soil 4
Glacial Till
Soil Model	Mohr-Coulomb
Unit Weight	135
Cohesion	0
Phi	36
Piezometric Line #	0
Ru	0
Pore-Air Pressure	0

Soil 5
Bedrock
Soil Model	Bedrock
Piezometric Line #	0
Ru	0
Pore-Air Pressure	0

AVRRDD Phase 5/6
Build Out Stability 22 Rotation Foundation



Attachment D.4 – Seismic Stability

CMA ENGINEERS, Inc. Civil/Environmental Engineers 35 Bow Street Portsmouth, NH 03801	Project: AVRRDD Mt. Carberry Landfill Stage 5&6 Success, New Hampshire Project No: 778 Date: February 2012 Calc. By: RJG Chkd. By:

OBJECTIVE: To evaluate the expected displacement in the liner from a design earthquake with a 10% probability of exceedance in 250 years.

GIVEN: Critical section and waste/liner properties and grades from previous static loading calculation.

REFERENCES: RCRA Subtitle D Seismic Design Guidance for Municipal Solid Waste Landfill Facilities, EPA, April 1995.

Makdisi and Seed, "Simplified Procedures for Estimating Dam and Embankment Earthquake Induced Displacements," Journal of Geotechnical Engineering, July 1978.

Idriss, "Response of Soft Soil Sites During Earthquakes," Proceedings Symposium to Professor H.B. Seed, Berkeley, CA, 1990.

ASSUMPTIONS: Apply pseudo-static stability analyses to critical stability section using same waste/interface shear strengths.

PROCEDURE:
1. Determine seismic coefficient (average maximum earthquake induced acceleration in the waste mass above the sliding surface).
2. Determine the yield acceleration using pseudo-static stability analyses (Slope/W).
3. Compare yield and seismic coefficient accelerations. If the seismic coefficient acceleration exceeds the yield acceleration, estimate the magnitude of displacement, and assess the effects on the landfill from estimated permanent displacements.

<u>Determine Seismic Coefficient</u>

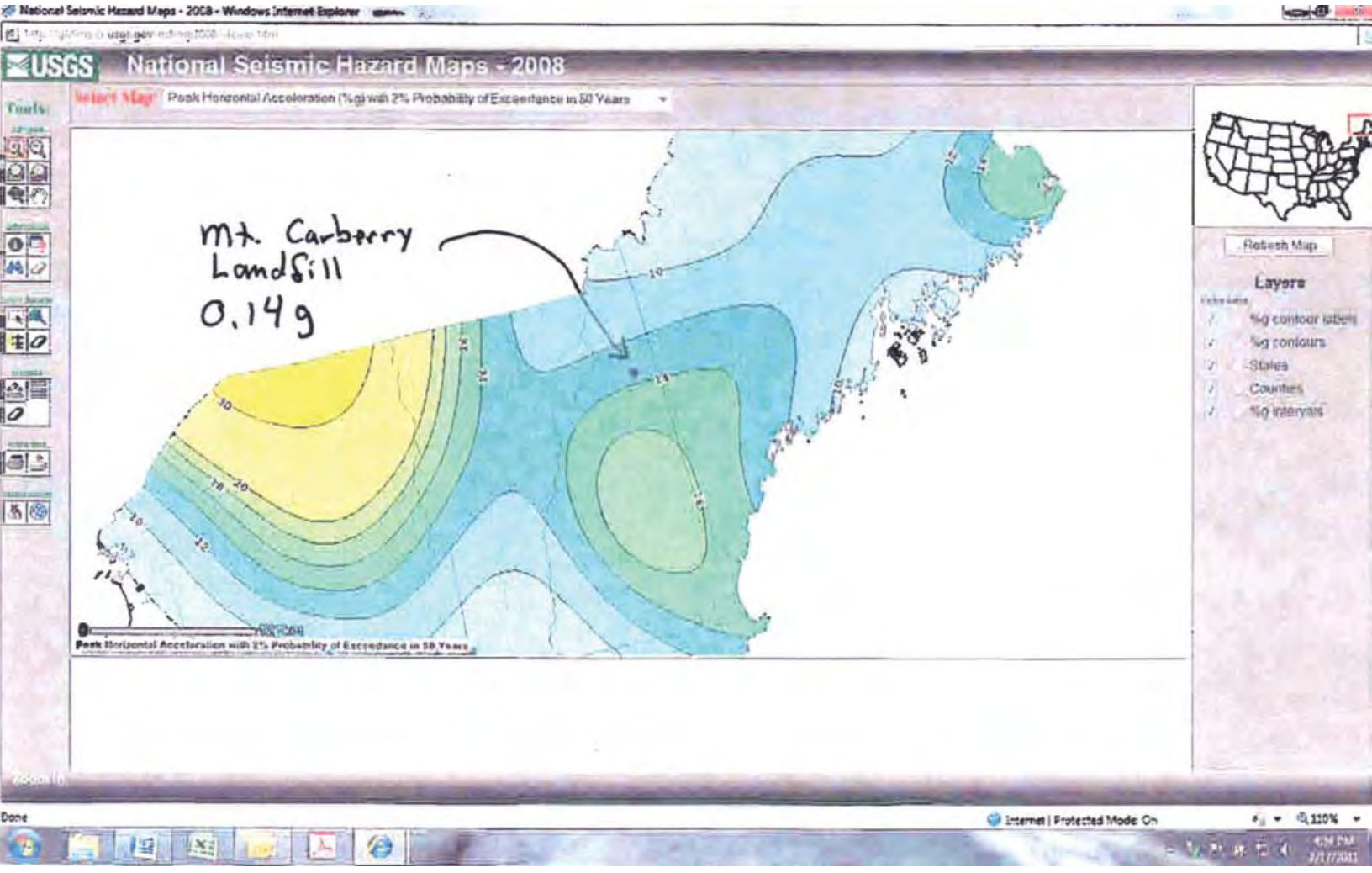
From the USGS Hazard Map (attached), design earthquake equals 0.14g at the top of bedrock. Conservatively assume no attenuation of earthquake acceleration in the medium to dense layers of till between bedrock and the lining system.

Seismic coefficient at the top of waste equals 0.24g per Singh and Sun, attached. Seismic coefficient at the base of the landfill equals 0.08g per Makdisi and Seed (0.24g times reduction factor of 0.3 = 0.08g.)

Determine Yield Acceleration

Pseudo-static analyses indicate a minimum yield acceleration of 0.18g.

CONCLUSION: The yield acceleration of 0.18g is greater than the seismic coefficient of 0.08g; therefore, the design earthquake would not cause permanent deformations in the lining system.


National Seismic Hazard Maps - 2008 - Windows Internet Explorer
USGS
National Seismic Hazard Maps - 2008
Select Map
Peak Horizontal Acceleration (%g) with 2% Probability of Exceedance in 50 Years
Tools
Mt. Carberry
Landfill
0.14g
Peak Horizontal Acceleration with 2% Probability of Exceedance in 50 Years
Refresh Map
Layers
%g contour labels
%g contours
States
Counties
%g intervals
Done
Internet | Protected Mode: On
110%

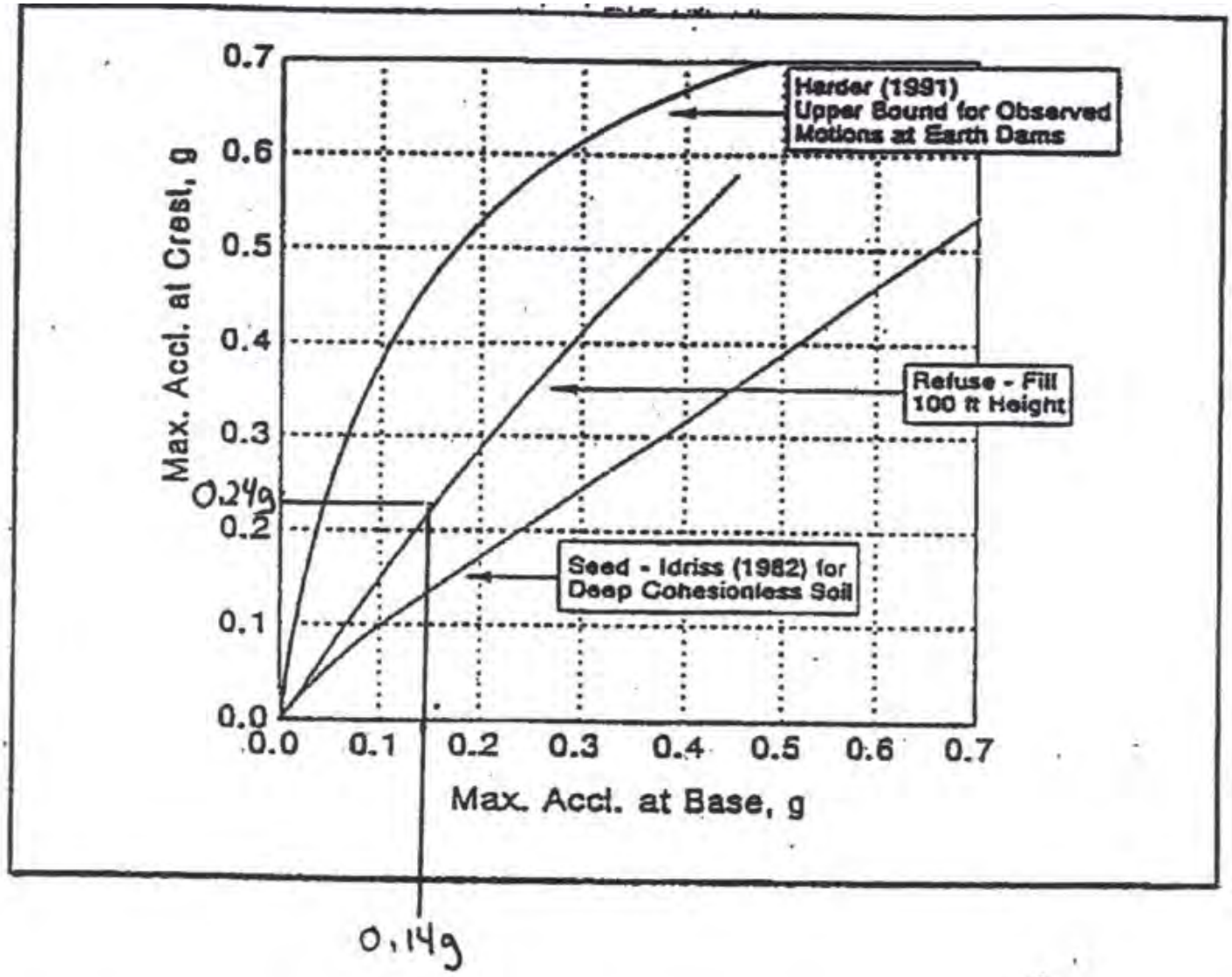


Figure 4.6 Approximate Relationship Between Maximum Accelerations at the Bas and Crest for Various Ground Conditions (Singh and Sun, 1995)

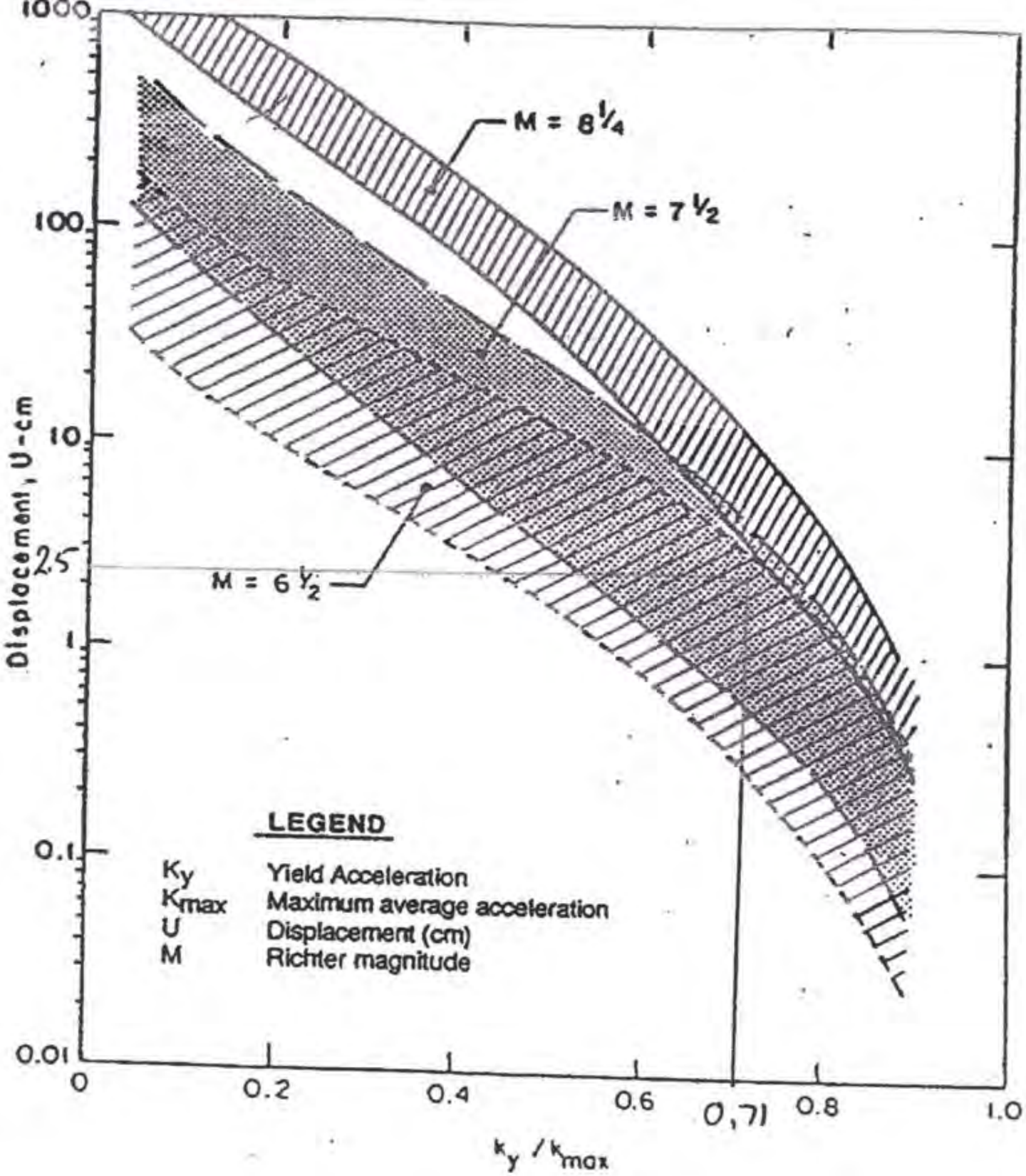
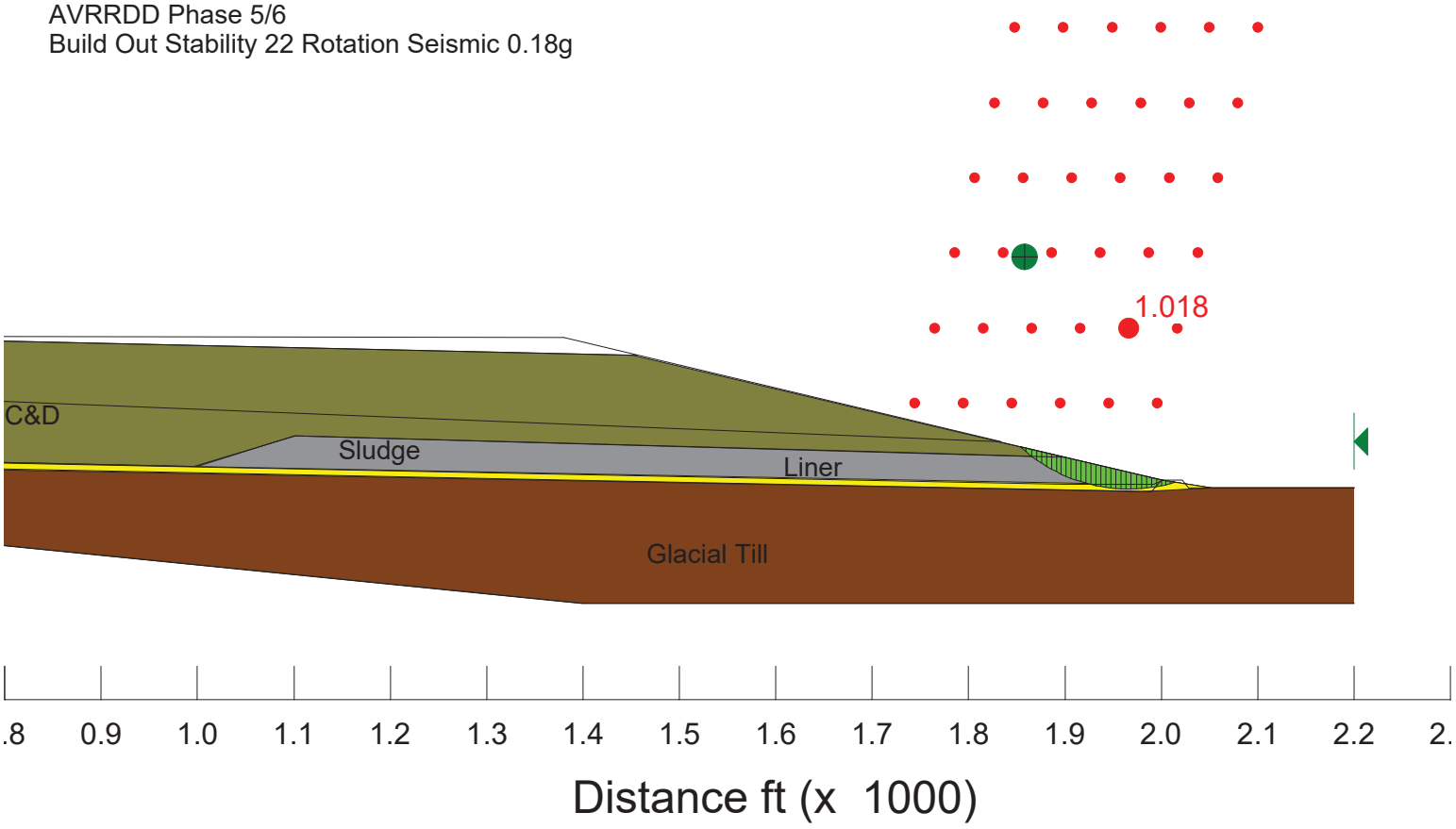


Figure 6.6 Makdisi and Seed Permanent Displacement Chart (Makdisi and Seed 1978).

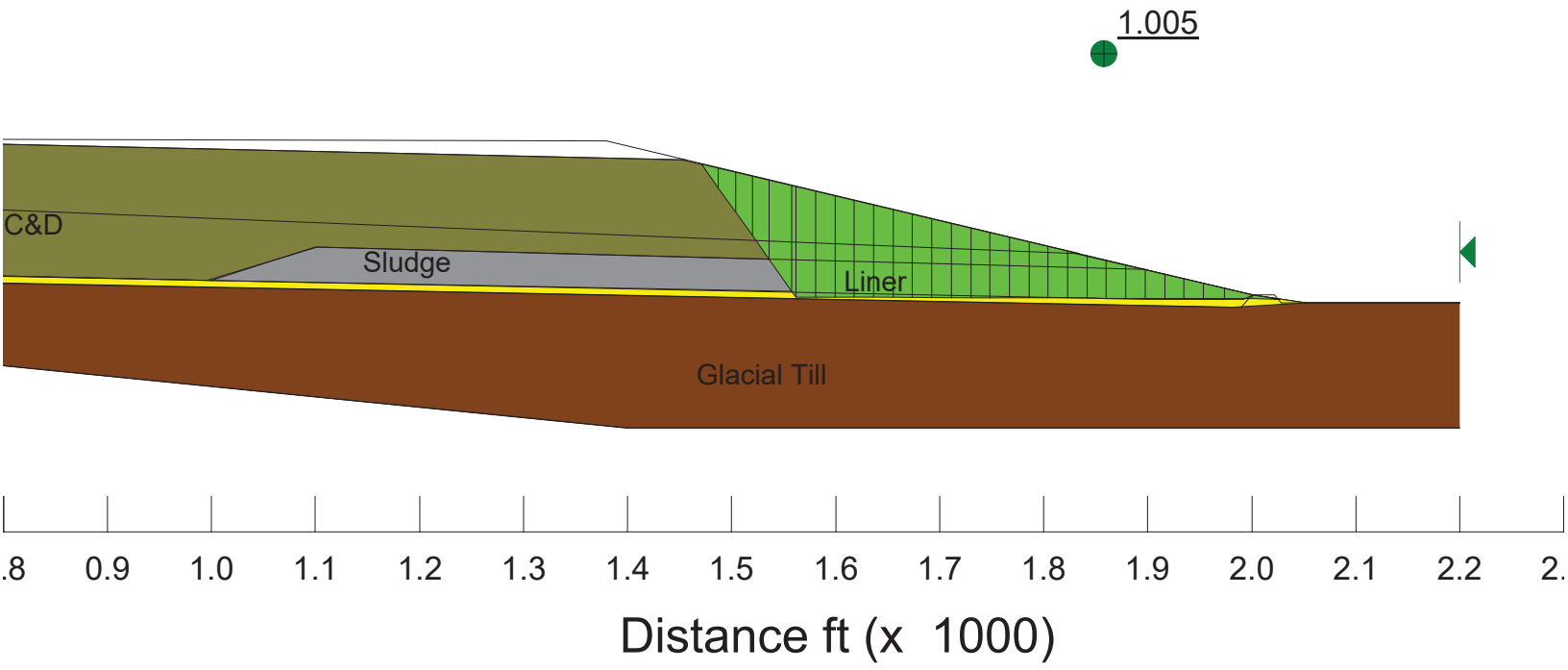
AVRRDD Phase 5/6
Build Out Stability 22 Rotation Seismic 0.18g



.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.

Distance ft (x 1000)

AVRRDD Phase 5/6
Build Out Stability Seismic 0.20g



CMA ENGINEERS, Inc. Civil/Environmental Engineers 35 Bow Street Portsmouth, NH 03801	Project: AVRRDD Mt. Carberry Landfill Stage 5&6 Success, New Hampshire Project No: 778 Date: February 2012 Calc. By: RJG Chkd. By:

OBJECTIVE: To evaluate the factor of safety against failure through components of the cap section under static and seismic loading conditions.

GIVEN: Final Grading Plan prepared by CMA Engineer. Cover section per Preliminary Design/Closure Plan Drawings.

ASSUMPTION: Closure construction to occur many years in future. Available materials and methods will likely vary from those available at this time. Assume minimum shear strength of the lining system to be 28 degrees.

METHOD – STATIC: Conservatively use simplified infinite slope procedure. Ignore buttressing effects of the toe and benches.

Equation: Factor of Safety = $\tan \varphi / \tan \beta$

Where: φ = min shear strength of 28 degrees

B = slope angle of 18.4 degrees

Factor of safety = 1.6

METHOD SEISMIC: Refer to method and references for liner stability in previous calculation.

REFERENCE: Matasovic, "Selection of Method for Seismic Slope Stability Analysis," Proceedings, Second International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics, St. Louis, MO 1991.

Determine Seismic Coefficient

From relationship developed by Singh and Sun (attached), maximum acceleration at refuse surface equals 0.24g.

Determine Yield Acceleration (α_y)

Equation per Matasovic: Factor of Safety = 1.0 = $\frac{\tan \varphi - \alpha_y \tan \beta \tan \varphi}{\alpha_y + \tan \beta}$

Solving for α_y:

$$\alpha_y = \mathbf{0.17g}$$

Determine Cap Displacement

From Makdisi and Seed (attached), and maximum acceleration divided by yield acceleration equaling a ratio of 0.71, displacement equals 2.5 centimeters, or about 1 inch.

RESULTS: Cap displacement resulting from the design earthquake will be one inch, which is less than the generally considered acceptable range of 6 inches to one foot.

Part X
Environmental Review Documentation

PART X: Environmental Review Documentation

Threatened or Endangered Species Review

A search of the NH Natural Heritage Bureau (NHB) database was performed using the online data check tool to determine whether threatened or endangered species exist in the project area. The database search included providing general project information and outlining the project area on USGS mapping. The results of the search indicated that bald eagles were identified within the search area. Bald Eagles are identified as a threatened species. A copy of the NH Natural Heritage Bureau database search results is provided below.

CMA Engineers contacted Kim Tuttle of the New Hampshire Fish and Game to request a review of the NHB findings and provide input. While bald eagles have been observed at the landfill, the primary concern identified is if bald eagles were nesting near the proposed construction area of the Phase IIIA landfill expansion. The Fish and Game department requested a survey for potential bald eagle nests within 660 feet of trees to be removed. A copy of the email correspondence between CMA Engineers and NH Fish and Game is attached.

In response to comments by New Hampshire Fish and Game, AVRRDD engaged the services of Stantec Consulting to conduct a survey of possible nesting sites within 660 feet of the proposed Phase IIIA expansion area. Stantec completed the survey to evaluate potential impacts of the landfill March 12, 2020. No bald eagle nests were observed in the survey area. The report by Stantec is also provided below. Based on these findings and the communications with the New Hampshire Fish and Game Department, the proposed Phase IIIA expansion will not adversely affect endangered or threatened species.

Wetlands Delineations

Wetlands delineations for the site have been completed by Stantec Consulting at several times over the past several years. The limits of the delineated wetlands are included on the project drawings where appropriate and are referenced at various points within the application. A copy of the delineation report is provided below.

CONFIDENTIAL – NH Dept. of Environmental Services review

Memo

NH Natural Heritage Bureau
NHB Datacheck Results Letter

To: Nicholas Messina
35 Bow St
Portsmouth, NH 03801

From: Amy Lamb, NH Natural Heritage Bureau
Date: 2/24/2020 (valid for one year from this date)
Re: Review by NH Natural Heritage Bureau
NHB File ID: NHB20-0456 Town: Success Location: Tax Maps: Map 16, Lot 1
Description: AVRRDD is proposing a horizontal expansion to the Mt. Carberry Landfill in Success, NH. This Phase IIIA expansions includes a new 23-acre landfill phase with three stages abutting and to the east of the existing landfill limits. The proposed development includes earthwork, site development, stormwater management, and ancillary structures including leachate piping, drainage, landfill gas, and other structures.

cc: Kim Tuttle

As requested, I have searched our database for records of rare species and exemplary natural communities, with the following results.

Comments: Please contact the NH Fish & Game Department.

Vertebrate species	**State[1]**	**Federal**	**Notes**
Bald Eagle (*Haliaeetus leucocephalus*)	SC	T	Contact the NH Fish & Game Dept and the US Fish & Wildlife Service (see below).

[1]Codes: "E" = Endangered, "T" = Threatened, "SC" = Special Concern, "--" = an exemplary natural community, or a rare species tracked by NH Natural Heritage that has not yet been added to the official state list. An asterisk (*) indicates that the most recent report for that occurrence was more than 20 years ago.

Contact for all animal reviews: Kim Tuttle, NH F&G, (603) 271-6544.

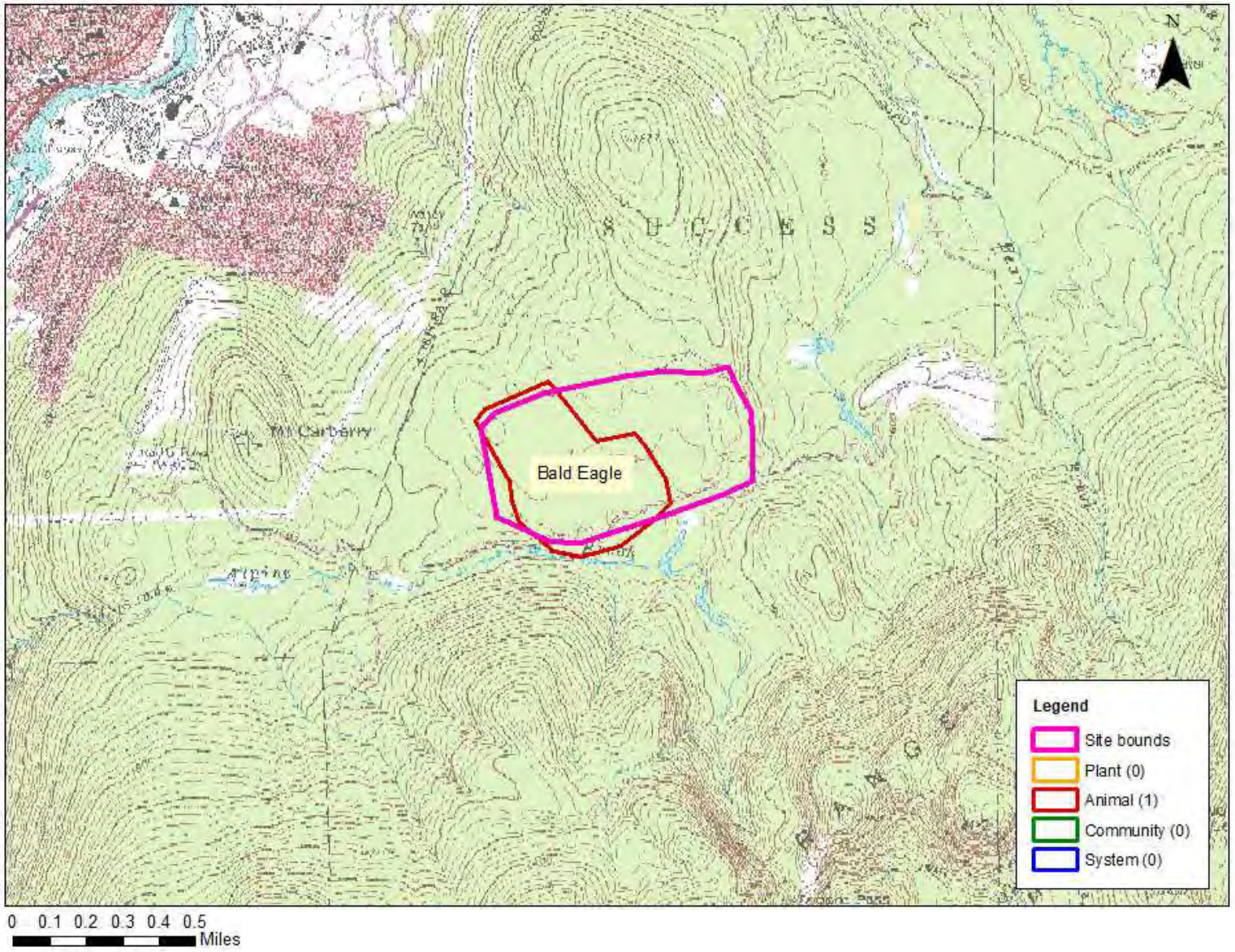
A negative result (no record in our database) does not mean that a sensitive species is not present. Our data can only tell you of known occurrences, based on information gathered by qualified biologists and reported to our office. However, many areas have never been surveyed, or have only been surveyed for certain species. An on-site survey would provide better information on what species and communities are indeed present.

Department of Natural and Cultural Resources
Division of Forests and Lands
(603) 271-2214 fax: 271-6488

DNCR/NHB
172 Pembroke Rd.
Concord, NH 03301

CONFIDENTIAL – NH Dept. of Environmental Services review

NHB20-0456



New Hampshire Natural Heritage Bureau - Animal Record

Bald Eagle (*Haliaeetus leucocephalus*)

Legal Status		Conservation Status	
Federal:	Listed Threatened	Global:	Demonstrably widespread, abundant, and secure
State:	Special Concern	State:	Imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank:	Not ranked
Comments on Rank:	--
Detailed Description:	2012: 1 eagle observed on 2/25.2011: 2 eagles observed on 2/26.2010: 3 eagles observed on 1/9.2009: 1 eagle observed on 2/28.2007: 4 eagles observed on 2/24.2006: 3 eagles observed on 1/7.2005: 4 eagles observed on 1/8. 4 eagles observed on 2/26.
General Area:	--
General Comments:	--
Management Comments:	--

Location

Survey Site Name:	Berlin landfill
Managed By:	James River Corp.
County:	Coos
Town(s):	Success
Size:	97.9 acres
Elevation:	

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: --

Dates documented

First reported:	2005-01-08	Last reported:	2012-02-25

The U.S. Fish & Wildlife Service has jurisdiction over Federally listed species. Please contact them at 70 Commercial Street, Suite 300, Concord NH 03301 or at (603) 223-2541.

CONFIDENTIAL – NH Dept. of Environmental Services review

Nick Messina

From: Tuttle, Kim <Kim.Tuttle@wildlife.nh.gov>
Sent: Tuesday, March 3, 2020 1:45 PM
To: Nick Messina
Cc: Houghton, Sandra; Kilborn, Jillian
Subject: RE: NHB20-0456 Carberry landfill expansion Berlin Tax Maps: Map 16, Lot 1

Nick,

If there is no indication of bald eagle nests, whether occupied or unoccupied or in the process of construction in the trees to be removed or within 660 ft. of the trees to be removed, the NHFG Nongame and Endangered Species Program has no further comments regarding potential impacts to bald eagle at this site.

Thanks,

Kim Tuttle
Wildlife Biologist
NH Fish and Game
11 Hazen Drive
Concord, NH 03301
603-271-6544

From: Nick Messina <NMessina@cmaengineers.com>
Sent: Tuesday, February 25, 2020 9:05 AM
To: Tuttle, Kim <Kim.Tuttle@wildlife.nh.gov>
Cc: Houghton, Sandra <Sandra.Houghton@wildlife.nh.gov>; Kilborn, Jillian <jillian.kilborn@wildlife.nh.gov>
Subject: RE: NHB20-0456 Carberry landfill expansion Berlin Tax Maps: Map 16, Lot 1

EXTERNAL: Do not open attachments or click on links unless you recognize and trust the sender.

Hello,

Please see the attached aerial and site plan. Tree removal would likely happen as soon as possible, pending permit approval from DES. The plan was to use jute matting.

Thanks,

Nick Messina, E.I.T.

CMA Engineers, Inc.
35 Bow St.
Portsmouth, NH 03801
P- 603-431-6196

www.cmaengineers.com

From: Tuttle, Kim <Kim.Tuttle@wildlife.nh.gov>
Sent: Tuesday, February 25, 2020 8:33 AM
To: Nick Messina <NMessina@cmaengineers.com>
Cc: Houghton, Sandra <Sandra.Houghton@wildlife.nh.gov>; Kilborn, Jillian <jillian.kilborn@wildlife.nh.gov>
Subject: NHB20-0456 Carberry landfill expansion Berlin Tax Maps: Map 16, Lot 1

Hello Nick,

The NHFG Nongame and Endangered Species Program will need to determine that this traditional bald eagle roost area does not contain any bald eagle nests anywhere on the property as they are protected under the federal bald and golden eagle protection act. The Phase IIIA expansions include a new 23-acre landfill phase with three stages abutting and to the east of the existing landfill limits. Bald eagles prefer supercanopy white pine for nesting. Could you send us an aerial with the limits of disturbance outlined? When would you be planning to do the tree removal?

Also, please avoid the use of welded plastic (e.g. polypropylene) or 'biodegradable plastic' netting or thread in erosion control matting, if needed. There are numerous documented cases of snakes and other wildlife being trapped and killed in erosion control matting with synthetic netting and thread. The use of erosion control berm, white Filtrexx Degradable Woven Silt Sock, or several 'wildlife friendly' options such as woven organic material (e.g. coco or jute matting such as North American Green SC150BN or equivalent) are readily available.

Thanks,

Kim Tuttle
Wildlife Biologist
NH Fish and Game
11 Hazen Drive
Concord, NH 03301
603-271-6544

From: Nick Messina <NMessina@cmaengineers.com>
Sent: Tuesday, February 25, 2020 7:40 AM
To: Tuttle, Kim <Kim.Tuttle@wildlife.nh.gov>
Subject: RE: NHB review: NHB20-0456

EXTERNAL: Do not open attachments or click on links unless you recognize and trust the sender.

Hello,

I am reaching out for an animal review by NH Fish and Game regarding the attached NHB site review.

Thank you,

Nick Messina, E.I.T.

CMA ENGINEERS

CMA Engineers, Inc.
35 Bow St.
Portsmouth, NH 03801
P- 603-431-6196
www.cmaengineers.com

From: Lamb, Amy <Amy.Lamb@dncr.nh.gov>
Sent: Monday, February 24, 2020 4:00 PM
To: Nick Messina <NMessina@cmaengineers.com>
Cc: Tuttle, Kim <Kim.Tuttle@wildlife.nh.gov>
Subject: NHB review: NHB20-0456

Attached, please find the review we have completed. If your review memo includes potential impacts to plants or natural communities please contact me for further information. If your project had potential impacts to wildlife, please contact NH Fish and Game at the phone number listed on the review.

Best,
Amy

Amy Lamb
Ecological Information Specialist

NH Natural Heritage Bureau
DNCR - Forests & Lands
172 Pembroke Rd
Concord, NH 03301
603-271-2834

Stantec

Memo

To:	Sharon Gauthier Androscoggin Valley Regional Refuse Disposal District	From:	Tom Tetreau Topsham ME Office
File:	195600461	Date:	March 20, 2020

Reference: Bald Eagle Nest Ground Survey, Mt. Carberry Landfill, Success, NH

On March 12, 2020, Stantec Consulting Services Inc. (Stantec) conducted a bald eagle (*Halieetus leucocephalus*) nest ground survey in areas surrounding the proposed Phase IIIA expansion area of the Mt. Carberry Landfill in Success, New Hampshire (survey area). The nest survey was in response to recommendations from the New Hampshire Natural Heritage Bureau (NHB) after their review of the proposed expansion project, because bald eagles are known to frequent the existing landfill area.

As recommended by NHB, Stantec conducted a meander survey of the Phase IIIA expansion area and areas within 660 feet of the expansion area (survey area; Attachment A, Figure 1). Within the survey area, Stantec used a mapping grade GPS receiver to locate super canopy eastern white pine (*Pinus strobus;* hereafter, pine) trees, which exceeded approximately 60 to 70 feet in height. The large pine trees were assumed to be the only species within the survey area that could be large and strong enough to support a bald eagle nest. To determine if a nest was present in identified canopy pine trees, Stantec viewed potential nest locations from the base of the tree where the understory allowed an unobstructed view and, where possible, viewed the trees with binoculars from other existing clearings or high points of land. Representative photographs of the large pines and existing conditions within the survey area are included in Attachment B.

No bald eagle nests were observed within the survey area. Stantec identified 25 large pine trees, averaging approximately 60 to 100 feet in height, within the survey area. Twenty-three of the large pines were located in the southern portion of the survey area, south of the existing landfill. The steep upland areas around the wetland complex associated with Cascade Alpine Brook are relatively undisturbed from past timber harvesting and contain mature stands of red spruce (*Picea rubens*) with several large pines mixed throughout. Two of the large pine trees were located within the remainder of the survey area. An extensive timber harvest occurred in portions of the survey area within the last 10 to 15 years; these areas are located east and northeast of the existing landfill and are dominated by regenerating red maple (*Acer rubrum*), quaking aspen (*Poulus tremuloides*), sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*) paper birch (*Betula papyrifera*), yellow birch (*Betula alleghaniensis*), white ash (*Fraxinus americana*), balsam fir (*Abies balsamea*), and striped maple (*Acer pensylvanicum*) saplings and trees approximately 10 to 25 feet tall. The northwest portion of the survey area slopes gradually down to the north and is dominated by a relatively mature hardwood forest with yellow birch, American beech, sugar maple, paper birch, red maple, quaking aspen, and white ash trees approximately 35 to 50 feet tall.

During arrival to survey area at approximately 7:30AM, one adult bald eagle was observed perched on a red spruce tree (~ 40 feet tall) north of the existing landfill, approximately 75–100 feet from the existing perimeter road. The tree was surveyed from the perimeter road and from its base, and no nest was observed.

Reference: Bald Eagle Nest Ground Survey, Mt. Carberry Landfill, Success, NH

Please contact me if you have any questions about the information contained in this report.

Regards,

Stantec Consulting Services Inc.

Tom Tetreau
Project Manager / Environmental Scientist

Phone: 207 406 5496
Fax: 207 729 2715
Tom.Tetreau@stantec.com

Attachment: Attachment A – Figure 1: Eagle Nest Ground Survey Results
Attachment B – Representative Photographs

c. Paul Schmidt, CMA Engineers

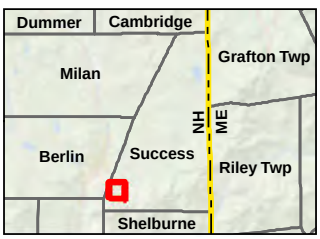
March 20, 2020

Sharon Gauthier
Attachments

Reference: Bald Eagle Nest Ground Survey, Mt. Carberry Landfill, Success, NH

ATTACHMENT A – FIGURE 1





Notes
1. Eagle nest ground survey performed on 3/12/20.
2. Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet
3. Background: 2015 1-foot Orthophotography for New Hampshire

Legend
- Large Pine Observation
- Eagle Observation
- Eagle Nest Survey Limit

0 800 Feet
(At original document size of 8.5x11)
1:9,600

N

Stantec

Project Location
Success, New Hampshire

Prepared by REM on 2020-03-13
TR by KWH on 2020-03-17
IR Review by TT on 2020-03-17

Client/Project 195600461
Androscoggin Valley Regional Refuse Disposal District
Mt. Carberry Landfill
Success, NH

Figure No.
1

Title
Eagle Nest Ground Survey Results

V:\1956\active\195600461\drawing\mxd\2020\00461_01_EagleNestGroundSurvey.mxd Revised: 2020-03-18 By: rmack

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

March 20, 2020

Sharon Gauthier
Attachments

Reference: Bald Eagle Nest Ground Survey, Mt. Carberry Landfill, Success, NH

ATTACHMENT B – REPRESENTATIVE PHOTOGRAPHS

March 20, 2020

Sharon Gauthier
Attachments

Reference: Bald Eagle Nest Ground Survey, Mt. Carberry Landfill, Success, NH



Photo 1: One of 23 large pines identified in the survey area south of the existing landfill. Stantec, March 12, 2020.

March 20, 2020

Sharon Gauthier
Attachments

Reference: Bald Eagle Nest Ground Survey, Mt. Carberry Landfill, Success, NH



Photo 2: Group of large pines south of the existing landfill (visible in background). Stantec, March 12, 2020.

March 20, 2020

Sharon Gauthier
Attachments

Reference: Bald Eagle Nest Ground Survey, Mt. Carberry Landfill, Success, NH



Photo 3: Representative view from the base of 1 of the 23 large pines identified in the survey area south of the existing landfill. Stantec, March 12, 2020.

March 20, 2020

Sharon Gauthier
Attachments

Reference: Bald Eagle Nest Ground Survey, Mt. Carberry Landfill, Success, NH



Photo 4: View of the wetland complex associated with Cascade Alpine Brook, south of the existing landfill. Stantec, March 12, 2020.

March 20, 2020

Sharon Gauthier
Attachments

Reference: Bald Eagle Nest Ground Survey, Mt. Carberry Landfill, Success, NH



Photo 5: Representative view of regenerating saplings and trees in the eastern portion of the survey area. Stantec, March 12, 2020.

March 20, 2020

Sharon Gauthier
Attachments

Reference: Bald Eagle Nest Ground Survey, Mt. Carberry Landfill, Success, NH



Photo 6: View of one of the two large pines (northern) located in the western and northern portions of the survey area. Stantec, March 12, 2020.

March 20, 2020

Sharon Gauthier
Attachments

Reference: Bald Eagle Nest Ground Survey, Mt. Carberry Landfill, Success, NH



Photo 7: View of hardwood slope in the northwestern portion of the survey area. Stantec, March 12, 2020.

March 20, 2020

Sharon Gauthier
Attachments

Reference: Bald Eagle Nest Ground Survey, Mt. Carberry Landfill, Success, NH



Photo 8: Adult bald eagle perched in red spruce tree observed through perimeter fence. Stantec, March 12, 2020.

March 20, 2020

Sharon Gauthier
Attachments

Reference: Bald Eagle Nest Ground Survey, Mt. Carberry Landfill, Success, NH



Photo 9: Closer view of red spruce tree from Photo 8. Stantec, March 12, 2020.

Stantec Consulting Services Inc.
30 Park Drive, Topsham, ME 04086-1737

March 20, 2020
File: 195600461

Attention: Sharon Gauthier
Androscoggin Valley Regional Refuse Disposal District
3 Twelfth Street
P.O. Box 336
Berlin, NH 03570

Reference: 2018 Wetland Delineation and 2020 Wetland Functional Assessment Results, Mt. Carberry Landfill, Success, New Hampshire

Dear Sharon,

This report replaces the previous wetland delineation report dated November 15, 2018, and provides additional functional assessment information.

On October 18, 2018, Stantec conducted a wetland and watercourse delineation of two locations (totaling approximately 20 acres) to the north and southeast of the active Mt. Carberry Landfill in Success, NH, operated by the Androscoggin Valley Regional Refuse Disposal District (AVRRDD). Wetland boundaries under local, state, and federal jurisdiction were determined using the technical criteria described in the *U.S. Army Corps of Engineers (Corps) Wetlands Delineation Manual*[1] and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Regional Supplement*[2]. Wetland boundaries were marked with pink, alphanumeric coded flags and located using a Trimble Global Positioning System (GPS) receiver. Jurisdictional determinations made during the wetland delineations were based on the criteria set forth in the NH Department of Environmental Services (NHDES) Wetlands Bureau Administrative Rules. Watercourses (e.g., streams) identified during the delineations were identified based on the definitions in NHDES Certified Administrative Rules Env-Wt 101.109 as well as the technical guidance available from the Corps on the identification of an Ordinary High Water Mark (OHWM)[3] and definition of a tributary as described in the Clean Water Act[4]. Data was collected on flow regime, bankfull and OHWM widths, dominant substrates, and evidence of biological use. GPS data were used to produce the attached Figure 1 (Attachment A), which also includes the wetlands delineated to the east of the landfill in 2017 (described in Stantec report dated September 1, 2017). Representative site photographs and Corps Wetland Determination Forms are provided at the end of the report in Attachments B and C, respectively.

On March 12, 2020, Stantec performed a wetland functional assessment of wetland 02TTC, which is located adjacent to the proposed Phase IIIA landfill expansion. The functional assessment was conducted in accordance with New Hampshire Wetland Rules (Env Wt) 311.10. No impacts are proposed to wetland

[1] Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS.
[2] U.S. Army Corps of Engineers. 2011. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0)*, ed. J. S. Wakeley, R. W. Lichvar, and C. V. Noble. ERDC/EL TR-12-1. Vicksburg, MS: U.S. Army Engineer Research and Development Center.
[3] U.S. Army Corps of Engineers. 2005. *Regulatory Guidance Letter: Ordinary High Water Mark Identification. December 8, 2005. No. 05-05*.
[4] U.S. Army Corps of Engineers. 2015. *33 Code of Federal Regulations, Part 328, "Waters of the United States". June 29, 2015*.

02TTC. The functional assessment was performed at the request of AVRRDD's engineers due the proximity of proposed work to wetland 02TTC.

SITE DESCRIPTION

The approximately 20-acre survey areas consist of forested uplands and wetlands. The wetlands are further described below in this section. The forested northern delineation area has been harvested within the past 10 to 15 years, resulting in uniform canopy height. Dominant tree and sapling species within the upland include sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), paper birch (*Betula papyrifera*), American witch-hazel (*Hamamelis virginiana*), black cherry (*Prunus serotina*), balsam fir (*Abies balsamea*), and red spruce (*Picea rubens*). Herbaceous vegetation was sparse due to the time of year and included evergreen wood fern (*Dryopteris intermedia*), red raspberry (*Rubus idaeus*), and wrinkle-leaf goldenrod (*Solidago rugosa*).

The U.S. Department of Agriculture Soil Survey of Coos County, NH[5], has mapped five primary soil types in this area: Pillsbury-Peachum-Peru association (poorly drained), Tunbridge-Peru complex (well drained), Tunbridge-Berkshire-Lyman complex (well drained), Skerry fine sandy loam (moderately well drained), and Bucksport muck (very poorly drained). Topography in the northern and southeastern portions of the survey areas is generally flat, sloping gently away from the existing landfill.

WETLAND DELINEATION RESULTS

Stantec identified three wetlands and two streams within the survey areas. Wetland delineations occurred outside the appropriate vernal pool breeding season (typically April–May), but no features were identified that might be considered potential vernal pools based on the New Hampshire Fish and Game protocols in *Identification and Documentation of Vernal Pools in New Hampshire*[6].

Wetland 02TTA is a palustrine forested (PFO)[7] community located near the eastern end of the northern delineation area. The wetland continues off-site to the north. The wetland receives hydrology from the outlet of the constructed stormwater basin on the northeast side of the existing landfill. Dominant tree species include yellow birch (*Betula alleghaniensis*), red maple, and gray birch (*Betula populifolia*). Red maple, gray birch, and broad-leaf meadowsweet (*Spiraea latifolia*) dominate the shrub layer. Dominant herbaceous vegetation includes melic manna grass (*Glyceria melicaria*), sensitive fern (*Onoclea sensibilis*), and cinnamon fern (*Osmundastrum cinnamomeum*). Hydric soils were indicated by 8 to 10 inches of mucky, organic material directly over rock/boulders. Hydrology indicators present at the time of the delineation include saturation at the soil surface, drainage patters, and areas of surface water (<1 inch deep).

Wetland 02TTB is a PFO community located near the center of the northern delineation area. The wetland extends south up to the perimeter road of the existing landfill and continues north where it narrows into intermittent stream 01TT and continues to flow off-site to the north. Dominant tree species include red maple, gray birch, and balsam fir. Speckled alder (*Alnus incana*), gray birch, red maple, and broad-leaf meadowsweet dominate the shrub layer. Dominant herbaceous vegetation includes cinnamon fern,

[5] Web Soil Survey, Natural Resources Conservation Service, United States Department of Agriculture. Available at: http://websoilsurvey.nrcs.usda.gov/ [accessed June 2015].
[6] New Hampshire Fish and Game Department. Third Edition, 2016. *Identification and Documentation of Vernal Pools in New Hampshire*.
[7] Wetland classifications based on: Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. Office of Biological Services, U.S. Fish and Wildlife Service. FWS/OBS-79/31.

interrupted fern (*Osmunda claytoniana*), and bluejoint (*Calamagrostis canadensis*). Hydric soils were indicated by 18 to 24 inches of mucky, organic material over rock/boulders. Hydrology indicators present at the time of the delineation include saturation at the soil surface, a high-water table at 2 inches below the soil surface, drainage patterns, and water stained leaves.

Wetland 02TTC is a PFO community located in the southeastern delineation area, south of the existing perimeter road. Wetland 02TTC is an extension of wetland 01TTA that was delineated in 2017. The delineated portion of the wetland is the northern edge of a large wetland complex that extends off-site to the south. Dominant tree species include balsam fir, red maple, red spruce, and yellow birch. Speckled alder and catberry (*Nemopanthus mucronatus*) dominate the shrub layer. Dominant herbaceous vegetation includes rattlesnake manna grass (*Glyceria canadensis*), bluejoint, melic manna grass, cinnamon fern, and sensitive fern. Hydric soils were indicated by greater than 30 inches of organic material. Hydrology indicators present at the time of the delineation include saturation at the soil surface and a high-water table at 10 inches below the soil surface.

Stream 01TT is an intermittent stream that originates where surface flow within wetland 02TTB consolidates and flows downslope to the north. The stream was identified as a scoured, defined channel through a portion of wetland 02TTB and the upland downslope of wetland 02TTB. The bankfull width of the stream is approximately 3 to 4 feet (ft) and the ordinary high-water mark (OHWM) is approximately 2 to 3 ft within the banks. Substrate within the stream channel consists of cobbles, gravel, and silt/muck. The stream's intermittent flow was estimated based on the small size of the channel and generally low flow volume observed at the time of the delineation. When water levels within the wetland are low, flow within the stream likely ceases.

Stream 02TT is a perennial stream that originates from a culvert that captures surface flow and runoff from the existing land fill and permitted Phase III cleared/filled areas. The stream flows generally south through wetland 02TTC and the large, off-site wetland complex. The stream was identified as a scoured, defined channel within wetland 02TTC. The bankfull width of the stream is approximately 5 to 6 ft and the OHWM is approximately 4 to 5 ft within the banks. Substrate within the stream channel consists of cobbles, gravel, sand, and silt. Aquatic moss and algae were observed within the stream.

WETLAND FUNCTIONAL ASSESSMENT

On March 12, 2020, Stantec performed a wetland functional assessment at wetland 02TTC and stream 02TT, located south of the existing perimeter road. Although no wetland or stream impacts are proposed, Stantec conducted the functional assessment to provide additional information on wetland 02TTC which will be located adjacent to the proposed landfill expansion. Wetland 02TTC is part of a larger wetland complex located offsite to the south that is associated with Cascade Alpine Brook. Stream 02TT is located within wetland 02TTC and flows off-site to the south.

Wetland and stream functions and values were evaluated through direct field observation and a review of existing public data resources following the Corps *Highway Methodology Workbook Supplement*[8] and the New Hampshire Method for evaluating the Ecological Integrity of the wetland and stream (RSA 482-A:2, XI). The Wetland Functional Assessment Worksheet and required wildlife and vegetation list is included in

[8] U.S. Army Corps of Engineers. 1999. The Highway Methodology Workbook Supplement, Wetland Functions and Values: A Descriptive Approach. U.S. Army Corps of Engineers. New England Division. 32pp. NAEEP-360-1-30a.

Attachment D. The required wetland delineation plans and photographs are included in Attachments A and B, respectively. Flood storage, Nutrient Trapping/Retention & Transformation, Production Export, Sediment Trapping, and Shoreline Anchoring were determined to be the principal functions of wetland 02TTC. Flood Storage, Sediment Trapping, and Shoreline Anchoring were determined to be the principal functions of stream 02TT.

STATE AND FEDERAL WETLAND AND WATERCOURSE REGULATIONS

The Corps and NHDES regulate the wetlands and waterbodies identified within the survey area. Under the provisions of Section 404 of the Clean Water Act, the Corps regulates activities within Waters of the United States, which include navigable waters and all their tributaries, adjacent wetlands, and other waters or wetlands where degradation or destruction could affect interstate or foreign commerce. For most projects, the Corps and NHDES review process is merged, unless proposed impacts exceed thresholds reviewable under the NH Programmatic General Permit (e.g., >3 acres of proposed impacts to inland wetlands or waterways), which would require an Individual Permit application review by the Corps.

Wetlands and waterbodies, as well as other protected natural resources, are regulated by NHDES under RSA 482-A and RSA 483-B. A permit from NHDES is required to dredge, fill, or build a structure in a wetland, surface water, or land within 100 feet of a municipally designated prime wetland or tidal waters. Projects proposing jurisdictional impacts of 10,000 square feet or greater will require a compensatory mitigation plan to be submitted to NHDES with the permit application.

NHDES permitting categories are classified as Minimum, Minor, and Major projects. Due to the previously permitted wetland impacts associated with the Phase III expansion area, the area of wetland impacts within the 2017 and 2018 wetland delineation areas would be added to the amount of wetland impacts permitted for the Phase III expansion. Therefore, if wetland alteration is planned for these wetland delineation areas, NHDES would classify the expansion as a Major Project. The following provides a general summary of relevant impacts corresponding to the Major Project permitting category:

- Projects that involve alteration of nontidal wetlands, nontidal surface waters, and banks adjacent to nontidal surface waters in excess of 20,000 square feet in the aggregate.
- Projects which, when taken in the aggregate with previous work on the property within the last 5 years, would be considered major. For example, if previous work on the property was fill of 15,000 square feet of nontidal wetlands and an individual applies to fill an additional 15,000 square feet of nontidal wetlands on the property, the application shall be deemed to be for a major project.
- Projects located in or adjacent to prime wetlands.
- Removal of more than 20 cubic yards of rock, gravel, sand, mud, or other material from public waters.
- Projects that alter the course of or disturb 200 or more linear feet of an intermittent or perennial nontidal stream or river channel or its banks.
- Projects in a wetland that have been identified by Natural Heritage Inventory – Department of Resources and Economic Development as an exemplary natural community and/or that has documented occurrences of state or federally listed Endangered or Threatened species.

Activities within a quarter mile of designated rivers are regulated under the Shoreland Water Quality Protection Act RSA 483-B. A state Shoreland Permit is required for most new construction, excavation, and filling activities within the Protected Shoreland (250 feet from reference line) of NHDES designated rivers,

Reference: 2018 Wetland Delineation and 2020 Wetland Functional Assessment Results, Mt. Carberry Landfill, Success, New Hampshire

lakes, and ponds. There are no designated rivers, streams, lakes, or ponds identified within the survey area or within one quarter mile that fall under the jurisdiction of the Shoreland Water Quality Protection Act.

Certain repair and/or maintenance activities do not require a permit or notification to NHDES per Env-Wt 303.05. Further consultation with NHDES and the Corps is advised to determine if any of the proposed project activities meet these criteria.

Please contact me if you have any questions about the information contained in this report.

Regards,

Stantec Consulting Services Inc.



Tom Tetreau PWS, NHCWS #283, CPESC
Project Scientist

Phone: 207 406 5496
Fax: 207 729 2715
thomas.tetreau@stantec.com

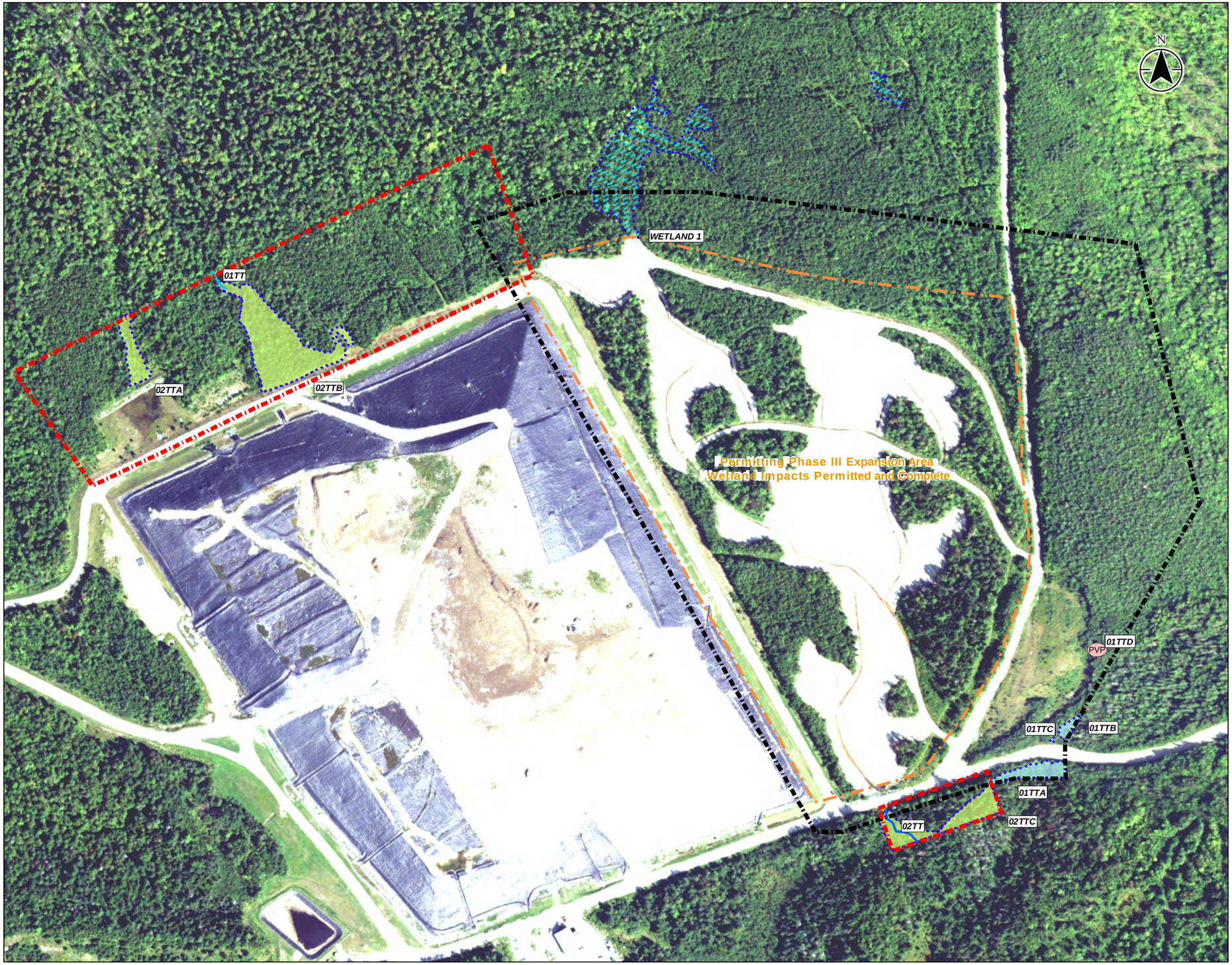
Attachment: Attachment A - Figure 1
Attachment B - Representative Photographs
Attachment C - Corps Wetland Determination Data Forms
Attachment D – Wetland Functional Assessment

c. Paul Schmidt, CMA Engineers

March 20, 2020
Sharon Gauthier
Attachment

Reference: 2018 Wetland Delineation and 2020 Wetland Functional Assessment Results, Mt. Carberry Landfill, Success, New Hampshire

ATTACHMENT A – FIGURE 1



Stantec

Legend

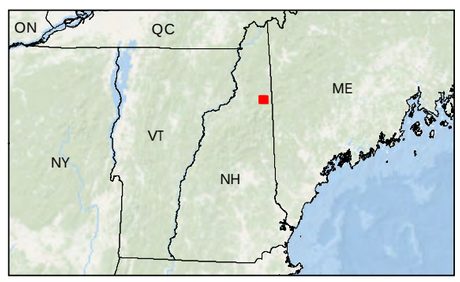
- PVP — Potential Vernal Pool
- Delineated Intermittent Stream (10/18/2018)
- Delineated Perennial Stream (10/18/2018)
- Previously Delineated Wetland (July 2015)
- Previously Delineated Wetland (8/4/2017)
- New Delineated Wetland (10/18/2018)
- Permitting Phase III Expansion Area (approx.)
- Limit of 2017 Wetland Delineation
- Limit of 2018 Wetland Delineation

0 350 700 Feet

1 inch = 350 feet (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet
2. Orthoimagery: 2016 National Agriculture Imagery Program (NAIP) aerial orthoimagery provided by USDA's Farm Service Agency.
3. Wetland boundaries delineated in accordance with USACE Wetland Delineation Manual (1987) or subsequent versions.
4. Wetland and vernal pool boundaries were located utilizing a Trimble GeoExplorer Series Receiver. Expected accuracy of GPS data is within 1 meter of actual position.



Project Location
Success, New Hampshire

195600461
Prepared by REM on 2018-11-12
Technical Review by KH on 2018-11-12
Independent Review by TT on 2018-11-12

Client/Project
Androscoggin Valley Regional Refuse Disposal District
Proposed Landfill Expansion Area Wetland Delineation

Figure No.
1

Title
Proposed Landfill Expansion Area
Wetland Delineation

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

V:\1956\active\195600461\drawing\mxd\2018\0403_01_ExpansionWetlands.mxd Revised: 2018-11-12 By: rmack

March 20, 2020
Sharon Gauthier
Attachment

Reference: 2018 Wetland Delineation and 2020 Wetland Functional Assessment Results, Mt. Carberry Landfill, Success, New Hampshire

ATTACHMENT B – REPRESENTATIVE PHOTOGRAPHS

March 20, 2020
Sharon Gauthier
Attachment

Reference: 2018 Wetland Delineation and 2020 Wetland Functional Assessment Results, Mt. Carberry Landfill, Success, New Hampshire



Photo 1: PFO wetland 02TTA in northern delineation area. Stantec, October 18, 2018.



Photo 2: Center of PFO wetland 02TTB in northern delineation area. Stantec, October 18, 2018.



Photo 3: Southern edge of PFO wetland 02TTB near the existing perimeter road/fence. Stantec. October 18, 2018.



Photo 4: PFO wetland 02TTC in southeastern delineation area, looking off-site to the south. Stantec. October 18, 2018.



Photo 5: Intermittent stream 01TT flowing north out of wetland 02TTB (background). Stantec. October 18, 2018.



Photo 6: View from perimeter road of perennial stream 02TT flowing south from culvert into wetland 02TTC. Stantec, October 18, 2018.



Photo 7: Perennial stream 02TT flowing through wetland 02TTC. Stantec, October 18, 2018.

March 20, 2020
Sharon Gauthier
Attachment

Reference: 2018 Wetland Delineation and 2020 Wetland Functional Assessment Results, Mt. Carberry Landfill, Success, New Hampshire

ATTACHMENT C – CORPS WETLAND DETERMINATION DATA FORMS

WETLAND DETERMINATION DATA FORM
Northeast and Northcentral Region

Project/Site:	Mt. Carberry Landfill	Stantec Project #:	195600461
Applicant:	AVRRDD		
Investigator #1:	Tom Tetreau	Investigator #2:	
Soil Unit:	Tunbridge-Peru Complex	NWI/WWI Classification:	n/a
Landform:	Shoulder	Local Relief:	Convex
Slope (%):	3%	Latitude: 44.460704°	Longitude: -71.152662 Datum: NAD 1983

Date:	10/18/18
County:	Coos
State:	New Hampshire
Wetland ID:	02TTA
Sample Point:	**Upland**
Community ID:	Upland

Are climatic/hydrologic conditions on the site typical for this time of year? (If no, explain in remarks) ☑ Yes ☐ No

Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed?
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic?

Are normal circumstances present? ☑ Yes ☐ No

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present? ☐ Yes ☑ No
Wetland Hydrology Present? ☐ Yes ☑ No
Hydric Soils Present? ☐ Yes ☑ No
Is This Sampling Point Within A Wetland? ☐ **Yes** ☑ **No**

Remarks:

HYDROLOGY

Wetland Hydrology Indicators (Check here if indicators are not present ☑):

Primary:
- ☐ A1 - Surface Water
- ☐ A2 - High Water Table
- ☐ A3 - Saturation
- ☐ B1 - Water Marks
- ☐ B2 - Sediment Deposits
- ☐ B3 - Drift Deposits
- ☐ B4 - Algal Mat or Crust
- ☐ B5 - Iron Deposits
- ☐ B7 - Inundation Visible on Aerial Imagery
- ☐ B8 - Sparsely Vegetated Concave Surface
- ☐ B9 - Water-Stained Leaves
- ☐ B13 - Aquatic Fauna
- ☐ B15 - Marl Deposits
- ☐ C1 - Hydrogen Sulfide Odor
- ☐ C3 - Oxidized Rhizospheres on Living Roots
- ☐ C4 - Presence of Reduced Iron
- ☐ C6 - Recent Iron Reduction in Tilled Soils
- ☐ C7 - Thin Muck Surface
- ☐ Other (Explain in Remarks)

Secondary:
- ☐ B6 - Surface Soil Cracks
- ☑ B10 - Drainage Patterns
- ☐ B16 - Moss Trim Lines
- ☐ C2 - Dry-Season Water Table
- ☐ C8 - Crayfish Burrows
- ☐ C9 - Saturation Visible on Aerial Imagery
- ☐ D1 - Stunted or Stressed Plants
- ☐ D2 - Geomorphic Position
- ☐ D3 - Shallow Aquitard
- ☐ D4 - Microtopographic Relief
- ☐ D5 - FAC-Neutral Test

Field Observations:

Surface Water Present?	☐ Yes	☑ No	Depth:	(in.)
Water Table Present?	☐ Yes	☑ No	Depth:	(in.)
Saturation Present?	☐ Yes	☑ No	Depth:	(in.)

Wetland Hydrology Present? ☐ Yes ☑ No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: N/A

Remarks:

SOILS

Map Unit Name: Tunbridge-Peru Complex — Series Drainage Class: well drained

Taxonomy (Subgroup):

Profile Description (Describe to the depth needed to document the indicator or confirm the absence of indicators.) (Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered/Coated Sand Grains; Location: PL=Pore Lining, M=Matrix)

Top Depth	Bottom Depth	Horizon	Matrix Color (Moist)	Matrix %	Mottles Color (Moist)	Mottles %	Mottles Type	Mottles Location	Texture (e.g. clay, sand, loam)
0	4	1	10YR 3/2	100	--	--	--	--	loam
4	5	2	10YR 4/1	100	--	--	--	--	silt loam
5	10	3	10YR 4/4	100	--	--	--	--	silt loam
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--

NRCS Hydric Soil Field Indicators (check here if indicators are not present ☑):
- ☐ A1- Histosol
- ☐ A2 - Histic Epipedon
- ☐ A3 - Black Histic
- ☐ A4 - Hydrogen Sulfide
- ☐ A5 - Stratified Layers
- ☐ A11 - Depleted Below Dark Surface
- ☐ A12 - Thick Dark Surface
- ☐ S1 - Sandy Muck Mineral
- ☐ S4 - Sandy Gleyed Matrix
- ☐ S5 - Sandy Redox
- ☐ S6 - Stripped Matrix
- ☐ S7 - Dark Surface (LRR R, MLRA 149B)
- ☐ S8 - Polyvalue Below Surface (LRR R, MLRA 149B)
- ☐ S9 - Thin Dark Surface (LRR R, MLRA 149B)
- ☐ F1 - Loamy Mucky Mineral (LRR K, L)
- ☐ F2 - Loamy Gleyed Matrix
- ☐ F3 - Depleted Matrix
- ☐ F6 - Redox Dark Surface
- ☐ F7 - Depleted Dark Surface
- ☐ F8 - Redox Depressions

Indicators for Problematic Soils [1]
- ☐ A10 - 2 cm Muck (LRR K, L, MLRA 149B)
- ☐ A16 - Coast Prairie Redox (LRR K, L, R)
- ☐ S3 - 5cm Mucky Peat of Peat (**LRR K, L, R**)
- ☐ S7 - Dark Surface (LRR K, L, M)
- ☐ S8 - Polyvalue Below Surface (**LRR K, L**)
- ☐ S9 - Thin Dark Surface (**LRR K, L**)
- ☐ F12 - Iron-Manganese Masses (**LRR K, L, R**)
- ☐ F19 - Piedmont Floodplain Soils (**MLRA 149B**)
- ☐ TA6 - Mesic Spodic (**MLRA 144A, 145, 149B**)
- ☐ TF2 - Red Parent Material
- ☐ TF12 - Very Shallow Dark Surface
- ☐ Other (Explain in Remarks)

[1] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (If Observed) Type: Rock/boulders Depth: 10"

Hydric Soil Present? ☐ Yes ☑ No

Remarks:

Stantec

WETLAND DETERMINATION DATA FORM

Northeast and Northcentral Region

Project/Site: Mt. Carberry Landfill Wetland ID: 02TTA Sample Point **Upland**

VEGETATION (Species identified in all uppercase are non-native species.)

Tree Stratum (Plot size: 10 meter radius)

	Species Name	% Cover	Dominant	Ind.Status
1.	*Acer saccharum*	25	Y	FACU
2.	*Acer rubrum*	15	Y	FAC
3.	*Acer pensylvanicum*	15	Y	FACU
4.	*Betula populifolia*	5	N	FAC
5.	*Fraxinus americana*	5	N	FACU
6.	--	--	--	--
7.	--	--	--	--
8.	--	--	--	--
9.	--	--	--	--
10.	--	--	--	--
	Total Cover =	65		

Sapling/Shrub Stratum (Plot size: 5 meter radius)

1.	*Acer saccharum*	20	Y	FACU
2.	*Acer pensylvanicum*	20	Y	FACU
3.	*Betula populifolia*	20	Y	FAC
4.	--	--	--	--
5.	--	--	--	--
6.	--	--	--	--
7.	--	--	--	--
8.	--	--	--	--
9.	--	--	--	--
10.	--	--	--	--
	Total Cover =	60		

Herb Stratum (Plot size: 2 meter radius)

1.	*Dryopteris intermedia*	50	Y	FAC
2.	--	--	--	--
3.	--	--	--	--
4.	--	--	--	--
5.	--	--	--	--
6	--	--	--	--
7.	--	--	--	--
8.	--	--	--	--
9.	--	--	--	--
10.	--	--	--	--
11.	--	--	--	--
12.	--	--	--	--
13.	--	--	--	--
14.	--	--	--	--
15.	--	--	--	--
	Total Cover =	50		

Woody Vine Stratum (Plot size: 10 meter radius)

1.	--	--	--	--
2.	--	--	--	--
3.	--	--	--	--
4.	--	--	--	--
5.	--	--	--	--
	Total Cover =	0		

Remarks:

Dominance Test Worksheet

Number of Dominant Species that are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ***42.9%*** (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by:	
OBL spp.	0	x 1 =	0
FACW spp.	0	x 2 =	0
FAC spp.	90	x 3 =	270
FACU spp.	85	x 4 =	340
UPL spp.	0	x 5 =	0
Total	175 (A)		610 (B)

Prevalence Index = B/A = ***3.486***

Hydrophytic Vegetation Indicators:

- ☐ Yes ☑ No Rapid Test for Hydrophytic Vegetation
- ☐ Yes ☑ No Dominance Test is > 50%
- ☐ Yes ☑ No Prevalence Index is ≤ 3.0 *
- ☐ Yes ☑ No Morphological Adaptations (Explain) *
- ☐ Yes ☑ No Problem Hydrophytic Vegetation (Explain) *

* Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub - Woody plants less than 3 in. DBH and greater than 3.28 ft. tall.

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft. tall.

Woody Vines - All woody vines greater than 3.28 ft. in height.

Hydrophytic Vegetation Present ☐ Yes ☑ No

Additional Remarks:

WETLAND DETERMINATION DATA FORM
Northeast and Northcentral Region

Project/Site:	Mt. Carberry Landfill	Stantec Project #:	195600461
Applicant:	AVRRDD		
Investigator #1:	Tom Tetreau	Investigator #2:	
Soil Unit:	Tunbridge-Peru Complex	NWI/WWI Classification:	PFO
Landform:	Depression	Local Relief:	Concave
Slope (%):	3%	Latitude: 44.460733°	Longitude: -71.152254 Datum: NAD 1983

Date:	10/18/18
County:	Coos
State:	New Hampshire
Wetland ID:	02TTA
Sample Point:	**Wetland**
Community ID:	PFO

Are climatic/hydrologic conditions on the site typical for this time of year? (If no, explain in remarks) ☑ Yes ☐ No

Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed?
Are Vegetation ☐ , Soil ☑ , or Hydrology ☐ naturally problematic?

Are normal circumstances present? ☑ Yes ☐ No

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present? ☑ Yes ☐ No
Wetland Hydrology Present? ☑ Yes ☐ No
Hydric Soils Present? ☑ Yes ☐ No
Is This Sampling Point Within A Wetland? ☑ **Yes** ☐ **No**

Remarks: Shallow organic material over rock/boulders

HYDROLOGY

Wetland Hydrology Indicators (Check here if indicators are not present ☐):

Primary:
- ☑ A1 - Surface Water
- ☐ A2 - High Water Table
- ☑ A3 - Saturation
- ☐ B1 - Water Marks
- ☐ B2 - Sediment Deposits
- ☐ B3 - Drift Deposits
- ☐ B4 - Algal Mat or Crust
- ☐ B5 - Iron Deposits
- ☐ B7 - Inundation Visible on Aerial Imagery
- ☐ B8 - Sparsely Vegetated Concave Surface
- ☑ B9 - Water-Stained Leaves
- ☐ B13 - Aquatic Fauna
- ☐ B15 - Marl Deposits
- ☐ C1 - Hydrogen Sulfide Odor
- ☐ C3 - Oxidized Rhizospheres on Living Roots
- ☐ C4 - Presence of Reduced Iron
- ☐ C6 - Recent Iron Reduction in Tilled Soils
- ☐ C7 - Thin Muck Surface
- ☐ Other (Explain in Remarks)

Secondary:
- ☐ B6 - Surface Soil Cracks
- ☑ B10 - Drainage Patterns
- ☐ B16 - Moss Trim Lines
- ☐ C2 - Dry-Season Water Table
- ☐ C8 - Crayfish Burrows
- ☐ C9 - Saturation Visible on Aerial Imagery
- ☐ D1 - Stunted or Stressed Plants
- ☐ D2 - Geomorphic Position
- ☐ D3 - Shallow Aquitard
- ☐ D4 - Microtopographic Relief
- ☐ D5 - FAC-Neutral Test

Field Observations:

Surface Water Present?	☑ Yes ☐ No	Depth:	0.5	(in.)
Water Table Present?	☐ Yes ☑ No	Depth:		(in.)
Saturation Present?	☑ Yes ☐ No	Depth:	0	(in.)

Wetland Hydrology Present? ☑ Yes ☐ No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: N/A

Remarks:

SOILS

Map Unit Name: Tunbridge-Peru Complex — Series Drainage Class: well drained

Taxonomy (Subgroup):

Profile Description (Describe to the depth needed to document the indicator or confirm the absence of indicators.) (Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered/Coated Sand Grains; Location: PL=Pore Lining, M=Matrix)

Top Depth	Bottom Depth	Horizon	Matrix Color (Moist)	Matrix %	Mottles Color (Moist)	Mottles %	Mottles Type	Mottles Location	Texture (e.g. clay, sand, loam)
8	0	1	--	--	--	--	--	--	Organic material
0	1	2	10YR	4/2	100	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--

NRCS Hydric Soil Field Indicators (check here if indicators are not present ☐):
- ☐ A1- Histosol
- ☐ A2 - Histic Epipedon
- ☑ A3 - Black Histic
- ☐ A4 - Hydrogen Sulfide
- ☐ A5 - Stratified Layers
- ☐ A11 - Depleted Below Dark Surface
- ☐ A12 - Thick Dark Surface
- ☐ S1 - Sandy Muck Mineral
- ☐ S4 - Sandy Gleyed Matrix
- ☐ S5 - Sandy Redox
- ☐ S6 - Stripped Matrix
- ☐ S7 - Dark Surface (LRR R, MLRA 149B)
- ☐ S8 - Polyvalue Below Surface (LRR R, MLRA 149B)
- ☐ S9 - Thin Dark Surface (LRR R, MLRA 149B)
- ☐ F1 - Loamy Mucky Mineral (LRR K, L)
- ☐ F2 - Loamy Gleyed Matrix
- ☐ F3 - Depleted Matrix
- ☐ F6 - Redox Dark Surface
- ☐ F7 - Depleted Dark Surface
- ☐ F8 - Redox Depressions

Indicators for Problematic Soils [1]
- ☐ A10 - 2 cm Muck (LRR K, L, MLRA 149B)
- ☐ A16 - Coast Prairie Redox (LRR K, L, R)
- ☐ S3 - 5cm Mucky Peat of Peat (**LRR K, L, R**)
- ☐ S7 - Dark Surface (LRR K, L, M)
- ☐ S8 - Polyvalue Below Surface (**LRR K, L**)
- ☐ S9 - Thin Dark Surface (**LRR K, L**)
- ☐ F12 - Iron-Manganese Masses (**LRR K, L, R**)
- ☐ F19 - Piedmont Floodplain Soils (**MLRA 149B**)
- ☐ TA6 - Mesic Spodic (**MLRA 144A, 145, 149B**)
- ☐ TF2 - Red Parent Material
- ☐ TF12 - Very Shallow Dark Surface
- ☐ Other (Explain in Remarks)

[1] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (If Observed) Type: Rock/boulders Depth: 9"

Hydric Soil Present? ☑ Yes ☐ No

Remarks: shallow organic material over rock/boulders

Stantec

WETLAND DETERMINATION DATA FORM

Northeast and Northcentral Region

Project/Site: Mt. Carberry Landfill | Wetland ID: 02TTA | Sample Point Wetland

VEGETATION (Species identified in all uppercase are non-native species.)

Tree Stratum (Plot size: 10 meter radius)

	Species Name	% Cover	Dominant	Ind.Status
1.	*Betula populifolia*	30	Y	FAC
2.	*Acer rubrum*	30	Y	FAC
3.	*Betula alleghaniensis*	20	Y	FAC
4.	--	--	--	--
5.	--	--	--	--
6.	--	--	--	--
7.	--	--	--	--
8.	--	--	--	--
9.	--	--	--	--
10.	--	--	--	--
	Total Cover =	80		

Sapling/Shrub Stratum (Plot size: 5 meter radius)

1.	*Acer rubrum*	25	Y	FAC
2.	*Betula populifolia*	15	Y	FAC
3.	--	--	--	--
4.	--	--	--	--
5.	--	--	--	--
6.	--	--	--	--
7.	--	--	--	--
8.	--	--	--	--
9.	--	--	--	--
10.	--	--	--	--
	Total Cover =	40		

Herb Stratum (Plot size: 2 meter radius)

1.	*Glyceria melicaria*	50	Y	OBL
2.	*Onoclea sensibilis*	15	N	FACW
3.	*Osmundastrum cinnamomeum*	15	N	FACW
4.	*Calamagrostis canadensis*	5	N	OBL
5.	--	--	--	--
6	--	--	--	--
7.	--	--	--	--
8.	--	--	--	--
9.	--	--	--	--
10.	--	--	--	--
11.	--	--	--	--
12.	--	--	--	--
13.	--	--	--	--
14.	--	--	--	--
15.	--	--	--	--
	Total Cover =	85		

Woody Vine Stratum (Plot size: 10 meter radius)

1.	--	--	--	--
2.	--	--	--	--
3.	--	--	--	--
4.	--	--	--	--
5.	--	--	--	--
	Total Cover =	0		

Remarks:

Dominance Test Worksheet

Number of Dominant Species that are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ***100.0%*** (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by:	
OBL spp.	55	x 1 =	55
FACW spp.	30	x 2 =	60
FAC spp.	120	x 3 =	360
FACU spp.	0	x 4 =	0
UPL spp.	0	x 5 =	0
Total	205 (A)		475 (B)

Prevalence Index = B/A = ***2.317***

Hydrophytic Vegetation Indicators:

- ☐ Yes ☑ No Rapid Test for Hydrophytic Vegetation
- ☑ Yes ☐ No Dominance Test is > 50%
- ☑ Yes ☐ No Prevalence Index is ≤ 3.0 *
- ☐ Yes ☑ No Morphological Adaptations (Explain) *
- ☐ Yes ☑ No Problem Hydrophytic Vegetation (Explain) *

* Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub - Woody plants less than 3 in. DBH and greater than 3.28 ft. tall.

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft. tall.

Woody Vines - All woody vines greater than 3.28 ft. in height.

Hydrophytic Vegetation Present ☑ Yes ☐ No

Additional Remarks:

WETLAND DETERMINATION DATA FORM
Northeast and Northcentral Region

Project/Site:	Mt. Carberry Landfill	Stantec Project #:	195600461
Applicant:	AVRRDD		
Investigator #1:	Tom Tetreau	Investigator #2:	
Soil Unit:	Tunbridge-Berkshire-Lyman Complex	NWI/WWI Classification:	n/a
Landform:	Shoulder	Local Relief:	Convex
Slope (%):	3%	Latitude: 44.460805°	Longitude: -71.151063 Datum: NAD 1983

Date:	10/18/18
County:	Coos
State:	New Hampshire
Wetland ID:	02TTB
Sample Point:	**Upland**
Community ID:	Upland

Are climatic/hydrologic conditions on the site typical for this time of year? (If no, explain in remarks) ☑ Yes ☐ No

Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic?

Are normal circumstances present? ☑ Yes ☐ No

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present? ☐ Yes ☑ No

Wetland Hydrology Present? ☐ Yes ☑ No

Hydric Soils Present? ☐ Yes ☑ No

Is This Sampling Point Within A Wetland? ☐ **Yes** ☑ **No**

Remarks:

HYDROLOGY

Wetland Hydrology Indicators (Check here if indicators are not present ☑):

Primary:
- ☐ A1 - Surface Water
- ☐ A2 - High Water Table
- ☐ A3 - Saturation
- ☐ B1 - Water Marks
- ☐ B2 - Sediment Deposits
- ☐ B3 - Drift Deposits
- ☐ B4 - Algal Mat or Crust
- ☐ B5 - Iron Deposits
- ☐ B7 - Inundation Visible on Aerial Imagery
- ☐ B8 - Sparsely Vegetated Concave Surface
- ☐ B9 - Water-Stained Leaves
- ☐ B13 - Aquatic Fauna
- ☐ B15 - Marl Deposits
- ☐ C1 - Hydrogen Sulfide Odor
- ☐ C3 - Oxidized Rhizospheres on Living Roots
- ☐ C4 - Presence of Reduced Iron
- ☐ C6 - Recent Iron Reduction in Tilled Soils
- ☐ C7 - Thin Muck Surface
- ☐ Other (Explain in Remarks)

Secondary:
- ☐ B6 - Surface Soil Cracks
- ☐ B10 - Drainage Patterns
- ☐ B16 - Moss Trim Lines
- ☐ C2 - Dry-Season Water Table
- ☐ C8 - Crayfish Burrows
- ☐ C9 - Saturation Visible on Aerial Imagery
- ☐ D1 - Stunted or Stressed Plants
- ☐ D2 - Geomorphic Position
- ☐ D3 - Shallow Aquitard
- ☐ D4 - Microtopographic Relief
- ☐ D5 - FAC-Neutral Test

Field Observations:

Surface Water Present?	☐ Yes ☑ No	Depth:	(in.)
Water Table Present?	☐ Yes ☑ No	Depth:	(in.)
Saturation Present?	☐ Yes ☑ No	Depth:	(in.)

Wetland Hydrology Present? ☐ Yes ☑ No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: N/A

Remarks:

SOILS

Map Unit Name: Tunbridge-Berkshire-Lyman Complex Series Drainage Class: well drained

Taxonomy (Subgroup):

Profile Description (Describe to the depth needed to document the indicator or confirm the absence of indicators.) (Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered/Coated Sand Grains; Location: PL=Pore Lining, M=Matrix)

Top Depth	Bottom Depth	Horizon	Matrix Color (Moist)		Matrix %	Mottles Color (Moist)		Mottles %	Mottles Type	Mottles Location	Texture (e.g. clay, sand, loam)
0	4	1	10YR	3/2	100	--	--	--	--	--	loam
4	5	2	10YR	4/1	100	--	--	--	--	--	silt loam
5	10	3	10YR	4/4	100	--	--	--	--	--	silt loam
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--

NRCS Hydric Soil Field Indicators (check here if indicators are not present ☑):
- ☐ A1- Histosol
- ☐ A2 - Histic Epipedon
- ☐ A3 - Black Histic
- ☐ A4 - Hydrogen Sulfide
- ☐ A5 - Stratified Layers
- ☐ A11 - Depleted Below Dark Surface
- ☐ A12 - Thick Dark Surface
- ☐ S1 - Sandy Muck Mineral
- ☐ S4 - Sandy Gleyed Matrix
- ☐ S5 - Sandy Redox
- ☐ S6 - Stripped Matrix
- ☐ S7 - Dark Surface (LRR R, MLRA 149B)
- ☐ S8 - Polyvalue Below Surface (LRR R, MLRA 149B)
- ☐ S9 - Thin Dark Surface (LRR R, MLRA 149B)
- ☐ F1 - Loamy Mucky Mineral (LRR K, L)
- ☐ F2 - Loamy Gleyed Matrix
- ☐ F3 - Depleted Matrix
- ☐ F6 - Redox Dark Surface
- ☐ F7 - Depleted Dark Surface
- ☐ F8 - Redox Depressions

Indicators for Problematic Soils [1]
- ☐ A10 - 2 cm Muck (LRR K, L, MLRA 149B)
- ☐ A16 - Coast Prairie Redox (LRR K, L, R)
- ☐ S3 - 5cm Mucky Peat of Peat (**LRR K, L, R**)
- ☐ S7 - Dark Surface (LRR K, L, M)
- ☐ S8 - Polyvalue Below Surface (**LRR K, L**)
- ☐ S9 - Thin Dark Surface (**LRR K, L**)
- ☐ F12 - Iron-Manganese Masses (**LRR K, L, R**)
- ☐ F19 - Piedmont Floodplain Soils (**MLRA 149B**)
- ☐ TA6 - Mesic Spodic (**MLRA 144A, 145, 149B**)
- ☐ TF2 - Red Parent Material
- ☐ TF12 - Very Shallow Dark Surface
- ☐ Other (Explain in Remarks)

[1] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (If Observed) Type: Rock/boulders Depth: 10"

Hydric Soil Present? ☐ Yes ☑ No

Remarks:

Stantec

WETLAND DETERMINATION DATA FORM

Northeast and Northcentral Region

Project/Site: Mt. Carberry Landfill Wetland ID: 02TTB Sample Point **Upland**

VEGETATION (Species identified in all uppercase are non-native species.)

Tree Stratum (Plot size: 10 meter radius)

	Species Name	% Cover	Dominant	Ind.Status
1.	*Acer saccharum*	25	Y	FACU
2.	*Acer rubrum*	15	Y	FAC
3.	*Acer pensylvanicum*	15	Y	FACU
4.	*Betula populifolia*	5	N	FAC
5.	*Fraxinus americana*	5	N	FACU
6.	--	--	--	--
7.	--	--	--	--
8.	--	--	--	--
9.	--	--	--	--
10.	--	--	--	--
	Total Cover =	65		

Sapling/Shrub Stratum (Plot size: 5 meter radius)

1.	*Acer saccharum*	20	Y	FACU
2.	*Acer pensylvanicum*	20	Y	FACU
3.	*Betula populifolia*	20	Y	FAC
4.	--	--	--	--
5.	--	--	--	--
6.	--	--	--	--
7.	--	--	--	--
8.	--	--	--	--
9.	--	--	--	--
10.	--	--	--	--
	Total Cover =	60		

Herb Stratum (Plot size: 2 meter radius)

1.	*Dryopteris intermedia*	50	Y	FAC
2.	--	--	--	--
3.	--	--	--	--
4.	--	--	--	--
5.	--	--	--	--
6	--	--	--	--
7.	--	--	--	--
8.	--	--	--	--
9.	--	--	--	--
10.	--	--	--	--
11.	--	--	--	--
12.	--	--	--	--
13.	--	--	--	--
14.	--	--	--	--
15.	--	--	--	--
	Total Cover =	50		

Woody Vine Stratum (Plot size: 10 meter radius)

1.	--	--	--	--
2.	--	--	--	--
3.	--	--	--	--
4.	--	--	--	--
5.	--	--	--	--
	Total Cover =	0		

Remarks:

Dominance Test Worksheet

Number of Dominant Species that are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ***42.9%*** (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by:	
OBL spp.	0	x 1 =	0
FACW spp.	0	x 2 =	0
FAC spp.	90	x 3 =	270
FACU spp.	85	x 4 =	340
UPL spp.	0	x 5 =	0
Total	175 (A)		610 (B)

Prevalence Index = B/A = ***3.486***

Hydrophytic Vegetation Indicators:

- ☐ Yes ☑ No Rapid Test for Hydrophytic Vegetation
- ☐ Yes ☑ No Dominance Test is > 50%
- ☐ Yes ☑ No Prevalence Index is ≤ 3.0 *
- ☐ Yes ☑ No Morphological Adaptations (Explain) *
- ☐ Yes ☑ No Problem Hydrophytic Vegetation (Explain) *

* Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub - Woody plants less than 3 in. DBH and greater than 3.28 ft. tall.

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft. tall.

Woody Vines - All woody vines greater than 3.28 ft. in height.

Hydrophytic Vegetation Present ☐ Yes ☑ No

Additional Remarks:

WETLAND DETERMINATION DATA FORM
Northeast and Northcentral Region

Project/Site:	Mt. Carberry Landfill	Stantec Project #:	195600461
Applicant:	AVRRDD		
Investigator #1:	Tom Tetreau	Investigator #2:	
Soil Unit:	Pillsbury-Peachum-Peru Complex	NWI/WWI Classification:	PFO
Landform:	Depression	Local Relief:	Concave
Slope (%):	0%	Latitude: 44.460837°	Longitude: -71.15091 Datum: NAD 1983

Date:	10/18/18
County:	Coos
State:	New Hampshire
Wetland ID:	02TTB
Sample Point:	**Wetland**
Community ID:	PFO

Are climatic/hydrologic conditions on the site typical for this time of year? (If no, explain in remarks) ☑ Yes ☐ No

Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed?
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic?

Are normal circumstances present? ☑ Yes ☐ No

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present? ☑ Yes ☐ No
Wetland Hydrology Present? ☑ Yes ☐ No
Hydric Soils Present? ☑ Yes ☐ No
Is This Sampling Point Within A Wetland? ☑ **Yes** ☐ **No**

Remarks:

HYDROLOGY

Wetland Hydrology Indicators (Check here if indicators are not present ☐):

Primary:
- ☐ A1 - Surface Water
- ☑ A2 - High Water Table
- ☑ A3 - Saturation
- ☐ B1 - Water Marks
- ☐ B2 - Sediment Deposits
- ☐ B3 - Drift Deposits
- ☐ B4 - Algal Mat or Crust
- ☐ B5 - Iron Deposits
- ☐ B7 - Inundation Visible on Aerial Imagery
- ☐ B8 - Sparsely Vegetated Concave Surface
- ☑ B9 - Water-Stained Leaves
- ☐ B13 - Aquatic Fauna
- ☐ B15 - Marl Deposits
- ☐ C1 - Hydrogen Sulfide Odor
- ☐ C3 - Oxidized Rhizospheres on Living Roots
- ☐ C4 - Presence of Reduced Iron
- ☐ C6 - Recent Iron Reduction in Tilled Soils
- ☐ C7 - Thin Muck Surface
- ☐ Other (Explain in Remarks)

Secondary:
- ☐ B6 - Surface Soil Cracks
- ☑ B10 - Drainage Patterns
- ☐ B16 - Moss Trim Lines
- ☐ C2 - Dry-Season Water Table
- ☐ C8 - Crayfish Burrows
- ☐ C9 - Saturation Visible on Aerial Imagery
- ☐ D1 - Stunted or Stressed Plants
- ☐ D2 - Geomorphic Position
- ☐ D3 - Shallow Aquitard
- ☐ D4 - Microtopographic Relief
- ☐ D5 - FAC-Neutral Test

Field Observations:

Surface Water Present?	☐ Yes	☑ No	Depth:	(in.)
Water Table Present?	☑ Yes	☐ No	Depth: 2	(in.)
Saturation Present?	☑ Yes	☐ No	Depth: 0	(in.)

Wetland Hydrology Present? ☑ Yes ☐ No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: N/A

Remarks:

SOILS

Map Unit Name: Pillsbury-Peachum-Peru Complex Series Drainage Class: poorly drained

Taxonomy (Subgroup):

Profile Description (Describe to the depth needed to document the indicator or confirm the absence of indicators.) (Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered/Coated Sand Grains; Location: PL=Pore Lining, M=Matrix)

Top Depth	Bottom Depth	Horizon	Matrix Color (Moist)	Matrix %	Mottles Color (Moist)	Mottles %	Mottles Type	Mottles Location	Texture (e.g. clay, sand, loam)
18	0	1	--	--	--	--	--	--	organic material
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--

NRCS Hydric Soil Field Indicators (check here if indicators are not present ☐):
- ☑ A1- Histosol
- ☐ A2 - Histic Epipedon
- ☐ A3 - Black Histic
- ☐ A4 - Hydrogen Sulfide
- ☐ A5 - Stratified Layers
- ☐ A11 - Depleted Below Dark Surface
- ☐ A12 - Thick Dark Surface
- ☐ S1 - Sandy Muck Mineral
- ☐ S4 - Sandy Gleyed Matrix
- ☐ S5 - Sandy Redox
- ☐ S6 - Stripped Matrix
- ☐ S7 - Dark Surface (LRR R, MLRA 149B)
- ☐ S8 - Polyvalue Below Surface (LRR R, MLRA 149B)
- ☐ S9 - Thin Dark Surface (LRR R, MLRA 149B)
- ☐ F1 - Loamy Mucky Mineral (LRR K, L)
- ☐ F2 - Loamy Gleyed Matrix
- ☐ F3 - Depleted Matrix
- ☐ F6 - Redox Dark Surface
- ☐ F7 - Depleted Dark Surface
- ☐ F8 - Redox Depressions

Indicators for Problematic Soils [1]
- ☐ A10 - 2 cm Muck (LRR K, L, MLRA 149B)
- ☐ A16 - Coast Prairie Redox (LRR K, L, R)
- ☐ S3 - 5cm Mucky Peat of Peat (**LRR K, L, R**)
- ☐ S7 - Dark Surface (LRR K, L, M)
- ☐ S8 - Polyvalue Below Surface (**LRR K, L**)
- ☐ S9 - Thin Dark Surface (**LRR K, L**)
- ☐ F12 - Iron-Manganese Masses (**LRR K, L, R**)
- ☐ F19 - Piedmont Floodplain Soils (**MLRA 149B**)
- ☐ TA6 - Mesic Spodic (**MLRA 144A, 145, 149B**)
- ☐ TF2 - Red Parent Material
- ☐ TF12 - Very Shallow Dark Surface
- ☐ Other (Explain in Remarks)

[1] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (If Observed) Type: Rock/boulders Depth: 18"

Hydric Soil Present? ☑ Yes ☐ No

Remarks:

Stantec

WETLAND DETERMINATION DATA FORM

Northeast and Northcentral Region

Project/Site: Mt. Carberry Landfill | Wetland ID: 02TTB | Sample Point Wetland

VEGETATION (Species identified in all uppercase are non-native species.)

Tree Stratum (Plot size: 10 meter radius)

	Species Name	% Cover	Dominant	Ind.Status
1.	*Acer rubrum*	25	Y	FAC
2.	*Betula populifolia*	15	Y	FAC
3.	*Abies balsamea*	15	Y	FAC
4.	--	--	--	--
5.	--	--	--	--
6.	--	--	--	--
7.	--	--	--	--
8.	--	--	--	--
9.	--	--	--	--
10.	--	--	--	--
	Total Cover =	55		

Sapling/Shrub Stratum (Plot size: 5 meter radius)

1.	*Alnus incana*	40	Y	FACW
2.	*Betula populifolia*	20	Y	FAC
3.	*Acer rubrum*	20	Y	FAC
4.	--	--	--	--
5.	--	--	--	--
6.	--	--	--	--
7.	--	--	--	--
8.	--	--	--	--
9.	--	--	--	--
10.	--	--	--	--
	Total Cover =	80		

Herb Stratum (Plot size: 2 meter radius)

1.	*Osmundastrum cinnamomeum*	25	Y	FACW
2.	*Osmunda claytoniana*	10	Y	FAC
3.	*Calamagrostis canadensis*	5	N	OBL
4.	--	--	--	--
5.	--	--	--	--
6	--	--	--	--
7.	--	--	--	--
8.	--	--	--	--
9.	--	--	--	--
10.	--	--	--	--
11.	--	--	--	--
12.	--	--	--	--
13.	--	--	--	--
14.	--	--	--	--
15.	--	--	--	--
	Total Cover =	40		

Woody Vine Stratum (Plot size: 10 meter radius)

1.	--	--	--	--
2.	--	--	--	--
3.	--	--	--	--
4.	--	--	--	--
5.	--	--	--	--
	Total Cover =	0		

Remarks:

Dominance Test Worksheet

Number of Dominant Species that are OBL, FACW, or FAC: 8 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ***100.0%*** (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by:	
OBL spp.	5	x 1 =	5
FACW spp.	65	x 2 =	130
FAC spp.	105	x 3 =	315
FACU spp.	0	x 4 =	0
UPL spp.	0	x 5 =	0
Total	175 (A)		450 (B)

Prevalence Index = B/A = ***2.571***

Hydrophytic Vegetation Indicators:

☐ Yes	☑ No	Rapid Test for Hydrophytic Vegetation
☑ Yes	☐ No	Dominance Test is > 50%
☑ Yes	☐ No	Prevalence Index is ≤ 3.0 *
☐ Yes	☑ No	Morphological Adaptations (Explain) *
☐ Yes	☑ No	Problem Hydrophytic Vegetation (Explain) *

* Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub - Woody plants less than 3 in. DBH and greater than 3.28 ft. tall.

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft. tall.

Woody Vines - All woody vines greater than 3.28 ft. in height.

Hydrophytic Vegetation Present ☑ Yes ☐ No

Additional Remarks:

WETLAND DETERMINATION DATA FORM
Northeast and Northcentral Region

Project/Site:	Mt. Carberry Landfill	Stantec Project #:	195600461
Applicant:	AVRRDD		
Investigator #1:	Tom Tetreau	Investigator #2:	
Soil Unit:	Bucksport Muck	NWI/WWI Classification:	n/a
Landform:	Footslope	Local Relief:	Convex
Slope (%):	8	Latitude: 44.456277	Longitude: -71.141186
Datum:	NAD 1983		

Date:	10/18/18
County:	Coos
State:	New Hampshire
Wetland ID:	02TTC
Sample Point:	**Upland**
Community ID:	upland

Are climatic/hydrologic conditions on the site typical for this time of year? (If no, explain in remarks) ☑ Yes ☐ No

Are Vegetation ☐, Soil ☑, or Hydrology ☐ significantly disturbed?
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic?

Are normal circumstances present? ☑ Yes ☐ No

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present?	☑ Yes ☐ No	Hydric Soils Present?	☐ Yes ☑ No
Wetland Hydrology Present?	☐ Yes ☑ No	Is This Sampling Point Within A Wetland?	☐ **Yes** ☑ **No**

Remarks: Sand fill from past road construction.

HYDROLOGY

Wetland Hydrology Indicators (Check here if indicators are not present ☑):

Primary:
- ☐ A1 - Surface Water
- ☐ A2 - High Water Table
- ☐ A3 - Saturation
- ☐ B1 - Water Marks
- ☐ B2 - Sediment Deposits
- ☐ B3 - Drift Deposits
- ☐ B4 - Algal Mat or Crust
- ☐ B5 - Iron Deposits
- ☐ B7 - Inundation Visible on Aerial Imagery
- ☐ B8 - Sparsely Vegetated Concave Surface
- ☐ B9 - Water-Stained Leaves
- ☐ B13 - Aquatic Fauna
- ☐ B15 - Marl Deposits
- ☐ C1 - Hydrogen Sulfide Odor
- ☐ C3 - Oxidized Rhizospheres on Living Roots
- ☐ C4 - Presence of Reduced Iron
- ☐ C6 - Recent Iron Reduction in Tilled Soils
- ☐ C7 - Thin Muck Surface
- ☐ Other (Explain in Remarks)

Secondary:
- ☐ B6 - Surface Soil Cracks
- ☐ B10 - Drainage Patterns
- ☐ B16 - Moss Trim Lines
- ☐ C2 - Dry-Season Water Table
- ☐ C8 - Crayfish Burrows
- ☐ C9 - Saturation Visible on Aerial Imagery
- ☐ D1 - Stunted or Stressed Plants
- ☐ D2 - Geomorphic Position
- ☐ D3 - Shallow Aquitard
- ☐ D4 - Microtopographic Relief
- ☐ D5 - FAC-Neutral Test

Field Observations:

Surface Water Present?	☐ Yes ☑ No	Depth:	(in.)
Water Table Present?	☐ Yes ☑ No	Depth:	(in.)
Saturation Present?	☐ Yes ☑ No	Depth:	(in.)

Wetland Hydrology Present? ☐ Yes ☑ No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: N/A

Remarks:

SOILS

Map Unit Name: Bucksport Muck — Series Drainage Class: very poorly drained

Taxonomy (Subgroup):

Profile Description (Describe to the depth needed to document the indicator or confirm the absence of indicators.) (Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered/Coated Sand Grains; Location: PL=Pore Lining, M=Matrix)

Top Depth	Bottom Depth	Horizon	Matrix Color (Moist)	Matrix %	Mottles Color (Moist)	Mottles %	Mottles Type	Mottles Location	Texture (e.g. clay, sand, loam)
0	10	1	10YR 4/3	100	--	--	--	--	sand
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--

NRCS Hydric Soil Field Indicators (check here if indicators are not present ☑):
- ☐ A1- Histosol
- ☐ A2 - Histic Epipedon
- ☐ A3 - Black Histic
- ☐ A4 - Hydrogen Sulfide
- ☐ A5 - Stratified Layers
- ☐ A11 - Depleted Below Dark Surface
- ☐ A12 - Thick Dark Surface
- ☐ S1 - Sandy Muck Mineral
- ☐ S4 - Sandy Gleyed Matrix
- ☐ S5 - Sandy Redox
- ☐ S6 - Stripped Matrix
- ☐ S7 - Dark Surface (LRR R, MLRA 149B)
- ☐ S8 - Polyvalue Below Surface (LRR R, MLRA 149B)
- ☐ S9 - Thin Dark Surface (LRR R, MLRA 149B)
- ☐ F1 - Loamy Mucky Mineral (LRR K, L)
- ☐ F2 - Loamy Gleyed Matrix
- ☐ F3 - Depleted Matrix
- ☐ F6 - Redox Dark Surface
- ☐ F7 - Depleted Dark Surface
- ☐ F8 - Redox Depressions

Indicators for Problematic Soils [1]
- ☐ A10 - 2 cm Muck (LRR K, L, MLRA 149B)
- ☐ A16 - Coast Prairie Redox (LRR K, L, R)
- ☐ S3 - 5cm Mucky Peat of Peat (**LRR K, L, R**)
- ☐ S7 - Dark Surface (LRR K, L, M)
- ☐ S8 - Polyvalue Below Surface (**LRR K, L**)
- ☐ S9 - Thin Dark Surface (**LRR K, L**)
- ☐ F12 - Iron-Manganese Masses (**LRR K, L, R**)
- ☐ F19 - Piedmont Floodplain Soils (**MLRA 149B**)
- ☐ TA6 - Mesic Spodic (**MLRA 144A, 145, 149B**)
- ☐ TF2 - Red Parent Material
- ☐ TF12 - Very Shallow Dark Surface
- ☐ Other (Explain in Remarks)

[1] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (If Observed) Type: rock Depth: 10"

Hydric Soil Present? ☐ Yes ☑ No

Remarks:

Stantec

WETLAND DETERMINATION DATA FORM

Northeast and Northcentral Region

Project/Site: Mt. Carberry Landfill Wetland ID: 02TTC Sample Point **Upland**

VEGETATION (Species identified in all uppercase are non-native species.)

Tree Stratum (Plot size: 10 meter radius)

	Species Name	% Cover	Dominant	Ind.Status
1.	*Abies balsamea*	25	Y	FAC
2.	*Acer rubrum*	10	Y	FAC
3.	*Betula papyrifera*	5	N	FACU
4.	--	--	--	--
5.	--	--	--	--
6.	--	--	--	--
7.	--	--	--	--
8.	--	--	--	--
9.	--	--	--	--
10.	--	--	--	--
	Total Cover =	40		

Sapling/Shrub Stratum (Plot size: 5 meter radius)

1.	*Acer rubrum*	10	Y	FAC
2.	*Abies balsamea*	10	Y	FAC
3.	*Hamamelis virginiana*	10	Y	FACU
4.	*Acer pensylvanicum*	5	N	FACU
5.	*Betula papyrifera*	5	N	FACU
6.	--	--	--	--
7.	--	--	--	--
8.	--	--	--	--
9.	--	--	--	--
10.	--	--	--	--
	Total Cover =	40		

Herb Stratum (Plot size: 2 meter radius)

1.	*Pteridium aquilinum*	50	Y	FACU
2.	*Aralia nudicaulis*	15	N	FACU
3.	*Rubus idaeus*	15	N	FACU
4.	*Osmunda claytoniana*	10	N	FAC
5.	--	--	--	--
6	--	--	--	--
7.	--	--	--	--
8.	--	--	--	--
9.	--	--	--	--
10.	--	--	--	--
11.	--	--	--	--
12.	--	--	--	--
13.	--	--	--	--
14.	--	--	--	--
15.	--	--	--	--
	Total Cover =	90		

Woody Vine Stratum (Plot size: 10 meter radius)

1.	--	--	--	--
2.	--	--	--	--
3.	--	--	--	--
4.	--	--	--	--
5.	--	--	--	--
	Total Cover =	0		

Remarks:

Dominance Test Worksheet

Number of Dominant Species that are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ***66.7%*** (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by:	
OBL spp.	0	x 1 =	0
FACW spp.	0	x 2 =	0
FAC spp.	65	x 3 =	195
FACU spp.	105	x 4 =	420
UPL spp.	0	x 5 =	0
Total	170 (A)		615 (B)

Prevalence Index = B/A = ***3.618***

Hydrophytic Vegetation Indicators:

- ☐ Yes ☑ No Rapid Test for Hydrophytic Vegetation
- ☑ Yes ☐ No Dominance Test is > 50%
- ☐ Yes ☑ No Prevalence Index is ≤ 3.0 *
- ☐ Yes ☑ No Morphological Adaptations (Explain) *
- ☐ Yes ☑ No Problem Hydrophytic Vegetation (Explain) *

* Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub - Woody plants less than 3 in. DBH and greater than 3.28 ft. tall.

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft. tall.

Woody Vines - All woody vines greater than 3.28 ft. in height.

Hydrophytic Vegetation Present ☑ Yes ☐ No

Additional Remarks:

WETLAND DETERMINATION DATA FORM
Northeast and Northcentral Region

Project/Site:	Mt. Carberry Landfill	Stantec Project #:	195600461
Applicant:	AVRRDD		
Investigator #1:	Tom Tetreau	Investigator #2:	
Soil Unit:	Bucksport Muck	NWI/WWI Classification:	PFO
Landform:	Footslope	Local Relief:	Concave
Slope (%):	0	Latitude: 44.456191	Longitude: -71.141163
Datum:	NAD 1983		

Date:	10/18/18
County:	Coos
State:	New Hampshire
Wetland ID:	02TTC
Sample Point:	**Wetland**
Community ID:	PFO

Are climatic/hydrologic conditions on the site typical for this time of year? (If no, explain in remarks) ☑ Yes ☐ No

Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed?
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic?

Are normal circumstances present? ☑ Yes ☐ No

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present? ☑ Yes ☐ No
Wetland Hydrology Present? ☑ Yes ☐ No
Hydric Soils Present? ☑ Yes ☐ No
Is This Sampling Point Within A Wetland? ☑ **Yes** ☐ **No**

Remarks:

HYDROLOGY

Wetland Hydrology Indicators (Check here if indicators are not present ☐):

Primary:
- ☐ A1 - Surface Water
- ☑ A2 - High Water Table
- ☑ A3 - Saturation
- ☐ B1 - Water Marks
- ☐ B2 - Sediment Deposits
- ☐ B3 - Drift Deposits
- ☐ B4 - Algal Mat or Crust
- ☐ B5 - Iron Deposits
- ☐ B7 - Inundation Visible on Aerial Imagery
- ☐ B8 - Sparsely Vegetated Concave Surface
- ☐ B9 - Water-Stained Leaves
- ☐ B13 - Aquatic Fauna
- ☐ B15 - Marl Deposits
- ☐ C1 - Hydrogen Sulfide Odor
- ☐ C3 - Oxidized Rhizospheres on Living Roots
- ☐ C4 - Presence of Reduced Iron
- ☐ C6 - Recent Iron Reduction in Tilled Soils
- ☐ C7 - Thin Muck Surface
- ☐ Other (Explain in Remarks)

Secondary:
- ☐ B6 - Surface Soil Cracks
- ☐ B10 - Drainage Patterns
- ☐ B16 - Moss Trim Lines
- ☐ C2 - Dry-Season Water Table
- ☐ C8 - Crayfish Burrows
- ☐ C9 - Saturation Visible on Aerial Imagery
- ☐ D1 - Stunted or Stressed Plants
- ☐ D2 - Geomorphic Position
- ☐ D3 - Shallow Aquitard
- ☐ D4 - Microtopographic Relief
- ☐ D5 - FAC-Neutral Test

Field Observations:

Surface Water Present?	☐ Yes	☑ No	Depth:	(in.)
Water Table Present?	☑ Yes	☐ No	Depth: 10	(in.)
Saturation Present?	☑ Yes	☐ No	Depth: 0	(in.)

Wetland Hydrology Present? ☑ Yes ☐ No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: N/A

Remarks:

SOILS

Map Unit Name: Bucksport Muck — Series Drainage Class: very poorly drained

Taxonomy (Subgroup):

Profile Description (Describe to the depth needed to document the indicator or confirm the absence of indicators.) (Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered/Coated Sand Grains; Location: PL=Pore Lining, M=Matrix)

Top Depth	Bottom Depth	Horizon	Matrix Color (Moist)	Matrix %	Mottles Color (Moist)	Mottles %	Mottles Type	Mottles Location	Texture (e.g. clay, sand, loam)
30	0	1	--	100	--	--	--	--	organic muck
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--

NRCS Hydric Soil Field Indicators (check here if indicators are not present ☐):
- ☑ A1- Histosol
- ☐ A2 - Histic Epipedon
- ☐ A3 - Black Histic
- ☐ A4 - Hydrogen Sulfide
- ☐ A5 - Stratified Layers
- ☐ A11 - Depleted Below Dark Surface
- ☐ A12 - Thick Dark Surface
- ☐ S1 - Sandy Muck Mineral
- ☐ S4 - Sandy Gleyed Matrix
- ☐ S5 - Sandy Redox
- ☐ S6 - Stripped Matrix
- ☐ S7 - Dark Surface (LRR R, MLRA 149B)
- ☐ S8 - Polyvalue Below Surface (LRR R, MLRA 149B)
- ☐ S9 - Thin Dark Surface (LRR R, MLRA 149B)
- ☐ F1 - Loamy Mucky Mineral (LRR K, L)
- ☐ F2 - Loamy Gleyed Matrix
- ☐ F3 - Depleted Matrix
- ☐ F6 - Redox Dark Surface
- ☐ F7 - Depleted Dark Surface
- ☐ F8 - Redox Depressions

Indicators for Problematic Soils [1]
- ☐ A10 - 2 cm Muck (LRR K, L, MLRA 149B)
- ☐ A16 - Coast Prairie Redox (LRR K, L, R)
- ☐ S3 - 5cm Mucky Peat of Peat (**LRR K, L, R**)
- ☐ S7 - Dark Surface (LRR K, L, M)
- ☐ S8 - Polyvalue Below Surface (**LRR K, L**)
- ☐ S9 - Thin Dark Surface (**LRR K, L**)
- ☐ F12 - Iron-Manganese Masses (**LRR K, L, R**)
- ☐ F19 - Piedmont Floodplain Soils (**MLRA 149B**)
- ☐ TA6 - Mesic Spodic (**MLRA 144A, 145, 149B**)
- ☐ TF2 - Red Parent Material
- ☐ TF12 - Very Shallow Dark Surface
- ☐ Other (Explain in Remarks)

[1] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (If Observed) Type: Depth:

Hydric Soil Present? ☑ Yes ☐ No

Remarks: Organic material continues deeper than 30"

WETLAND DETERMINATION DATA FORM
Northeast and Northcentral Region

Project/Site: Mt. Carberry Landfill | Wetland ID: 02TTC | Sample Point: Wetland

VEGETATION (Species identified in all uppercase are non-native species.)

Tree Stratum (Plot size: 10 meter radius)

	Species Name	% Cover	Dominant	Ind.Status
1.	*Acer rubrum*	30	Y	FAC
2.	*Abies balsamea*	30	Y	FAC
3.	*Betula papyrifera*	5	N	FACU
4.	--	--	--	--
5.	--	--	--	--
6.	--	--	--	--
7.	--	--	--	--
8.	--	--	--	--
9.	--	--	--	--
10.	--	--	--	--
	Total Cover =	65		

Sapling/Shrub Stratum (Plot size: 5 meter radius)

1.	*Nemopanthus mucronatus*	50	Y	OBL
2.	*Acer rubrum*	25	Y	FAC
3.	*Abies balsamea*	10	N	FAC
4.	*Betula alleghaniensis*	5	N	FAC
5.	--	--	--	--
6.	--	--	--	--
7.	--	--	--	--
8.	--	--	--	--
9.	--	--	--	--
10.	--	--	--	--
	Total Cover =	90		

Herb Stratum (Plot size: 2 meter radius)

1.	*Glyceria canadensis*	50	Y	OBL
2.	*Calamagrostis canadensis*	50	Y	OBL
3.	*Doellingeria umbellata*	15	N	FACW
4.	*Osmundastrum cinnamomeum*	15	N	FACW
5.	*Solidago rugosa*	5	N	FAC
6	--	--	--	--
7.	--	--	--	--
8.	--	--	--	--
9.	--	--	--	--
10.	--	--	--	--
11.	--	--	--	--
12.	--	--	--	--
13.	--	--	--	--
14.	--	--	--	--
15.	--	--	--	--
	Total Cover =	135		

Woody Vine Stratum (Plot size: 10 meter radius)

1.	--	--	--	--
2.	--	--	--	--
3.	--	--	--	--
4.	--	--	--	--
5.	--	--	--	--
	Total Cover =	0		

Remarks:

Dominance Test Worksheet

Number of Dominant Species that are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ***100.0%*** (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by:	
OBL spp.	150	x 1 =	150
FACW spp.	30	x 2 =	60
FAC spp.	105	x 3 =	315
FACU spp.	5	x 4 =	20
UPL spp.	0	x 5 =	0
Total	290 (A)		545 (B)

Prevalence Index = B/A = ***1.879***

Hydrophytic Vegetation Indicators:

- ☐ Yes ☑ No Rapid Test for Hydrophytic Vegetation
- ☑ Yes ☐ No Dominance Test is > 50%
- ☑ Yes ☐ No Prevalence Index is ≤ 3.0 *
- ☐ Yes ☑ No Morphological Adaptations (Explain) *
- ☐ Yes ☑ No Problem Hydrophytic Vegetation (Explain) *

* Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub - Woody plants less than 3 in. DBH and greater than 3.28 ft. tall.

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft. tall.

Woody Vines - All woody vines greater than 3.28 ft. in height.

Hydrophytic Vegetation Present ☑ Yes ☐ No

Additional Remarks:

March 20, 2020
Sharon Gauthier
Attachment

Reference: 2018 Wetland Delineation and 2020 Wetland Functional Assessment Results, Mt. Carberry Landfill, Success, New Hampshire

ATTACHMENT D – WETLAND FUNCTIONAL ASSESSMENT

WETLANDS FUNCTIONAL ASSESSMENT WORKSHEET

Water Division/Land Resource Management
Wetlands Bureau

Check the Status of your Application

RSA/Rule: RSA 482-A / Env-Wt 311.03(b)(10); Env-Wt 311.10

APPLICANT LAST NAME, FIRST NAME, M.I.: Gauthier, Sharon

As required by Env-Wt 311.03(b)(10), an application for a standard permit for minor and major projects must include a functional assessment of all wetlands on the project site as specified in Env-Wt 311.10. This worksheet will help you compile data for the functional assessment needed to meet federal (US Army Corps of Engineers (USACE); if applicable) and NHDES requirements. Additional requirements are needed for projects in tidal area; please refer to the Coastal Area Worksheet for more information.

Both a desktop review and a field examination are needed to accurately determine surrounding land use, hydrology, hydroperiod, hydric soils, vegetation, structural complexity of wetland classes, hydrologic connections between wetlands or stream systems or wetland complex, position in the landscape, and physical characteristics of wetlands and associated surface waters. The results of the evaluation are to be used to select the location of the proposed project having the least impact to wetland functions and values (Env-Wt 311.10). This worksheet can be used in conjunction with the Written Narrative (NHDES-W-06-089) or Avoidance and Minimization Checklist (NHDES-W-06-050) to address Env-Wt 313.03 (Avoidance and Minimization). If more than one wetland/ stream resource is identified, multiple worksheets can be attached with the application. All wetland, vernal pools, and stream identification (ID) numbers are to be displayed and located on the wetlands delineation of the subject property.

SECTION 1 - LOCATION (USACE HIGHWAY METHODOLOGY)	
ADJACENT LAND USE: Existing landfill, forestry	
CONTIGUOUS UNDEVELOPED BUFFER ZONE PRESENT? ☐ Yes ☒ No	
DISTANCE TO NEAREST ROADWAY OR OTHER DEVELOPMENT (in feet): 25	
SECTION 2 - DELINEATION (USACE HIGHWAY METHODOLOGY; Env-Wt 311.10)	
CERTIFIED WETLAND SCIENTIST (if in a non-tidal area) or QUALIFIED COASTAL PROFESSIONAL (if in a tidal area) who prepared this assessment: Tom Tetreau, NHCWS #283	
DATE(S) OF SITE VISIT(S): March 12, 2020	DELINEATION PER ENV-WT 406 COMPLETED? ☒ Yes ☐ No
CONFIRM THAT THE EVALUATION IS BASED ON: ☒ Office and ☒ Field examination.	
METHOD USED FOR FUNCTIONAL ASSESSMENT (check one and fill in field if “other”): ☒ USACE Highway Methodology. ☐ Other scientifically supported method (enter name/ title):	

SECTION 3 - WETLAND RESOURCE SUMMARY (USACE HIGHWAY METHODOLOGY; Env-Wt 311.10)	
WETLAND ID: 02TTC	LOCATION: (LAT/ LONG) 44.455892°/-71.142368°
WETLAND AREA: Approx. 1 acre surveyed, extends off-site	DOMINANT WETLAND SYSTEMS PRESENT: forested, scrub-shrub
HOW MANY TRIBUTARIES CONTRIBUTE TO THE WETLAND? 1	COWARDIN CLASS: PFO, PSS, R3SB
IS THE WETLAND A SEPARATE HYDRAULIC SYSTEM? ☐ Yes ☒ No if not, where does the wetland lie in the drainage basin? Approx. 96 acres of drainage area is present upslope of the wetland (USGS stream stats).	IS THE WETLAND PART OF: ☐ A wildlife corridor or ☐ A habitat island? IS THE WETLAND HUMAN-MADE? ☐ Yes ☒ No
IS THE WETLAND IN A 100-YEAR FLOODPLAIN? ☐ Yes ☒ No	ARE VERNAL POOLS PRESENT? ☐ Yes ☒ No (If yes, complete the Vernal Pool Table)
ARE ANY WETLANDS PART OF A STREAM OR OPEN-WATER SYSTEM? ☒ Yes ☐ No	ARE ANY PUBLIC OR PRIVATE WELLS DOWNSTREAM/ DOWNGRADIENT? ☐ Yes ☒ No
PROPOSED WETLAND IMPACT TYPE: None, landfill expansion proposed upslope.	PROPOSED WETLAND IMPACT AREA: 0

SECTION 4 - WETLANDS FUNCTIONS AND VALUES* (USACE HIGHWAY METHODOLOGY; Env-Wt 311.10)

The following table can be used to compile data on wetlands functions and values. The reference numbers indicated in the "Functions/ Values" column refer to the following functions and values:

1. Ecological Integrity (from RSA 482-A:2, XI)
2. Educational Potential (from USACE Highway Methodology: Educational/Scientific Value)
3. Fish & Aquatic Life Habitat (from USACE Highway Methodology: Fish & Shellfish Habitat)
4. Flood Storage (from USACE Highway Methodology: Floodflow Alteration)
5. Groundwater Recharge (from USACE Highway Methodology: Groundwater Recharge/Discharge)
6. Noteworthiness (from USACE Highway Methodology: Threatened or Endangered Species Habitat)
7. Nutrient Trapping/Retention & Transformation (from USACE Highway Methodology: Nutrient removal)
8. Production Export (Nutrient) (from USACE Highway Methodology)
9. Scenic Quality (from USACE Highway Methodology: Visual Quality/Aesthetics)
10. Sediment Trapping (from USACE Highway Methodology: Sediment /Toxicant Retention)
11. Shoreline Anchoring (from USACE Highway Methodology: Sediment/Shoreline Stabilization)
12. Uniqueness/Heritage (from USACE Highway Methodology)
13. Wetland-based Recreation (from USACE Highway Methodology: Recreation)
14. Wetland-dependent Wildlife Habitat (from USACE Highway Methodology: Wildlife Habitat)

First, determine if a wetland is suitable for particular function and value ("Suitability" column) and indicate the rationale behind your determination ("Rationale" column). Please use the rationale reference numbers listed in Appendix A of USACE *The Highway Methodology Workbook Supplement*. Second, indicate which functions and values are principal (Principal Function/value?" column). As described in *The Highway Methodology Workbook Supplement*, "functions and values can be principal if they are an important physical component of a wetland ecosystem (function only) and/or are considered of special value to society, from a local, regional, and/or national perspective".

"Important Notes" are to include characteristics the evaluator used to determine the principal function and value of the wetland.

FUNCTIONS/ VALUES	SUITABILITY (Y/N)	RATIONALE (Reference #)	PRINCIPAL FUNCTION/VALUE? (Y/N)	IMPORTANT NOTES
1	☐ Yes ☒ No		☐ Yes ☒ No	An existing, active landfill is present uplope of the wetland. The drainage area leading towards the wetland and other surrounding areas have been altered significantly by the landfill operations and forestry practices. The wetland and associated stream is connected to a culvert that drains areas in and arround the existing landfill development.
2	☐ Yes ☒ No		☐ Yes ☒ No	There are no unique characteristics that would make the wetland suitable for educational purposes. The area is also not open to public access.
3	☒ Yes ☐ No	4, 5, 10, 14, 15, 16, 17	☐ Yes ☒ No	The stream and wetland are connected to Cascade Alpine Brook and is large enough to possible support small fish species, although none were observed. The stream and upslope development likely limit fish use and therefore this would not be considered a principal function.
4	☒ Yes ☐ No	1, 2, 3, 5, 6, 8, 9, 10, 13, 14, 16, 18	☒ Yes ☐ No	The stream and associated wetland complex has potential to store flood flow during spring melt and heavy rain events.
5	☒ Yes ☐ No	2, 7	☐ Yes ☒ No	A perennial stream is present within the wetland. Other than the presence of the stream, the wetland did not show any other signs of recharge/discharge and therefore this would not be considered a principal function.
6	☐ Yes ☒ No		☐ Yes ☒ No	Threatened or endangered species were not observed or known to occur within the wetland.
7	☒ Yes ☐ No	1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14	☒ Yes ☐ No	The wetland and stream receive flow from the upslope drainage area and has potential to process nutrients. Dense emergent and woody vegetation is present in wetland areas off-site to the south.

8	☒ Yes ☐ No	1, 2, 4, 7, 10, 12	☒ Yes ☐ No	The wetland contains abundant scrub-shrub vegetation, such as common winterberry and catberry, which may provide a food source to birds and other animals.
9	☐ Yes ☒ No		☐ Yes ☒ No	Surveyed areas of the wetland do not provide any scenic views and are adjacent to active landfill operations.
10	☒ Yes ☐ No	1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 15, 16	☒ Yes ☐ No	The wetland has the potential to capture excess sediment and toxicants from the upslope area. The associated stream likely decreases in velocity in the off-site portions of the wetland.
11	☒ Yes ☐ No	2, 3, 4, 6, 7, 12, 13, 14, 15	☒ Yes ☐ No	The wetland surrounding the stream likely stabilizes the streambanks against erosion. Potential sediment sources are present upslope/upstream and a wide wetland with dense vegetation borders the stream.
12	☐ Yes ☒ No		☐ Yes ☒ No	The wetland does not contain any attributes relative to aspects of public health, recreation, or habitat diversity and is not unique within the surrounding landscape.
13	☐ Yes ☒ No		☐ Yes ☒ No	The wetland does not provide any recreational opportunities and is not accessible by the public.
14	☒ Yes ☐ No	5, 6, 7, 8, 13, 16, 17	☐ Yes ☒ No	The wetland is continguous with larger wetland areas off-site that may provide some wildlife habitat for birds and mammals. Coyote, fox, bear, snowshoe hare, and squirrel tracks were observed within the wetland. Wildlife use was documented throughout the surrounding area and was not specific to the wetland, therefore this would not be considered a principal function.

SECTION 5 - VERNAL POOL SUMMARY (Env-Wt 311.10)

Delineations of vernal pools shall be based on the characteristics listed in the definition of "vernal pool" in Env-Wt 104.44. To assist in the delineation, individuals may use either of the following references:

- *Identifying and Documenting Vernal Pools in New Hampshire 3rd Ed.*, 2016, published by NHF&G; or
- The USACE *Vernal Pool Assessment* draft guidance dated 9-10-2013 and form dated 9-6-2016, Appendix L of the USACE New England District *Compensatory Mitigation Guidance*.

All vernal pool ID numbers are to be displayed and located on the wetland delineation of the subject property.

"Important Notes" are to include documented reproductive and wildlife values, landscape context, and relationship to other vernal pools/wetlands.

Note: For projects seeking federal approval from the USACE, please attach a completed copy of The USACE "Vernal Pool Assessment" form dated 9-6-2016, Appendix L of the USACE New England District *Compensatory Mitigation Guidance*.

VERNAL POOL ID NUMBER	DATE(S) OBSERVED	PRIMARY INDICATORS PRESENT (LIST)	SECONDARY INDICATORS PRESENT (LIST)	LENGTH OF HYDROPERIOD	IMPORTANT NOTES
1					
2					
3					
4					
5					
6					
7					
8					

SECTION 6 - STREAM RESOURCES SUMMARY

DESCRIPTION OF STREAM: Perennial, from culvert	STREAM TYPE (ROSGEN): G
HAVE FISHERIES BEEN DOCUMENTED? ☐ Yes ☒ No	DOES THE STREAM SYSTEM APPEAR STABLE? ☒ Yes ☐ No
OTHER KEY ON-SITE FUNCTIONS OF NOTE: Receives flow from upslope landfill/development	

The following table can be used to compile data on stream resources. "Important Notes" are to include characteristics the evaluator used to determine principal function and value of each stream. The functions and values reference number are defined in Section 4.

FUNCTIONS/ VALUES	SUITABILITY (Y/N)	RATIONALE	PRINCIPAL FUNCTION/VALUE? (Y/N)	IMPORTANT NOTES
1	☐ Yes ☒ No		☐ Yes ☒ No	An existing, active landfill is present uplope of the stream. The drainage area leading towards the stream and other surrounding areas have been altered significantly by the landfill operations and forestry pracitces. The wetland and associated stream is connected to a culvert that drains areas in and arround the existing landfill development.
2	☐ Yes ☒ No		☐ Yes ☒ No	There are no unique characteristics that would make the wetland suitable for educational purposes. The area is also not open to public access.
3	☒ Yes ☐ No	1, 8, 14, 15, 16, 17	☐ Yes ☒ No	The stream and wetland are connected to Cascade Alpine Brook and is large enough to possible support small fish species, although none were observed. The stream and upslope development likely limit fish use and therefore this would not be considered a principal function.
4	☒ Yes ☐ No	14, 16	☒ Yes ☐ No	The stream and associated wetland complex has potential to store flood flow during spring melt and heavy rain events.
5	☐ Yes ☒ No		☐ Yes ☒ No	Perennial stream. Other than the presence of the stream, the wetland did not show any other signs of recharge/discharge and therefore this would not be considered a function.
6	☐ Yes ☒ No		☐ Yes ☒ No	Threatened or endangered species were not observed or known to occur within the wetland or stream.

7	☒ Yes ☐ No	14	☐ Yes ☒ No	The wetland and stream receive flow from the upslope drainage area and has potential to process nutrients. Dense emergent and woody vegetation is present in wetland areas off-site to the south. This function is present but present more as a wetland function than a stream function.
8	☒ Yes ☒ No		☐ Yes ☒ No	The wetland surrounding the stream contains abundant scrub-shrub vegetation, such as common winterberry, which may provide a food source to birds and other animals. This is a wetland function and not a stream function.
9	☐ Yes ☒ No		☐ Yes ☒ No	Surveyed areas of the stream do not provide any scenic views and are adjacent to active landfill operations.
10	☒ Yes ☐ No	10, 11, 13, 14	☒ Yes ☐ No	The stream has the potential to capture excess sediment and toxicants from the upslope area. The associated stream likely decreases in velocity in the off-site portions of the wetland.
11	☒ Yes ☐ No	3, 4, 6, 12, 13	☒ Yes ☐ No	The wetland surrounding the stream likely stabilizes the streambanks against erosion. Potential sediment sources are present upslope/upstream and a wide wetland with dense vegetation borders the stream.
12	☐ Yes ☒ No		☐ Yes ☒ No	The stream does not contain any attributes relative to aspects of public health, recreation, or habitat diversity and is not unique within the surrounding landscape.
13	☐ Yes ☒ No		☐ Yes ☒ No	The stream does not provide any recreational opportunities and is not accessible by the public.
14	☐ Yes ☒ No		☐ Yes ☒ No	No wildlife use was documented within the stream. The wetland and stream are continguous with larger wetland areas off-site that may

				provide some wildlife habitat for birds and mammals. Coyote, fox, bear, snowshoe hare, and squirrel tracks were observed within the wetland. Wildlife use was documented throughout the surrounding area and was not specific to the wetland or stream, therefore this would not be considered a principal function.

SECTION 7 - ATTACHMENTS (USACE HIGHWAY METHODOLOGY; Env-Wt 311.10)

☒ Wildlife and vegetation diversity/abundance list.

☒ Photograph of wetland attached.

☒ Wetland delineation plans showing wetlands, vernal pools, and streams in relation to the impact area and surrounding landscape. Wetland IDs, vernal pool IDs, and stream IDs must be indicated on the plans.

☐ For projects in tidal areas only: additional information required by Env-Wt 603.03/603.04 (please refer to the Coastal Area Worksheet for more information)

March 20, 2020
Sharon Gauthier
Attachment

Reference: 2018 Wetland Delineation and 2020 Wetland Functional Assessment Results, Mt. Carberry Landfill, Success, New Hampshire

Wildlife and Vegetation List

Observed October 18, 2018, and March 12, 2020

Wildlife:

Coyote (*Canis latrans*) – tracks
Red fox (*Vulpes Vulpes*) – tracks
Black bear (*Ursus americanus*) – tracks
White-tailed deer (*Odocoileus virginianus*) - tracks
Red squirrel (*Tamiasciurus hudsonicus*)
Black-capped chickadee (*Poecile atricapillus*)
Downy woodpecker (*Dryobates pubescens*)
American crow (*Corvus brachyrhynchos*)

Vegetation:

Speckled alder (*Alnus incana*)
Catberry (*Nemopanthus mucronatus*)
Common winterberry (*Ilex verticilata*)
Balsam fir (*Abies balsamea*)
Red spruce (*Picea rubens*)
Red maple (*Acer rubrum*)
Yellow birch (*Betula alleghaniensis*)
Gray birch (*Betula populifolia*)
Broad-leaf meadowsweet (*Spiraea latifolia*)
Fowl manna grass (*Glyceria striata*)
Melic manna grass (*Glyceria melicaria*)
Sensitive fern (*Onoclea sensibilis*)
Cinnamon fern (*Osmundastrum cinnamomeum*)

Part XI

Landfill Gas Collection System Master Plan

Phase 3A Landfill Gas Collection System Master Plan

Mount Carberry Sanitary Landfill

Androscoggin Valley Regional Refuse Disposal District
3 12th Street
PO Box 336
Berlin, New Hampshire 03570-0336
603-752-3342

SCS ENGINEERS

13208015.55 | March 25, 2020

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Appendix B LFG Recovery Projections
Appendix C Phase 3A LFG Collection System Master Plan
Appendix D Preliminary Technical Specifications

1 INTRODUCTION

The Androscoggin Valley Regional Refuse Disposal District (AVRRDD) is applying for approval to construct and operate Phase 3A of the Mount Carberry Sanitary Landfill (Landfill), located in Success, New Hampshire. This report describes how landfill gas generated in Phase 3A will be collected and controlled.

2 WASTE FILLING PROJECTIONS

Phase 3A of the Mount Carberry Landfill will accept waste from 2026 (i.e., closure of Phase 1/2) through mid-2041. Waste filling is proposed to continue to be limited under the solid waste permit to 305,500 cubic yards (cy) per year. The 2017 and 2018 Landfill Capacity Updates, as prepared by CMA, indicate that in-place waste and cover material density ranged between 1,900 and 2,200 pounds per cubic yard (lb/cy). Using the 2017-2018 average in-place density, future waste filling rate is estimated at 312,800 tons/year, maximum of all material disposed, including cover materials.

For the purpose of projecting LFG recovery, waste is categorized into three main types: municipal solid waste (MSW), construction and demolition debris (C&D) and inert. Wastes that have higher LFG generation potential due to high organic and/or water content are included in the MSW category. Wastes that have reduced potential for LFG generation (but still some potential) as compared to MSW due to low organic and/or water content (which is typical of many actual C&D wastes) are included in the C&D category. Wastes that have little to no LFG generation potential are included in the inert category.

To estimate future waste filling by waste category (i.e., MSW and C&D) for the purpose of LFG recovery modeling, we applied the 2017-2019 actual average waste composition against waste to be placed in 2020 and future years. For 2017-2019, actual average composition was approximately 47.8 percent MSW, 25.3 percent C&D and 26.9 percent inert. The MSW and C&D fractions were applied against the total future waste filling rate, as estimated above, to estimate annual MSW and C&D filling rates. A table summarizing historical and projected waste filling rates by waste type/category is included in **Appendix A**.

3 LFG RECOVERY PROJECTIONS AND LFG CONTROL CAPACITY

LFG recovery projections, based on the historical and projected waste filling rates, are included in **Appendix B**. These projections include an estimated peak LFG recovery rate of approximately 2,000 scfm at 50 percent methane in 2041 (i.e., cessation of waste filling in Phase 3A). The capacity of the existing utility flare system is 2,000 scfm at 50 percent methane, and is therefore capable of handling this peak LFG recovery rate. However, LFG at the Landfill is typically collected at a methane content of 45 percent, which results in higher volumetric flow. The peak LFG recovery rate at 45 percent methane is approximately 2,200 scfm. Temporary Air Permit TP-0227 limits flow to the utility flare to 2,000 scfm, regardless of methane content.

The LFG-to-energy Project (LFGE Project), which supplies compressed, dried and filtered LFG for use at an off-site paper mill (Mill), also provides LFG flow capacity. While the LFGE Project is the preferred LFG control device, there are periods when the LFGE Project is offline (e.g., due to maintenance). Thus, the capacity of the LFGE Project is not considered with respect to LFG control

capacity. As such, if LFG continues to be recovered at a methane content below 50 percent, one of the following options would need to be pursued as actual LFG recovery rates approach 2,000 scfm:

- Modify temporary air permit TP-0227 (with or without physical modifications to the utility flare) to increase the allowable flare flow capacity; and/or,

- Supplement or replace the existing utility flare with another flare to provide additional LFG control capacity.

4 PHASE 3A LFG COLLECTION SYSTEM DESCRIPTION

A LFG collection system master plan is included in **Appendix C**, which was prepared based on permit-level landfill design drawings for Phase 3A. LFG will be collected from Phase 3A using a variety of LFG collectors, including vertical LFG extraction wells, horizontal collectors and LFG connections to leachate collection system cleanouts. **Appendix C** indicates the preliminary design locations of vertical LFG extraction wells and leachate cleanout connections. There are 43 vertical LFG extraction wells and two (2) leachate cleanout connections included within the Phase 3A footprint on **Appendix C**. Horizontal collectors will be designed and installed as waste filling progresses. The extent of the outer ring of these vertical LFG extraction wells is based on a minimum 40 foot well depth, with minimum 10-foot vertical space from bottom of the wells to the top of the base liner system. The wells are spaced from each other assuming a 100-foot radius of influence (ROI), with some ROI overlap between wells to minimize LFG collection system coverage gaps.

Appendix C also includes 22 new vertical LFG extraction wells adjacent to existing wells within the waste footprint of Phases 1 and 2, where Phase 3A filling includes at least 10 feet of additional filling over Phases 1 and 2 (i.e., most notably on the eastern sideslope of Phase 2). These wells may be installed as supplemental shallow wells to collect LFG from the upper reaches of waste, or they may be installed as full-depth wells and entirely replace the existing wells.

LFG lateral piping will extend generally northwards and southwards from LFG collectors to main perimeter LFG header piping installed in the north and south base liner system anchor trenches. The laterals will be installed to allow collection from each stage of filling as it is filled, and not be reliant upon laterals installed in future stages (i.e., collectors installed in Stage 14 will be connected to laterals installed in Stages 14 and 13, but not Stage 15).

The main perimeter LFG headers will be installed during liner installation. LFG lateral pipe crossings over the liner anchor trench will also be installed during liner construction at locations as shown in **Appendix C**. Installation of the header in the anchor trench during liner installation will prevent waste settlement impacts on header operation while also reducing header installation costs and reducing the potential for damage to the liner system. The main perimeter LFG headers will connect to existing LFG header piping in Phase 2 to allow conveyance of LFG collected from Phase 3A to the blower/flare system and LFGE Project. The north and south main perimeter LFG headers will each terminate at a blind flange on the east side to allow extension in the future to Phase 3B.

Sizing of the north and south side perimeter headers is based on the size of header pipe into which they connect in Phase 2 (i.e., 18-inch for south side header; 12-inch for north side header). Sizing of LFG laterals is based on an estimated average 20 cubic feet per minute (cfm) of LFG flow from each wellhead, maximum LFG velocity of 50 feet per second and maximum pressure loss of 1 inch of water column (in-w.c.) per 100 feet of pipe. All LFG piping will be SDR17 HDPE. 4-inch laterals will

convey LFG from only one collector; for multiple LFG collectors, minimum lateral size is 6 inch. Thus, laterals are sized as follows:

- 4-inch: 1 collector
- 6-inch: 2-18 collectors
- 8-inch: ≥19 collectors

Condensate from LFG wells in Phase 3A will drain along LFG laterals to the main perimeter LFG headers on the north and south sides of Phase 3A, where it will then drain to a header low point and sump on each of these two main perimeter LFG headers. Each of these sumps will be equipped with a pump which will move condensate from the sump into a nearby leachate cleanout or manhole, where condensate will be managed with leachate.

Preliminary technical specifications for items included on the plan in **Appendix C** are included in **Appendix D**.

5 METHANE MIGRATION MONITORING SYSTEM

The Landfill includes a network of methane migration monitoring probes. As part of the Phase 3A expansion of the Landfill, additional methane migration monitoring probes will be installed. Design criteria for new methane migration monitoring wells are as follows:

- Locate along the perimeter where off-site buildings are located.
- Locate to facilitate construction and operations, while avoiding utilities.
- Drill to groundwater, if feasible.

With respect to methane migration monitoring, Federal and New Hampshire regulations (specifically, 40 CFR 258.23 and Env-Sw 806.07), respectively) require the following (taken from Env-Sw 806.07):

"(a) Decomposition gases shall be controlled to prevent hazards to health, safety or property.

(b) Facility operations shall not cause the concentration of methane and other explosive gases to:

(1) Exceed 25 percent of the lower explosive limit for gases in structures on or off-site, excluding leachate collection and gas control and recovery components; and,

(2) Exceed 50 percent of the lower explosive limit for the gases at and beyond the property boundary within the soil.

(c) To assure that the requirements in (a) above are met, a monitoring program shall be implemented by the permittee in accordance with provisions in the facility's approved operating plan and closure plan.

(d) The type and frequency of monitoring shall be based on the following factors:

(1) Soil conditions;
(2) The hydrogeological and hydraulic conditions surrounding the disposal area; and

(3) The location of any man-made structures and property boundaries.

(e) If methane or other explosive gases are detected above the limits specified in (b) above, the permittee shall notify the department immediately and implement contingency procedures to ensure the protection of public health and safety.

(f) A decomposition gas program shall be implemented by the permittee under the provisions of the facility's approved operating plan and closure plan to assure that the facility complies with the federal clean air act and state air quality standards."

Neither USEPA nor NHDES have any specific guidance related to locating methane migration monitoring wells. There are no property lines or sensitive receptors in the immediate vicinity of Phase 3A. Based on evaluation and input from NHDES, AVRRDD intends to install new methane migration monitoring probes (along with new groundwater monitoring wells) at the following locations:

- Northwest of the Landfill along the Landfill main access road.
- West of the Landfill along Bean Brook Road.
- Directly north of Landfill Phase 3A.

Preliminary details for these probes are included in **Appendix C**, and a technical specification is included in **Appendix D**.

Appendix A

Waste Filling Data/Projections

Waste Receipt Summary 1989 - 2002									Modified Bulk MSW		
	Sludge	Ash	Lime	Grit	Gravel	Misc	Paper/ MSW	Total	MSW	C&D	Inerts
1989	10,110	748	248	17	1,501		21	12,645	10,131	248	2,266
1990	88,874	14,867	6,855	8,245	39,837	3,135	510	162,323	89,384	6,855	66,084
1991	91,714	12,944	8,751	11,040	51,192	3,456	1,334	180,431	93,048	8,751	78,632
1992	82,556	13,774	8,262	9,945	53,202	2,100	1,349	171,188	83,905	8,262	79,021
1993	93,344	8,327	6,058	9,341	34,349	3,859	7,531	162,809	100,875	6,058	55,876
1994	88,734	5,622	7,496	5,822	54,503	3,813	10,045	176,035	98,779	7,496	69,760
1995	97,366	11,380	15,255	5,822	115,208	5,336	13,723	264,090	111,089	15,255	137,746
1996	98,279	16,821	12,855	16,178	93,264	5,285	14,111	256,793	112,390	12,855	131,548
1997	89,553	13,318	11,831	5,392	164,186	7,810	13,931	306,021	103,484	11,831	190,706
1998	80,910	8,262	10,129	1,387	167,229	5,741	14,927	288,585	95,837	10,129	182,619
1999	61,790	6,768	10,817	144	114,342	2,180	15,522	211,563	77,312	10,817	123,434
2000	68,399	6,863	10,115	653	91,571	4,497	27,183	209,281	95,582	10,115	103,584
2001	52,170	5,471	6,289	570	57,972	3,996	14,005	140,473	66,175	6,289	68,009
2002	16,764	895	171	93	39,083	4,623	16,364	77,993	33,128	171	44,694

	Waste Receipt Summary 2003 - 2017																																
	Paper Mill												Towns & Commercial												Reusable								
	Sludge	Asbestos	Ash	Lime	Grit	Contam. Excav. Debris	Sand/ Gravel	Sawdust w/ Absorbed Chems	Paper/ Core Felts	MSW	MSW-C&D Bulky	Subtotal	Sludge	Misc	Grit	C&D Fines	Ash	Asbestos	Paper/ Cores	MSW	C&D	Bulky	Auto Fluff	Contam. Soil	Subtotal	Glass	Auto Fluff	Biomass	Sand/ Gravel	Subtotal	Total	MSW	C&D	Inerts
2003	50,914	13	11,729	4,906	1,056	6,669	4,146	1,222	662		993	82,310	2,021	341	0	0		18	555	41,070	39,804	407	0	156	84,372	519		1,116	26,335	27,970	194,652	96,338	47,332	50,982
2004	62,272		7,893	8,176	86	314	898	1,603	866	168	113	82,389	2,112	188	0	0	233	92	532	26,497	113,052	1,001	0	315	144,022	504	15,794	1,316	27,444	45,058	271,469	93,763	123,945	53,761
2005	64,270	1	13,147	11,701		25	1,908	1,774	922	212	404	94,364	2,010	113	0	0	151	62	512	28,260	115,084	1,867	0	60	148,119	468	39,596	1,209	30,055	71,328	313,811	97,395	130,830	85,586
2006	41,844		3,728	4,416			1,276	1,898	874	90	207	54,333	1,851	79	0	0	112	381	387	27,949	126,778	1,038	0	69	158,644	444	63,015	2,228	35,712	101,399	314,376	75,223	134,337	104,816
2007	23,832	17				92		10	732	70	34	24,787	1,782		0	0	108	2,076	390	29,027	114,881	1,003	0	97	149,364	444	83,106	2,188	13,926	99,664	273,815	58,021	115,928	99,866
2008	16,450	30					87		683	4	39	17,293	1,823	15	0	0	136	203	39	31,833	100,788	1,254	0	341	136,432	556	78,562	2,149	22,747	104,014	257,739	52,981	102,081	102,677
2009	14,162	18	6				11		530		41	14,768	1,802	17	0	568	101	867	8	31,762	100,872	1,257	0	223	137,477	767	63,120	1,525	7,718	73,130	225,375	49,789	102,738	72,848
2010	9,685								375			10,060	1,662	19	0	22,575	30	185	1	33,669	108,090	1,123	0	201	167,555	1,238	40,455	2,174	8,804	52,671	230,286	47,566	131,788	50,932
2011	5,153	39							178		25	5,395	1,565	18	0	38,418		154	0	31,780	111,822	1,178	0	2,973	187,908	891	47,758	812	6,557	56,018	249,321	39,488	151,443	58,390
2012	12,882	5	6						518		135	13,547	1,594		0	31,187	83	1,004	0	30,278	111,741	1,118	0	6,157	183,162	681	74,687	1,277	2,439	79,084	275,793	46,549	144,181	85,062
2013	16,192						26		455		6	16,679	1,649		0	24,031	826	1,446	0	36,585	93,310	1,118	0	9,594	168,559	668	70,002	6,453	2,947	80,070	265,308	61,334	118,465	85,509
2014	7,987								232	6	1	8,226	13,354	1	0	17,966	4665	356	0	43,977	75,320	1,136	0	403	157,178	682	57,396	6,224	16,213	80,515	245,920	71,780	94,423	79,716
2015	6,121								193		1	6,315	1,826	18	0	18,288	151	345	0	51,395	87,047	1,332	0	24	160,426	857	45,067	3,066	12,306	61,296	228,037	62,601	106,668	58,768
2016	11,576	0	0	0	0	0	0	0	318	0	12	11,906	1,729	25	0	11,915	66.63	105	0	72,670	89,966	1,231	0	183	177,891	686	49,933	3,711	18,334	72,663	262,460	90,005	103,124	69,331
2017	10,827	0	0	0	0	0	0	0	394	0	10	11,230	1,919	30	0	3,142	19.31	41	0	110,239	57,929	1,422	0	3,681	178,421	755	50,630	1,133	11,604	64,121	253,772	124,511	62,502	66,759
2018	9,359	0	0	0	0	0	0	0	450	0	4	9,813	2,020	6	17	0	0	201	0	125,239	62,133	1,657	0	2,278	193,550	615	40,140	990	26,371	68,117	271,480	138,058	63,794	69,628
2019	11,658	0	0	0	0	24	0	0	496	0	20	12,199	2,047	6	0	0	0	323	0	126,383	89,132	1,624	4,039	26	223,581	589	28,751	1,860	60,845	92,045	327,824	142,445	90,777	94,603
2020+																															312,832	149,502	79,061	84,269

Notes:

1. 2019+ filling rate based on maximum waste filling rate of 305,500 cy/year and average of 2017-2018 in-place waste and cover material density (1,903-2,193 lb/cy).
2. Categorization of waste for LFG modeling (i.e., as MSW, C&D and inert) based on average of 2017-2019 actual average categorized waste content. Inert waste is projected to produce no gas.

Appendix B

LFG Recovery Projections

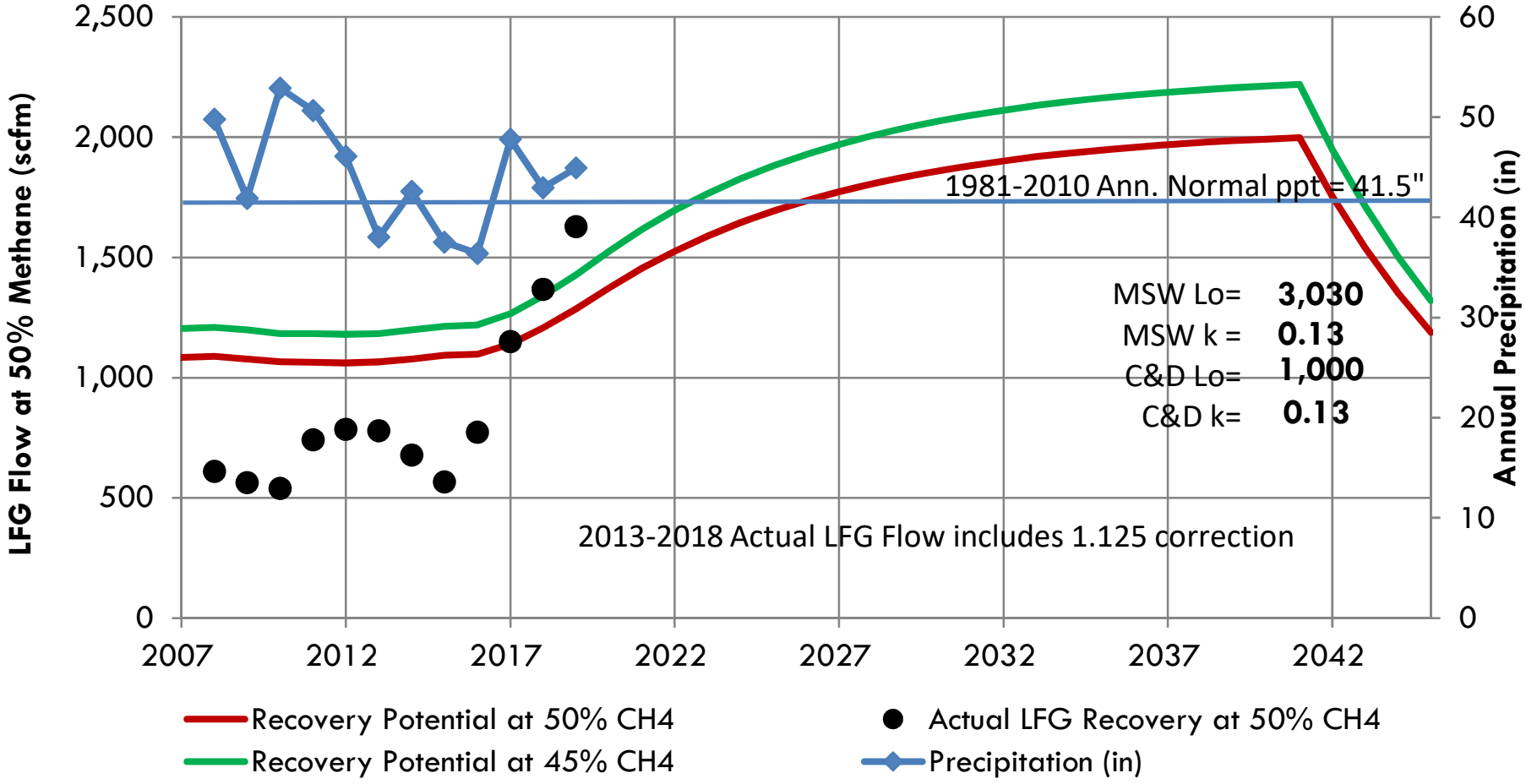
EXHIBIT 1. LFG RECOVERY PROJECTION
Mount Carberry Landfill, Success, NH

Year	Annual Total Waste Disposal (tons/yr)	Total Waste In Place (tons)	LFG Recovery Potential at 50% CH4 (scfm)	(mmcf/day)	(mmBtu/yr)	LFG Recovery Potential at 45% CH4 (scfm)	(mmcf/day)	(mmBtu/yr)
1989	10,379	10,379	0	0.00	0	0	0.00	0
1990	96,239	106,618	14	0.02	3,850	16	0.02	4,278
1991	101,799	208,417	143	0.21	37,931	158	0.23	42,146
1992	92,167	300,584	261	0.38	69,474	290	0.42	77,194
1993	106,933	407,517	352	0.51	93,665	391	0.56	104,072
1994	106,275	513,792	455	0.66	121,030	506	0.73	134,478
1995	126,344	640,136	543	0.78	144,447	603	0.87	160,497
1996	125,245	765,381	642	0.92	170,617	713	1.03	189,574
1997	115,315	880,696	729	1.05	193,788	810	1.17	215,319
1998	105,966	986,662	792	1.14	210,649	880	1.27	234,054
1999	88,129	1,074,791	836	1.20	222,360	929	1.34	247,067
2000	105,697	1,180,488	849	1.22	225,745	943	1.36	250,828
2001	72,464	1,252,952	886	1.28	235,518	984	1.42	261,687
2002	33,299	1,286,251	874	1.26	232,538	972	1.40	258,375
2003	143,670	1,429,921	815	1.17	216,701	905	1.30	240,779
2004	217,708	1,647,629	874	1.26	232,492	971	1.40	258,324
2005	228,225	1,875,854	959	1.38	254,920	1,065	1.53	283,244
2006	209,560	2,085,414	1,041	1.50	276,839	1,157	1.67	307,599
2007	173,949	2,259,363	1,084	1.56	288,164	1,204	1.73	320,182
2008	155,062	2,414,425	1,088	1.57	289,333	1,209	1.74	321,481
2009	152,527	2,566,952	1,078	1.55	286,736	1,198	1.73	318,596
2010	179,354	2,746,306	1,065	1.53	283,335	1,184	1.70	314,817
2011	190,931	2,937,237	1,065	1.53	283,124	1,183	1.70	314,583
2012	190,730	3,127,967	1,062	1.53	282,340	1,180	1.70	313,711
2013	179,799	3,307,766	1,066	1.53	283,409	1,184	1.71	314,899
2014	166,203	3,473,969	1,078	1.55	286,722	1,198	1.72	318,580
2015	169,269	3,643,238	1,093	1.57	290,578	1,214	1.75	322,865
2016	193,129	3,836,367	1,098	1.58	292,027	1,220	1.76	324,475
2017	187,013	4,023,380	1,140	1.64	303,190	1,267	1.82	336,878
2018	201,852	4,225,232	1,207	1.74	320,946	1,341	1.93	356,607
2019	233,222	4,458,453	1,285	1.85	341,806	1,428	2.06	379,784
2020	228,563	4,687,017	1,373	1.98	365,134	1,525	2.20	405,704
2021	228,563	4,915,580	1,454	2.09	386,820	1,616	2.33	429,801
2022	228,563	5,144,143	1,526	2.20	405,864	1,696	2.44	450,960
2023	228,563	5,372,707	1,589	2.29	422,585	1,765	2.54	469,539
2024	228,563	5,601,270	1,644	2.37	437,269	1,827	2.63	485,854
2025	228,563	5,829,834	1,693	2.44	450,162	1,881	2.71	500,180
2026	228,563	6,058,397	1,735	2.50	461,483	1,928	2.78	512,759
2027	228,563	6,286,960	1,773	2.55	471,425	1,970	2.84	523,805
2028	228,563	6,515,524	1,805	2.60	480,154	2,006	2.89	533,505
2029	228,563	6,744,087	1,834	2.64	487,820	2,038	2.93	542,022
2030	228,563	6,972,650	1,860	2.68	494,550	2,066	2.98	549,500
2031	228,563	7,201,214	1,882	2.71	500,461	2,091	3.01	556,068
2032	228,563	7,429,777	1,901	2.74	505,651	2,113	3.04	561,834
2033	228,563	7,658,340	1,918	2.76	510,208	2,132	3.07	566,898
2034	228,563	7,886,904	1,933	2.78	514,209	2,148	3.09	571,344
2035	228,563	8,115,467	1,947	2.80	517,723	2,163	3.11	575,248
2036	228,563	8,344,031	1,958	2.82	520,809	2,176	3.13	578,676
2037	228,563	8,572,594	1,968	2.83	523,518	2,187	3.15	581,687
2038	228,563	8,801,157	1,977	2.85	525,897	2,197	3.16	584,330
2039	228,563	9,029,721	1,985	2.86	527,986	2,206	3.18	586,651
2040	228,563	9,258,284	1,992	2.87	529,821	2,214	3.19	588,690
2041	0	9,258,284	**1,998**	2.88	531,431	**2,220**	3.20	590,479
2042	0	9,258,284	1,755	2.53	466,647	1,950	2.81	518,497
2043	0	9,258,284	1,541	2.22	409,761	1,712	2.47	455,290
2044	0	9,258,284	1,353	1.95	359,809	1,503	2.16	399,788
2045	0	9,258,284	1,188	1.71	315,947	1,320	1.90	351,052

	MSW	C&D
Methane Content of LFG Adjusted to:	50%	50%
Selected Decay Rate Constant (k):	0.130	0.130
Selected Ultimate Methane Recovery Rate (Lo):	3,030 cu ft/ton	1,000 cu ft/ton

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EXHIBIT 2. LFG RECOVERY PROJECTION - Mount Carberry Landfill, Success, NH



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Appendix C

Phase 3A LFG Collection System Master Plan

10/2 NEW FLANGE ADAPTER/BLIND FLANGE FOR FUTURE CONNECTION (TYP. OF 2)

1/3 2/3 NEW LFG HEADER LOW POINT AND CONDENSATE SUMP (TYP. OF 2)

4/3 ANCHOR TRENCH CROSSING AND LATERAL CONNECTION TO NEW HEADER (TYP.)

7/2 NEW LFG LATERAL PIPE IN LANDFILL (TYP.)

NEW LFG CONNECTION TO LEACHATE CLEANOUT

1/2 2/2 NEW VERTICAL EXTRACTION WELL AND WELLHEAD (TYP.)

3/3 NEW MAIN PERIMETER LFG HEADER PIPE IN LINER ANCHOR TRENCH

CONNECT NEW HEADER TO EXISTING BLIND FLANGE

CONNECT LATERAL TO EXISTING BURIED HEADER (TYP.) 6/2

LEGEND

- EW-3A-01 PROPOSED VERTICAL EXTRACTION WELL/WELLHEAD
- EW-3A-01S PROPOSED SHALLOW VERTICAL EXTRACTION WELL/WELLHEAD
- LC-3A-01 PROPOSED LEACHATE COLLECTOR WELLHEAD
- PROPOSED LEACHATE MANHOLE/CLEANOUT
- PROPOSED LEACHATE DRAIN LINE
- PROPOSED GAS SYSTEM HEADER/LATERAL PIPING (PIPE DIAMETER AS SHOWN, EG. 6")
- AT PROPOSED PHASE IIIA ANCHOR TRENCH
- LP PROPOSED LOW POINT DRAIN PIT
- EW-19-01 VERTICAL EXTRACTION WELL/WELLHEAD
- SC-19-01 SURFACE COLLECTOR WELLHEAD
- GW-31LCR LEACHATE COLLECTOR WELLHEAD
- GAS SYSTEM HEADER/LATERAL PIPING (PIPE DIAMETER AS SHOWN, EG. 6")
- SURFACE COLLECTOR PERFORATED PIPING TRENCH
- HP HIGH POINT
- LP LOW POINT DRAIN PIT
- GAS HEADER ISOLATION VALVE
- MP HEADER SYSTEM ACCESS RISER/MONITORING POINT
- HC-105 HORIZONTAL COLLECTOR WELLHEAD
- HORIZONTAL COLLECTOR TRENCH
- 1710 EXISTING 10' GRADE CONTOUR
- EXISTING 2' GRADE CONTOUR
- EXISTING LEACHATE MANHOLE/CLEANOUT
- CONDENSATE DRAIN/FORCE MAIN
- LANDFILL LEACHATE DRAIN LINE
- FUTURE ROAD LIMITS
- LANDFILL CELL DIVISION LIMITS
- AREAS WITH ASBESTOS
- EXISTING GRAVEL ROAD LIMITS

GENERAL NOTES:

1. LOCATION OF 2016 LFG COLLECTORS AND PIPING BASED ON YORK LAND SERVICES, LLC SURVEY PERFORMED ON 5/10/2016, 7/6/2016, 8/4–8/8/2016 AND 8/12/2016. (FILE NAME: 16043–cbi–revised).
2. LOCATION OF 2017 LFG COLLECTORS AND PIPING BASED ON ALVIN J. COLEMAN & SON, INC. SURVEY PERFORMED ON 6/27/2018. (FILE NAME: LFG As Built (Rev1)).
3. LOCATION OF 2018 LFG COLLECTORS AND PIPING BASED ON KINGSBURY COMPANIES, LLC SURVEY PERFORMED ON 12/27/2018. (FILE NAME: 2018 LFG Expansion v7.25.18. KCOS AB 11.28.18.REV2.2 .21.19).
4. LOCATION OF 2019 LFG COLLECTORS AND PIPING BASED ON YORK LAND SERVICES, LLC SURVEY PERFORMED ON 9/27/2019. (FILE NAME: 19091–DOT ENERGY AS–BUILT.dwg).
5. PHASE IIIA EXPECTED GRADES BASED ON WASTE PROJECTIONS PROVIDED BY CMA (FILE NAME: 777–PHIIIA–Closure Shape–2020214–to SCS.dwg).
6. BASE GRADE INFORMATION PROVIDED ON 3/5/2020 (FILE NAME: 777–PHIIIA–20200305–to SCS.dwg).
7. LEACHATE CLEANOUT LOCATIONS BASED ON PLAN PROVIDED ON 12/10/2010. FILE NAME: 750–SME–Leachate Collection ECP AND FIELD OBSERVATIONS BY SCS ON JANUARY 14 & 15. 2011
8. EXISTING STAGE 10 AND 11 LFG COLLECTION PIPING AND WELLS BASED ON PROJECT RECORD DRAWINGS DATED 07/10/2014 AND 03/07/2016 PROVIDED BY CMA ENGINEERS. 2014 LFG COLLECTION EXPANSION AS–BUILT SURVEY PERFORMED BY THRONE SURVEY BETWEEN NOVEMBER AND DECEMBER 2014, AND AS PROVIDED BY ALVIN J. COLEMAN & SONS, INC., ON 3/15/2015 VIA EMAIL IN FILE NAME "As Built 2015".
9. WORK WILL INVOLVE EXCAVATION NEAR ASBESTOS AREAS. WHILE ASBESTOS CONTAINING MATERIALS (ACM) ARE NOT EXPECTED TO BE ENCOUNTERED DURING WORK, CONTRACTOR SHALL STOP WORK IMMEDIATELY AND NOTIFY OWNER UPON ENCOUNTERING SUSPECTED ACM.
10. LANDFILL HORIZONTAL DATUM IS NORTH AMERICAN DATUM OF 1983 (NAD83), AND VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) FROM OPUS DERIVED POSITION OF ON–SITE CONTROL POINTS – REBAR IN LEDGE NEAR SALT SHED, AND REBAR IN LEDGE NEAR GARAGE.

100 50 0 100 200
SCALE: 1"=100'

no.	revision	date	by

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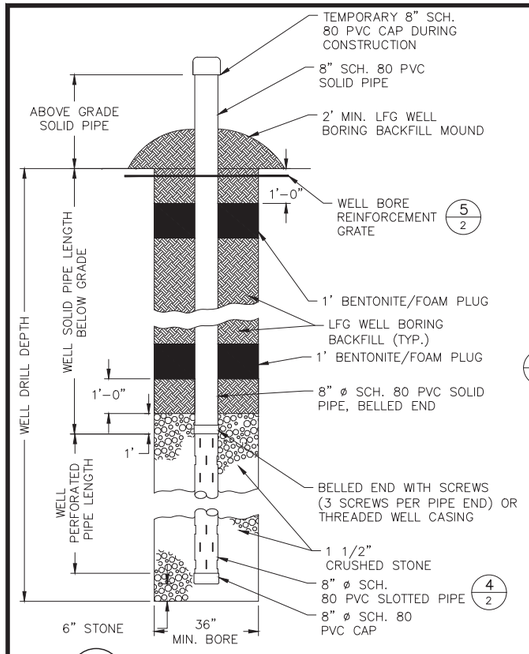
STATE OF NEW HAMPSHIRE – MARCUS SPRINGFORD – 14658 – LICENSED PROFESSIONAL ENGINEER

designed by: MMS/PSC
drawn by: PSC
approved by: MMS
date: March 26, 2020
project no: 773
file name: 13208015.55
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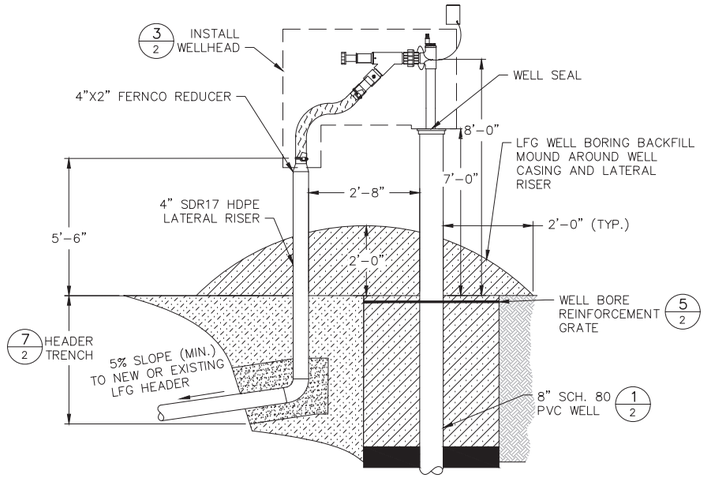
Androscoggin Valley Regional Refuse Disposal District
Mt. Carberry Landfill - Permit # DES-SW-88-029
Phase IIIA LFG Master Plan Site Plan

drawing no. 1
sheet: 1 of 3

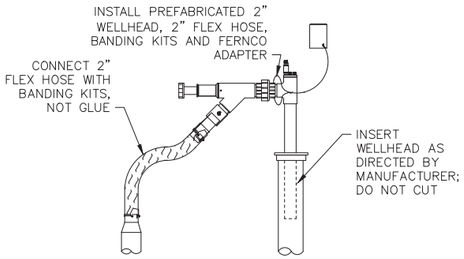
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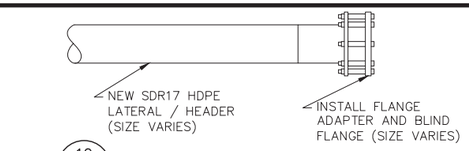
1/2 LFG EXTRACTION WELL DETAIL
N.T.S.



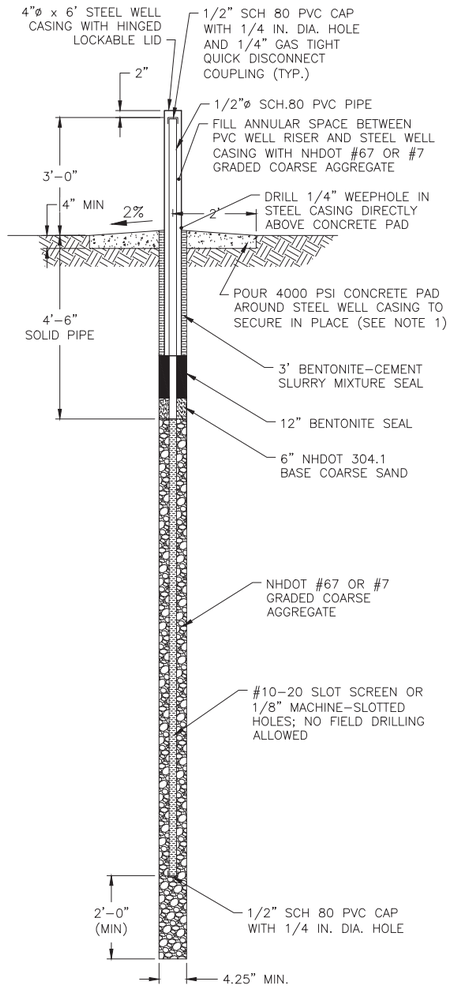
2/2 WELLHEAD INSTALLATION AT VERTICAL LFG EXTRACTION WELL
N.T.S.



3/2 LFG EXTRACTION WELLHEAD
N.T.S.



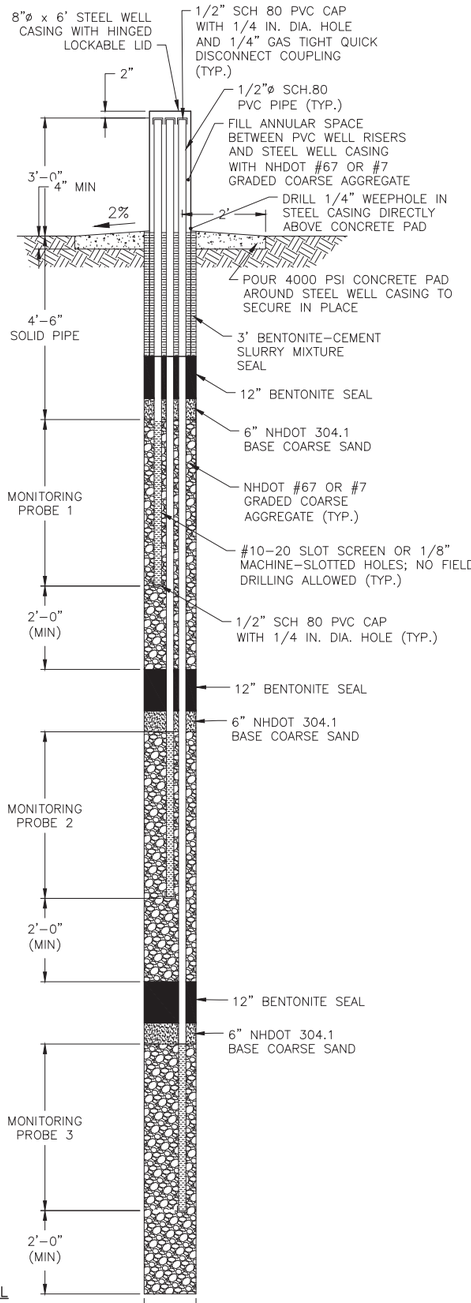
10/2 BLIND FLANGE FOR FUTURE CONNECTION
N.T.S.



NOTES:

1. DO NOT INSTALL CONCRETE PAD FOR MONITORING WELLS WITH REMOTE RISERS.

8/2 SINGLE PROBE METHANE MIGRATION MONITORING WELL
N.T.S.



9/2 MULTI-PROBE METHANE MIGRATION MONITORING WELL
N.T.S.

NOTES:

1. STAGGER SLOTS BY 45° FOR ADJACENT ROWS
2. PROVIDE FACTORY FABRICATED SLOTTED PIPE

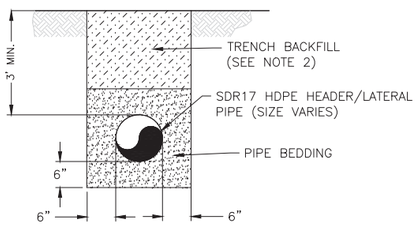
4/2 EXTRACTION WELL SLOTTED PIPE
N.T.S.

6/2 NEW CONNECTION TO EXISTING BURIED HEADER
N.T.S.

NOTES:

1. WELL BORE REINFORCEMENT GRATE TO BE INSTALLED 6" TO 2' BELOW GRADE, ABOVE THE TOP BENTONITE/FOAM PLUG.
2. WELL BORE REINFORCEMENT GRATE TO BE INSTALLED ON GRADE AT THE TIME OF WELL CASING INSTALLATION, AND BURIED WITH THE INSTALLATION OF VACUUM PIPING.

5/2 WELL BORE REINFORCEMENT GRATE
N.T.S.



NOTES:

1. SLOPE OF PIPE IN ALL LANDFILL AREAS MUST BE 5% MINIMUM UNLESS OTHERWISE NOTED.
2. BACKFILL TRENCH ABOVE PIPE BEDDING WITH WASTE EXCAVATED; MAXIMUM PARTICLE SIZE < 3". MOUND MIN. 6" THICK SAND COVER OVER BACKFILLED TRENCH.
3. DEPTH MAY INCREASE TO ATTAIN MINIMUM REQUIRED SLOPE AND COVER.

7/2 LFG HEADER/LATERAL PIPE TRENCH
N.T.S.

no.	revision	date	by

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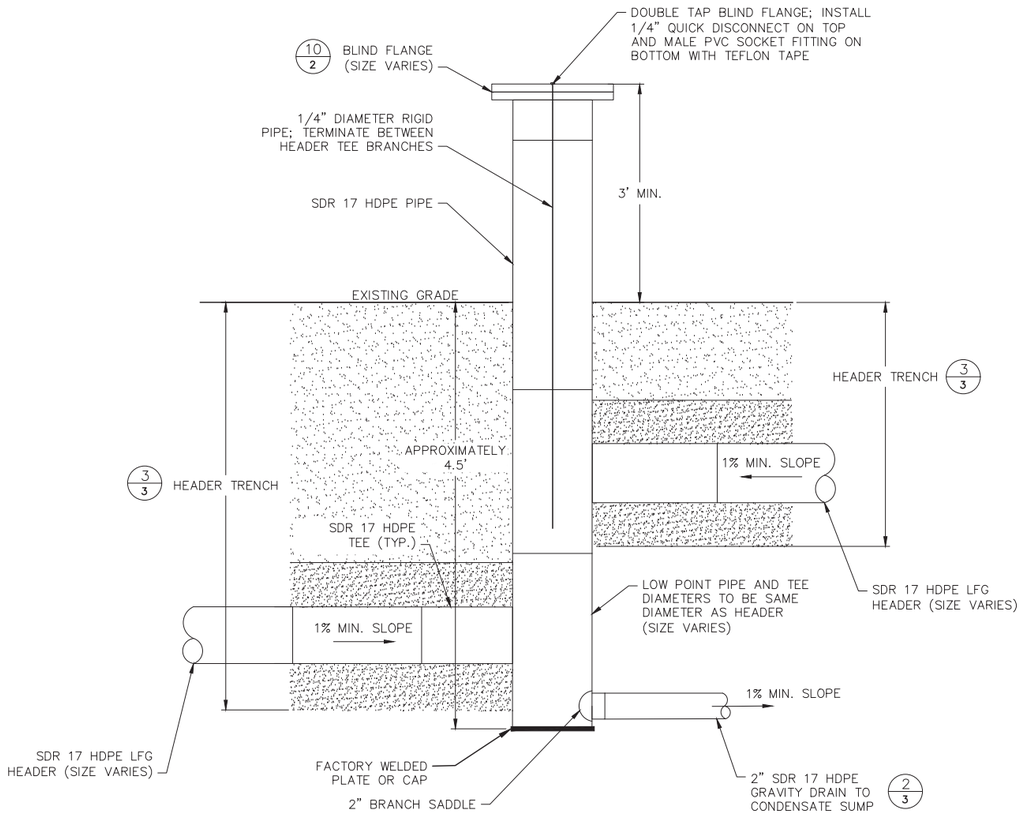
designed by:	drawn by:	approved by:	scale:
MMS/PSC	PSC	MMS	No Scale

date:	project no:	file name:
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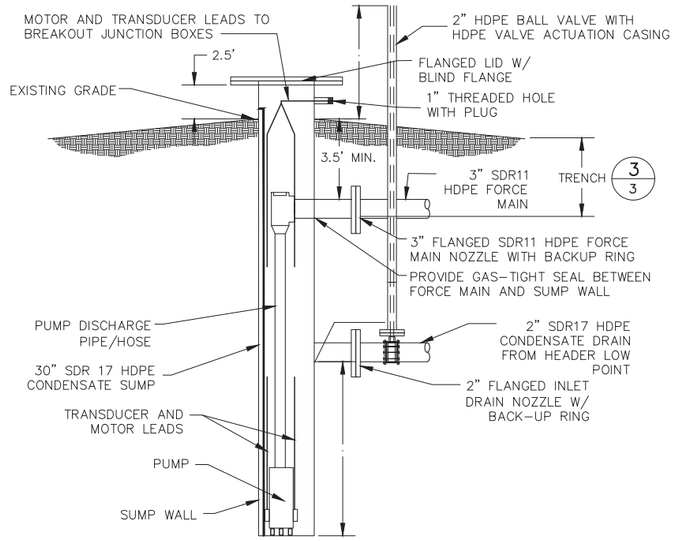
Androscoggin Valley Regional Refuse Disposal District
Mt. Carberry Landfill - Permit # DES-SW-88-029
Phase IIIA LFG Master Plan Details I

drawing no. 2
sheet: 2 of 3

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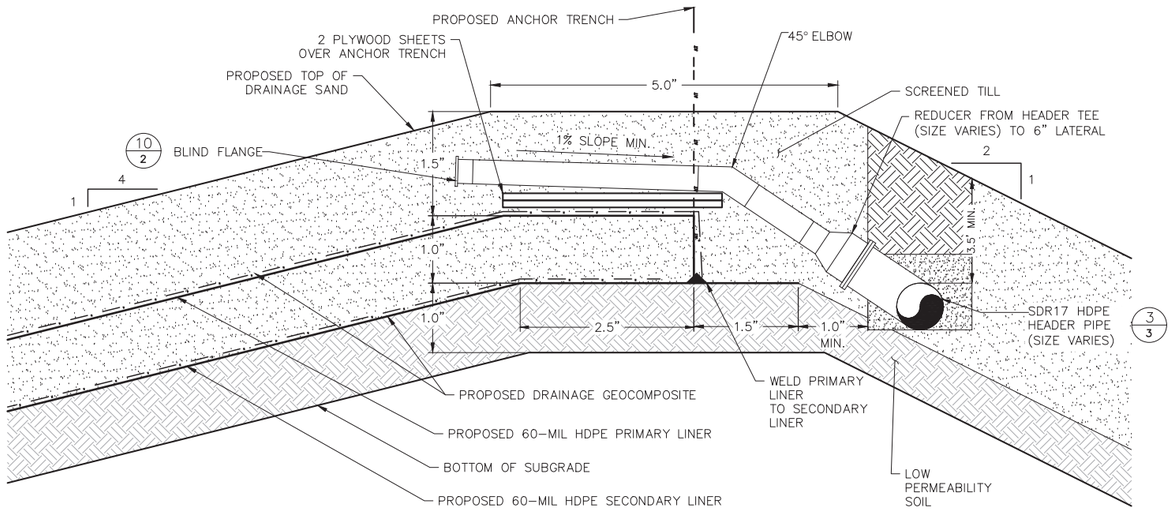


1/3 LFG HEADER LOW POINT
NTS

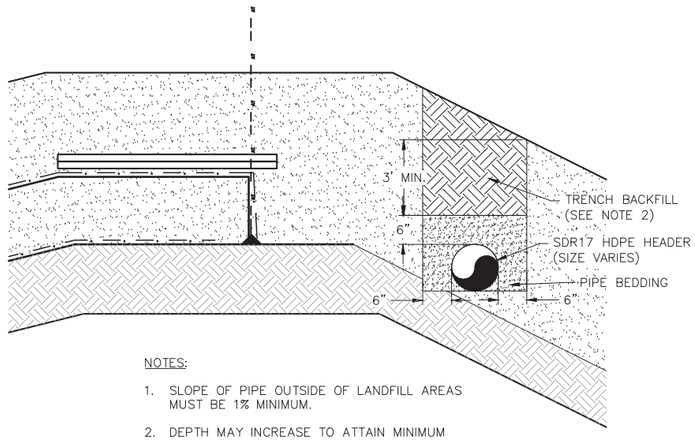


NOTES:
1. CONDENSATE SUMP SHALL BE FACTORY-FABRICATED.
2. PROVIDE T-BAR FOR BALL VALVE ACTUATION.

2/3 CONDENSATE SUMPS
N.T.S.



4/3 ANCHOR TRENCH CROSSING AND CONNECTION TO LFG HEADER
N.T.S.



NOTES:

1. SLOPE OF PIPE OUTSIDE OF LANDFILL AREAS MUST BE 1% MINIMUM.
2. DEPTH MAY INCREASE TO ATTAIN MINIMUM REQUIRED SLOPE AND COVER.

3/3 LFG HEADER PIPE TRENCH OUTSIDE LANDFILL
N.T.S.

no.	revision	date	by

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NEW HAMPSHIRE - STATE OF - MARCH 9 - No. 13869 - LICENSED PROFESSIONAL ENGINEER

designed by: MMS/PSC	drawn by: PSC	approved by: MMS	scale: No Scale
date: March 26, 2020	project no: 773	file name: r:\2020\15.05	

Androscoggin Valley Regional Refuse Disposal District
Mt. Carberry Landfill - Permit # DES-SW-88-029
Phase IIIA LFG Master Plan Details II

drawing no. 3

sheet: 3 of 3

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Appendix D

Preliminary Technical Specifications

SECTION 01 79 01

ODOR CONTROL PLAN

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. This Odor Control Plan has been prepared to organize and supplement in a single document the contract requirements for controlling emissions of odors during the Contractor's excavation and relocation of waste materials.

B. The District actively manages nuisance landfill odor and strives to mitigate odor point sources. Odor mitigation is incorporated into the facility's regular operations by minimizing open area, applying daily and intermediate cover over waste, operating a landfill gas (LFG) collection system to sequester LFG and odors. Refer to the Facility Operating Plan for more information on the facility's regular odor control practices.

C. Work included in this Contract has the potential to generate nuisance odors. Such work includes, but is not limited to, waste excavation and connecting new LFG management infrastructure to existing infrastructure. The Contractor shall coordinate all work with Landfill Operators. The Contractor is responsible for managing odors that are generated as a result of work performed under this Contract.

D. This project includes excavation and relocation of waste materials for the construction of vertical and horizontal landfill gas collectors, vertical LFG extraction wells, gas header and lateral pipes, and appurtenances.

E. Contractor shall coordinate with the Owner for relocation of waste materials to the active filling area and as required for working around and connecting to existing landfill gas collection system piping and structures.

F. If odors are noted or reported by the Owner or the public, Contractor may be required to enhance the use of the soil cover and odor neutralizing agents or other protocol.

G. Odor complaints from the public are received by calling the District's office at (603) 752-3342. The Landfill Manager will coordinate with the Contractor, the Engineer, and other landfill staff for evaluating and mitigating odor complaints.

PART 2 PRODUCTS

2.01 MATERIALS

A. Daily Cover – Contractor shall cover the open waste surface with soil cover or other NHDES approved methods.

B. Interim HDPE Geomembrane Cover – Portions of the existing interim HDPE geomembrane cover will be impacted in order to perform the work included in this Contract. The Contractor shall coordinate all work impacting the existing geomembrane cover with Landfill Operators and the District's geomembrane contractor. The Contractor shall perform work as to minimize the amount of time that any existing geomembrane cover is cut and waste is exposed to the extent practical.

C. Odor Neutralizing Agents – The odor neutralizing agents shall include Odor Lieutenant manufactured by NWCI or F.O.G. manufactured by Aqua Tite or approved equivalent.

1. Contractor shall submit proposed odor neutralizing agents and dispensing equipment to the Engineer for review prior to commencing waste relocation activities.

2. Contractor shall have on-site the neutralizing liquid to apply to the waste materials each day and setup the mobile mist dispensing equipment and neutralizer, for use as needed.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare horizontal collector/vertical well pipe, headers, and laterals and bedding and cover materials in advance of excavation of waste.

B. Prepare stockpile of bedding and cover materials for placement over excavated waste in advance of excavation. Mobilize spray on daily cover and odor neutralizing materials and application equipment.

C. Waste excavation may be restricted by the Owner during periods when winds are out of the east-southeast or strong enough to carry potential odors off-site.

3.02 EXCAVATION

A. Excavation of Unclassified Waste Material: Excavation of existing intermediate cover material and waste material shall be completed to the limits indicated on the Drawings. All work will be completed in accordance with the Contractor's Health and Safety Plan. Excavated waste materials shall be relocated to the active filling area for placement and compaction by the Owner.

B. Excavation of waste materials shall be performed in a timely manner which controls odors, dust, vectors, and migration of waste. Contractor shall install a minimum of 4" of soil cover at the end of each day. In areas with interim HDPE geomembrane, Contractor shall fold back geomembrane to cover waste and

ballast the membrane until the District's geosynthetics contractor repairs impacted geomembrane.

C. Owner shall spread and compact the relocated waste materials using the same protocol as daily waste disposal operations that include installing a minimum of 4" soil cover over the placed waste materials at the end of each day.

3.03 ODOR CONTROL DURING WASTE EXCAVATION

A. If odors are detected by the Owner that are potentially moving off-site, Contractor shall apply the liquid neutralizing agent over the waste materials during waste excavation, as needed to mitigate odors.

B. If detection of odors persists following the use of the neutralizing agent, Contractor shall operate the mobile misting station, as recommended by the manufacturer, to further mitigate odor generation and migration.

C. Contractor shall coordinate with the Owner to monitor the LFG collection system on a daily basis for gas quality and vacuum during waste relocation.

D. Contractor shall coordinate with the Owner for their evaluation of odors off-site on a daily basis, with reconnaissance to all areas surrounding the excavation and relocation area. If odors are noted or reported, Contractor may be required to enhance the use of the waste cover placement and odor neutralizing agents.

E. If the facility receives an odor complaint, in accordance with the Operating Plan, The District will implement an odor inspection to confirm the odors at the alleged source and if necessary to identify the source of the odor.

F. The facility maintains a log of odor complaints which document the time and place odors were noted, and identifies the response implemented by the facility.

3.04 ODOR CONTROL DURING WASTE RELOCATION

A. Limit the area of waste placement each day to the minimum area practical, and cover the area with a minimum 4" of daily soil cover. If odors are detected by the Owner that are potentially migrating off-site from the relocation area, Owner shall apply odor neutralizing agents over the waste during waste placement, prior to installation of the daily soil cover materials.

B. If detection of odors persists from the relocation area following the use of neutralizing agent and enhanced daily cover, Owner shall operate its mobile misting station to further mitigate odor generation and migration.

C. Monitor the LFG collection system on a daily basis for gas quality and vacuum during waste relocation.

D. Contractor shall coordinate with the landfill operators for the evaluation of odors off-site on a daily basis, with reconnaissance to all areas surrounding the excavation and relocation area. If odors are noted or reported, Contractor and/or Owner may be required to enhance the use of the soil placement and odor neutralizing agents.

END OF SECTION

SECTION 31 20 10
CRUSHED STONE AND GRAVEL

PART 1 - GENERAL

1.1 Description

A. Scope:
1. CONTRACTOR shall furnish and place crushed stone or gravel of the types specified at locations shown and as ordered by the ENGINEER, including that necessary for pipe trenches, foundations, and extraction wells/collectors.

B. Related Sections:
1. Section 31 23 16, Excavating and Trenching.
2. Section 31 23 23, Filling, Backfilling and Compaction.

1.2 SUBMITTALS

CONTRACTOR shall furnish grain size analyses for the crushed stone or gravel for each use to the ENGINEER and shall advise of the source location. CONTRACTOR shall submit samples to a commercial testing laboratory for sieve analysis.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Crushed Stone or Gravel for Trenches, drain pits and LFG extraction wells/collectors.

1. Material shall consist of clean, hard, durable, uncoated particles, free from lumps of clay, organic matter, and all deleterious substances. Crushed stone shall meet New Hampshire Department of Transportation (NHDOT) #4 graded coarse aggregate (in accordance with NHDOT Specifications, Section 703- Aggregates, Table 1E), with the following gradation requirements: 100% passing 2-inch sieve; 90-100% passing 1½-inch sieve; 20-55% passing 1-inch sieve; 0-15% passing ¾-inch sieve; and 0-5% passing $^{3}/_{8}$-inch sieve.

2. The stone shall be washed such that less than 0.5 percent passes the No. 200 sieve.

3. Stone shall be hard, durable, resistant to weathering and to water action, and free from overburden, spoil, and organic materials. Shale and stone with shale seams are not acceptable. Crushed stone shall contain less than 10 percent calcium carbonate by weight as determined when tested in accordance with ASTM D-3042 modified to run at a pH of 4, or less than 5 percent loss of weight when tested in accordance with ASTM D4373.

B. Crushed Stone for methane migration monitoring wells.

1. Monitoring well stone shall be No. 67 or 7 coarse aggregate as defined in Table 703 1 of the New Hampshire Department of Transportation (NHDOT) Standard Specifications (2016 edition), or approved equal, and shall meet the following gradation: 100 percent passing the 1-inch sieve, 90-100 percent passing the ¾-inch sieve, 90-100 percent passing the ½ inch sieve, 40-70 percent passing the 3/8-inch sieve, 0-15 percent passing the No. 4 sieve and 0-5 percent passing the No. 5 sieve. Stone fill shall be composed of clean, hard and durable fragments, resistant to weathering and to water action, free of overburden, spoil, silt, clay, dirt, vegetation and other organic materials. Shale and stone with shale seams are not acceptable. Material data sheets shall be submitted to the ENGINEER for approval prior to use on-site.

PART 3 – EXECUTION

3.1 PLACING

A. Where applicable, installation shall be in accordance with NHDOT Specifications for each individual items including placement, compaction, testing and quality control.

B. Aggregate for foundations, trenches, collectors and drain pits shall be spread in layers of uniform thickness not exceeding 8 inches and shall be thoroughly compacted with suitable power driven tampers or other power driven equipment. The placing of crushed stone or gravel shall conform to applicable requirements of Section 31 23 23.

END OF SECTION

SECTION 31 23 16
EXCAVATING AND TRENCHING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required on the Design Drawings to excavate and trench designated areas.

B. General Definition: Excavation and trenching shall mean the removal of soil and waste from designated areas.

C. No classification of type of excavated materials will be made. Excavation includes all soil and waste materials, regardless of type, character, composition, moisture content, or condition thereof.

D. The cost of all excavation inside limits of disturbance shall be incorporated into the base bid. No distinction will be made insofar as payment between soil and waste materials.

E. The CONTRACTOR is responsible for all construction layout.

F. Related Work Specified Elsewhere:

1. Section 31 23 23 Filling, Backfilling, and Compaction
2. Section 01 79 01 Odor Control Plan

1.2 DEFINITIONS

A. Excavation

Excavation consists of removal of soil, waste, debris and all other materials to the proposed trench bottom grade indicated on the Design Drawings.

1. Unauthorized Excavation

a. Unauthorized excavation consists of removal of materials beyond indicated areas without specific approval of the OWNER or ENGINEER. Unauthorized excavation shall be at CONTRACTOR's expense.

b. Unauthorized excavations shall be backfilled as specified for authorized excavations at no additional cost to the OWNER, unless otherwise directed by the ENGINEER.

1.3 QUALITY CONTROL

A. All materials and labor furnished under this section shall comply with OSHA, ASTM, AA, NEC, ANSI and all other applicable Federal, State and Municipal codes and regulations including revisions to date of Contract.

B. Use adequate number of skilled workmen who are thoroughly trained and experienced in the specified requirements and the methods needed for proper performance of the work in this Section.

1.4 PROTECTION OF PEOPLE AND PROPERTY

A. The CONTRACTOR shall plan and conduct operations so as to prevent damage to existing structures and utilities, safeguard people and property, protect the structures to be installed, and provide safe working conditions.

B. Excavation may be made without sheeting and bracing within the limitations and requirements of the governmental agencies having jurisdiction. Failure of the ENGINEER to order the use of bracing or sheeting and shoring or direct changes to systems in place, shall not in any way or to any extent relieve the CONTRACTOR of any responsibility concerning the condition of excavations or of his obligations under the Contract. The CONTRACTOR shall be responsible for the condition of all excavations made by him. All slides and caves shall be removed without extra compensation, at whatever time and under whatever circumstances they may occur. Work is restricted to the land provided for the CONTRACTOR's use.

C. Side slopes will be maintained in stable condition under all normal anticipated weather conditions for the period that the excavation will be open. The CONTRACTOR shall regrade sideslopes as necessary to maintain stable conditions.

D. In cases where excavation without sheeting or bracing is not permissible solely because of protection of workmen, trench boxes may be used.

E. Dispose of excess soil and waste materials to designated areas on-site as approved by the ENGINEER and OWNER

F. In the event that any act by the OWNER results in the keeping of any excavation open longer than would otherwise have been necessary, the CONTRACTOR shall not be relieved from his responsibility of properly and adequately protecting the excavation from caving or slipping nor from any of his obligations under the Contract relating to protection of persons and property.

1.5 SAFETY

A. All excavations shall comply with the applicable requirements as stated in:

1. OSHA excavation safety standards 29 CFR, 1926-650, Subpart P.

2. State construction safety regulations.

3. Trench safety guidelines as specified by the Landfill Gas Division of the Solid Waste Association of North America (SWANA).

1.6 PROJECT CONDITIONS

A. Site Information: The CONTRACTOR shall be responsible for having determined to his satisfaction, prior to the submission of his bid, the conformation of the ground, the characteristics and quality of the substrata, the types and quantities of materials to be encountered, the nature of the groundwater conditions, the prosecution of the work, the general and local conditions and all other matters which can in any way affect the work under this Contract. Subsurface information such as boring logs is available from the OWNER to the CONTRACTOR for information only. Information on conditions is not intended as a representation or warranty of accuracy or continuity between soil borings. The OWNER will not be responsible for interpretations or conclusions drawn from this data by CONTRACTOR. Additional test borings and other exploratory operations may be performed by CONTRACTOR at the CONTRACTOR's option and only with OWNER’s approval; however, the OWNER will not pay for such additional exploration.

B. Existing Structures: Shown on the Contract Drawings are surface and underground structures adjacent to the work including, but not limited to, the active landfill gas system, leachate systems, perimeter stormwater drainage system, and utilities. This information has been obtained from existing records and is shown for the convenience of the CONTRACTOR. The CONTRACTOR shall explore ahead of the required excavation, by hand if necessary, to determine the exact location of all structures. They shall be supported and protected from injury by the CONTRACTOR. If they are broken or injured, they shall be restored immediately by the CONTRACTOR at his expense.

C. Use of Explosives: Use of explosives is not permitted.

D. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights, as appropriate.

E. Protection of Landfill Liners and Caps:

The CONTRACTOR shall not damage the existing landfill liners/caps, except as noted on the Drawings. If the CONTRACTOR should damage any part of any existing landfill liner or cap, he will be held responsible for appropriate repair and restoration of the liner or cap. In the event of any damage to an existing landfill liner or cap, the CONTRACTOR shall immediately notify the OWNER and the ENGINEER.

F. Dust Control: Dust Control will be provided by the CONTRACTOR.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PREPARATION

A. Identify required lines and levels.

1. Locate, identify and protect utilities from damage.

2. Protect bench marks, survey control points, monitoring wells, existing structures and fences from excavating equipment and vehicular traffic.

B. Dewatering

1. The CONTRACTOR shall at all times during construction provide and maintain proper equipment and facilities to remove water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory foundation condition until the fill, structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels.

2. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottom, and soil changes detrimental to stability of subgrades and foundations. Subgrade soils which become soft, loose, "quick", or otherwise unsatisfactory for support of structure as a result of inadequate dewatering or other construction methods shall be removed and replaced by crushed stone as required by the ENGINEER at the CONTRACTOR’s expense. The bottom of excavations shall be firm and without standing water before placing structures or pipes.

3. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.

4. Disposal of Water Removed by Dewatering System:

a. Water conveyed away from excavations which has not contacted waste materials shall be routed to existing drainage channels or discharged to areas approved by the OWNER or ENGINEER.

b. Water in excavations which has contacted waste materials shall be pumped out of trenches directly into the nearest leachate structure, or into a water tight storage container for subsequent discharge into a leachate manhole.

c. Dispose of water by procedures approved by the OWNER or ENGINEER in such a manner as to cause no inconvenience to the OWNER, the ENGINEER, or others involved in work about the site.

3.2 EXCAVATION

A. General:

1. Excavation shall not commence until the CONTRACTOR has staked out the proposed work, including the alignment of trenches.

2. Excavations, except as specified hereinafter, shall be adequately sheeted and braced. Where the installation of sheeting is impractical or might cause damage, as a result of, but not limited to, vibration settlement or lateral movement, the CONTRACTOR shall utilize other acceptable methods.

3. Grade top perimeter of excavation to prevent surface water from draining into excavation.

4. Notify OWNER or ENGINEER of unexpected subsurface conditions and discontinue affected work in area until a plan is developed to address the conditions.

5. Excavation shall be carried to the dimensions indicated, specified or as required, to provide sufficient clearance for the construction and inspection of the structure to be installed.

6. Underpin adjacent structures which may be damaged by excavating work.

7. Excavation equipment operators and other concerned parties shall be familiar with subsurface obstructions as shown on the Contract Drawings.

8. Excavation work shall be performed in a safe and proper manner with appropriate precautions being taken against hazards and in accordance with the Health and Safety Plan. Excavations shall provide adequate working space and clearances for the work to be performed therein. If walls of the excavation cannot be kept stable, the excavation shall be properly shored and braced.

9. Excavation is unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.

10. Excavation shall conform to the limits indicated on the Contract Drawings and as specified herein. This work shall include shaping, sloping, grading and other work necessary in bringing the site to the required grade, alignment, and cross-section.

11. Unsatisfactory materials shall be removed to the required depth and replaced to the satisfaction of the ENGINEER with crushed stone. Unsatisfactory materials shall be removed and disposed at the working face of the Landfill.

12. Clean excavated materials shall be stockpiled in such a manner as to prevent nuisance conditions. Surface drainage shall not be hindered.

13. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity; perform compaction in accordance with SECTION 31 23 23, FILLING, BACKFILLING AND COMPACTION.

3.3 TRENCHING

A. Trench Excavation for Pipes or Conduits

1. Trench width shall be minimized to greatest extent practical but shall conform to the following:

a. Sufficient to provide room for installing, jointing, and inspecting piping, but in no case wider at top of pipe than pipe barrel outside diameter plus 12 inches unless otherwise approved by the ENGINEER.

b. Enlargements at pipe joints may be made if required and approved by the ENGINEER.

c. Sufficient for sheeting, bracing, sloping, and dewatering.

d. Sufficient to allow thorough compacting of backfill adjacent to bottom half of pipe.

2. Excavate trenches to depth indicated or as required to establish indicated slope and minimum cover over pipe.

a. For pipes 6 inches or larger in nominal size, shape bottom of trench to fit bottom of pipe. At each pipe joint, dig holes to relieve pipe joint of loads and ensure continuous bearing of pipe barrel on bearing surface.

3. No more than 200 feet of trench may be opened in advance of pipe laying operations at one time unless approved by the OWNER or ENGINEER.

4. All trenches shall be constructed in a uniform grade, and free of standing water. The CONTRACTOR shall be responsible for maintaining these conditions. Subgrade soils that become soft, loose, or unsatisfactory as a result of inadequate dewatering and cannot be stabilized or recompacted shall be removed and replaced by crushed stone underlain with 10 oz./sy nonwoven geotextile at the CONTRACTOR's expense.

3.4 STABILITY OF EXCAVATIONS

A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.

B. Side slopes of excavations shall comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations during period excavations will be open. Extend shoring and bracing as excavation progresses.

3.5 STORAGE OF EXCAVATED MATERIALS

A. Stockpile excavated materials in a location designated by the OWNER or ENGINEER. Place, grade, and shape stockpiles for proper drainage.

B. Locate and retain excavated soil and backfill materials away from edge of excavations. No excavated materials or other construction materials shall be placed within thirty (30) feet of the edge of pavement of any public road unless otherwise approved by the OWNER or ENGINEER.

3.6 DISPOSAL OF WASTE MATERIALS

Dispose of waste materials to active phase of landfill to be coordinated with landfill operator.

3.7 FINISHING WORK

A. Unless otherwise specified by the ENGINEER, the slope of pipe and conduit shall conform to slopes shown on the Design Drawings.

B. During trench excavation, no trench may be left open overnight. All open excavations must be covered by 1-inch thick steel sheeting and adequately barricaded.

3.8 FIELD QUALITY CONTROL

The depth and limit of excavation will be in accordance with these Specifications, the Design Drawings and the ENGINEER's direction, and will be verified during the course of excavation by the ENGINEER.

3.9 ODOR CONTROL

A. The CONTRACTOR shall continuously monitor for odors resulting from excavating and trenching work, including excavation work for LFG extraction well installation under Section 33 21 70 – Extraction Wells and Wellheads. If the CONTRACTOR detects significant odors from such excavations at any time that the CONTRACTOR

reasonably believes will migrate off-site, the CONTRACTOR shall immediately notify the OWNER of such odor issues. The OWNER will adjust operations of their LFG collection system to improve LFG collection from the odorous area.

B. As indicated in Part 3.05 of Section 33 21 70, during installation of borings for LFG extraction wells, the CONTRACTOR shall dispose of construction waste, including well cuttings, at the active portion of the landfill as directed by the ENGINEER and approved by the OWNER. The CONTRACTOR shall remove spoils daily and shall be responsible for controlling odors from the spoils.

END OF SECTION

SECTION 31 23 23
FILLING, BACKFILLING, AND COMPACTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work in this section includes all labor, materials, equipment and incidentals required to perform all filling, backfilling, compaction, grading, and stockpiling required for the purpose of site grading, pipe trenches and bedding, and related structures as shown on the Design Drawings, specified herein and in the General Conditions.

B. Related Work Specified Elsewhere:

1. Section 31 20 10 Crushed Stone and Gravel
2. Section 31 23 16 Excavating and Trenching

1.2. REFERENCES

The publications listed below form a part of this specification to the extent referenced in the text. The publications are referenced to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
STANDARD TEST METHODS/PRACTICE

ASTM E 11	Wire-Cloth Sieves for Testing Purposes
ASTM C 88	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 131	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM D 75	Sampling Aggregates
ASTM D 422	Particle Size Analysis of Soils
ASTM E 548	Guide for General Criteria Used for Evaluating Laboratory Competence.
ASTM D 698	Laboratory Compaction Characteristics Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
ASTM D 1556	Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D 2434	Permeability of Granular Soils (Constant Head)
ASTM D 2487	Classification of Soils for Engineering Purposes
ASTM D 2922	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

1.3 DEFINITIONS

A. General Fill Material

A variety of soil materials obtained from excavation or borrow sources having unspecified soil classification suitable for filling, backfilling, and grading within designated locations.

B. Bedding Materials

A variety of select soil materials obtained from borrow sources having specified soil classification suitable for filling, backfilling, and grading, within designated locations.

C. Crushed Stone & Gravel

Granular commercial sources having specified characteristics and designated or reserved for use for specified purposes.

D. Maximum Dry Density

Maximum Dry Density: Maximum dry weight in pounds per cubic foot (pcf) of a specific soil material as determined by ASTM D 698.

E. Optimum Moisture Content

Optimum Moisture Content: The moisture content at which the maximum dry density of a soil material is determined by ASTM D 698.

F. The Standard Proctor Test: ASTM D 698 will be used to determine the percentage of compaction required.

1.4 QUALITY CONTROL

Use adequate number of skilled workmen who are thoroughly trained and experienced in the specified requirements and the methods needed for proper performance of the work in this Section.

1.5 SUBMITTALS

A. Submit a grain size analysis for bedding material if it is from an off-site source. Moisture/density curves and independent soils testing laboratory test results, as required.
B. Submit a grain size analysis and permeability analysis for LFG well boring backfill material.

PART 2 - PRODUCTS

2.1 GENERAL FILL

General fill shall be clean soil free of stone, rock or gravel larger than three (3) inches in any dimension, debris, waste, frozen materials, vegetation, organic materials, roots, and other deleterious matter. Excavated soil material may be used provided it is capable of maintaining its stability on proposed slopes.

2.2 BEDDING MATERIAL AND COVER SAND

Bedding material and cover sand shall be sand backfill and shall consist of clean, hard, durable, uncoated particles, free from lumps of clay and all deleterious substances. Sand backfill shall meet the following gradation requirements:

Sieve Size	% Passing
3”	100
No. 4 (4.75 mm)	70-100
No. 200 (0.075 mm)	0-15

A 12-inch layer of cover sand shall be placed over disturbed areas in the landfill to provide a soil cover over relocated waste. Cover sand shall be graded to provide a relatively smooth finish landfill surface over disturbed areas. Cover sand is not required over active fill areas.

Sand backfill is available for bedding material and cover soil use on this project from the OWNER’s Alcohol Springs pit. This material is available to the CONTRACTOR at no cost. Sand backfill shall be screened by the CONTRACTOR, as necessary, to meet the required gradation specification. See Special Conditions for additional requirements related to the borrow pit.

2.3 BENTONITE PLUG

Bentonite shall be hydrated sodium bentonite pellets or chips. Bentonite material shall consist of clay greater than 85% sodium montmorillonite, without additives. Bentonite shall be $^{3}/_{8}$-inch Holeplug as manufactured by Baroid or equal.

2.4 LFG WELL BORING BACKFILL

LFG Well Boring Backfill shall be a low permeability soil utilized when backfilling LFG vertical wells between the two bentonite plugs, see plans for detail. Low permeable soil shall be free of combustible organic materials, loam, trash, snow, ice, frozen soil, or other unsuitable material.

The proposed low permeability backfill soil shall meet the following grain size distribution and also meet the permeability requirements below (permeability requirements are likely more restrictive). Modifications to the grain-size distribution for the #4, #40, and #200 sieve sizes may be acceptable if the material meets the permeability requirements below, and other requirements of the specification.

U.S. Standard Sieve Size	% Finer By Weight
2”	100
#4	50-90
#40	30-70
#200	10-50

The proposed boring backfill shall have a permeability of less than 10-4 cm/S at 93% of the maximum dry density and 2% wet optimum moisture content as determined by ASTM D1557. Laboratory testing of permeability shall be in accordance with ASTM D5084, performed at a confining pressure of 2 psi.

One test result shall be provided for grain size distribution, maximum dry density and permeability for each source of material.

2.5 OTHER BACKFILL MATERIALS

See Crushed Stone and Gravel, Section 31 20 10.

PART 3 - EXECUTION

3.1 EXAMINATION

Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected and approved by the ENGINEER.

3.2 PREPARATION

Remove water to prevent softening of foundation bottom, and soil changes detrimental to stability of subgrades and foundations. Subgrade soils which become soft, loose, "quick", or otherwise unsatisfactory for support of structure as a result of inadequate dewatering or other construction methods shall be removed, replaced, and compacted to a density equal to or greater than the requirements for the subsequent fill material at the CONTRACTOR's expense.

3.3 GENERAL BACKFILLING

A. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces. Areas where fill is to be placed shall be proofrolled with a vibratory compactor or other approved construction equipment. Soft or unstable areas identified during the proofrolling operations shall be excavated and filled with approved material and compacted as specified.

B. Place and compact material in equal continuous layers not exceeding 8 inches loose depth unless otherwise noted (also see Part 3.5.A.2 of this Section). Perform compaction of materials using rollers, compactors or other equipment and compaction procedures for the type of fill material being placed as approved by the ENGINEER. The ENGINEER may at any time, when fill material changes character or consistency, require the CONTRACTOR to revise his fill methods accordingly in order to achieve the required compaction requirements.

C. Employ a placement method that does not disturb or damage other Work.

D. If required, maintain optimum moisture content of backfill materials to attain required compaction density. Backfill material shall be within -2% to +4% of the optimum moisture content as established from the appropriate proctor moisture density curve for the specified degree of compaction.

E. Restoration: After the completion of backfilling, all roads and other places intersecting with or adjacent to the line of work shall be left free, clean and in good order.

3.4 TRENCH BACKFILLING

A. No connections, branches, fittings of any character, or any part of a pipe line or other structure that needs to be located or measured shall be filled over or around until the required measurements have been made by the ENGINEER and his permission to do so has been given. Any such items that are covered without authorization shall be uncovered by the CONTRACTOR at his expense.

B. Backfill around a structure or pipe shall be brought up evenly on all sides so that no unbalanced pressure will be imposed on the structure or pipe.

C. In backfilling of pipelines, backfill material shall be carefully placed about the pipe in uniform layers to a depth as shown on the Design Drawings. Each layer shall be compacted with proper tools (e.g., vibratory compactor), making three passes and in such a manner as not to disturb or damage the pipe. Backfilling shall be carried on simultaneously on both sides of the pipe so that damaging side pressures do not occur.

D. After bedding material around pipe has been placed and tamped to the specified depth over the top of the pipe, the remainder of the trench may be backfilled with backfill material as shown on the drawings. Backfill material shall be placed in uniform layers thoroughly compacted with heavy duty power tamping tools in layers to the density specified and/or to the satisfaction of the ENGINEER.

E. Whenever the trenches have not been properly backfilled or settlement occurs, they shall be refilled, smoothed off and made to conform to the surface of the ground. Backfilling shall be carefully performed and the original surface shall be restored to the full satisfaction of the ENGINEER, at no additional cost to the OWNER. Surplus material shall be stockpiled in a location directed by the OWNER.

3.5 PLACEMENT AND COMPACTION

A. General:

1. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or scarify surfaces to a depth of six (6) inches so that fill materials will bond with existing surfaces.

2. Place all backfill and fill materials in horizontal layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated equipments.

3. Do not place backfill or fill material on surfaces that are submerged, soft, muddy, frozen, or unstable.

4. Adjust moisture condition as necessary to achieve compaction. No additional compensation shall be given to the CONTRACTOR for re-working of areas that require re-compaction, moisture conditioning or other efforts to achieve minimum compaction and moisture content.

5. Place backfill and fill materials evenly against structures or piping to required elevations. Prevent wedging action of backfill against structures or

displacement of piping by carrying material uniformly around structure or piping to approximately same elevation in each lift.

6. Compact layers with a vibratory compactor making a minimum of 3 passes.

3.6 GRADING

General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finish surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

3.7 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

C. Reconditioning Compacted Areas: Where complete compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

D. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface of finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.8 DISPOSAL OF EXCESS AND WASTE MATERIALS

Dispose of excess and waste materials to designated areas on-site as approved by the ENGINEER and OWNER.

3.9 FINISHING WORK

A. All grading and drainage structures shall be constructed and maintained as necessary along the completed section.

B. Unless otherwise specified by the ENGINEER, the elevation of all grading and drainage structures shall be within 2 inches of those shown on the Design Drawings.

C. All disturbed areas shall be restored to original conditions, unless specified otherwise.

END OF SECTION

SECTION 33 21 70
LFG EXTRACTION WELLS AND WELLHEADS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The CONTRACTOR shall provide all equipment, materials, and labor needed to install landfill gas (LFG) extraction wells and wellheads as specified herein and as indicated on the PLANS.

B. It is expected that combustible methane gas will be venting from boreholes drilled to install the wells. The CONTRACTOR'S bid price shall include provision for all equipment and procedures necessary to safely install wells under this condition.

C. Related Work Described Elsewhere:

1. Section 31 20 10: Crushed Stone and Gravel
2. Section 31 23 16: Excavating and, Trenching
3. Section 31 23 23: Filling, Backfilling and Compaction
4. Section 33 51 10: Plastic Pipe and Fittings

1.02 QUALIFICATIONS

A. The CONTRACTOR shall engage a qualified LFG extraction well drilling firm (Driller) to drill all borings for the vertical LFG extraction wells shown on the PLANS. The Driller shall meet the following qualifications:

1. Driller shall own all equipment necessary to complete drilling of the LFG extraction wells as specified in this Section, and shall be capable of drilling to at least 100 feet depth.
2. Driller shall have minimum 15 years of experience in drilling borings for LFG extraction wells. The Driller's proposed foreman shall have minimum 10 years of experience in drilling borings for LFG extraction wells.
3. Driller shall have installed at least 1,000 LFG extraction well borings, including at least 50,000 vertical feet, over at least 50 successful projects.

B. Driller shall be:

1. Recovery Drilling Services, LLC
   PO Box 53, 157 West Main
   Dudley, Massachusetts 01571
   Phone: 508-943-1182

2. Les Entreprises Forlam Inc.
   4085 Lavoisier
   Boisbriand, Québec, Canada J7H 1N1
   Phone: 450 430-0441

3. B&H Drilling Service
   7180 SW 18th Street
   Plantation, Florida 33317
   Phone: 954-614-0492

4. American Environmental Group Ltd.
   3600 Brecksville Road
   Suite 100
   Richfield, Ohio 44286
   Phone: 330-659-5930

5. Commonwealth Drilling
   9118 Clearfield Curwensville Highway
   Clearfield, Pennsylvania 16830
   Phone: (814) 768-3505

6. Or approved equal, based on meeting qualifications above and review of project references, as required in Part 1.03A of this Section.

1.03 SUBMITTALS

A. The CONTRACTOR shall submit the qualifications and at least five (5) project references for the CONTRACTOR's proposed Driller for review and approval by the ENGINEER. If the CONTRACTOR's proposed Driller does not meet the qualifications listed under Part 1.02A above, or the submitted project references indicate that the proposed Driller has not completed prior work to the satisfaction of other clients, the proposed Driller will be rejected, and the CONTRACTOR will be required to propose another Driller. No extensions to the project schedule will be granted to allow for resubmission as a result of any such rejection.

B. The CONTRACTOR shall prepare and submit to the ENGINEER for review and approval catalog cuts on materials furnished, and manufacturer's brochures containing complete information and instructions pertaining to the storage, handling, installation, and inspection of wellhead assemblies and other appurtenances furnished.

C. The CONTRACTOR shall submit to the ENGINEER for review and approval samples of all well backfill materials and the name of the vendor(s) and source of materials furnished.

D. The CONTRACTOR shall prepare and submit to the ENGINEER for review and approval Shop Drawings showing dimensions, materials, and configuration of the wellhead assembly.

E. Within 21 days after drilling is complete, the CONTRACTOR shall submit to the ENGINEER well logs (drilling and construction) based on information recorded in the field during construction.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Backfill Materials:

1. Stone fill shall be as specified in Section 31 20 10.

2. LFG well boring backfill shall be as specified in Section 31 23 23.

3. "Bentonite or Foam Plug" as shown on the PLANS, shall refer to a well seal comprised of hydrated sodium bentonite pellets or chips, or foam, of a thickness indicated on the PLANS. Bentonite material shall consist of clay greater than 85% sodium montmorillonite, without additives. Bentonite shall be $^{3}/_{8}$-inch Holeplug as manufactured by Baroid or equal. Foam material shall be Pour System ES 24-005 by Foam Concepts, LLC of Boise, Idaho. Foam shall only be used in place of bentonite where there is no perched liquid level in the boring and temperatures of LFG as extracted at adjacent existing wells is less than 200°F.

B. Slotted PVC Pipe: The piping shall be as specified in Section 33 51 10. The slots in vertical extraction well piping shall be as shown on the PLANS and shall be supplied by the factory.

C. Perforated HDPE Pipe: The piping shall be as specified in Section 33 51 10. The perforations in horizontal collection well piping shall be as shown on the PLANS and shall be supplied by the factory.

D. Wellheads: LFG Wellhead assemblies shall be QED Environmental 2-inch vertical Accu-Flo Wellhead (Model 200) with Exact-FLO Valve.

1. QED Environmental Easy Port fittings (model 40986) shall be installed on all sampling/monitoring ports on wellheads.

2. Flexible hose shall be 2-inch Kanaflex flexible hose (Model 101 PS UVOR), and shall be attached to wellhead PVC piping using Kanaflex Power Lock clamps (2.375"). Flexible hoses shall be connected to LFG lateral risers using Fernco Flexseal couplings or approved equal, with reducing dimensions to suit dimensions of flexible hoses and LFG laterals.

3. CONTRACTOR shall provide a brass tag on each wellhead, embossed with the corresponding well number shown on the Contract Drawings, and connected to the wellhead using a stainless steel tie.

E. Well seals: Well seals shall be QED Environmental 8-inch diameter well caps without fittings, for 2-inch diameter wellhead (Model GWC82).

F. Well bore reinforcement grate: Well bore reinforcement grates shall be fabricated as shown on the Design Drawings. Well bore reinforcement grates are not required if foam plugs are utilized in lieu of bentonite plugs in well borings.

PART 3 - EXECUTION

3.01 VERTICAL WELL DRILLING

A. The CONTRACTOR shall coordinate the start of drilling with the ENGINEER.

B. The CONTRACTOR shall provide a thoroughly experienced, competent driller during all drilling operations.

C. The CONTRACTOR shall survey and stake the well locations prior to drilling. Well locations will be approved and may be adjusted by the ENGINEER or the OWNER prior to beginning drilling.

D. The CONTRACTOR must use dry drilling equipment. Wet rotary drilling equipment may not be used.

E. Wells are to be drilled to the depth and diameter as shown on the PLANS. The boring depths shown on the PLANS are estimated and may be adjusted in the field by the ENGINEER. Under no circumstances are the drilling depths from the well schedule on the PLANS to be exceeded unless approved by the ENGINEER in advance.

1. Wet Borings:

   a. If water is encountered in a boring, the CONTRACTOR may be directed to drill beyond the point at which it was encountered. If wet conditions remain, the boring may be terminated and the length of perforated pipe adjusted by the ENGINEER. If wet conditions cease (e.g., due to a perched water layer), then drilling will continue to the design depth.

   b. If water is encountered in a boring at a shallow depth, the ENGINEER may decrease the well depth and length of perforated pipe, or relocate the well.

2. Abandoned Borings: If, in the opinion of the ENGINEER, the borehole has not reached a sufficient depth to function as an effective extraction well, the CONTRACTOR shall abandon this borehole by backfilling it with cuttings removed during drilling. If cuttings are unsuitable as backfill (for example, box springs, tires, etc.) the CONTRACTOR shall use soil backfill material. A 2-foot thick bentonite plug will be placed in the borehole when the depth

is 4 feet below the existing grade. The remaining 2 feet of the borehole will then be filled with soil material and compacted to approximately match the elevation of the existing grade.

F. The bore for the well shall be straight and vertically plumb and the well pipe shall be installed in the center of the borehole. The CONTRACTOR shall take all necessary precautions to maintain the well pipe vertically plumbed during the backfill operation of the bored hole to the satisfaction of the ENGINEER. If the pipe installed is out of plumb, as determined by the ENGINEER, the CONTRACTOR, at his own expense, shall correct the alignment.

G. The CONTRACTOR shall keep detailed well logs for all wells drilled, including the total depth of well, the static water level, the depth, thickness, and description of soil or waste strata, the occurrence of any water bearing zones. The logs shall also include detailed well construction diagrams for all wells installed. These diagrams shall include dimensions that indicate total well depth, length of slotted pipe, length of solid pipe, length of stick-up to the top of the wellhead, thickness of stone, thickness of bentonite plug, and thicknesses of soil material. Well logs shall be submitted to the ENGINEER.

3.02 JOINING OF PIPES

A. Pipes shall be joined as specified in Section 33 51 10. In addition, lag screws shall be installed at each coupling to secure vertical piping during placement in well boring. Four sheet metal screws per coupling or two screws per bell fitting shall be installed. The length of the lag screws shall equal the sum of the pipe and coupling (or bell fitting) wall thicknesses. PVC slip joint couplings shall be installed as shown on the PLANS for wells that will be connected to the header with a remote wellhead.

3.03 BACKFILLING

A. Backfilling of the well shall commence immediately after well drilling is completed and the well piping has been installed. Backfill materials shall be placed carefully within the wells to the dimensions shown on the PLANS and as approved by the ENGINEER. The ENGINEER, on the basis of a visual examination, may reject gravel and soil backfill containing foreign material. Both well piping and backfill shall be installed with a safety grate installed over the boring.

B. The bentonite plugs shall be backfilled in 6-inch lifts. Prior to placing each lift, the CONTRACTOR shall soak the in-place bentonite in accordance with manufacturer recommendations.

C. Foam Installation:

1. Review manufacturer technical information provided in each box of foam for detailed mixing and installation instruction. Mix and install foam seals in the well borings as follows:

a. Remove the foam from the shipping box and outer bag.

b. Place the bag on a flat clean work area to minimize puncturing the bag during mixing.

c. Remove the center white divider and discard.

d. Mix the two chemicals together by lifting the bag by two corners and rotating.

e. Knead the bag vigorously for about 40 – 60 seconds until the chemicals are mixed to a consistent cream color. Confirm that the liquids in the corners of the bag are adequately mixed.

f. Leave temporary 8" cap off the well casing during foam plug installation. This will allow pressure relief through the well casing and prevent gas from blowing through the seal as it is curing.

g. Move to the borehole and cut across the corner of the bag creating a 3" to 5" hole.

h. Once the reaction begins and the contents begin to expand, allow the foam to rise up and out of the bag and into the hole. Evenly distribute the foam around the boring. Minimize the amount foam contacting the pipe and well sidewalls. Never turn the bag upside down; pour the foam until the contents have stopped expanding out of the bag.

i. Depending on ambient temperature, it may take up to 10 minutes for the foam to set. The foam is ready for the next layer when a small pebble dropped into the boring bounces off the foam.

j. When adding the second layer of foam, repeat a-i above and apply directly onto the previous layer until the specified thickness is attained.

k. Each well seal generally requires two bags of foam (i.e., two bags for the lower seal and two bags for the upper seal). If the seal integrity is questionable for any reason, add another bag.

2. Confirm the thickness of the foam seal by measurement of boring depth. Wait at least 20 minutes for the foam to cure before placing soil backfill above the foam plug.

D. LFG well boring backfill shall be rodded into the boring to provide even distribution and compaction.

E. The ENGINEER shall inspect the extraction well borings 4 to 8 weeks after completion of the final well. Excessive settlement (6 inches or more below

surrounding grade) in the boring shall be repaired by the CONTRACTOR by adding compacted fill around the well casing at no additional cost to the OWNER.

3.04 TEMPORARY CAP

A. The CONTRACTOR shall temporarily cap the riser pipe of the vertical extraction well to prevent direct venting of LFG through the riser pipe. The temporary cap shall be installed upon completion of well construction, and removed during the installation of the wellheads. Wells to be connected to remote wellheads shall be provided with flange adapters and a blind flange, rather than temporary caps, as shown on the PLANS.

3.05 WASTE DISPOSAL

A. The CONTRACTOR shall dispose of construction waste, including well cuttings, at the active portion of the landfill as directed by the ENGINEER and approved by the OWNER. The CONTRACTOR shall remove spoils daily and shall be responsible for controlling odors from the spoils.

3.06 WELLHEAD INSTALLATION

A. Wellhead assembly shall be installed on wells in accordance with the manufacturer's recommendations and the PLANS. Care shall be taken not to damage the impact pitot tube during installation. If a pitot tube is damaged during installation, CONTRACTOR shall replace it at no cost to the OWNER.

B. The wellhead shall be connected to the lateral riser via flexible PVC pipe, as shown on the PLANS.

C. Horizontal collection wellhead traps shall be filled with water prior to installation of wellhead or blind flange on trap riser.

- END OF SECTION -

SECTION 33 21 80

METHANE MIGRATION MONITORING WELLS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The CONTRACTOR shall provide all material, equipment, and labor needed to install methane migration monitoring wells as shown on the Contract Drawings or as directed by the ENGINEER.

B. Methane, hydrogen sulfide, and other landfill gases may vent from boreholes drilled to install methane migration monitoring wells. The CONTRACTOR's bid price shall include provision for all equipment and procedures necessary to safely install wells under this condition.

C. All work shall be performed by qualified workers in accordance with the best standards and practices available.

D. The CONTRACTOR shall keep the premises free from accumulation of drill tailings, waste materials or rubbish caused by operations. Upon completion of each day's work, the CONTRACTOR shall remove all drill tailings from the site for appropriate off-site disposal.

E. Related Sections:

1. Section 33 21 80: Earthwork.

2. Section 33 51 10: Plastic Pipe and Fittings.

1.02 SUBMITTALS

A. Detailed manufacturer information for the following materials, including but not limited to grain size analyses and product data, shall be submitted at least ten (10) days in advance of well installation:

1. Well stone gradation

2. Bentonite

3. Cement/concrete

B. The following information shall be submitted within ten (10) days of completion of methane migration monitoring wells:

1. Final boring/excavation logs.

2. Well construction diagrams.

3. Boring abandonment logs (if required).

1.03 JOB CONDITIONS

A. Methane migration monitoring wells are to be drilled near property boundary, outside the landfill waste placement/liner system/final cover system limits.

PART 2 - PRODUCTS

2.01 WELL CASING AND COVER

A. Pipe and fittings shall be Schedule 80 PVC and shall meet the requirements of Section 33 51 10 of these specifications. Slotted pipe shall meet the requirements shown on the Contract Drawings.

B. Covers for the methane migration monitoring wells shall be 4- or 8-inch inside diameter, 6-foot long steel casings with rust-resistant coating and lockable, hinged lid.

C. Padlocks for well covers shall be keyed alike with one key per padlock provided to the OWNER.

2.02 BACKFILL

A. Crushed stone shall be as specified in Section 31 20 10.

B. Bentonite shall be sodium bentonite pellets or chips. Bentonite material shall consist of clay greater than 85% sodium montmorillonite, without additives. Bentonite shall be ¾-inch Holeplug as manufactured by Baroid or equal.

C. Bentonite-cement slurry shall be composed of bentonite as specified in Part 2.02B above, mixed at a ratio of approximately 1:1 with cement, to result in a mixture which is hard but not brittle after drying. Dry cement shall be added to mixed, hydrated bentonite.

2.03 CONCRETE

A. Concrete shall be ready mixed conforming to ASTM C-94. Cement shall be Type I Portland cement conforming to NHDOT Specifications. Concrete shall be air-entrained with an air content between 4 and 5 percent.

B. The concrete shall provide 28-day compressive strength of 3,000 psi.

C. All concrete formwork, placement, protection and curing shall be in accordance with ACI 318 and NHDOT Specifications.

D. The Contractor shall etch the methane migration monitoring well identification number into the concrete surface for each well prior to the concrete taking a set.

PART 3 - EXECUTION

3.01 GENERAL

A. The CONTRACTOR shall furnish materials, which fully comply with PART 2 of this Section at all times.

B. The CONTRACTOR shall submit all submittals as required by Part 1.02 of this Section. Work shall not commence on this item until written approval of the pre-construction submittals is received from the ENGINEER.

C. The CONTRACTOR shall coordinate the start of drilling with the ENGINEER and OWNER. Required drilling permits shall be obtained prior to commencing work.

D. The CONTRACTOR shall provide at all times a thoroughly experienced, competent driller during all operations at the drill site.

E. Methane migration monitoring well locations will be surveyed and staked out by the CONTRACTOR's New Hampshire state licensed land surveyor, and CONTRACTOR shall install wells at staked locations following OWNER and ENGINEER review and approval.

F. Where necessary, CONTRACTOR shall construct temporary benches using soil materials provided by the OWNER to allow installation of wells at locations shown on the Contract Drawings. CONTRACTOR shall remove temporary benches after well installation. Such benches shall be installed and removed by the CONTRACTOR at no additional cost to the OWNER.

3.02 DRILLING

A. The bore hole for the methane migration monitoring wells shall be drilled to the depths shown on the Contract Drawings using dry drilling equipment. Wet rotary drilling equipment shall not be used. Under no circumstances are the drilling depths from the well schedule on the Plans to be exceeded unless approved by the ENGINEER in advance.

B. If groundwater table is encountered above drill depth shown on the Contract Drawings, boring shall be terminated at the groundwater depth.

C. If, during the drilling of a boring, an obstruction is reached, the driller must use all reasonable means to advance the drilling. If the drilling rate falls to less than 2 feet per hour and the well cannot be completed as shown on the Contract Drawings, the ENGINEER shall be consulted as to whether the borehole has advanced to a sufficient depth. The CONTRACTOR shall backfill drill tailings, and additional fill as required, in the hole if abandoned. Backfill in abandoned borings shall be compacted at grade. Compensation for abandoned well borings shall be at the unit price shown on the Schedule of Prices.

D. The CONTRACTOR shall keep detailed well logs for all wells drilled, including the total depth of the well, length of slotted pipe, the static water level, the depth, thickness, and description of soil or waste strata, and the occurrence of any water bearing zones. Logs shall be submitted to the ENGINEER.

E. No borings will be left open overnight.

3.03 GAS MONITORING WELL INSTALLATION

A. Pipe Installation:

1. Pipe and pipe fittings shall be prepared, aligned, and joined, in accordance with Section 33 51 10 and the Contract Drawings. Pipe and pipe fittings which do not fit together to form a tight fitting shall be rejected. All loose dirt and moisture shall be wiped form the exterior of the pipe and the interior of the pipe fitting.

2. Pipe sections shall be joined by threading. Socket couplings shall be dry joined. Solvent cement shall not be utilized for joining pipes and fittings for methane migration monitoring wells. Teflon tape shall be used on threaded PVC tee joints at the top of gas monitoring wells, where such PVC tees are required.

3. The bore for the well shall be straight and the pipes shall be installed vertically plumb in the center of the boring. Derricks, ropes, or other suitable equipment or manual labor shall be used for lowering the pipes into the well borings, subject to the approval of the ENGINEER. Pipe shall be installed with a safety grate installed over the boring.

B. Backfilling:

1. The CONTRACTOR shall take all necessary precautions to maintain the well pipe vertically plumb during the backfill operation. Care shall be taken during installation of backfill materials to prevent damage to the well piping.

2. If the borehole collapses partially or completely during backfill operations, the CONTRACTOR will be required to redrill the borehole, at no additional cost, upon the direction of the ENGINEER.

3. Backfilling of the well shall commence immediately after drilling of the corresponding borehole is completed and the well piping has been installed. Backfill materials shall be placed carefully within the wells to the dimensions shown on the Contract Drawings and as approved by the ENGINEER. Crushed stone and soil backfill containing foreign material may be rejected on the basis of a visual examination. Both well piping and backfill shall be installed with a safety grate installed over the boring.

4. Bentonite plug shall be backfilled in 6-inch lifts. The CONTRACTOR shall soak each lift with clean water prior to filling the next lift as directed by the ENGINEER. Bentonite-cement slurry seal materials shall be fully hydrated prior to placement in the boring.

5. Soil backfill shall be rodded in the boring to provide even distribution and compaction.

6. Suitable erosion control provisions shall be made to prevent erosion of disturbed areas.

7. Well covers shall be installed in accordance with the plans and as approved by the Engineer. Well covers shall be coated with rust-resistant primer inside and outside prior to installation. Final painting on the outside of the well cover shall be completed after installation. Locks and keys shall be provided to the OWNER upon completion of the gas monitoring well installation.

3.04 DRILLING CUTTINGS DISPOSAL

A. The CONTRACTOR shall place drilling cuttings in neat piles adjacent to the work area. The CONTRACTOR shall haul the excavated waste materials to the working face of the landfill for disposal.

END OF SECTION

SECTION 33 51 10
PLASTIC PIPE AND FITTINGS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work: The Contractor shall supply all materials, equipment, and labor needed to install complete and make ready for use all plastic pipe and fittings, as specified herein and as indicated on the Drawings.

B. Related Work Described Elsewhere:

1. Section 31 23 16 – Excavating and Trenching

2. Section 33 21 70 – LFG Extraction Wells and Wellheads

3. Section 33 51 20 – Valves

1.02 SUBMITTALS

A. The Contractor shall prepare and submit to the Engineer, for review and approval, certificates of compliance on materials furnished and manufacturer's brochures containing complete information and instructions pertaining to the storage, handling, installation, inspection, maintenance, and repair of each type of pipe and fitting furnished.

B. The Contractor shall prepare and submit Shop Drawings to the Engineer for review and approval. The Shop Drawings shall show all dimensions, slopes, and invert elevations at connections. All tie-ins to the existing system shall be field-verified and shown on the Shop Drawings.

1.03 REFERENCE

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. Use of the most recent version is required.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1248	Specification for Polyethylene Plastics Molding and Extrusion Materials
ASTM D 1784	Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
ASTM D 1785	Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

ASTM D 2321 Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe

ASTM D 2467 Specification for Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

ASTM D 2513 Specification for Thermoplastic Gas Pressure Pipe Tubing and Fittings

ASTM D 2564 Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems

ASTM D 2774 Practice for Underground Installation of Thermoplastic Pressure Piping

ASTM D 2855 Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings

ASTM D 3350 Specification for Polyethylene Plastics Pipe and Fittings Materials

ASTM F 1417 Test Method for Installation Acceptance of Plastic Gravity Sewer Lines using Low-Pressure Air

AMERICAN NATIONAL STANDARD INSTITUTE (ANSI)

ANSI B 31.8 Code for Pressure Piping, Appendix N

PLASTICS PIPING INSTITUTE (PPI)

PPI TR-31/9-79 Technical Report

PART 2 - PRODUCT

2.01 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. All PVC pipe and pipe fittings shall be Schedule 80 PVC conforming to ASTM D 1784, ASTM D 1785 (for pipe), and ASTM D 2467 (for fittings).

B. PVC pipe and pipe fittings shall be manufactured from a compound which meets the requirements of Type 1, Grade 1, Polyvinyl Chloride PVC 1120, Class 12454-B, as outlined in ASTM D 1784. A Type 1, Grade 1 compound is characterized as having the highest requirements for mechanical properties and chemical resistance.

1. Compound from which pipe is produced shall have a design stress rating of 2000 psi at 73 degrees F, listed by the Plastic Piping Institute.

2. Materials from which pipe and pipe fittings are manufactured shall have been tested and approved by NSF International.

3. Pipe shall conform to the requirements of ASTM D-2241. Pipe shall be homogenous throughout and shall be free from cracks, holes, foreign inclusions, and other defects.

C. PVC Pipe Storage:

1. PVC pipe shall be stored or stacked so as to prevent damage by marring, crushing, or piercing. Maximum stacking height shall be limited to 6 feet. For storage over 5 days, a location shall be chosen out of direct sunlight or the piping and fittings will be covered.

2.02 PVC FLANGES

A. Flanges shall be Schedule 80 PVC and shall be plate type, ANSI Class 150 pounds.

B. The bolts, studs, nuts, and washers for the flanges shall be hot dipped galvanized steel. All below grade studs and bolts shall be coated with Polyken Primer, or equal, just after installation, to prevent corrosion.

C. Flange gaskets shall be full-face Neoprene.

2.03 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

A. General:

1. All HDPE pipe and fittings greater than 3-inch diameter as indicated on the Drawings shall be Standard Dimension Rating (SDR) 17 high density polyethylene pipe using a PE 4710 type resin, or approved equal. HDPE pipe and fittings that are 3-inch diameter and less shall be SDR 11.

2. Pipe shall be extruded from a Type III, Class C, Category 5, Grade P34 compound as described in ASTM D 1248. PE 4710 material shall be classified as cell 445574C, according to ASTM D 3350. The pipe shall be manufactured to meet the requirements of ASTM D 2513, and shall be listed as meeting NSF-61. Manufacturer's literature shall be adhered to when "manufacturer's recommendations" are specified. All pipe and fittings shall be provided by one manufacturer. Acceptable piping manufacturers include Performance Pipe, JM Eagle or Flying W. Fittings; acceptable fitting manufacturers include Isco Industries.

3. CONTRACTOR shall use factory-fabricated tees or reducing tees for joining different pipes together. Branch saddles shall only be used where specifically approved by the ENGINEER, and shall require leak testing as specified in Part 3.14 of this Section.

2.04 FLANGES FOR HDPE PIPE

A. Flanges for HDPE pipe shall be convoluted ductile iron back-up rings with a minimum thickness of 1 inch, as manufactured by Improved Piping Products (925-254-0962), Inc., of Orinda, California or approved equal. Back-up rings shall be finished with red oxide primer.

B. The bolts, studs, nuts, and washers for the flanges shall be hot dipped galvanized steel. All below grade studs and bolts shall be coated with Polyken Primer, or equal, just after installation, to prevent corrosion.

2.05 HDPE ELECTROFUSION COUPLINGS

A. All HDPE electrofusion couplings shall be for HDPE pipe sizes and Standard Dimension Ratings (SDR) as indicated on the Drawings.

B. Manufacturer for electrofusion couplings shall be IPEX/Friatec or approved equal.

PART 2 - EXECUTION

3.01 GENERAL

A. Pipe shall be stored or stacked so as to prevent damage by marring, crushing, or piercing. Maximum stacking height shall be limited to 6 feet.

B. Pipe and pipe fittings shall be handled carefully in loading and unloading. They shall be lifted by hoists and lowered on skidways in such a manner as to avoid shock. Derricks, ropes, or other suitable equipment shall be used for lowering the pipe into the extraction well borings. Pipe and pipe fittings shall not be dropped or dumped.

3.02 PVC PIPE STORAGE

A. For storage of PVC pipe and fittings over 5 days, a location shall be chosen out of direct sunlight, or the piping and fittings shall be covered.

3.03 PVC PIPE INSTALLATION

A. PVC pipe installation shall conform to these specifications, the manufacturer's recommendations, and as outlined in ASTM D 2774.

3.04 JOINING OF PVC PIPE

A. Joining of pipe shall be in accordance with ASTM D 2855.

B. Preparation:

1. All pipe shall be inspected for cuts, scratches, or other damage prior to installation. Pipe with imperfections shall not be used. All burrs, chips, etc. shall be removed from pipe interior and exterior. The interior of the pipe shall cleared of foreign matter; e.g., loose dirt, tape, and paper. All loose dirt and moisture shall be wiped from the interior and exterior of the pipe end and the interior of the fitting. All pipe cuts shall be square, perpendicular to the center line of pipe. Pipe ends shall be beveled prior to applying primer and solvent cement so that the cement does not get wiped off during insertion into the fitting socket.

C. Solvent Welding:

1. A coating of primer as recommended by pipe supplier shall be applied to the entire interior surface of the fitting socket and to an equivalent area on the exterior of the pipe prior to applying solvent cement. The solvent cement shall comply with the requirements of ASTM D 2564 and shall be applied in strict accordance with manufacturer's specifications. Pipe shall not be primed or solvent welded during precipitation or when atmospheric temperature is below 40 degrees F or above 90 degrees F.

D. Curing:

1. After solvent welding, the pipe shall remain undisturbed until cement has thoroughly set. As a guideline for joint setting time, use 1 hour for ambient temperatures 60-90 degrees F, or 2 hours when ambient temperature is 40-60 degrees F.

E. Alignment:

1. Pipe and pipe fittings shall be selected so that there will be as small a linear deviation as possible at the joints, and so that inverts present a smooth surface. Pipe and fittings which do not fit together to form a tight fitting will be rejected.

3.05 FLEXIBLE PVC PIPE CONNECTIONS

A. Connections to pipe shall be made with clamps in accordance with manufacturer's step by step procedures and recommendations.

3.06 HDPE PIPE HANDLING

A. HDPE pipe shall not be bent more than the minimum radius recommended by the manufacturer for type, grade, and SDR. Care shall be taken to avoid imposing strains that will overstress or buckle the HDPE piping or impose excessive stress on the joints.

B. Joining HDPE Pipe: Only two methods shall be utilized to joining HDPE pipe: heat fusion and mechanical joining.

1. Mechanical Joining shall be accomplished with HDPE flange adapters, neoprene gaskets, and ductile iron back-up flanges, and shall be used only where shown on the Drawings. Refer also to Part 3.10.

2. Heat Fusion joints shall be made in accordance with manufacturer's step by step procedures and recommendations. Fusion equipment and a trained operator shall be provided by the Contractor. Pipe fusion equipment shall be of the size and nature to adequately weld all pipe sizes and fittings necessary to complete the project. Branch saddle fusions shall be made in accordance with manufacturer's recommendations and step by step procedures. Branch saddle fusion equipment will be of the size to facilitate saddle fusion within the pipe trench. Heat fusion shall be performed outside of the trench whenever practical. Before heat fusing pipe, each length shall be inspected for the presence of dirt, sand, mud, shavings, and other debris. Any foreign material shall be completely removed. At the end of each day, all open ends of fused pipe shall be capped or otherwise covered to prevent entry by animals or debris.

3. As per the manufacturer’s instructions, no fusion shall be performed in precipitation unless a shelter is provided.

3.07 HDPE FUSION PROCEDURE

A. Heating tool surfaces must be to temperature before commencing fusion (minimum 400°F, maximum 450°F). All points on both heating tool surfaces where the heating tool surfaces will contact the pipe or fitting ends must be within the prescribed minimum and maximum temperatures and the maximum temperature difference between any two points on the heating tool fusion surfaces must not exceed 20°F for equipment for pipe smaller than 18 inches diameter, or 35°F for larger equipment. Heating tool surfaces must be clean.

B. Interface pressure: Minimum 60 psig – Maximum 90 psig; (4.16 – 6.21 bar). Interface pressure is used to calculate a fusion joining pressure value for hydraulic butt fusion machines or manual machines equipped with force reading capability. The interface pressure is constant for all pipe sizes and all butt fusion machines. However, fusion joining pressure settings are calculated for each butt fusion machine, which are dependent upon the OD and DR (Dimension Ratio).

C. For hydraulic machines, the interface pressure, the fusion surface area, the machine’s effective piston area and frictional resistance, and if necessary, the pressure needed to overcome external drag resistance, are used to calculate hydraulic fusion joining pressure gauge settings. The equipment manufacturer’s instructions are used to calculate this value. The proper amount of force should be verified by visual inspection of the joint.

D. The interface pressure and the hydraulic gauge pressure are not the same. For manual machines without force reading capability, the correct fusion joining force is the force required to roll the melt beads over to the pipe surface during joining.

E. Once the heating tool surface temperature has been achieved, and the correct fusion joining pressure setting has been determined, clean the inside and outside of the component, pipe or fitting ends by wiping with a clean, dry, lint-free cloth or paper towel. Remove all foreign matter. Align the components of the machine, place them in the clamps, and then close the clamps. Do not force pipes into alignment against open fusion clamps. Component ends should protrude past the clamps enough so that facing will be complete. Bring the ends together and check high-low alignment. Adjust alignment as necessary by tightening the high side down.

F. Place the facing tool between the component ends, and face them to establish smooth, clean, parallel mating surfaces. Complete facing produces continuous circumferential shavings from both ends. Face until there is minimal distance between the fixed and moveable clamps. If the machine is equipped with facing stops, face down to the stops. Stop the facer before moving the pipe ends away from the facer. Remove the facing tool, and clear all shavings and pipe chips from the component ends. Facing pressure shall be minimum 60 psig and maximum 90 psig (4.16 – 6.21 bar).

G. Bring the component ends together, check alignment and check for slippage against fusion pressure. Look for complete contact all around both ends with no detectable gaps, and outside diameters in high-low alignment. If necessary, adjust the high side by tightening the high side clamp. Do not loosen the low side clamp because components may slip during fusion. Re-face if high-low alignment is adjusted.

H. Verify that the contact surface of the heating tool is maintaining the correct temperature. Place the heating tool between the component ends, and move the ends against the heating tool. Bring the component ends together under pressure to ensure full contact. The initial contact pressure should be held very briefly and released without breaking contact. Pressure should be reduced when evidence of melt appears on the circumference of the pipe. Hold the ends against the heating tool without force (drag force may be necessary to ensure contact). Beads of melted polyethylene will form against the heating tool at the component ends. When the proper melt bead size is formed, quickly separate the ends, and remove the heating tool. The proper bead size is dependent upon the size of the component. Approximate values are shown in Table I below. During heating, the melt bead will expand out flush to the heating tool surface, or may curl slightly away from the surface. If the melt bead curls significantly away from the heating tool surface, unacceptable pressure during heating may have occurred.

Table II
Bead Widths per Wall Thickness

Minimum Wall Thickness, in.	Approximate Bead Width (B), in.		Minimum Wall Thickness, in.	Approximate Bead Width (B), in.	
	Minimum	Maximum		Minimum	Maximum
.118	5/32	1/4	1.06	19/32	25/32
.157	5/32	9/32	1.18	5/8	13/16
.197	3/16	5/16	1.34	21/32	7/8
.246	1/4	11/32	1.57	11/16	29/32
.315	9/32	3/8	1.77	25/32	1
.354	5/16	7/16	1.97	7/8	1-1/16
.433	11/32	1/2	2.16	15/16	1-3/16
.512	3/8	9/16	2.36	1	1-1/4
.630	7/16	19/32	2.56	1-1/8	1-7/16
.710	1/2	5/8	2.76	1-3/16	1-1/2
.750	1/2	11/16	2.95	1-1/4	1-9/16
.870	1/2	11/16	3.15	1-5/16	1-11/16
.940	9/16	3/4	3.35	1-3/8	1-3/4
			3.54	1-1/2	1-13/16

Instructions:
Determine the wall thickness of the pipe/fitting. Find the wall thickness above. If the exact wall thickness is not shown, use the next lowest wall thickness for determination of bead width.

I. Immediately after the heating tool is removed, quickly inspect the melted ends, which should be flat, smooth and completely melted. If the melt surfaces are acceptable, immediately and in a continuous motion, bring the ends together and apply the correct joining force (or fusion pressure). The correct fusion pressure will form a double bead that is rolled over to the surface on both ends. A concave melt surface is unacceptable; it indicates pressure during heating. Do not continue. Allow the component ends to cool and return to Part 3.07.E of this Section.

J. Hold joining force against the ends until the joint is cool. The joint is cool enough for gentle handling when the double bead is cool to the touch. Cool for about 30 – 90 seconds per inch of pipe diameter. Do not try to decrease the cooling time by applying water, wet cloths, or the like.

1. Avoid pulling, installation, pressure testing and rough handling for at least an additional 30 minutes.

2. Heavier wall thickness pipes require longer cooling times.

K. On both sides, the double bead should be rolled over to the surface, and be uniformly rounded and consistent in size all around the joint. The gap between the two single beads must not be below the fusion surface throughout the entire circumference of the butt joint. The displacement between the fused ends must not exceed 10% of the pipe/fitting minimum wall thickness. Refer to Table II for general guidelines for bead width, B, for each respective wall thickness.

L. The size differential between two single beads (Smax - Smin) shall not exceed X% of the actual bead width (B):

$$X = \frac{S}{B} \times 100$$

Where;
X=Percent difference of bead width, %
Pipe to pipe, maximum X = 10%
Pipe to fitting, maximum X = 20%
Fitting to fitting, maximum X = 20%
S = Smax - Smin, inches
B = Width of bead, inches

When butt fusing to molded fittings, the fitting side bead may have an irregular appearance. This is acceptable provided the pipe side bead is correct.

3.08 HDPE PIPE FUSION TEST

A. Prepare a sample joint. Sample lengths should be at least 6 inches or 15 times the minimum wall thickness (see Figure I).

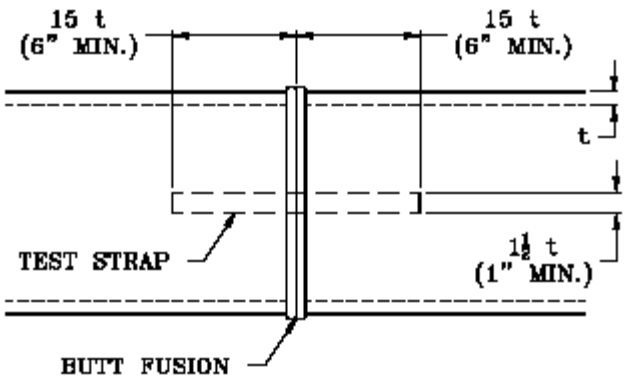
B. Observe the fusion process and verify the recommended procedure for butt fusion is being followed.

C. Visually inspect the sample joint for quality.

D. Allow the joint to cool completely (minimum one hour).

E. Prepare the sample as shown in Figure I. The sample should be cut lengthwise into at least three longitudinal straps with a minimum of 1 inch or 1.5 times the wall thickness in width.

Figure I
Butt Fusion Bent Strap Test Specimen
(Reference ASTM D2657)



F. Visually inspect the cut joint for any indications of voids, gaps, misalignment or surfaces that have not been properly bonded.

G. Bend each sample at the weld with the inside of the pipe facing out until the ends touch. The inside bend radius should be less than the minimum wall thickness of the pipe. In order to successfully complete the bend back, a vise may be needed. For thick wall pipe, a hydraulic assist may be required.

H. The sample must be free of cracks and separations within the weld location. If failure does occur at the weld in any of the samples, then the fusion procedure should be reviewed and corrected. After correction, another sample weld should be made per the new procedure and re-tested.

3.09 HDPE PIPE INSTALLATION

A. Pipe installation shall comply with the requirements of ASTM D 2321, PPI TR-31/9-79, and the manufacturer's recommendations.

B. Lengths of fused pipe to be handled as one section shall not exceed 50 feet.

C. The Engineer shall be notified prior to any pipe being installed in the trench in order for him/her to have an opportunity to inspect the following items:

1. All butt and saddle fusions.

2. Pipe integrity.

3. Trench excavation for rocks and foreign material.

4. Proper trench slope.

5. Trench contour to ensure the pipe will have uniform and continuous support.

D. Any irregularities found by the ENGINEER during this inspection must be corrected before lowering the pipe into the trench. Pipe shall be allowed sufficient time to adjust to trench temperature prior to any testing, segment tie-ins, and/or backfilling.

E. Tie-ins shall be made out of the trench whenever possible. When tie-ins can only be made in the trench, a bell hole shall be excavated large enough to ensure an adequate and safe work area.

F. All branch saddle connections shall be made within the trench. For such operations, a bell hole shall be excavated large enough to ensure an adequate and safe work area.

G. Any landfilled waste, which may be encountered during excavation shall be transported to the active face of the landfill.

3.10 FLANGED CONNECTIONS

A. Flanged connections for PE pipe shall be made with two PE flange adapters with ductile iron back-up rings for bolting.

3.11 HDPE ELECTROFUSION COUPLING INSTALLATION

A. Measure the pipe O.D. using a Pi tape to verify true diameter. The pipe O.D. must be within the I.D. minimum/maximum tolerance of the coupling. Make sure to check and measure pipe ends for toe-in. If pipe toe-in O.D. is smaller than true pipe O.D, that pipe section must be cut out prior to installation. If unsure, contact the manufacturer for additional information. For 24-inch couplings, the existing pipe must have a minimum O.D. of 24.00 inches.

B. Measure and mark the pipe insertion depth or the pipe surface covered by the coupling with the FRIALEN Silver Pipe Marker, or approved equal.

C. Scrape off the oxidized layer on the pipe using either a hand scraper or IPEX scraper tool model number FWSG 710L or approved equal. It may be necessary to scrape two or three times. Localized scraping after checking the ovality with the coupling is also sometimes needed. Do not remove more than 10% of the pipe wall thickness.

D. Scrape off edge, inside and outside. Bevel the outer edge more than the inner edge and remove shavings and debris from the pipe.

E. If needed, re-round oval pipe with re-rounding clamp. A hydraulic re-rounding clamp is required.

F. Clean pipe surface and inside of coupling liberally with 96% or greater Isopropyl Alcohol or Acetone. Make sure surfaces are completely dry before assembly. The use of denatured alcohol is not permitted.

G. Install coupling to marked insertion depth on pipe. The use of a hammer and board placed across the open end face of the coupling is permissible to properly position coupling. If excessive resistance is met, repeat step Part 3.11.F. Leave the plastic bag over the open end of the coupling during assembly to keep contamination out of the fusion zone area and also to retain the Prewarming and Fusion Time heat if only one pipe has been inserted. If both pipes have been inserted, place tape over area covering the inner diameter of the coupling and the outer diameter of the pipe to retain heat. Due to high ovality in 16-inch and larger pipe, check for any gap areas between the I.D. of fitting and O.D. of pipe by checking the complete circular area with a plastic cable tie. If gap areas exist, the Prewarming Barcode must be used to bring the pipe to the coupling. Cooling time between Prewarming Cycles is 10 minutes and the gap areas must be tested again. Repeat Prewarming procedure until gaps are eliminated. Once gap areas are eliminated, the Fusion Cycle Barcode is ready to be utilized. If no gap areas exist, the coupling is to be subjected to one Prewarming Cycle prior to Fusion Cycle.

H. Assembly of pipe and coupling must be in a clean, supported, and as stress free condition as possible. Support coupling during fusion and cooling cycles.

I. Connect coupling to universal fusion processor and start fusion. Each side of the coupling is fused independently from the opposite side of the coupling. Prewarming and Fusion is required for both sides of the fitting.

J. Fusion technician must maintain a 3-foot minimum distance from the coupling during fusion.

K. After completing the fusion process, document the end of fusion time, total fusion time (in seconds), installers initials, cooling time (in minutes), and date on the pipe using a FRIALEN Silver Pipe Marker, or approved equal. Also record all information on a field log and submit to Engineer at project closeout.

L. All fusion must be performed by a certified technician that has completed a training session as prescribed in Title 49 of CFR, Section 192.285.

M. CONTRACTOR shall provide at least one employee for installation of electrofusion couplings who has completed an HDPE electrofusion coupling manufacturer's training course specific to installation of large diameter HDPE electrofusion couplings, and has received the corresponding certification from the manufacturer. Such training shall be provided by Central Plastics or equal. Such certification shall be current, requiring annual recertification. The certified employee shall also have at least eight years of experience in installing large diameter HDPE electrofusion couplings.

3.12 ELECTROFUSION COUPLING TESTING

A. All testing of electrofusion couplings shall be performed in the presence of the ENGINEER. The CONTRACTOR shall provide the ENGINEER with a minimum 48 hours notice prior to testing.

B. All electrofusion couplings installed on vacuum service lines shall be tested by applying a foaming agent (e.g. shaving cream) to the interface between the electrofusion coupling and the pipe. Vacuum service on the pipe shall then be activated, and observations shall be made by the CONTRACTOR and ENGINEER. Test failure shall be indicated if the foaming agent is pulled into the interface at any location.

C. All electrofusion couplings installed on pressure service lines shall be tested by applying a detergent to the interface between the electrofusion coupling and the pipe. Pressure service on the pipe shall then be activated, and observations shall be made by the CONTRACTOR and ENGINEER. Test failure shall be indicated if bubbles are formed by gas passing through the detergent at any point along the interface.

D. Upon test failure, the CONTRACTOR shall, at their own cost, remove the faulty electrofusion coupling, and replace it with two new electrofusion couplings, by reinitiating installation at Part 3.11 A of this Section.

3.13 PIPE SUPPORTS

A. All piping and valves shall be supported in such a manner as to prevent any stress being transmitted between sections and connected equipment and appurtenances.

B. Release of any joint shall result in no transverse piping movement and shall allow easy removal and replacement of any piping component.

3.14 SEGMENT TESTING

A. All PE header pipes shall be subjected to an air test as described herein and in accordance with ASTM F 1417 to detect any leaks in the piping. Testing shall be performed below grade (inside the trench). The Contractor shall accept the responsibility for location, uncovering (if previously backfilled), and repairing any leaks detected during testing. Testing segments shall be connected to a testing apparatus on one end and fitted with fusion-welded caps on all openings.

B. The segment to be tested should be allowed time to reach constant and/or ambient temperature before initiating the test.

C. The test should be performed during a period when the pipe segment will be out of direct sunlight when possible; i.e., early morning, late evening, or cloudy days. This will minimize the pressure changes which will occur during temperature fluctuations.

D. The test pressure shall be 5 psig.

E. Pressure drop during the test shall not exceed one percent of the testing gauge pressure over a period of one hour. This pressure drop shall be corrected for temperature changes before determining pass or failure. (See Part 3.15 for test failures). The Engineer shall sign off on a test form to indicate test compliance.

F. The ENGINEER shall be notified prior to commencement of the testing procedure and shall be present during the test.

G. Equipment for this testing procedure will be furnished by the Contractor. This shall consist of a polyethylene flange adaptor with a PVC or HDPE blind flange. Polyethylene reducers shall be utilized to adapt test flange to size of pipe being tested. Tapped and threaded into the blind flange shall be a temperature gauge of 32 to 212°F, a "Schrader tire valve" to accommodate an air compressor hose, a ball valve to release pipe pressure at completion of test, and a pressure measuring device. The pressure measuring device shall be a digital manometer capable of measuring positive pressures of air and other non-corrosive gases over a range of 0 to 200 in-w.c., Model No. 475-3 as manufactured by Dwyer Instruments, Inc. (770-427-9406), or approved equal.

H. Pipe system cleaning, CONTRACTOR shall clean and remove all loose cuttings and any other materials from the completed pipe system by means approved by the ENGINEER.

3.15 TEST FAILURE

A. The following steps shall be performed when a pipe segment fails the one percent - one hour test described in Part 3.14 of this Section.

1. The pipe and all fusions shall be inspected for cracks, pinholes, or perforations.

2. All blocked risers and capped ends shall be inspected for leaks.

3. Leaks shall be located and/or verified by applying a soapy water solution and observing soap bubble formation.

B. All pipe and fused joint leaks shall be repaired by cutting out the leaking area and refusing the pipe.

C. After all leaks are repaired, a retest shall be performed in accordance with Part 3.14 of this Section.

- END OF SECTION -

SECTION 33 51 20
LFG SYSTEM VALVES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The CONTRACTOR shall provide all materials, equipment, and labor needed to install and make ready all valves as specified herein and as indicated on the Drawings.

B. Related Work Described Elsewhere:

1. Section 31 23 16: Excavating & Trenching

2. Section 31 23 23: Filling, Backfilling, and Compaction

3. Section 33 51 10: Plastic Pipe and Fittings

1.02 SUBMITTALS

A. The CONTRACTOR shall prepare and submit to the ENGINEER, for review and approval, manufacturer's brochures containing complete information and instructions pertaining to the storage, handling, installation, inspection, maintenance, operation, and repair of each type of valve furnished. Shop drawings shall be submitted for butterfly valve assemblies requiring spacers per these SPECIFICATIONS.

PART 2 - MATERIALS

2.01 GENERAL

A. All valves shall be complete with all necessary operators, actuators, handwheels, chain wheels, extension stems, floor stands, worm and gear operators, operating nuts, chains, wrenches, and other accessories or appurtenances which are required for the proper completion of the work. Operators, actuators, and other accessories shall be sized and furnished by the valve supplier and factory mounted.

B. Valves shall be suitable for the intended service. Renewable parts including discs, packing, and seats shall be of types recommended by valve manufacturer for intended service, but not of a lower quality than specified herein.

C. Valves and operators shall be suitable for buried or exposed conditions, as applicable. Valves shall have all safety features required by OSHA.

D. Unless otherwise shown on the Drawings, valves shall be the same size as the adjoining pipe.

2.02 HEADER ISOLATION VALVES

A. Header isolation valves shall be butterfly bubble tight, wafer design, with a PVC body, nitrile or Buna-N seat, and compatible with a flat face flange, as manufactured by Asahi/America or equal. Stem extensions shall be stainless steel in an epoxy-coated carbon steel outer housing with a gear box assembly and visual valve position indicator mounted on top and equipped with a removable manual operating wheel.

PART 2 - EXECUTION

2.01 INSTALLATION

A. Valves shall be installed in accordance with the manufacturer's recommendations and the following:

1. Butterfly valves shall be installed between two flanges as shown on the Drawings; care shall be taken to avoid stripping bolts when tightening.

2. Flanges shall be joined with hot dipped galvanized steel studs and nuts. All below grade studs and nuts shall be coated with anti-seize compound, or approved equivalent, after installation and prior to backfilling. Stud and nut diameters shall be sized as recommended by the manufacturer for each size valve. Stud lengths shall accommodate the required distance between flanges including spacers, if necessary.

B. The CONTRACTOR shall wrap and tape the valve, flanges, and bolts in 5-mil polyethylene sheeting prior to backfilling to help protect the valve assembly from corrosion.

C. Flanged butterfly valves may require spacers between the flange adapters and the valve body in order to allow full travel of the internal disk. If spacers are necessary for any butterfly valve, the CONTRACTOR will install valve spacers subject to the approval by the ENGINEER.

- END OF SECTION -

Part XII

Application for Waivers

WAIVER APPLICATION FORM

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Waste Management Division

For Office Use Only:
WMD Log #:_____
Date Rec'd.:_____
No. of Copies:_____

APPLICATION FOR WAIVER

pursuant to
the provisions of Part Env-Sw 202 of the New Hampshire Solid Waste Rules

APPLICATION FILING AND PROCESSING INSTRUCTIONS

(1) Complete this form by providing all of the information requested. If you need more space than provided on the form to answer a particular question and you are using a paper copy of this form, attach additional pages as necessary; mark each page clearly to show both the applicant name and the question being answered; and indicate on the form that the additional pages are attached

(2) Submit **THREE** copies of the completed waiver application, **EACH bearing ORIGINAL signatures**. Applications may be submitted to the department electronically. If the applicant chooses to submit an application electronically, a single paper copy shall also be submitted to the department to the following address:

New Hampshire Department of Environmental Services (DES)
Waste Management Division (WMD)
Permitting & Design Review Section (P&DRS)
29 Hazen Drive, PO Box 95
Concord, NH 03302-0095

(3) All references on this form that begin with "Env-Sw" are citations from the New Hampshire Solid Waste Rules. You may obtain a copy of the Rules from the DES Public Information and Permitting Office at (603) 271-2975. The Rules are also available on the Internet at http:\\www.des.nh.gov.

(4) DES will process your application in conformance with Env-Sw 202, Env-Sw 304 and Env-Sw 305.

(5) For further assistance with completing this form, contact the DES Permitting & Design Review Section (P&DRS) at (603) 271-2925 or at the above noted mailing address.

(6) You may also contact DES at TDD Access: Relay NH 1 (800) 735-2964.

SECTION I. APPLICANT IDENTIFICATION

(1)	Name: Androscoggin Valley Regional Refuse Disposal District				
(2)	Mailing address: AVRRDD, 3 Twelfth Street, PO Box 336, Berlin, NH 03570				
(3)	Telephone number: 603-752-3342				
(4)	If different than above, identify the individual associated with and designated by the applicant to be the contact individual for matters concerning this application:				
	(a)	Name: Sharon Gauthier	(b)	Title: Executive Director	
	(c)	Mailing address: AVRRDD, 3 Twelfth Street, PO Box 336, Berlin, NH 03570			
	(d)	Telephone number: 603-752-3342	(e)	E-mail: sgauthier@avrrdd.org	
(5)	If the applicant is an individual, provide date of birth and go to Section II:				
(6)	If the applicant is a corporation, partnership or other association, provide the following information as specified:				
	(a)	The facility is owned by a: ☐ corporation ☐ partnership ☒ other association			
	(b)	State of incorporation/formation: NH			
	(c)	Principal business address: AVRRDD, 3 Twelfth Street, PO Box 336, Berlin, NH 03570			
	(d)	Provide on separate paper and attach/mark as "Attachment I(6)(c)," the names and addresses of all directors, officers and shareholders (*), if for a corporation; all partners (whether general or limited), if for a partnership; or all principals, members or participants, if for another type of association. (*) For a privately held corporation, identify all shareholders. For a publicly traded corporation, identify all shareholders owning 10% or more of the corporation's equity or debt.			

SECTION II. FACILITY OR ACTIVITY TO WHICH THIS REQUEST RELATES

Identify the particular facility or activity to which this application for waiver relates.

(1)	Related activity [check that which applies]:			
	☐	Application for a Standard Permit	☐	Application for a Permit-by-Notification
	☐	Application for an Emergency Permit	☐	Application for Research & Development Permit
	☐	Application to certify a waste-derived product for distribution and use	☐	Application for Operator Certification
	☒	Application to modify a permit (specify the permit number): DES-SW-88-029-		
	☐	Other (specify):		
(2)	If the requested waiver relates to a particular application, provide the date the application was/will be submitted to DES: To be submitted April 2020			
(3)	If the requested waiver relates to a particular facility, provide the facility name and location in the space below. (Note: For a waiver relating to a particular facility, you must also notice the host municipality, host solid waste district and, in some instances, the abutters, as specified by Section IV of this form).			
	(a)	Facility name: Mount Carberry Secure Landfill		
	(b)	Street address: Bean Brook Road		
	(c)	Town/City: Success NH,		

SECTION III. SPECIFIC RULE(S) FOR WHICH A WAIVER IS SOUGHT

Below, identify the specific solid waste rule(s) that you wish to have waived. Give the complete "Env-Sw" citation(s).

Env-Sw 804.03 (e), 805.05(j), 805.07(b)(1), see attached

SECTION IV. NOTICE OF FILING REQUIREMENTS

(1) If this application for waiver relates to a particular facility, you must send by certified mail, or deliver in hand, a complete copy of this application and a "notice of filing" to the host municipality, host solid waste management district and other affected entities, as specified by Env-Sw 303. To identify the host solid waste management district, contact the host town/city office or the P&DRS at (603) 271-2925.

(2) In addition, if this application for waiver is to reduce the required setback distance to any residence or property line, a notice of filing must be provided to the affected property owner(s) as specified in Env-Sw 303.

(3) A copy of the required notice(s) of filing and proof of receipt [i.e., signature(s) of the recipient(s) acknowledging receipt] must be attached to and submitted with this application for waiver, unless you are combining the notice of filing with the notice requirements for a related permit application as indicated by item (4) below.

(4) If this application for waiver is being submitted as part of an application for a facility permit or permit modification, the required notice(s) of filing may be combined with the notice(s) of filing prepared for the permit application/permit modification application itself. If so, check here: ☐

(5) For assistance with preparing the required notice of filing, please refer to either Env-Sw 303 or "A Guide for Preparing Notices of Filing." If the guide is not included with this application form, you may obtain a copy from the P&DRS at (603) 271-2925.

SECTION V. REASON FOR REQUESTING WAIVER

Explain why a waiver is being requested, including an explanation of the hardship that would be caused by having to comply with the rule. Use extra paper as necessary.

See Attached.

SECTION VI. PROPOSED ALTERNATE PROCEDURE, METHOD OR ACTIVITY

Provide a full explanation of any alternate procedure, method, or other activity that you propose to substitute for the procedure, method or activity you wish to have waived. Include written documentation and/or data to support the proposed alternative. Use extra paper as necessary.

See Attached.

SECTION VII. DURATION OF WAIVER

Specify the proposed duration for the requested waiver. If you are seeking a "permanent" waiver, including one that would expire when the facility to which it relates may close, so state and provide the desired starting date.

Proposed effective/starting date: Upon approval	
Proposed expiration date:	*OR* ☒ I am seeking a "permanent" waiver

SECTION VIII. DEMONSTRATION OF CRITERIA

Provide a full explanation of why you believe that having the waiver granted will meet the below listed criteria. [Note: Economic, technological, practical application and safety issues shall be considered in evaluating a demonstration of the criteria; however, the merits of the application shall not be weighed solely on the basis of cost].

Criteria for Waiver, pursuant to Env-Sw 202.04:

(a) Exemption from complying with the rule shall:
   1. Not result in an adverse effect to the environment or natural resources of the state, public health or to public safety.
   2. Not result in an impact on abutting properties that is more significant than that which would result from complying with the rule.
   3. Be in keeping with the intent and purpose of the rule being waived.

(b) One or more of the following conditions shall be satisfied:
   1. Strict compliance with the rule will result in an adverse effect on the environment, public health or safety; AND/OR
   2. Strict compliance with the rule will result in a circumvention of the goals and objectives of the state's solid waste management program, as specified in RSA 149-M:1 through 3 and the state solid waste management plan; AND/OR
   3. Strict compliance with the standard will provide no benefit to the public and will cause an operational or economic hardship to the applicant.

Use the space below to provide your demonstration. Use extra paper as necessary.

See Attached.

SECTION IX. CERTIFICATION OF COMPLIANCE/COMPLIANCE REPORT

If you are able to certify that each of the following statements is true, do so by your signature. If you are unable to certify that each of the following statements is true, you must prepare a separate Compliance Report as specified by Env-Sw 303.15.

COMPLIANCE STATEMENT

The applicant shall certify that each of the statements listed in (1)-(8) below are true for each of the following individuals and entities:

- ☐ **the applicant, and**
- ☐ **the facility owner, and**
- ☐ **the facility operator, and**
- ☐ **all individuals and entities holding 10% or more of the applicant's debt or equity, and**
- ☐ **all of the applicant's officers, directors, and partners, and**
- ☐ **all individuals and entities having managerial, supervisory or substantial decision making authority and responsibility for the management of facility operations or the activity(s) for which approval is being sought**

(1)	No individual or entity listed above has been convicted of or plead guilty or no contest to a felony in any state or federal court during the 5 years before the date of the application.	
(2)	No individual or entity listed above has been convicted of or plead guilty or no contest to a misdemeanor for a violation of environmental statutes or rules in any state or federal court during the 5 years before the date of the application.	
(3)	No individual or entity listed above has owned or operated any hazardous or solid waste facility which has been the subject of an administrative or judicial enforcement action for a violation of environmental statutes or rules during the 5 years before the date of the application.	
(4)	No individual or entity listed above has been the subject of any administrative or judicial enforcement action for a violation of environmental statutes and rules during the 5 years before the date of the application.	
(5)	All hazardous and solid waste facilities owned or operated in New Hampshire by any individual or entity listed above are in compliance with either.	
	(a)	All applicable environmental statutes, rules, and DES permit requirements.
	(b)	A DES approved schedule for achieving compliance therewith.
(6)	All individuals and entities listed above are in compliance with all civil and criminal penalty provisions of any outstanding consent agreement, settlement, or court order to which DES is a party.	
(7)	All individuals and entities listed above have paid, or are in compliance with the payment schedule for any administrative fine assessed by DES.	
(8)	All individuals and entities listed above are in compliance with all terms and conditions under every administrative order, court order or settlement agreement relating to programs implemented by DES.	

Signature of the applicant certifying the above statements are true:

Applicant Name **(Print Clearly or Type)** Linda Cushman, Chair

Applicant Signature Linda Cushman

Date 3/25/2020

OR

Circle the untrue statement(s) and attach a Compliance Report, pursuant to Env-Sw 303.15

SECTION X. APPLICANT SIGNATURE REQUIREMENTS

The applicant must sign the following statement prior to submitting this application. All copies of the application filed with DES must bear the applicant's original signature. If the applicant is not an individual, an individual duly authorized by the applicant shall sign the application.

To the best of my knowledge and belief, the information and material submitted herewith is correct and complete. I understand that any approval granted by DES based on false and/or incomplete information shall be subject to revocation or suspension, and that administrative, civil or criminal penalties may also apply.

Applicant Name **(Print Clearly or Type)** Linda Cushman, Chair

Applicant Signature Linda Cushman

Date 3/25/2020

SECTION XI. PROPERTY OWNER SIGNATURE

For applications relating a specific facility or activity, sited or to be sited on property not owned by the applicant, the property owner must also sign this form as follows. All copies of the application filed with DES must bear the property owner's ORIGINAL signature. If the property owner is not an individual, an individual duly authorized by the property owner shall sign the application.

(1)	I hereby affirm that the applicant has, or shall be granted, the legal right to occupy and use the property on which the subject facility is or will be located for the purposes specified in this application.
(2)	I hereby affirm that I shall grant access to the property for closure and post-closure monitoring of the subject facility and site as required by RSA 149-M and the New Hampshire Solid Waste Rules (Env-Sw 100-300 and Env-Sw 400-2000), as amended.

Property Owner Name **(Print Clearly or Type)** The property is owned by the applicant

Property Owner Signature _____

Date _____

SECTION I
APPLICANT IDENTIFICATION

Attachment

Facility Name:	Mt. Carberry Secure Landfill
Permit Number:	DES-SW-88-029
Location:	Success, New Hampshire
Applicant Name:	Androscoggin Valley Regional Refuse Disposal District
Mailing Address:	3 Twelfth Street PO Box 336 Berlin, NH 03570

Application Contact

Name:	Sharon Gauthier
Title:	Executive Director
Mailing Address:	Same As Above
Telephone Number:	(603) 752-3647

Organizational Status: The applicant is a public entity organized under NH RSA:53B. The entity is a quasi-municipal solid waste district made up of 10 member municipalities as listed alphabetically below:

Berlin	Dummer	Errol
Gorham	Jefferson	Milan
Northumberland	Randolph	Stark
Coos County for Unincorporated Places		

Local Tax Map and Lot Numbers: Landfill: Tax Map 1612: Lot 1

Latitude and Longitude: Latitude 44º 27’ N; Longitude 71º 9’ W

SECTION III
SPECIFIC RULE(S) FOR WHICH A WAIVER IS SOUGHT

Mount Carberry Secure Landfill is seeking a waiver for the rule Env-Sw 804.03 (e) relative to setback of the landfill from wetlands, and Env-Sw 805.05 (j) and Env-SW 805.07(b)(1) relative to the base liner systems of the existing landfill, as follows:

> *Env-SW 804.03 (e) "The footprint of a landfill shall not be located within 200 feet upgradient and 100 feet downgradient of a wetland within the jurisdiction of RSA 482-A, excluding any drainage appurtenances related to the site, that is not allowed to be filled under the authority of RSA 482-A."*

As described in additional detail in Section V, a waiver of the setback of Phase IIIA footprint upgradient of an existing wetland is requested. The proposed footprint is based on the original permitted landfill footprint such that the anchor trench of Phase IIIA will tie into the anchor trench of existing Phase II.

> *Env-Sw 805.05(j) "Liner systems shall not be penetrated by any appurtenances including pipes in low areas or in any location where leachate might collect."*

As described in additional detail in Section V for Env-Sw 805.05(j), the original construction of the existing Phases I & II of the landfall included gravity removal of leachate from the landfill, which was the standard at the time, which included liner penetrations for the primary and secondary leachate lines as they left the landfill. This waiver is only relative to existing Phases I & II to the extent the waste placement of the Phase IIIA expansion will be over the top of the existing landfill.

> *Env-Sw 805.07(b)(1)"Convey liquids to an observation point for detection, based on a maximum time of concentration equal to 24-hours under saturated hydraulic conditions;"*

As described in additional detail in Section V for 805.07 (b)(1), the original construction of the landfill in Stage 1 and Stage 2 did not include drainage geocomposite, which was the standard at the time. The use of drainage geocomposite is necessary to meet a 24-hour time of concentration as set forth in the rule above. This waiver is sought for the 24 hour requirement for Stages 1 and 2 to the extent the waste placement of the Phase IIIA expansion will be over the top of the existing landfill.

SECTION IV
NOTICE OF FILING REQUIREMENTS

In accordance with Env-Sw 303, notice of filing of the Application for Waiver has been included with the notifications of submittal of the Type I-A Permit Modification for Phase IIIA, which was sent to abutters to the landfill, the host community of Coos County, NH Fish and Game and NH Natural Heritage Bureau. Copies of the notifications can be found in the Legal Notices section of the application.

SECTION V
REASON FOR REQUESTING WAIVER

Env-Sw 804.03(e) - Relative to Wetland Offset

Introduction and Discussion

AVRRDD is requesting this waiver to allow for construction of the proposed Phase IIIA wetland to be constructed in a manner that most effectively ties into the existing Phase II landfill footprint and allows for full development of the expansion per original permitting of Phase III.

Env-Sw 804.03 (e) defines the minimum buffer between the footprint of a landfill and a wetland as 200 feet upgradient and 100 feet downgradient. This requirement was added to the rules in 2014. NHDES issued DES-SW-029/Part II in July 1989, which permitted waste disposal areas for Phases I, II, and III. The proposed footprint of Phase IIIA is based on the original permitted footprint of Phase III which abuts and ties into the adjacent existing Phase II of the landfill along its full length.

The proposed footprint lies approximately 112 feet upgradient from the delineated wetland boundary at its nearest point. This point is the outlet of an existing drainage pipe and as such would be considered a drainage appurtenance. Most of the wetland boundary lies no closer than 180 feet from the proposed footprint. Approximately 0.31 acres of wetlands is located with the 200' setback of the proposed Phase IIIA landfill. A portion of the existing Phase II landfill footprint, to which the Phase III Stage 13 liners need to connect, is also within the 200' setback to the delineated wetland.

The footprint of Phase IIIA is designed to tie into the existing corner of Phase II to provide a continuous extension of the base liner systems from Phase II into Phase IIIA. The design allows for filling of the landfill to tie into and extend existing sideslopes of Phase II in a seamless manner.

Considerations of Alternatives to a Waiver

Setting the anchor trench to fully meet the 200' setback poses a series of construction related and operational difficulties. The liner tie-in to the existing landfill would be complicated by jogging the anchor trench approximate 85' to the north from the southeast corner of Phase II. This would negatively impact liner system connection details and would result in a sharp perpendicular transition from Phase II to Phase IIIA. Filling of Phase IIIA would also be at a perpendicular angle up against the side slope of Phase II resulting in an additional internal corner. This landfill configuration would be subject to challenges of stormwater management and additional risk of erosion both during operations and for the final closure shape. Moving the footprint to maintain strict adherence would add cost for initial construction, operational costs, and closure construction costs, and would result in a reduction in landfill capacity.

Another potential alternative to meet the requirements of the wetland setback requirements of Env-Sw 804.03(e) would be to apply for a wetlands permit to fill the wetlands in question, creating the required 200 foot setback. This would meet the rules, but would result in loss of wetlands with no attendant benefit. Doing so would serve no valid purpose.

Env-Sw 805.05(j) - Relative to Penetrations of the Liner System

Introduction

The proposed Phase IIIA expansion provides for a horizontal expansion of the landfill footprint adjacent to Phase II to provide an additional 16.3 years of capacity. Filling for Phase IIIA would extend up over the existing landfill and result in overfill of Stages 2, 3, 7, 8, and 9. Based on prior discussions, NHDES has requested that AVRRDD evaluate the originally constructed base liner systems in comparison to current NHDES rules and apply for a waiver if the underlying base liner system does not meet current requirements.

Discussion

Env-Sw 805.05 (j) requires that liner systems shall not be penetrated by any appurtenances. This requirement was added to the rules in 2014. Prior to that time, the standard of practice was to maximize use of gravity management of leachate and to construct a liner 'boot' around the primary and secondary leachate pipes as they left the landfill cell. Both Stage 1, which is the lowest cell in Phase I and Stage 7, which is the lowest cell in Phase II, were constructed in this way, with penetrations for both the primary and the secondary liners. This was completed in full conformance with NHDES rules and requirements at the time. This allowed the entire leachate collection system, all the way to the treatment plant, to operate by gravity and avoided relying on pumping systems for management of leachate.

The waiver is requested based on NHDES' approach that the underlying base liner systems be evaluated for filling that extends vertically over the base landfill cell. No changes to the existing penetrations are proposed as part of Stage 12. The Stage 12 filling is all well above the base liner system and will have no impact at all on the existing pipe penetrations. All available information is that the current landfill is meeting current standards for secondary leak detection, groundwater monitoring and overall leachate monitoring. The leachate piping outside the landfill on each of the lines leaving the landfill was upgraded over the past three years, and there were no indications of any leakage in the excavations outside the landfill during that work. The existing pipe boots and penetrations are working as designed and there are no indications of leakage.

Considerations of Alternatives to a Waiver

Two alternatives are considered here that would eliminate the need for a waiver. Neither is practical, effective or better than leaving the existing liner systems as they are.

Alternative 1

The first alternative is complete reconstruction of the leachate liner systems to eliminate the penetrations. Retrofitting the existing collection system would not be feasible due to health and safety concerns, accessibility, substantially increased environmental risks during construction

and excessive costs.

Reconstruction of the liner system at the low areas, including construction of a new sump, would be necessary and would increase the risk of leachate related impacts to the environment during construction. Env-Sw 805.05 (j) was enacted to prevent weak liner areas where leachate would collect and cause a leak. By removing the existing liner penetrations to meet the intent of the rule, the anchor trench liner system would need to be reconstructed and the risk of additional liner welds would still hold the possibility of leachate leakage.

In addition, such an alternative would require the relocation of a substantial volume of older waste. The waste at the anchor trench by Phase I consists mostly of old paper mill sludge presenting concerns with stability and odor issues during construction. The reconstruction effort would be a considerable expense to the district and the existing liner boot penetrations have been in place for close to 30 years with no indication of any leaks or impacts to the environment.

Alternative 2
The second alternative would be construction of a complete new base liner system under Stage 12, over the top of Stages 1 through 11. This would not be practical for such a small additional capacity at very significant cost and effort. Such a liner system would involve added risk and challenges to construction and operation of a liner system over top of the existing landfill.

Env-Sw 805.07(b)(1) - Relative to 24 hour Leak Detection Time

Introduction

The proposed Phase IIIA expansion provides for a horizontal expansion of the landfill footprint adjacent to Phase II to provide an additional 16.3 years of capacity. Filling for Phase IIIA would extend up over the existing landfill and result in overfill of Stages 2, 3, 7, 8, and 9. Based on prior discussions, NHDES has requested that AVRRDD evaluate the originally constructed base liner systems in comparison to current NHDES rules and apply for a waiver if the underlying base liner system does not meet current requirements.

Discussion

Env-Sw 805.07 (b)(1) requires a maximum time of concentration within the secondary leak system to not exceed 24 hours under saturated flow conditions. The current standard of practice for secondary leak detection systems is to incorporate geocomposite over the entire secondary leachate collection system, which provides for relatively rapid flow conditions to meet the 24 hour requirement currently in the rules. When the landfill was initially constructed, prior to current uses of geosynthetics and current regulatory requirements, the standard of practice was to space leachate and leak detection piping within the sand of the collection system to reduce flow travel time. Stage 2 leak detection liner systems were constructed with 12" of drainage sand, pipe spaced every 50 feet, and without the use of drainage geocomposite. This was completed in full conformance with NHDES rules and requirements at the time. This system does not meet the 24 hour time of concentration requirement set forth in Env-Sw 805.07 (b)(1). This requirement is intended for new landfill base liner systems where it is important during early

filling operations to identify leaking locations quickly in the liner system while waste is being placed. After the initial depths of waste are placed, the risk of damage to the liners is greatly reduced and therefore the need to detect them quickly (within 24 hours) is also greatly reduced. Since initial construction, and for the duration of the operation of the landfill, there have been no indications of a leak in the lining systems. The waste depth above Stage 1 and 2 far exceeds waste depths that filling operations could impair the base liner system.

The waiver is requested based on NHDES' approach that the underlying base liner systems be evaluated for filling that extends vertically over the base landfill cell. No changes to the existing landfill footprint or operations are proposed in areas of Phase IIIA overfilling. The Phase IIIA overfilling is all well above the base liner system and will have almost no possibility of affecting the integrity of the base liner system. All available information is that the current landfill is meeting current standards for secondary leak detection, groundwater monitoring and overall leachate monitoring and the current system is adequately monitoring the performance of the landfill liner systems.

Considerations of Alternatives to a Waiver

Two alternatives are considered here that would eliminate the need for a waiver. Neither is practical, effective nor better than the leaving the existing liner systems as they are.

Alternative 1

The first alternative is complete reconstruction of the landfill base liner systems within Stage 1 and 2. Reconstruction would require full waste removal from Stage 1 and 2 and would require a new landfill site to dispose of the large percentage of the landfill's waste mass. Much of the lower waste levels in Stage 1 and 2 are paper mill sludge which if excavated would pose odor issues and stability risks with adjacent stages.

In addition, excavation down to the liner system within Stage 1 and 2 would greatly increase the risk of damaging the base liner system, creating environmental impacts. The intent of the rule Env-Sw 805.07 (b)(1) is to allow for quick detection of liner impacts during early filling periods and excavation to the liner system would be contrary to this intent.

Reconstruction would not be feasible due to health and safety concerns, accessibility, removing a substantial majority of the waste volume, increased environmental risks during construction and excessive costs.

Alternative 2

The second alternative would be construction of a complete new base liner system under Stage 12, over the top of Stages 1 through 11. This would not be practical for such a small additional capacity at very significant cost and effort. Such a liner system would involve added risk and challenges to construct and operation of a liner system over top of the existing landfill.

SECTION VI

PROPOSED ALTERNATE PROCEDURE, METHOD OR ACTIVITY

Env-Sw 804.03(e) - Relative to Wetland Offset

AVRRDD is proposing to create a more effective tie into the existing Phase II footprint to ensure the liner systems are connected effectively and filling of the landfill can proceed in an effective manner to minimize potential erosion and improve management of stormwater runoff at the Phase II/Phase III tie in. The proposed liner system is designed to protect from impacts to groundwater and the adjacent wetland. A permanent litter fence is proposed on the perimeter roadway uphill from the wetland to minimize litter impacts to the wetland. Stormwater improvements are proposed to provide treatment of all runoff from the landfill prior to discharge to the culvert that drains to the wetland area (note that both the existing and the proposed stormwater drainage is discharge to the wetland via an existing culvert).

Env-Sw 805.05(j) & 805.07(b)(1) - Relative to Penetrations of the Liner System and relative to 24 Hour Leak Detection Time

Continued operation of the existing leachate collection and liner systems in the base landfill cells is proposed, with continued monitoring of secondary leachate leak detection flows and groundwater monitoring in accordance with the existing permit and operational approvals.

SECTION VIII

DEMONSTRATION OF CRITERIA

Criteria for Waiver Under the Solid Waste Rules

Env-Sw 202.04(a) states:

A. Subject to (b), below, a request for a waiver shall be granted if:

1. Exemption from complying with the rule will:

a. Not result in an adverse effect to the environment or natural resources of the state, public health or to public safety;

b. Not result in an impact on abutting properties that is more significant than that which would result from complying with the rule; and

c. Be in keeping with the intent and purpose of the rule being waived; . . . .

2. One or more of the following conditions is satisfied:

a. Strict compliance with the rule will result in an adverse effect on the environment, public health and safety;

b. Strict compliance with the rule will result in a circumvention of the goals and objectives of the state's solid waste management program, as specified in RSA 149-M:1 - 3 and the state solid waste management plan;

c. Strict compliance with the rule will provide no benefit to the public and will cause an operational or economic hardship to the applicant.

Env-Sw 804.03(e) - Relative to Wetland Offset

Evaluation of Criteria

Documentation of each of the criteria is provided below.

Env-SW 202.04, subsection (a)(1)(a): Maintaining the original footprint for the Phase III expansion will have no adverse effect on the environment, health, or safety and no increased impact on abutting properties and is "in keeping" with the intent and purpose of the rule being waived. The facility will be constructed with a double liner system to protect groundwater resources and is designed so that stormwater runoff will be collected in swales upgradient of these wetland areas and directed to stormwater treatment and retention basins.

Env-Sw 202.01, subsection (a)(1)(b): Maintaining the original proposed Phase III expansion footprint will not result in any impact on abutting properties that is more significant than that which would result from complying with the rule. Strict compliance with Env-Sw 202.04 (a)(1)(b) would result in alternative design efforts that would pose a similar risk to the abutting properties.

Env-SW 202.04, subsection (a)(1)(c): Maintaining the original proposed Phase IIIA expansion footprint will be in keeping with the intent and purpose of the rule being waived. The intent of Env-Sw 803.04 (e) is to prohibit lateral expansion into wetlands and to protect wetlands. Construction and facility operations within the setback area will be minimized. The facility is designed to direct stormwater from landfill sideslopes to stormwater treatment basins and fencing will be utilized to deter litter from entering wetlands. Further, a substantial portion of the setback will be preserved.

Env-Sw 202.04, subsection (a)(2)c: Strict compliance with the rule will not provide any additional benefit to the public as the proposed footprint will allow for better tie into the existing Phase II landfill. Strict compliance would cause economic and operational hardship to the applicant due to decreased landfill capacity, increased construction costs particularly for eventual closure design, and operational challenges associated with filling and maintaining the landfill surfaces where they tie into Phase II.

Env-Sw 805.05 (j) – Relative to Penetrations of the Liner System

Evaluation of Criteria

Documentation of each of the criteria is provided below.

Env-SW 202.04, subsection (a)(1)(a): Maintaining the current landfill liner systems and operations will have no adverse effect on the environment, health, or safety and no increased impact on abutting properties and is "in keeping" with the intent and purpose of the rule being waived. The existing liner boot penetrations have not indicated any signs of leakage or failure.

Env-Sw 202.01, subsection (a)(1)(b): Maintaining the current landfill liner systems will not result in an impact on abutting properties that is more significant than that which would result from complying with the rule. Strict compliance with Env-Sw 202.04 (a)(1)(b) would result in reconstruction efforts that would pose a greater risk to the abutting properties through potential odor issues from waste relocation, risks associated with excavation of waste and risks during reconstruction of the liner systems.

Env-Sw 202.04, subsection (a)(1)(c): Maintaining the current landfill liner systems and operation will be in keeping with the intent and purpose of the rule being waived." The intent of Env-Sw 805.05 (j) is to prevent leachate related impacts resulting from weak liner boot penetrations and minimize risks associated with liner systems. It is intended to primarily apply for design and construction of new landfill cells. The existing primary liner boots and secondary liner boots have

been in place for many years with no indication of leachate related impacts or leakage. There have been no impacts to the environment or abutters with the existing system. In its present state, the landfill meets the overall intent of the rule and the alternative, reconstruction, would result in new risks that would not be entirely consistent with the overall intent of the Env-Sw 805.05 (j).

Env-Sw 202.04, subsection (1)(2)c: Strict compliance with the rule would have no benefit to the public as detailed above, and would cause a hardship with economic, technological, practical, environmental, safety and risk considerations if the alternative to fully reconstruct the existing liner penetrations was implemented.

Env-Sw 805.07 (b)(1) – Relative to 24 Hour Leak Detection Time

Evaluation of Criteria

Documentation of each of the criteria is provided below.

Env-SW 202.04, subsection (a)(1)(a): Maintaining the current landfill liner systems and operations will have no adverse effect on the environment, health, or safety and no increased impact on abutting properties and is "in keeping" with the intent and purpose of the rule being waived. The existing base liner systems have not had any indication or any signs of leakage or failure.

Env-Sw 202.01, subsection (a)(1)(b): Maintaining the current landfill liner systems will not result in an impact on abutting properties that is more significant than that which would result from complying with the rule. Strict complying with Env-Sw 202.04 (a)(1)(b) would result in reconstruction efforts that would pose a greater risk to the abutting properties through potential odor issues from extensive waste relocation efforts, risks associated with excavation of waste and risks during reconstruction of the lining systems.

Env-SW 202.04, subsection (a)(1)(c): Maintaining the current landfill liner systems and operation will be in keeping with the intent and purpose of the rule being waived." The intent of Env-Sw 805.07 (b)(1) is to quickly identify leaks and liner impairments following construction and during early waste placement. It is intended to primarily apply for design and construction of a new landfill cells. The existing base liner system has been in place for many years with no indication of leachate related impacts or leakage. There have been no impacts to the environment or abutters with the existing system. In its present state, the landfill meets the overall intent of the rule and the alternative, reconstruction, would result in new risks that would not be entirely consistent with the overall intent of the rule Env-Sw 805.07 (b)(1).

Env-Sw 202.04, subsection (1)(2)c: Strict compliance with the rule would have no benefit to the public as detailed above, and would cause a hardship with economic, technological, practical, safety and risk considerations under the alternative to fully reconstruct the existing base liner system in Stage 1 and 2.

100' DOWN GRADIENT OFFSET FROM A WETLAND

190'

WETLAND IS MORE THAN 100' UP GRADIENT OF THE EXISTING ANCHOR TRENCH

104'

PROPOSED STAGE 13-15 LANDFILL FOOTPRINT

PERMITTED LANDFILL FOOTPRINT FROM 1989

200' SETBACK FROM SURFACE WATER AND WETLANDS

112'

180'

WETLAND DELINEATED BY STANTEC CONSULTING SERVICES IN 2018

WETLAND WITHIN 200' OF THE 1989 PERMITTED LANDFILL FOOTPRINT – 13,566 SQFT

WETLAND WITHIN 200' OF THE EXISTING LANDFILL FOOTPRINT – 25,030 SQFT

0 300' 600'

Scale: 1" = 300'

Notes:

1. Existing lower topography is a field survey of the entire landfill footprint performed by York Land Services, LLC, of Berlin, NH, during the week of October 4, 2019. Horizontal datum is based on NH State Plane NAD83 coordinate system and the Vertical Datum is based on NAVD88.
2. Wetlands delineation performed by Stantec Consulting Services of Topsham Maine in October, 2018 based on US Army Corp of Engineers Wetlands Delineation Manual, as supplemented and as reported in a letter report by Stantec dated March 20, 2020.
3. Flow lines and surface water data is from NH GRANIT.

Legend:

- 1700 — Existing 2' Contour
- 1700 — Existing 10' Contour
- at — at — Existing Anchor Trench
- AT — AT — Proposed Anchor Trench
- Existing Cell Division
- NH Granit Flow Lines
- NH Granit Surface Water
- Existing Wetlands
- Offset from Proposed Landfill Footprint
- P-06-17 Existing Monitoring Well

CMA ENGINEERS
CIVIL/ENVIRONMENTAL/STRUCTURAL
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603/431-6196 • 603/627-0708 • 207/541-4223
cmaengineers.com

AVRRDD - Berlin, NH
Mt Carberry Secure Landfill
Phase III Landfill Expansion
Type I-A Permit Modification

Phase IIIa - Surface Water Setback

Part XIII

Revised Facility Operating Plan

Androscoggin Valley Regional Refuse Disposal District
Permit Number: DES-SW-88-029

MT. CARBERRY SECURE LANDFILL
FACILITY OPERATING PLAN

Approved on February 25, 2019

Revised for Stage 12: February 2020
Revised for Phase IIIA: April 2020

Prepared for:

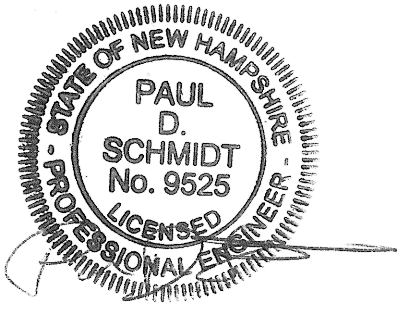
Androscoggin Valley Regional Refuse Disposal District
3 Twelfth Street
Berlin, NH 03570

for Submittal to:

NHDES Waste Management Division
Permitting & Design Review Section
29 Hazen Drive
Concord, NH 03302-0095

Prepared by:

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ANDROSCOGGIN VALLEY REGIONAL REFUSE DISPOSAL DISTRICT
MT. CARBERRY SECURE LANDFILL
FACILITY OPERATING PLAN

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Figure 1 – Approved 1988 Closure Plan
Figure 2 – Landfill Monitoring Site Plan
Figure 3 – Property Line Gas Probe

Appendix A – Waste Receipt Forms
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1.0 GENERAL

1.1 Facility Information

Facility Name:	Mt. Carberry Secure Landfill
Facility Mailing Address:	3 Twelfth St, PO Box 336 Berlin, NH 03570-0336
Physical Facility Location:	Bean Brook Road Success, NH
Permit #:	DES-SW-88-029
Capacity of Facility:	Phases I ~~&,~~ II, & IIIA, Stages 1-~~12: 8,346~~15: 13,334,000 cubic yards
Facility Type:	Lined landfill
Facility Service Type:	Unlimited
Facility Service Area	Unlimited
Permittee/Owner:	Androscoggin Valley Regional Refuse Disposal District 3 Twelfth Street, PO Box 336 Berlin, NH 03570-0336 Telephone: 603-752-3342 Sharon E. Gauthier, Executive Director
Contract Operator:	Cianbro Corporation P.O. Box 66 Berlin, NH 03570 Telephone: 603-752-3647 Cell Phone: 603-723-5890

1.2 Purpose

The purpose of this manual is to provide information to the personnel involved in the operation, maintenance, and closure of the Mt. Carberry Secure Landfill (MCSL). Guidelines for development and operation are provided herein for Phases I ~~&,~~ II, & IIIA. This document will be revised to describe the development of future phases, as necessary.

It is important to recognize that some of the procedures in this manual may require modification over time as improved methods are developed for carrying out the day-to-day landfill activities. Changes in procedures must be approved by the New Hampshire Department of Environmental Services - Waste Management Division (NHDES) prior to implementation.

This manual was prepared in accordance with the NHDES Solid Waste Rules. It includes descriptions of development procedures, landfill operations, site maintenance, safety procedures, monitoring requirements, leachate management, and numerous other important procedures which must be adhered to. Everyone associated with the management and operation of the landfill should be familiar with this manual to insure a safe and environmentally secure facility.

1.3 Certified Copies and Annual Review

A certified copy of this Operation Manual is maintained at the Mt. Carberry Secure Landfill. A "Certified Copy" is "a copy of the NHDES approved operating manual implemented by the Owner/Operator of a landfill facility that is assigned to be updated and tracked by a person specified by the "Owner/Operator".

The certified copies of the manuals reflect operational changes made at the facility, and that these changes will be distributed to those individuals whose job assignments require them to be aware of the changes. At a minimum, the manual must be reviewed on an annual basis by the District and the Operator and updated as necessary to reflect changes to facility operations.

To track changes to these Certified Copies of the Manual, a Revision Sheet is located just inside the Title Page of the Manual. The Revision Sheet tracks changes to the Operations Manual, including date, page, plan component, removal page numbers, and inserted page numbers.

1.4 Design Concept

It is not the purpose of this document to provide a detailed account of the design of the landfill, however, a general discussion of the design concept is presented herein. The Landfill Operations personnel are encouraged to review the Design Report and Engineering Drawings which provide detailed descriptions of the landfill facilities.

The original Mt. Carberry Secure Landfill Application for a Solid Waste Facility was submitted in 1987. The Solid Waste Permit was issued in two parts: Part I was issued in 1988 and Part II was issued in 1989. Part I of the permit authorizes construction of the Stage 1 underdrain system. Part II was issued following the completion and successful demonstration of the required minimum groundwater separation achieved by the underdrain system. Part II authorizes development and operation of Phase I Stage I. Subsequent landfill development is based on the performance of the constructed facility. The approved final grading plan included in the permit application is presented in this Facility Operating Plan as Figure 1.

The MCSL incorporates a redundant liner system (two liners) beneath the waste to minimize the potential for leakage to the underlying groundwater. The upper and bottom liners consist of 60-mil high density polyethylene (HDPE). The bottom liner is overlain by a drainage geocomposite and sand with embedded perforated pipe. This layer discharges into the leachate transport system and serves as a leak detection layer. The upper geomembrane is overlain by a network of perforated pipe embedded in stone and sand. This layer collects and transports leachate in both Phases I and II. The perforated pipe networks connect to separate leachate transport systems for each phase through a series of manholes. The manholes are connected via 18-inch gravity sewer lines in both phases, which discharge to a sewer vault. Precipitation which contacts the waste and runs across the surface of the landfill is collected through a network of inlet structures which connect into the perforated pipes. This leachate flows into the leachate transport line.

Phase I and Phase II leachate transport combine flow in the sewer vault which discharges through gravity lines to a diversion structure associated with the 1.34 million-gallon leachate storage pond. The leachate storage pond is followed by a flow measuring structure (1.0 HS flume) before discharge to the leachate gravity sewer. Leachate in the gravity sewer discharges to the leachate siphon chamber which transports leachate by gravity via inverted siphon pressure pipes to the Berlin Water Pollution Control Facility (BPCF).

The leachate system was updated after 2016 in response to a corrective action plan. This included replacement of manholes and piping sections.

Phase IIIA is expected to begin construction in 2022 and begin operations in 2025. Phase IIIA includes a riser building to pump leachate from two 24" primary riser pipes and one secondary leak detection pipe riser, all of which collect leachate and secondary leak detection flow from all of Phase IIIA. This will be the first riser/pump station at the facility. Leachate and secondary leak detection flows are then combined and discharged into a leachate manhole alongside the riser building and flow by gravity and connect into the existing leachate gravity sewer at LMH-1C.

1.5 Development Concept

The landfill consists of access roads, waste containment areas, a leachate collection system, a leak detection system, a leachate storage pond, and gravity pipeline to transfer leachate from the landfill to the siphon chamber, and a siphon force main to dispose leachate at the Berlin Pollution Control Facility (BPCF). The landfill area of 66.6 acres is divided in two phases: Phase I, which occupies approximately 37.4 acres; and Phase II which occupies approximately 29.2 acres. Each phase is subdivided into stages and again into cells. Phase III was permitted with the original landfill permit and situated to the east of Phase II. Phase III, which is a total of approximately 46.9 acres has ~~not yet~~ been ~~constructed~~split into a phases IIIA and a future IIIB. Figure 1 presents the original permitted closure plan for Phases I, II, & III.

Phase I has been developed in four base stages consisting of Stage 1 through Stage 4. Stages 5&6 are part of Phase I above Stages 1 – 4. The District received construction approval for Stage 5&6 in April 2013. The Stage 5&6 closure grading plan was later revised and approved in April 2015 and a Notice of Intent to Operate was received by the NHDES in June 2015. Phase II has been developed in three base stages consisting of Stage 7, 8, & 9. Stages 10 & 11 consist of the vertical expansion above Stages 7, 8, & 9. In October 2016, a permit application for Stage 12 was submitted to the NHDES. Stage 12 spans portions of both Phase I and Phase II and is located vertically above Stage 5&6 and Stage 10&11. Stage 12 was approved on February 25, 2019 by the NHDES. Prior to Stage 12 operation, a Notice of Intent to Operate must be filed with NHDES and closure construction and post closure maintenance funds must be increased to the amounts in the approved Stage 12 Financial Assurance.

Phase IIIA is being submitted as a Type IA Permit Modification in April 2020. Phase IIIA consists of Stages 13-15 and is a horizontal expansion to the East of the existing landfill and within the permitted Phase III footprint from the 1988 permit. Stages 13-15 overfill Stages 2,3,7,8,9 as part of the closure shape and optimization of landfill capacity. Phase IIIA adds 4,992,000 cy or 16.3 years of capacity.

Dikes constructed of glacial till soil and covered with two layers of HDPE liner create the containment for the base stages. Development and operation in this manner allows separation of clean surface water runoff from the waste, thus minimizing leachate generation. Section 3.0 provides a detailed account of the ~~Phase I and Phase II~~landfill development.

1.6 History of Landfill Development

Landfill operations began in Stage 1 in 1989. The waste mix landfilled in Stage 1 was primarily pulp/paper mill sludge with a small quantity of mill trash, paper, etc. There was no municipal solid waste (MSW) landfilled in Stage 1. When Stage 1 reached capacity, operations moved into Stage 2. The waste mix in Stage 2 was similar to that landfilled in Stage 1.

Not until the opening of Stage 3 was MSW included in the waste mix. Stage 3 reached capacity in 1998 and operations moved into Stage 4B. Stage 4B reached capacity in February 2000. Instead of moving from Stage 4B to Stage 4A, the operations were relocated back to Stages 1, 2, and 3. Over the years, the pulp/paper mill sludge in Stages 1 and 2 had consolidated a considerable amount. The consolidation created depressions on the crown area making diversion of clean surface water from the temporary cover impossible. The operation was moved back to Stages 1, 2, and 3 in order to regrade the crown area. The regrading of Stages 1, 2, and 3 continued until December 2002, at which time the operation was moved to Stage 4A. During September 2003, the landfilling operation shifted back to Stages 1, 2, and 3, in order to, once again, regrade the crown along with the south and west side slopes of Stages 1 and 2. In December 2003, the operations were moved back to Stage 4A because of winter conditions. Operations continued in Stage 4A during 2004 along with final grading in Stages 1 and 2.

During the summer of 2004 operations moved into Stage 7. Stage 7 of Phase II was developed during the 2003 construction season. Stage 7 has a total capacity of about 458,000 cubic yards and reached final grade in 2006. Upon completion of final waste grading, intermediate cover, 30-mil HDPE geomembrane, was installed on the crown of Stages 1 and 2 in the fall of 2004 and the crown of Stages 3 and 4 during the fall of 2005. Intermediate geomembrane cover was installed for the diversion of clean surface water off the landfill and to control odors associated with landfill gas emissions. During 2006, intermediate cover was placed on the south, west, and north side slopes of Phase I (Stages 1, 2, 3, and 4). Additionally, portions of the east slopes of Stages 3 and 4 as well as Stage 7 were covered with intermediate geomembrane in 2006. Prior to the installation of geomembrane on the side slopes of Phase I and Stage 7, a 6-inch layer of sand was placed over the waste surface. This layer serves as a gas collection layer, a drainage layer, and provided a smooth surface for temporary cover. Gas collection piping was installed in the sand and connected to Passive flares. Passive flares were also connected to leachate collection structures to temporarily control landfill gas emissions.

Operations moved into Stage 8 during the winter of 2006. Stage 8 of Phase II was developed during the 2005 construction season and has a capacity of about 500,000 cubic yards. Construction during 2007 included the completion of Stage 9 development and the installation of the Landfill Gas Extraction System. The landfill gas extraction and treatment system was installed to control odors associated with landfill gas emissions. Gas collection and transmission piping was installed in the waste of Phase I and Stage 7 by cutting and temporarily folding back the intermediate geomembrane. The intermediate cover system was repaired once gas collection and transmission piping was completed. Landfilling in Stage 9 began in March 2008 with subsequent gas collection expansions as landfilling progressed.

NHDES approved the operation of Stage 10 & 11, which consists of the lifts vertically above Stages 7, 8, and 9, in June 2012. No landfill cell construction was required for the operation of Stage 10 & 11. Operations continued from Stage 9 into Stage 10 in Fall of 2011. Currently, landfilling operations are progressing from north to south from Stage 10 to Stage 11. Interim 40 mil HDPE liner is installed periodically over areas which have reached interim or final grades Approximately 8.5 acres of temporary cover was installed over portions of the northern and eastern side slopes of Stage 9 during October 2012.

During Summer of 2011, the landfill gas collection system was expanded to provide collection in newly placed waste within Stage 9 and 10. Also as part of the 2011 construction, the landfill gas collection header pipe was extended and closed the loop between the Phase I and Phase II header pipes. Improvements to the leachate management system were made in 2011, which included the reconstruction of the leachate storage pond, and the construction of the leachate siphon sewer. The leachate management improvements constructed in 2011 were part of a Corrective Action Plan for the District's Wastewater Treatment Plant Administrative Order. The siphon sewer connects the landfill leachate gravity pipeline to the BPCF, which receives and treats all landfill leachate. The District holds a Leachate Treatment Agreement with the City of

Berlin for the disposal and treatment of leachate, which was executed in June 2011. The Agreement is included in Appendix F.

During Summer of 2012, additional new horizontal and vertical gas collection wells were constructed to provide collection in newly placed waste within Stage 10, and supplemental collection in Stage 4. Also in 2012, a 12" new gas header was constructed to replace the existing 8" east side header and a new supplemental 12" header was constructed in Phase I to improve gas conveyance. As part of an agreement with the Gorham Paper & Tissue (GPT) Mill, the District constructed a landfill gas to energy processing facility and conveyance pipeline for the beneficial use of gas at the GPT during 2011 and 2012.

In April 2013, the District received operational approval of Stage 5 & 6, which consists of the lifts vertically above Stages 1, 2, 3, and 4. The Stage 5&6 closure grading plan was later revised in April 2015. Operations moved into Stage 5&6 in July 2015. Similar to 10 & 11, no landfill cell construction is required for the operation of Stage 5 & 6.

~~A Type I-A solid waste permit modification application~~Stage 12 was ~~submitted to~~approved by the NHDES ~~in October 2016 for Stage 12~~on February 25, 2019, which is an additional vertical expansion spanning portions of the Phase I and II footprint and is located vertically above Stage 5&6 and Stage 10&11. It is anticipated that Stage 12 will not be operated until Stage 5&6 has reached full capacity.

A Type I-A solid waste permit modification application was submitted to the NHDES in April 2020 for Phase IIIA, a horizontal landfill expansion adding 4,992,000 CY or 16.3 years of capacity and is anticipated to begin filling in 2025.

The landfill gas collection system is expanded to provide gas collection as filling occurs, with construction typically once per year.

3.0 ROUTINE OPERATIONS PLAN

3.1 Hours of Operation

The Mt. Carberry Secure Landfill will accept mill wastes and wastes from municipalities who have contracts with the District five days per week. The landfill will not accept waste on weekends except under special circumstances. Normal facility operating hours will be as follows:

	Scales	Dumping
Monday through Friday	6:30 AM – 4:00 PM	7:00 AM – 3:30 PM
Saturday and Sunday	Closed	Closed

The start of the workday for Operators and scale personnel will be concurrent. The Operators will perform daily maintenance and move the equipment to the operating area within 1/2 hour of commencement of dumping. An Operator or the Landfill Manager shall be present at the operating area at the commencement of dumping.

All active and routine facility operations, including waste disposal, facility inspections, maintenance, repairs and monitoring, shall occur between 6:00 a.m. and 6:00 p.m. under normal non-emergency circumstances, as per Env-Sw 1105.08(a).

The Mt. Carberry Secure Landfill may be closed on holidays at the District's and the Operator's discretion.

3.2 Facility Access Control and On-site Traffic Patterns

The Weigh Master at the scale house will be responsible for monitoring traffic and informing vehicles and visitors of traffic flow. All vehicles and visitors will enter the site via the gated road on Hutchins Street in Berlin. The entrance to the landfill will have a facility sign which includes the following:

- The facility name and permit number;
- The name, address, and telephone number of the District, and the name and address and telephone number of the landfill Operator;
- The days and hours that the facility is open to accept waste;
- The type of wastes accepted; and
- The penalty for unlawful dumping.

Vehicles to be weighed will check in at the scale house which is located at the landfill entrance road off of Hutchins Street. All waste haul vehicles proceeding to the disposal area will first proceed to the scales and be weighed in without exception. The haul vehicles will be weighed out upon return from the landfill.

Facility traffic flow to and from the landfill is by the entrance road off of Hutchins Street, which is a two lane road that has multiple points providing access the active landfill area, maintenance office and garage, leachate pond, landfill gas facility, and sand and gravel pits. The landfill also has a two -lane perimeter road around the entire landfill for additional access. The landfill is also accessible via gated entrances off Success Pond Road and Bean Brook Road.

The District and the Operator will have unrestricted access to the landfill facility. All others will proceed only after receiving clearance from the gate house attendant. No visitors will be allowed on-site unaccompanied and the number of visitors will be minimized. During non-operational hours the gate at the entrance to the site will be locked at the Bean Brook Road entrance.
Bean Brook Road and Success Pond Road both provide access to seasonal camps located in Success, NH. Camp tenants have unrestricted access to these roads only for accessing the camps. The facility has video surveillance and security alarms at various locations and entrances around the facility to monitor site security.

3.3 Waste Acceptance, Unloading, and Inspection Procedures

The District implements measures to restrict acceptance of prohibited wastes at this facility. Loads identified as having prohibited wastes are to be rejected.

All waste delivery vehicles stop at the scale house prior to proceeding to the active landfill area. The haul trucks are weighed in prior to unloading, the driver will return the empty truck to the scales, where the weigh master weighs the empty truck and records the information on the disposal receipt. All wastes are accounted by electronic and paper scale slips. A sample scale slip is included in Appendix A. The disposal receipt will be complete at this time. Each day the disposal receipts will be submitted to the District office so that the electronic scale receipts can be checked. The District maintains daily accounting information.

The scale Operator will inspect delivery slips to determine if the waste is allowed at the landfill. If the waste is not allowed at the landfill, the scale Operator will notify the truck driver of alternative landfills, which may accept the load.

The landfill Operator will also inspect each load. If an unpermitted waste is disposed, the landfill Operator shall notify the Landfill Manager who shall in turn notify the Owner of the haul vehicle. The waste shall be removed at the haul vehicle Owner's expense and disposed of in a proper facility. The Landfill Manager shall identify to the Owner of the haul vehicle, an alternative landfill that may accept the waste that the Mt. Carberry Secure Landfill Operators have to reject. Two other landfills known to accept a wide range of wastes are:

Waste Management, Inc.
Turnkey Landfill
90 Rochester Neck Road
Rochester, NH 03839
603-330-2100

North Country Environmental Services
P.O. Box 9
Bethlehem, NH 03574
603-869-3366

Contact NHDES Waste Management Division
603-271-2900

Once haulers are in the active landfilling area, equipment operators visually inspect wastes as the hauler dumps onto the working face. Some materials may be segregated for use as an alternative daily cover admixture or for other reasons. As waste is spread and compacted, operators will visually inspect for unacceptable materials.

The likelihood of unacceptable wastes being delivered to this facility will be minimized by:

- Customer education;
- Landfill Operator training;
- Signs posted at the facility; and
- Inspections of incoming waste.

Wastes that are not accepted at the MSCL that are inadvertently dumped at the disposal area will not be pushed off. The Operator shall barricade and isolate the waste to prevent the waste from being put into the landfill. The Operator shall notify the Landfill Manager who shall notify the owner of the haul vehicle and the District. Arrangements to remove the waste shall be coordinated with the District, NHDES-WMD, and the Owner of the waste.

In the event a special waste generated by Gorham Paper & Tissue (GPT) needs to be landfilled, GPT will obtain approval from NHDES prior to any disposal. Special solid wastes include those materials which exist in such an unusual quantity or in such a chemical or physical state, or any combination thereof, which may disrupt or impair effective waste management or threaten public health, human safety or the environment if not provided with special handling, transportation, or disposal procedures. Typical examples include industrial and industrial process wastes, contaminated soils and dredge spoils, sand blast grit, non-liquid paint waste, spent filter media and residue, high or low pH wastes, etc.

Except as specifically listed by Condition 2.2 of the DES-SW-88-029 Part II Permit, the disposal of special solid waste, not classified as a hazardous waste per RSA 147-A:2 VII and the New Hampshire Department of Environmental Services' Hazardous Waste Rules, shall require prior approval from the NHDES-WMD. Requests for approval shall be accompanied by sufficient waste profile and

waste generation information to facilitate the NHDES'-WMD's review and decision-making process (see Special Waste Review section 3.3.1).

3.3.1 Special Waste Review

This is the comprehensive procedure for handling Special Waste and is in addition to the procedures for unloading and inspecting in Section 3.3. For this section, Special Wastes are wastes that are otherwise in the list of acceptable waste for the landfill but due to their nature require additional evaluation or testing to confirm they are in fact acceptable waste. This could include solid wastes from industrial or commercial sources, contaminated soil, or similar wastes. The evaluation of Special Waste is conducted by representatives of the District including consultation with the District's engineers and includes the following:

- Requests for approval of Special Wastes are to be reviewed by the District's review staff to ensure the waste is non-hazardous and may be excepted under the permit.
- Special Waste producers are to provide the District with all applicable information for the waste in review, such as process information, analytical data, safety data sheets, and any other available information. Special Waste producers must also fill out the Special Waste Characterization Form (see Appendix A, waste receipt forms).
- Special Waste requests may require additional analytical testing including, but not limited to, TCLP, ignitability, PCBs, VOCs/SVOCs and asbestos testing, as determined by the technical staff.
- The District will approve or reject Special Waste requests based upon the technical review and any analytical results. Approved Special Wastes will receive written approval from the District prior to transport to the landfill for disposal.

3.4 Waste Quantity and Source Accounting

As indicated in Section 3.2, all haulers stop at the scale house and check in with the Weigh Master before dumping. Waste type, source, and tonnage are recorded by the Weigh Master and records are maintained at the facility. Additional information on facility and waste record keeping is included in Section 8 of this Facility Operating Plan.

3.5 Outgoing Waste, Certified Waste-Derived Products, or other Materials

The facility does not anticipate generating solid waste requiring offsite disposal. Any certified waste-derived product or other material which has been segregated for offsite transport will be weighed at the scales and recorded in the same manner as incoming wastes.

Leachate is collected and managed by the leachate collection system, storage pond, and ancillary structures. Leachate is conveyed and disposed of at the City of Berlin Water Pollution Control Facility via the gravity sewer and siphon sewer forcemain. Leachate flow is measured at the flume manhole just downstream of the pinch valve building. See Section 4 – Residual Waste Management Plan for more information on leachate management.

3.6 Waste Storage Time and Capacity Limits

All wastes accepted for disposal will be stored and disposed within the landfill. The landfill operators will minimize the time and volume of temporary stockpiled or stored wastes. All stockpiled and stored wastes will receive approved daily cover materials in the same manner as waste in the active filling area.

3.7 Waste Handling, Placement, and Filling Sequence

An objective of the design and development of the landfill is to minimize leachate generation by limiting, to the extent possible, the amount of precipitation and stormwater that comes in contact with waste. The filling of the landfill will be done in accordance with the filling sequence plans and under the supervision of the landfill manager.

Equipment adequate for all operations at the landfill shall be maintained at all times. Equipment shall be maintained to provide for initial placement/grading of waste, compaction, re-grading of waste, placement of alternate daily cover, and excavation and placement of soil daily and intermediate cover. The following is a list of required equipment to carryout daily operations:

- Bulldozer;
- Sheep's foot solid waste compactor;
- Backhoe;
- Front-end loader;
- Contractor's gasoline powered pump;
- Snow removal equipment;
- Ten-wheeled dump trunk;
- Communication system (cell phones, CB radio, etc.); and
- Field office for operations center and scale facility.

Additional or duplicate pieces of equipment may be used to aid in daily operations.

3.7.1 Regular Operations

Several operational details will be common to all waste placement practices and are as follows:

- Prior to waste placement over the bottom of the cell, a 5-foot thick layer of MSW or select waste shall be spread over the leachate collection sand. Care should be taken to remove wastes from the first lift which may puncture or damage the landfill liner. Compaction of the first lift shall be completed using a bulldozer or similar equipment to limit the potential for damage to the liner.
- C&D debris and oversized bulky waste (OBW) shall not be disposed of closer than 5 feet from the liner. C&D debris and OBW shall not be disposed of closer than two feet and five feet from the outer waste sideslopes, respectively.
- The waste shall be spread uniformly over the entire open operational area.
- Generally, all finished sideslopes in Stages 10 & 11 will be 3H:1V. Landfill sideslopes in Stages 5 & 6 are designed to have the following maximum slopes. These slopes are based

on stability considerations that are intended to continue extension of existing slopes on the eastern and southern slopes of Stages 1 – 4. The Stage 10 & 11 and Stage 5 & 6 final grading plans are included in the Closure Drawings included as Appendix H and the Fill Sequence Plans are included in Appendix J.

- 3H:1V on the northern slope to match northern Stage 10 & 11 grades
- 3.5H:1V on the eastern slope to continue and match existing waste grades
- 4.2H:1V on the southern slope to continue and match existing waste grades in Phase I. The southern slope grades will transition from 4.2H:1V in Stage 6 (Phase I) to 3H:1V in Stage 11 (Phase II).
- As shown on the sequence fill drawings, a portion of the southern slope will be 3H:1V in between the equipment road and the main haul road.

- Generally, all finished side slopes of Stage 12 will continue and match the lower elevations of the respective Stage.
- All finished side slopes of Phase IIIA will be 3H:1V until elevation 1810, where slide slopes begin to transition to 5%.
- Filling on the outer slopes may be filled at a steeper slope than shown on the sequence fill grades to allow for settling of waste such that after settlement the waste is within the final required grades, and in no instance is steeper than 2.6H:1V.
- Sludges or other low-strength wastes shall not be placed closer than 100 feet from the exterior sideslopes unless they are mixed with higher strength wastes such as construction and demolition debris, ash, biomass, etc. At a minimum these wastes shall be placed no closer than 50 feet from the exterior sideslopes of the facility, when mixed with the higher strength wastes to a consistency that landfill compaction equipment can travel over the mixed waste after it has been placed.
- The following certified waste-derived products used as alternative daily cover shall be used only on interior slopes and are not permitted for use on final sideslopes:
  - Waste-derived Product #6 – Processed C&D and Soil Mixture
  - Waste-derived Product #9 – Auto Shredder Residue & Kiln Dust
  - Waste-derived Product #10 – Wood-fired Boiler Bottom Ash
  - Waste-derived Product #13 – Biosolids Incinerator Ash (bottom ash)
  - Waste-derived Product #14 – Metal Shredder Residue
- The working open waste placement area shall be limited to approximately 0.5 acres or less.
- The waste shall be graded in the active fill area to promote positive surface water drainage to the interior of the phase, where it can be collected and transported to the leachate collection sump. Waste dikes, at a minimum of 2 feet high, shall be constructed at the outer edge of the waste to contain surface water runoff, to allow it to infiltrate into the waste.
- As outside slopes are brought to final waste grade, they shall be covered with a 9-inch soil cover or a 30 or 40-mil temporary synthetic cover at a minimum of once every 6 months, to the extent permitted by winter conditions.

As MSW is placed in these thin layers, the solid waste compactor operator shall track the MSW for a minimum of three passes. As the thin layers are placed, the waste surface is graded and smoothed to a minimum slope of 2 percent so that precipitation is diverted away from the working face and to the closest leachate collection system component. The landfill operator shall minimize the area of waste that drains to the 12-inch diameter leachate collection inlet to 2 acres, and to the 6-inch diameter leachate collection inlets to 0.5 acres. If an active operating area contributing to an inlet becomes too large, the inlet capacity may be reached and it will be necessary to divert runoff to other leachate collection inlets. Diversion of runoff will be accomplished by regrading the waste surface or by applying temporary HDPE geomembrane cover over the waste and shedding water away from the leachate collection inlets. The landfill operator shall implement pre-storm event measures outlined in Section 2(L) Contingency Plan, for storm events of similar intensity and/or duration to a 25-year storm event.

As the working face becomes larger, areas that will not receive waste for an extended period of time shall be graded to drain away from the working face and the surface shall be topped off with a thin layer of soil cover or ADC to provide intermediate cover. Routine closure of unused areas of the working face speeds the stabilization of the waste disposal area allowing better working foundation for future waste layers and lifts. The top waste lift surfaces shall be graded to a minimum of 2 percent for interim closure conditions or a minimum of 5 percent for final closure conditions. A final and interim waste surface shall be graded to drain precipitation to the perimeter leachate collection system.

Traveling over the base of the landfill should be done only in areas where more than 5 feet of waste has been placed. This waste placement plan requires a great deal of forethought by the operators to manage the location of the haul vehicles and provide enough trafficable areas for all waste dumping. The waste placement plan detailed herein should be followed during normal operations. Contingency plans will be developed for wastes which would cause operational difficulties at MCSL. The contingency plans will be submitted to NHDES-WMD for approval.

Off-spec paper rolls and asbestos shall be disposed of away from the sideslopes. As a waste cell's outer final sideslopes are brought to finish grade, the operator will apply temporary HDPE geomembrane cover to the sideslopes, weather permitting. This will minimize recharge of precipitation into the waste. The cover material will be installed so that the temporary HDPE geomembrane cover over the upper waste cell can be easily connected. The placement of the temporary HDPE geomebrane cover will require advance planning by the Landfill Manager.

Access roads to the waste disposal area shall be constructed to minimize waste contact with the haul vehicles. Access roads will be scraped to remove waste that may be tracked off the site. In freezing weather conditions, scraping of the access roads may not be possible so gravel shall be added as needed to prevent waste from being tracked off the landfill.

Waste shall be placed such that final waste lift thickness in each cell is 5 to 10 feet. Waste shall be placed in the landfill in a manner that enables the operator to commingle the waste. Like waste

loads shall be evenly distributed throughout the landfilling area. Wastes shall be placed and spread using a solid waste compactor, bulldozer, or wheeled loader in layers one to two feet thick to optimize waste density and compaction effort. Outer sideslopes shall be graded as indicate above using select waste. Inner waste sideslopes can be graded 2H:1V with MSW or construction demolition debris.

At the completion of each cell, the outer sideslopes shall be covered with intermediate cover. Other areas to be temporarily closed shall be graded and covered with intermediate cover so that clean water is shed from the landfill area.

3.7.2 Special Handling of Waste

Landfilling procedures for the sludge, municipal waste, and C&D debris, as discussed above, are straight forward. Certain wastes require special handling to dispose of them. Wastes which require special handling include lime from the paper mills; boiler ash from wood fired boilers; and asbestos. The safe disposal of each waste is discussed below.

- Dry Lime: Dry lime is brought out to the landfill on a rare basis. Because of the chemical nature of lime, special handling is required to allow it to hydrate (absorb water) without generation of excessive heat. To control the reaction, the Operator will designate an area within the landfill in which loads of lime will be placed. This means the hauling vehicle should advance as the material is dumped, thereby spreading the lime. This will allow the lime to dissipate the heat of hydration. The Operator must also level the piles after the hydration reaction has been completed.

- Boiler Ash: Ash from wood burning boilers may consist of bottom ash, fly ash, or a mix of the two. No hot loads of ash shall be accepted. When ash is not fully water quenched, ash shall be deposited on a pad prepared of inert material (existing ash or soil) to minimize risk of fire. The bottom ash may consist of soil, small rocks, bark, and charred wood. Bottom ash from wood fired boilers that meet the requirements can be utilized as alternate daily cover in accordance with requirements for ADC outlined in 3.7.6.1 and appendix E. Bottom ash can be landfilled by spreading over the working face, maintaining a 2-foot separation above the sand blanket over the synthetic liner. The fly ash is a much finer material and can dry out and become dusty. The operator shall inspect the load to ensure that depositing the material will not create blowing of ash. Whenever there is a risk of drying and blowing of ash, the ash shall be covered with a layer of sludge or other cover material.

3.7.3 Asbestos Disposal Procedures.

- Notification and Approval Procedures: Anyone wishing to dispose of asbestos containing waste at MCSL must contact the District (603) 752-3342 at least 24 hours prior to disposal time. The scale operator will contact the landfill operators to expect a load and the Landfill Manager or a certified asbestos supervisor will provide supervision for unloading.

Disposal hours for asbestos are from 7:30 AM – 3:30 PM on weekdays only.

The landfill operation will provide staff and equipment to manage the disposal of asbestos in the landfill. The staff that will be handling asbestos will be trained in compliance with NHDES Env-Sw 901.08(a).

- Site Security and Maintenance: During the unloading of asbestos waste at the landfill, the Landfill Manager will assure that all personnel and equipment not directly involved with the unloading activity are kept at least 100 feet back from the disposal area. If the driver of the truck that hauled the asbestos has not been trained, he/she will remain in the truck with the windows up during a manual unloading process of friable asbestos or during clean-up of asbestos materials. Or the driver should be 100 feet away as per the Rules. Immediately after placing the asbestos waste, at least 3 feet of compacted non-asbestos cover or 18 inches of soil will be placed over the waste.
  The asbestos disposal area at the landfill shall be permanently identified on a map as an asbestos waste disposal area in compliance with the requirements of NHDES Solid Waste Management Rules, Env-Sw 901.04.

- Disposal Procedures: Vehicles used to transport asbestos-containing waste material must be marked during loading and unloading per 40 CFR 61.149(d)(1)(iii). All trucks must be weighed at the landfill scales on their way in and must reweigh when empty. The weight tickets must be signed by the transporter before departure. All friable or potentially friable asbestos waste will be transported to the disposal area in double 6-mil poly bags, labeled in compliance with 29 CFR 1926.58(k). The transport container shall be leak-tight and labeled in compliance with 40 CFR 61.152. Non-friable asbestos may be transported without bagging if the transport container is poly lined and the material is adequately wetted and covered with 6-mil poly cover, secured to prevent the effects of wind or evaporation on the material during transport. The generator, contractor, or hauler has the responsibility to properly package and label the asbestos waste. Additionally, the landfill operator can reject loads that are not properly packaged and labeled. Non-friable asbestos shall not be shredded, crushed, or subjected to any other form of volume reduction prior to placement in the landfill.

  Trucks approaching the asbestos unloading area shall approach as closely as possible before unloading waste. Unloading of the asbestos materials at the designated area shall be the responsibility of the hauler. Waste containers shall be lowered to the ground at the disposal area and not pushed or dropped from the back of a truck. All containers shall be inspected during unloading and any damaged containers shall be immediately wetted sufficiently to prevent dispersal of asbestos fibers during the burying of the waste. The operators can then cover the asbestos with the proper amount of cover material.

Damage to containers outside the disposal area may be repaired by the landfill operators (properly trained and licensed) under the supervision of the Landfill Manager. The amount of asbestos material that may be repacked by the landfill crew is limited to "Minor asbestos abatement projects" as defined by Env-A 1802.41. These Rules allow the abatement of disturbances of less than or equal to 10 linear feet of friable asbestos material on pipes or ducts, or 25 square feet of friable asbestos material on structures other than pipes and not more than 10 linear feet, 25 square feet, or 3 cubic feet of regulated asbestos containing material. If the quantities are greater than the allowed quantities, an asbestos abatement contractor shall be used to clean-up the asbestos release. Workers who must handle or repack damaged bags must wear proper protection equipment, which includes disposable protective clothing, gloves and respirators equipped with HEPA filters, and must be properly trained and licensed to work with asbestos. All protective clothing and poly lining in the container shall be disposed of in compliance with the asbestos requirements of Env-Sw 901 of NHDES Solid Waste Management Rules.

Once the unloading is accomplished, any discrepancies must be noted in the proper place on the Waste Shipment Record (WSR), and the WSR must be signed by the Landfill representative. The landfill copy of the WSR will then be dropped off at the Landfill Scales, where it will be filed.

Please refer to Env-Sw 901.04 of the Certified Administrative Rules for asbestos disposal requirements.

3.7.4 Winter Operations

Provisions must be made for snow removal during the winter to maintain relatively normal operations. Waste placement, grading, and site cleanliness become more important during the winter since waste such as ungraded frozen sludge can become a barrier to traffic movement. The access road will be plowed and sanded to provide safe travel conditions. Salt should be used sparingly because it may seep into the groundwater and could impact the groundwater quality data. Sanding will be the preferred method of road treatment. No final cover will be placed over frozen waste. Drainage structures such as catch basins or culverts should be kept free of ice and snow to ensure unrestricted runoff during thaw conditions.

3.7.5 Wet Weather

During very wet weather, access to the working face may become difficult. The working area should be managed so operations will naturally occur near the access road during the fall and spring rainy seasons. This will allow trucks to dump close to the access road and be near the working face. Gravel should be used to provide a stable traffic mat to improve movement of vehicles on the landfill as needed, but the amount of these materials should be held to a minimum.

3.7.6 Cover Systems

Cover materials shall perform the following important functions:

- Minimize problems with fire, vectors (rodents, seagulls, etc.), litter, odors, and dust; and
- Minimize the infiltration of precipitation and promote runoff.

3.7.6.1 Daily Cover

At the end of each working day, daily cover materials shall be applied on the active areas. Municipal sludges shall be covered as necessary if odor is a problem. Other waste materials susceptible to blowing shall be covered as necessary.
Daily cover shall be a six-inch soil layer or one of the approved alternate daily cover (ADC) methods which are functionally equivalent to 6" of soil daily cover. Daily cover shall be in accordance with the Section Env-Sw 806.03 of the NHDES Solid Waste Rules. ADCs must serve all the cover material functions identified above and may only be used after gaining NHDES approval. The following ADC materials include:

- Wastewater Treatment Plant Sludge;
- Waste Derived Product #6 – C&D and Soil or Sludge (maximum 50% wood mixture);
- Waste Derived Product #9 – Auto Shredder Residue & Kiln Dust;
- Waste Derived Product #10 – Wood-fired Boiler Bottom Ash;
- Waste Derived Product #13 – Biosolids Incinerator Ash (bottom ash);
- Waste Derived Product #14 – Metal Shredder Residue;
- Geosynthetic Tarps; and
- Contaminated soil and media in accordance with Env-Sw 903.05.

Permitted daily cover materials or ADC materials with additional information and specifications are included in Appendix E.

Geosynthetic tarps are to be used as daily cover following normal daily filling operations or upon completing a filling area. Additional cover materials are to be used at the end of the day where geosynthetic tarps are not being used. Geosynthetic tarps should be used as cover in areas that are going to be actively filled again within a short period of time.

Additional ADC or soil cover, particularly when using Waste Derived Product #9 and #14, shall be placed in areas anticipated to not receive waste for more than one month. Additional cover, geosynthetic tarps, or ADC shall be placed should previously covered waste become exposed.

3.7.6.2 Intermediate Cover

As interim grades are reached, a 9-inch layer of intermediate cover shall be applied to areas of the landfill which will not receive additional waste for a period of 30 days or greater. Intermediate cover may include use of sand or fluff to mitigate landfill gas. Areas of the landfill which will not receive additional waste for a period of one year or greater will generally be covered with interim HDPE geomembrane cover.

The lifts will be constructed so as to maximize the area capable of discharging uncontaminated runoff to the stormwater system. In general, the slope of the intermediate cover system will be between 5% and 15%. On temporary or permanent side slopes within a stage, slopes of 3:1 will receive intermediate cover systems as described above. As necessary, temporary stormwater diversion swales shall be constructed to minimize erosive conditions which persist.

3.7.7 Filling Sequence

This section describes the development and operation of the remaining Phase I & II landfill capacity. The Fill Sequence Plans included as Appendix J provide are included to specifically guide the construction of lifts and uses of cover during stages of development. The Phase I liner system was subdivided into four stages: Stages 1, 2, 3, and 4. The Phase II liner system was subdivided into 3 stages: Stages 7, 8, and 9. Stages 5&6 are vertical fills over the top of Stage 1-4 in Phase I. Stages 10 & 11 comprise the vertical expansion which spans over Stages 7, 8, & 9 in Phase II. Stage 12 spans both Phase ~~I~~I & II and is the airspace located vertically above Stage 5&6 and Stage 10&11. Phase IIIA will begin filling at the end of Stage 12's lifespan and begin with Stage 13 and then Stage 14 and last Stage 15. The locations of these stages are shown in the Closure Drawings which is included as Appendix H.

Temporary geomembrane cover is deployed as waste filling has reached interim grades. Waste in temporarily covered areas has been graded to shed clean stormwater to the stormwater management system.

Future lift construction will proceed in a manner generally consistent with the plans developed for the facility, and as described herein. Using survey and control as necessary, the operator will maintain accurate elevation information as lifts are constructed to assure that sequenced development is continuing in accordance with the final grading plans. The operator will maintain boundary markers located at the bottom liner anchor trenches to assure that waste is not deposited outside of the bottom liners.

Waste delivered to the landfill will be directed to the working face where it will be deposited and compacted. Upon delivery to the landfill, waste will be deposited at the working face and compacted using a steel sheepsfoot-wheeled landfill compactor. In general, daily deposits of waste will be limited to the smallest practical area. Waste will be pushed to a daily cell configuration with approximately a 2:1 sideslope and to conform to filling plans. In general, waste layers of one to three feet thickness will be placed with successive passes of the compacting machine. A minimum of three passes of the compacting equipment will be made over each 1-3 foot lift.

3.7.7.1 Stage 5&6

Access to the working face of the landfill is from the main landfill access road to the west near the Stage 2/3 interface. Vehicles leaving the landfill face exit either via the main access road or from the secondary access road near the Stage 4/9 interface to the north. The toe of the waste has been kept and shall be maintained about one to two feet lower than the top of the anchor trench berm. Waste placement will be sequenced to contain all run-off within the landfill cell, so as to collect it as leachate.

All interim waste grades shall be graded in a manor to shed clean stormwater away from the landfill to the stormwater management system. Temporary cover shall be placed over interim grades as soon as practicable to minimize leachate generation and control landfill gas. Based on the current filling rate, it is anticipated that the District will reach interim Stage 5&6 waste grades by mid 2024.

3.7.7.2 Stage12

Once Stage 5&6 waste grades are reached, landfilling operations will continue vertically into Stage 12, which is located over portions of Phase I and Phase II. Landfilling operations will remain generally unchanged. Additional capacity will be gained within the existing landfill footprint by additional filling over the areas of Phase I and II. Waste is to be placed and compacted in 10 foot thick lifts progressing east to west as a 200 foot wide platform. As waste is filled, a 24' wide gravel access road shall be benched into the sideslopes at a 10% slope or less in order to reach the top of the active face. The Stage 12 maximum top of waste elevation is 1830'.

3.7.7.3 Phase III

Phase III was originally permitted 1988 along with Phases I & II and is the undeveloped area to the east of Phase II. Phase III is approximately 46.9 acres. The land in the vicinity of the Phase III expansion was formerly a wetland. The District relocated these wetlands as part of the Wetlands Compensation project, completed in June 2009, to the Bean Brook mitigation area, which was formerly a sand and gravel pit. Additional work to preclude the redevelopment wetlands in the Phase III area was completed late 2015. Ongoing maintenance including mowing and cleaning drainage swales will be performed by Landfill Operators to preclude the redevelopment of wetlands in this area. Phase III construction shall be completed in anticipation of achieving Stage 5 & 6 final waste grades so that landfilling operations are uninterrupted. Prior to Phase III operation, the District must demonstrate a minimum six feet of separation between the landfill lining system and seasonal high groundwater elevation, per Part II, Section 3.2 of the facility solid waste permit, in addition to all other permitting requirements.

Phase III is being permitted as two Phases, Phase IIIA and Phase IIIB. Phase IIIA Type IA Permit Modification Application was submitted in April 2020 for an additional 16.3 years of capacity. Phase IIIA is about half of Phase III's total footprint, or 22.9 acres of the original 46.9, and is the western portion of the Phase III footprint. The additional 24 acres not included in this Type IA Permit Application are located East of Phase IIIA.

Phase IIIA also includes the construction of a riser/pump building for removing leachate and leak flows. The existing landfill has liner penetrations to remove leachate from the low areas in each stage and to meet modern standards, Phase IIIA will require pumps.

The riser building is proposed to have two 150gpm automatic pumps for the leachate collection that have an internal piezometer for measuring head on liner. Leachate elevations measured higher than 3.5 feet from the bottom of the sump are considered more than a foot of head on liner. The primary leachate collection system has two 24" primary riser pipes, one being backup in the case of high flows or pump repairs.

The one 24" secondary riser is anticipated to require a 40pgm pump. A supplemental riser building and pump O&M plan will be added during final permitting for Stage 13.

Phase IIIA is will begin construction in 2020, which will include the 6' of fill under the liner system and monitoring for a year to demonstrate a 6' separation from groundwater. After the groundwater demonstration, the liner system can be constructed as well as the riser building and leachate system tie in, stormwater ponds, and the perimeter road. Phase IIIA Stage 13 is anticipated to begin filling in 2025. Additional permitting is required before construction of Phase IIIA Stage 13.

4.0 RESIDUALS WASTE MANAGEMENT

Per Env-Sw 1105.10 – Management of Residual Waste, facility operations shall include provisions to properly manage residual wastes. The anticipated residual waste from the MCSL is leachate. Leachate generation and management is described herein.

4.1 Landfill Leachate

Leachate is generated in the landfill through two mechanisms. The major source of leachate is through precipitation falling onto the active landfill areas. Precipitation generated leachate will be minimized through the placement of a soil or geosynthetic cover over areas which have reached intermediate grade. Leachate is also generated through waste consolidation and subsequent drainage of entrained water.

4.1.1 Leachate Collection & Management System

The MCSL leachate collection system is a double lined system with a primary leachate collection and secondary leak detection. Leachate is collected through a gridwork of perforated pipes that underlie the waste. Leachate flows by gravity through the ~~entire~~ leachate collection system for Phase I and Phase II. The Phase IIIA leachate collection system is serviced by a pumping station, that pumps leachate through a three-inch dual containment forcemain that discharges into the gravity leachate sewer~~. Flow begins~~ at ~~the landfill~~LMH-1E. The leachate from each of Phases I, II and III combine in the gravity lines and travels through the pinch valve chamber, flume, gravity line, siphon forcemain, and ultimately to the City of Berlin Water Pollution Control Facility (BPCF).

Leachate generated in Phase IIIA is directed through a series of pipes into a sump at the lowest point of Stage 13A. The sump contains two 24" HDPE risers connected to the pumping station adjacent to the sump outside of the anchor trench of Stage 13A. Each riser contains a pump with a pumping capacity of 150 gallons per minute (GPM). The leachate level within the sump is measured using transducers attached to the top of each pump. These transducers transmit a signal to the Supervisory Control and Data Acquisition (SCADA) system. The sump is used to store collected leachate until a sufficient quantity is available for efficient pumping. The SCADA system has two set points, one equal to the top of the sump to activate the pumps, and one at a lower elevation to shut the pumps off. The entire system is connected to communications wiring allowing system components to be monitored remotely and serviced as needed by site personnel.

Secondary leak detection flows within Phase IIIA are pumped through a paddle wheel flow meter before discharging into the primary sump. The flow data is stored by the SCADA system and transmitted to Site personnel for active monitoring.

In the event of a power outage, sufficient generator capacity is available at the site office building to continue normal operation of the pump station and SCADA system at the Site. In the event of a large weather event that generates flows in excess of what the other storage systems at the site have the capability of containing, the leachate can be effectively stored on the liner within Stage

13A. Storage capacity of Stage 13A is designed to contain the flow from a 100 year storm. Any leachate stored on liner as a result of a 100-year storm event will be removed within 7 days.

If needed, leachate can be stored in the lined leachate storage pond during elevated flow periods, sewer maintenance, or emergencies. The leachate storage pond utilizes a double 60-mil HDPE liner with leak detection. The capacity of the pond is approximately 1.34 million gallons. The leachate storage pond also has an underdrain system to relieve hydrostatic pressure on the bottom of the leak detection geomembrane. The pond underdrain system discharges at the headwall located to the south of the pond.

The leachate pond and sewer are equipped with an automated pinch valve and multiple manual gate valves for leachate flow control and leachate storage. During normal operations, leachate flow control is automated using instantaneous flow data measured at the flume and also through instrumentation and controls provided in the SCADA system. Leachate flow can also be controlled manually during any maintenance, power outage, or for any other reason. When leachate flow exceeds the operator-specified flow setpoint, leachate will be stored in the leachate storage pond automatically by the pinch valve reducing the flow capacity. There are no actions required by the landfill Operator for the flow to be diverted. Once the flow falls below the setpoint, the pond will begin to empty.

The leachate gravity sewer is comprised of various sizes of ductile iron and HDPE pipes. The gravity leachate sewer conveys leachate from the landfill to the siphon chamber. The leachate gravity sewer follows the access road connecting the landfill to the District WWTP property.

A portion of the leachate sewer is an inverted siphon forcemain, which utilizes available head to overcome a low point in the sewer route. There are two-three inch diameter forcemains and one-six inch forcemain that discharge at the BPCF headworks building influent channel. The leachate siphon chamber is designed to collect, equalize, remove sediment, and distribute leachate to one or more of the siphon forcemains. The siphon chamber is also equipped with operations monitoring instrumentation and relays data to the landfill office through the SCADA system. The siphon forcemain travels along the shoulder of Shelby Street and onto the BPCF property.

For more information regarding operations and maintenance of the leachate pond, pinch valve, SCADA system, siphon chamber, and siphon forcemains, please refer to the Leachate Sewer O&M Manual prepared by CMA Engineers and to the manufactures' O&M manuals.

Appendix B includes landfill inspection forms, which include inspection of the leachate collection system. Also included in the Leachate Sewer O&M Manual are routine inspection forms and inspection and maintenance schedules.

4.1.2 Leachate Monitoring and QA/QC

Monitoring and reporting of leachate quantity and quality, including quality assurance and quality control, shall be conducted in accordance with this section to assure compliance with landfill monitoring requirements and to meet requirements of the City of Berlin for disposal of leachate.

Leachate head on liner, quality, and quantity shall be monitored as outlined in Env-Sw 806.08(d).

Head on liner in Phases I and II is measured at six locations by Geokon vibrating wire pressure transducers. The transducers monitor head in cells 7A, 7B, 8A, 8B, 9A and 9B. Head on liner is calculated using field data and is corrected for changes in barometric pressure and temperature. Transducer locations are shown on Figure 2.

Head on liner in Phase IIIA is measured by the level transducers in the primary leachate pump system.

Leachate flow is measured at the flume manhole downstream of the pinch valve. The flume is a HS 1.0 fiberglass flume and is equipped with a stilling well and ultrasonic level sensor. The level sensor is integrated with the flow meter located in the pinch valve building and the facility SCADA system. Flow is measured and recorded continuously and summarized daily by the facility SCADA system.

The District holds a leachate disposal agreement with the City of Berlin for the disposal and treatment of leachate. Additional leachate monitoring requirements are required by the Agreement. Several leachate monitoring parameters overlap between the Rules and the Agreement. See Appendix F for the Leachate Treatment Agreement by and between the AVRRDD and the City of Berlin.

Leachate sampling is conducted per the Rules and the Agreement. The auto-sampler is located in the shed next to the pinch valve building and draws a 24-hour composite sample from the flume manhole. The table below outlines the leachate sampling schedule for the Rules and the Agreement.

Leachate Sampling Schedule

	Parameter	Frequency	Sample Type	Reporting Due Date
City of Berlin Leachate Disposal Agreement	Leachate Flow (gpd) Daily Max Average Daily	Continuous		Quarterly
	pH	Once Per Month	Composite	Quarterly
	BOD			
	TSS			
	Ammonia-N			
	TKN			
	VOC (8260B)	Once Per Quarter	Composite	Quarterly
	ABN (625)			

	Specific Conductance	Once Per Quarter	Composite	Quarterly
	Alkalinity			
	Total Hardness			
	Sulfate (SO_4)			
	Sulfite (SO_2)			
	Sulfide (S)			
	Chloride			
	Nitrate (NO_3)			
	Nitrite (NO_2)			
	Total Phosphorus			
	8 RCRA Metals (listed below)	Once Per Six Months	Composite	Quarterly
	Arsenic (As)			
	Barium (Ba)			
	Cadmium (Cd)			
	Chromium (Cr)			
	Lead (Pb)			
	Mercury (Hg)			
	Selenium (Se)			
	Silver (Ag)			
	Aluminum (Al)			
	Copper (Cu)			
	Iron (Fe)			
	Manganese (Mn)			
	Nickle (Ni)			
	Zinc (Zn)			
	Cyanide	Once Per Year	Composite	Quarterly
	Total Phenols			
	Calcium (Ca)			
	Magnesium (Mg)			
	Oil and Grease			
	Total Petroleum Hydrocarbon (TPH)			
Solid Waste Rules	pH	Triannual		Quarterly
	Temperature	-		
	COD			
	Specific Conductance	April/May		
	Iron (Fe)			
	Manganese (Mn)	July/August		
	Sulfate (SO4)			
	Chloride	November		
	Chromium			
	Lead			
	Cadmium			
	VOCs			

Notes:

Shaded field is a duplicate sampling requirement

Green is more frequent

Gray is less frequent

Secondary leak detection leachate flow rates in Phase I and II are measured once daily during regular operating hours at four landfill measuring points and one leachate pond measuring point. A sample leak detection monitoring form is included in Appendix C.

Secondary leak detection leachate flow rates in Phase IIIA is measured by the flow meter in the Phase IIIA pumping station building and are reported through the SCADA system.

Flows within the leak detection system cannot exceed 25 gallons per acre per day over a 30 day rolling period except in cases where the NHDES agrees elevated flows are the result of dewatering or construction projects. If the flow rate exceeds 25 gallons per acre per day a report must be made to NHDES within one week of identification of the exceedance. Per Env-Sw 806.09 if an exceedance greater than 100 gallons per acre per day is identified, AVRRDD is to file an investigative report to identify the cause of the leak.

4.1.3 Leachate Disposal and Backup Facility

As mentioned above, the District holds a leachate disposal agreement with the City of Berlin for the disposal and treatment of leachate. Leachate discharge screening limits are:

- Peak Day Flow = 250,000 GPD;
- Maximum Monthly Flow = 155,000 GPD; and
- Annual Average Flow = 65,000 GPD.

In addition to discharges screening limits, the Agreement also includes loading screening limits for BOD, Ammonia, and TSS. Refer to the Agreement for those screening limits.

If it anticipated that any of the flow rates listed above will be exceeded, the Operator shall contact the BPCF for guidance on whether to continue conveying leachate for treatment or for storage in the leachate storage pond. Actual leachate generation will be dependent on precipitation, temperature, volume of waste in place, waste moisture content, and open area.

Env-Ws 1105.10 requires that AVRRDD obtain and maintain access to at least 2 authorized locations where adequate capacity exists to handle the leachate generated from the landfill.
The City of Manchester WPCF has agreed to be a backup disposal facility for leachate with the proper notification in the event leachate cannot be disposed of at the BPCF. Leachate transportation arrangements must be made for leachate disposal at any facility other than the BPCF. A copy of this agreement is included in Appendix F.

4.2 Landfill Gas & Condensate Management

The MCSL has an active gas collection system and landfill gas processing facility. The facility operates under a NHDES-ARD Title V operating permit (# TV-0057). The major components of the gas collection and processing facility are:

- Vertical & horizontal gas collection wells;
- Gas conveyance piping and valves;
- Condensate traps and knockout pot;
- Gas blower;
- Gas flare;
- Sulfa-treat system;
- Compressor skid;
- Desiccant dryer;
- Glycol chiller;
- Gas analyzer;
- Controls and electrical building; and
- Other ancillary units.

Refer to the Landfill Gas Extraction System Operations, Monitoring, and Maintenance Plan for more information on the landfill gas systems, which also includes the Landfill Gas to Energy Processing Facility.

Condensate generated in the landfill gas collection system and processing facility is collected at multiple locations and either flows by gravity or is pumped to the leachate collection system. Condensate may emit a strong odor. Odor neutralizers may be employed to the leachate stream or carbon filters may be added or replaced to mitigate noxious odors.

5.0 FACILITIY MAINTENANCE, INSPECTION, & MONITORING PLAN

Landfill inspection and maintenance will be an ongoing activity. All personnel will be expected to observe the condition of landfill facilities throughout their workday and notify the Landfill Manager of areas and equipment which may need repair and maintenance. Formal landfill inspections will be conducted in the spring and fall of each year. Additional inspections may be warranted following unusual climatic or operational events including, but not limited to, major rain storms, flood, fire, hurricane, or earthquake. These inspections will follow the inspection forms attached in Appendix B. The Operations Manager is ultimately responsible to insure that the inspection and maintenance of all landfill facilities and equipment occurs.

5.1 Spontaneous Combustion & Other Fire Hazards

Fire protection controls onsite include daily and intermediate cover, fire extinguishers, and a water truck. Waste shall be inspected as it is dumped for gas containers, materials with elevated temperature, and other potentially flammable materials. The landfill gas composition and temperature are monitored at gas collection wells across the site to prevent subsurface fires. The landfill gas technician shall tune the well field to sequester gas to the extent possible and avoid conditions that promote subsurface fires.

Landfill gas is composed of approximately 45-60% methane, which is a colorless, odorless gas and is explosive when it is present within its lower and upper explosive limits (LEL and UEL). The LEL and UEL for methane is 5% and 15%, respectively, by volume. Though a source emitting methane gas at a concentration above the UEL may not meet explosive conditions, a location somewhere away from the source may be within the explosive range. Smoking is not permitted anywhere on site due to the potential of gas migration.

Stockpiles of cover materials, including auto-fluff and chipped C&D waste, shall be actively managed to avoid the potential for fires. Risk of fire for material with organic (e.g. wood waste) material includes heat generated from natural biological degradation. This risk is minimized by maintaining smaller stockpiles of waste and actively managing the materials. As a general rule of thumb, stockpiles should not exceed 15 feet in height, be larger than 50 foot in diameter, and shall not sit unused for more than 3 months.

5.2 Vector Management

Daily and intermediate cover limits vector access to the waste. The District holds a US Fish & Wildlife permit to control vectors. The District voluntarily contracts the services of a full time USDA wildlife warden to control vectors at the facility. If additional measures are necessary, the AVRRDD will contract a professional exterminator.

5.3 Generation of Methane, Hazardous, or Explosive Gas

Landfill gas is a gaseous byproduct of anaerobic organic waste decomposition. Typically, LFG is composed of mainly methane and carbon dioxide with smaller amounts of nitrogen and water

vapor and trace amounts of hydrogen sulfide, other sulfur compounds, and volatile organic compounds (VOCs). Gas temperatures at the extraction wellhead typically range from ambient temperature to 120°F and inside the landfill from 50-120°F. The following table presents typical landfill gas composition.

Component	Percent (dry volume basis except moisture)
Methane	45 – 60
Carbon Dioxide	40 – 60
Nitrogen	2 – 5
Oxygen	0.1 – 1
Hydrogen sulfides, disulfides and other sulfur compounds	0 – 3
Ammonia	0.1 – 1
Hydrogen	0 – 0.2
Carbon Monoxide	0 – 0.2
Moisture	2 – 12
Volatile Organic Compounds (VOCs)	0.01 – 0.6

The active gas collection system and temporary cover manages landfill gas and minimizes fugitive gas. As landfilling progresses, the gas collection system will be expanded to provide coverage of recently placed waste. Refer to the separate Landfill Gas Operations, Monitoring, and Maintenance Plan for more information on the landfill gas systems.

Four gas probes and eight ambient air sample locations are monitored for fugitive gas on a quarterly basis. See Figure 2 & 3 for these gas monitoring locations. Also see Appendix B-6 – Gas Monitoring Form for the list of monitoring locations and recording form.

The following steps are to be implemented in the event that monitoring results indicate combustible gas concentrations in the soil exceed 50 percent of the lower explosive limit (LEL) at the property line or 25 percent of the LEL in on-Site structures excluding leachate collection and gas recovery components (note that the LEL defined above corresponds to 5 percent methane by volume in air):

- Take all necessary steps to ensure protection of human health and notify NHDES [This notification shall be deemed to have taken place when the Department's Project Manager in the Solid Waste Compliance Section 603-271-2925 is notified.];
- Within seven (7) days of detection, place in the operating record the methane gas levels detected and a description of the steps taken to protect human health; and
- Within sixty (60) days of detection, implement a remediation plan for the methane gas release, place a copy of the plan in the operating record, and notify the Director that the plan has been implemented. The plan shall describe the nature and extent of the problem and the proposed remedy.

Locations where gas concentrations exceed 50 percent of the LEL at the property line are to be identified in a separate report which is to be forwarded to NHDES. Should the combustible gas concentrations be determined to exceed 50 percent of the LEL at and beyond the property line, an evaluation is to be made to determine whether the frequency of monitoring should be increased, and whether the monitoring network and type of monitoring should be modified to enhance detection. If continued monitoring indicates elevated levels of landfill gas at the property line, an appropriate plan to control gas concentrations, such as further expansion of the active gas system, is to be developed and submitted to NHDES for review.

If monitoring indicates that additional control measures are necessary, they are to be installed so that:

- Gas concentrations at and beyond the property boundaries will be less than 50 percent of the LEL; and
- Gas concentrations at any structure will be less than 25 percent of the LEL.

In addition to methane, hydrogen sulfide gas may be present at the facility. Proper confined space entry procedures shall be followed when performing work in a confined space, including the use of a continuously monitoring gas detector. See Appendix D for Cianbro's confined space policy. Outside contractors may also be used to provide confined space entry.

5.4 Odors

Use of daily and intermediate cover and operating the gas collection system will control landfill odors. Other measures to control odors which may be considered include deployment of odor control products. An odor-neutralizing chemical may also be applied as a mist in areas where odors are noted. Leachate and condensate may also emit undesirable odors. Activated carbon filters have been installed on air vents at the pond outlet structure, gravity sewer manholes, and siphon chamber. In addition, the pond outlet pipe and overflow pipe have Tideflex check valves to contain odors within the leachate management system.

If waste streams are identified which routinely exhibit unacceptable odor, the generator will be informed and required to take measures to reduce odor. If this cannot be accomplished, the waste stream will not be accepted at the facility.

Items to check during routine inspections include:

- The active gas collection system records to observe that gas is being extracted effectively from the various collection locations:
- That there is adequate daily or intermediate cover on the waste; and
- If necessary, solid odor neutralizing products or misting agents be deployed.

When the facility receives an odor complaint, the facility shall evaluate the complaint as appropriate, including collecting additional information, investigate the nature of the odors, evaluate potential sources of the odors and evaluate potential responses including possible corrective actions as

appropriate. The facility shall communicate, when appropriate, back to the complainant information relevant to the complaint and applicable follow up actions, if any, including future avenues of communication. Records of the complaint shall be maintained. See section 5.13 and Appendix L, for procedures for documentation, record keeping and response for nuisance complaints.

5.5 Dust

Dust control at the landfill shall be achieved through the use of a water truck on landfill roadways. As conditions warrant, the water truck shall be operated to moisten the soils on the unpaved section of roadway to minimize dust production. The landfill roadways from the scale to the lined landfill area are paved. The generation of dust from the paved sections of roadway as a result of tracking of soils from unpaved areas should be minimal. Operators are supplied with dust masks to minimize the inhalation of dust.

5.6 Windblown Litter

Blowing litter is to be minimized by limiting the active working face, applying daily cover to the active fill areas and fencing. Additionally, litter fencing is installed around portions of the landfill to prevent windblown litter from traveling. Occasionally, during operations, litter will be carried off the active filling area by heavy winds. This litter will be picked up on a daily basis by the Operator, Monday through Friday, weather conditions permitting, to avoid any nuisance or harm to the surrounding ecosystems.

5.7 Leachate

Leachate flow is continuously measured by the SCADA system at the flume manhole adjacent to the leachate pond. Leachate pond storage is measured visually by Operators using the markers painted on the pond lining system. Leachate levels in the siphon chamber are also monitored by the SCADA system. Leachate flow control is automated using the SCADA system and the actuated pinch valve. However, flow can also be controlled by manual gate valves in the pinch valve building.

Secondary flows from Phase IIIA are measured using a paddle wheel flow meter located on the force main in the Phase III pumping station prior to pumping to the primary riser. The primary pumps discharge to leachate manhole LMH-1E, eventually mixing with leachate generated in Phase I and Phase II before storage in the leachate pond or measurement in the flume.

Monitoring requirements for Leachate are outlined in Section 4.

For more information regarding operations and maintenance of the Phase IIIA pumping station, leachate pond, pinch valve, SCADA system, siphon chamber, and siphon forcemains, please refer to the Leachate Sewer O&M Manual prepared by CMA Engineers and to the manufactures O&M manuals.

5.8 Spills

Any spills and material releases must be inspected, contained, documented, and reported. The written incidents report shall identify the source of the material release, the date, time and type of incident, the location of the release, the estimated quantity released, the containment/remediation procedures implemented, and an assessment of actual or potential hazards to human health or environment.

A material release form is included in Appendix B of this manual.

5.9 Stormwater Management

The surface water management systems are inspected and managed in accordance with the facility's Stormwater Pollution Prevention Plan (SWPPP). In addition to the ditches and detention ponds, sideslopes and surfaces of the exterior landfill berms are to be inspected for erosion. All sideslopes should have well-established vegetation or be in the process to be vegetated. A copy of the SWPPP is included kept at the District and landfill offices.

5.10 Groundwater Monitoring

Sampling and analyses of groundwater is performed in accordance with the current NHDES Groundwater Release Detection Permit. The permit expires after five years and shall be renewed prior to expiration. The permit may be amended with NHDES approval.

Permanent groundwater monitoring wells are installed to monitor groundwater quality at the Site. The monitoring wells are typically constructed using polyvinyl chloride (PVC) well screen and riser piping. The well screen for the monitoring wells is surrounded by a sand filter. A bentonite seal and cement/bentonite grout surrounds the riser pipe from the sand filter to the ground surface. Monitoring wells are provided with protective casings and locking caps. See Appendix G for the Groundwater Release Detection Permit. Also, see Figure 2 for sampling locations.

In addition to the Groundwater Release Detection Permit, the underdrain and surface water sampling locations shall be tested once per two months for specific conductance and pH per Part II Section 6.3.2.3.4 of the solid waste permit. It has been the District's practice to perform this sampling once per month. See Figure 2 for sampling locations.

5.11 Leachate Breakouts

Inspections are to include observations of landfill sideslopes for evidence of leachate breakouts. Breakouts are to be repaired promptly. Methods to repair breakouts may include excavation of the breakout and backfill with free draining material to promote drainage into the landfill. Leachate breakout locations are recorded on a field sketch and submitted with the quarterly facility report.

5.12 Soil Stockpiles

Soil stockpiles for landfill operations shall be minimized in areas between the landfill and downgradient groundwater monitoring wells and especially in the vicinity of CMW-97701 and CMW-97702. Historically, soil stockpiles for construction and road maintenance have been stored in the area west of Stages 3 & 4 which presumably have had minor impacts on groundwater quality at the two locations previously stated. Stockpiles for landfill use may be stored on the landfill, the Wide Spot, or other areas that will not affect groundwater monitoring.

5.13 Nuisance Complaints

When the facility receives a nuisance complaint, the facility shall evaluate the complaint as appropriate, including collecting additional information, investigate the nature and potential sources of the nuisance, and evaluate potential responses including possible corrective actions as appropriate. The facility shall communicate, when appropriate, back to the complainant information relevant to the complaint and applicable follow up actions, if any, including future avenues of communication.

The facility shall complete and maintain records of complaints received from outside parties. Documentation shall include a record of complaints received and related response actions. A nuisance complaint form and odor complaint form are included in Appendix L.

Androscoggin Valley Regional Refuse Disposal District

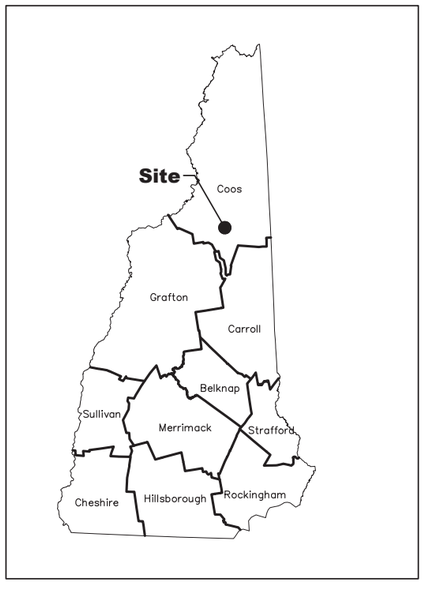
Mt. Carberry Landfill
Phase IIIA Development

Phase IIIA Filling Sequence

April 2020

Sheet Index

1	Stage 13 - Cell A 10' of Fill,
2	Stage 13 Filling,
3	Stage 14 Filling
4	Stage 15 Filling, Interim Grades
5	Final Phase IIIA Development



Locus Plan

Prepared For:

Androscoggin Valley Regional Refuse Disposal District
3 Twelfth Street
Berlin, New Hampshire 03570

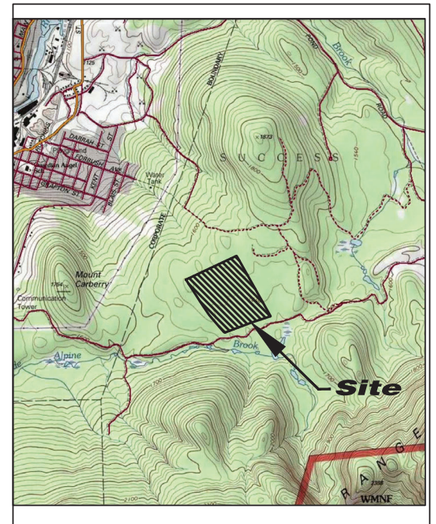
Prepared By:

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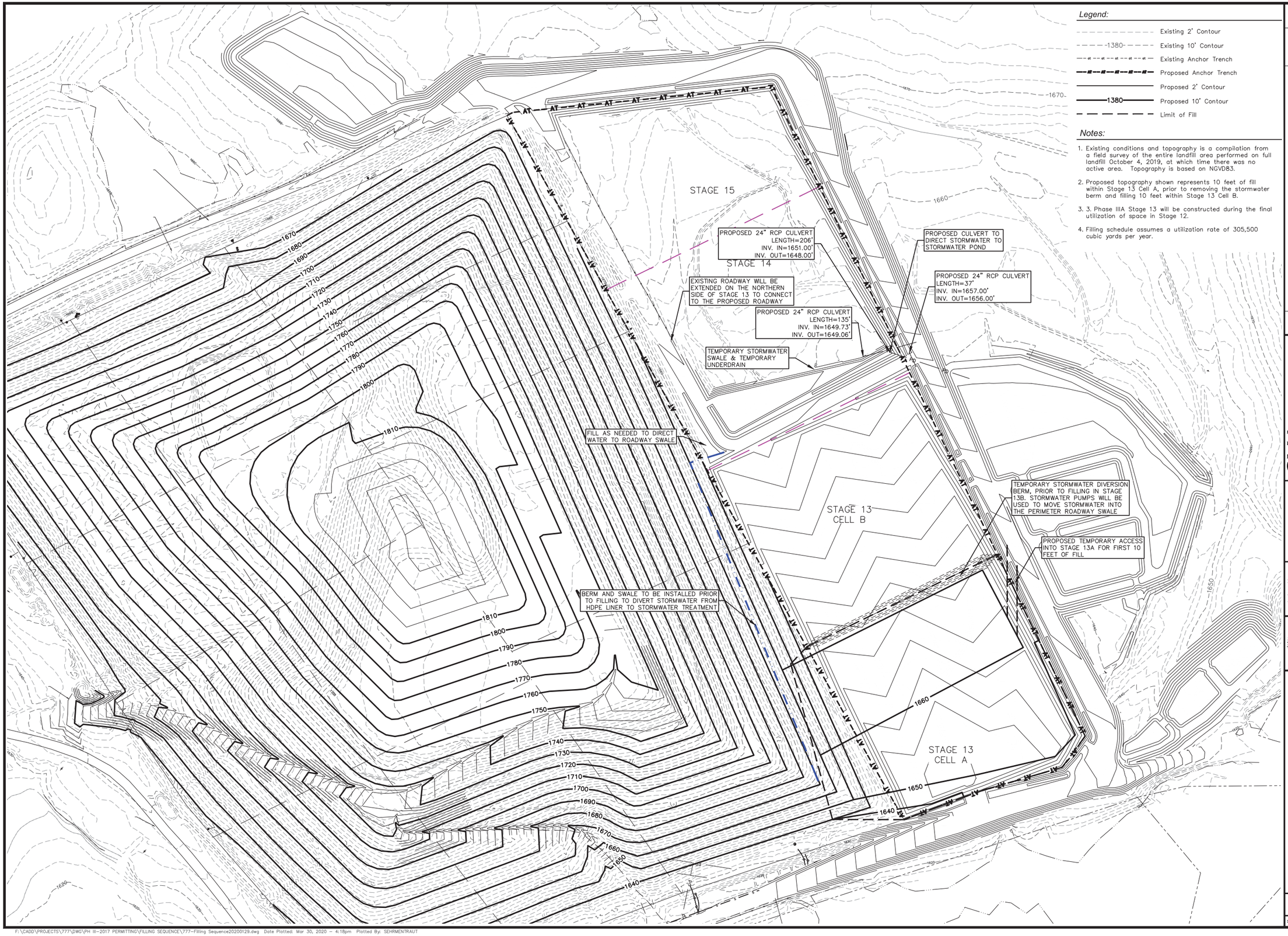
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Project Location

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Legend:

- Existing 2' Contour
- Existing 10' Contour (1380)
- Existing Anchor Trench
- Proposed Anchor Trench
- Proposed 2' Contour
- Proposed 10' Contour (1380)
- Limit of Fill

Notes:

1. Existing conditions and topography is a compilation from a field survey of the entire landfill area performed on full landfill October 4, 2019, at which time there was no active area. Topography is based on NGVD83.
2. Proposed topography shown represents 10 feet of fill within Stage 13 Cell A, prior to removing the stormwater berm and filling 10 feet within Stage 13 Cell B.
3. 3. Phase IIIA Stage 13 will be constructed during the final utilization of space in Stage 12.
4. Filling schedule assumes a utilization rate of 305,500 cubic yards per year.

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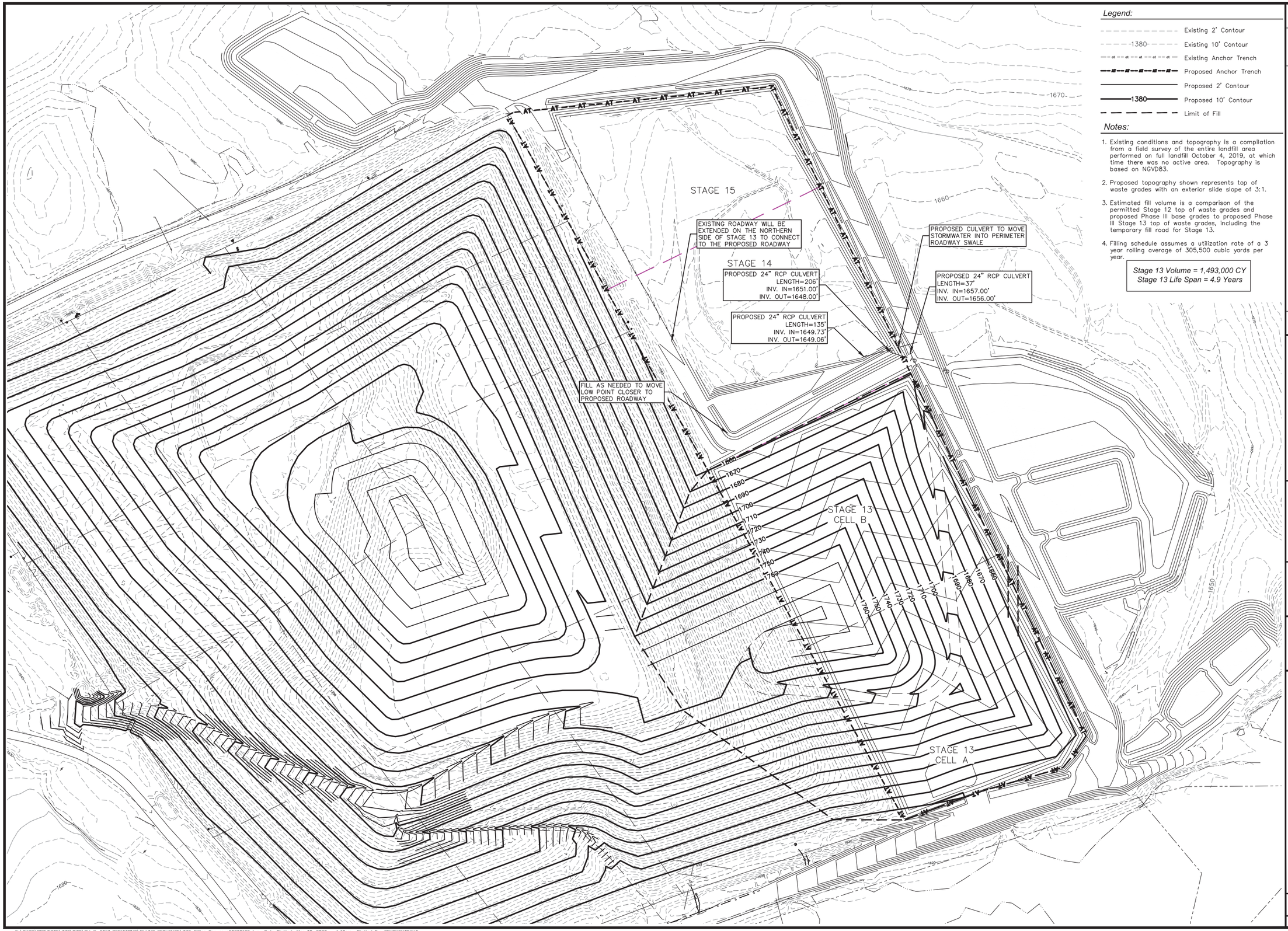
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drawn by: PDS/SJE
approved by: PDS
date: April 2020
project no: 777
file name: 777-Filling Sequence20200128.dwg
scale: 0 150' 300' Scale: 1" = 150'

Androscoggin Valley Regional Refuse Disposal District
Mt. Carberry Landfill
Phase IIIA Development
Stage 13 - Cell A 10' of Fill

drawing no. 1
sheet: 1 of 5

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Legend:

- Existing 2' Contour
- Existing 10' Contour
- Existing Anchor Trench
- Proposed Anchor Trench
- Proposed 2' Contour
- Proposed 10' Contour
- Limit of Fill

Notes:

1. Existing conditions and topography is a compilation from a field survey of the entire landfill area performed on full landfill October 4, 2019, at which time there was no active area. Topography is based on NGVD83.
2. Proposed topography shown represents top of waste grades with an exterior slide slope of 3:1.
3. Estimated fill volume is a comparison of the permitted Stage 12 top of waste grades and proposed Phase III base grades to proposed Phase III Stage 13 top of waste grades, including the temporary fill road for Stage 13.
4. Filling schedule assumes a utilization rate of a 3 year rolling average of 305,500 cubic yards per year.

Stage 13 Volume = 1,493,000 CY
Stage 13 Life Span = 4.9 Years

no.	revision	date	by

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PAUL D. SCHMIDT No. 9625 REGISTERED PROFESSIONAL ENGINEER STATE OF NEW HAMPSHIRE

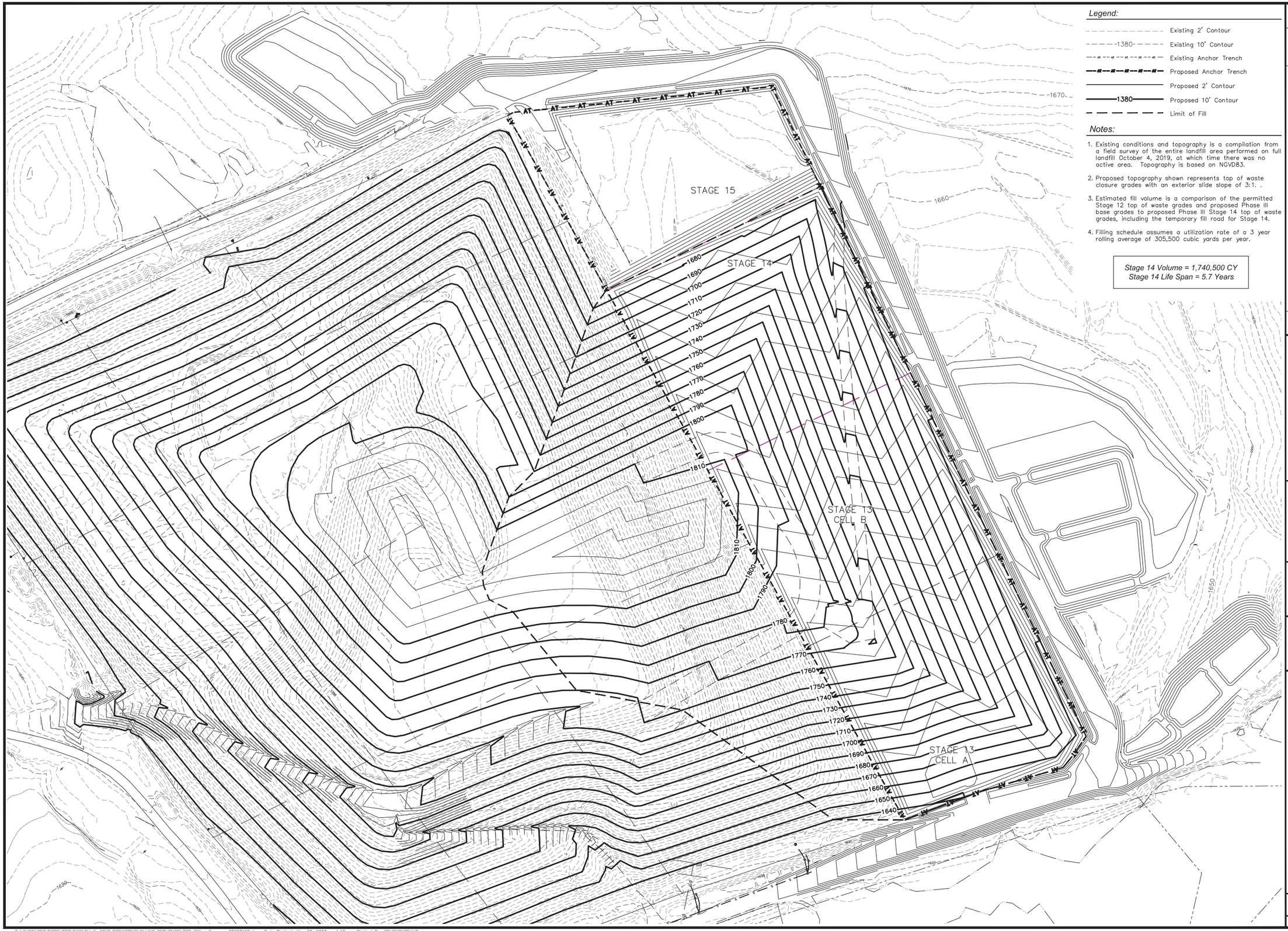
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drawn by: PDS/SJE	project no: 777
approved by: PDS	file name: 777-Filling Sequence20200129.dwg
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Androscoggin Valley Regional Refuse Disposal District
Mt. Carberry Landfill
Phase IIIA Development
Stage 13 Filling

drawing no. 2

sheet: 2 of 5

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Legend:

- Existing 2' Contour
- 1380 Existing 10' Contour
- Existing Anchor Trench
- Proposed Anchor Trench
- Proposed 2' Contour
- 1380 Proposed 10' Contour
- Limit of Fill

Notes:

1. Existing conditions and topography is a compilation from a field survey of the entire landfill area performed on full landfill October 4, 2019, at which time there was no active area. Topography is based on NGVD83.
2. Proposed topography shown represents top of waste closure grades with an exterior slide slope of 3:1. .
3. Estimated fill volume is a comparison of the permitted Stage 12 top of waste grades and proposed Phase III base grades to proposed Phase III Stage 14 top of waste grades, including the temporary fill road for Stage 14.
4. Filling schedule assumes a utilization rate of a 3 year rolling average of 305,500 cubic yards per year.

Stage 14 Volume = 1,740,500 CY
Stage 14 Life Span = 5.7 Years

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STATE OF NEW HAMPSHIRE · PAUL D. SCHMIDT · No. 9625 · LICENSED PROFESSIONAL ENGINEER

designed by: PDS
drawn by: PDS/SJE
approved by: PDS
date: April 2020
project no: 777
file name: 777-Filling Sequence20200129.dwg
scale: 150' 0 300' Scale: 1" = 150'

Androscoggin Valley Regional
Refuse Disposal District
Mt. Carberry Landfill
Phase IIIA Development

Stage 14 Filling

drawing no. 3

sheet: 3 of 5

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Legend:

- Existing 2' Contour
- Existing 10' Contour
- Existing Anchor Trench
- Proposed Anchor Trench
- Proposed 2' Contour
- Proposed 10' Contour
- Limit of Fill

Notes:

1. Existing conditions and topography is a compilation from a field survey of the entire landfill area performed on full landfill October 4, 2019, at which time there was no active area. Topography is based on NGVD83.
2. Proposed topography shown represents top of waste closure grades with an exterior slide slope of 3:1.
3. Estimated fill volume is a comparison of the permitted Stage 12 top of waste grades and proposed Phase III base grades to proposed Phase III Stage 15 top of waste grades, including the temporary fill road for Stage 15.
4. Filling schedule assumes a utilization rate of a 3 year rolling average of 305,500 cubic yards per year.

Stage 15, Interim Grading Volume = 1,694,000 CY
Stage 15, Interim Grading Life Span = 5.5 Years

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PAUL D. SCHMIDT No. 9625

designed by: PDS	date: April 2020
drawn by: PDS/SJE	project no: 777
approved by: PDS	file name: 777-Filling Sequence20200129.dwg

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Androscoggin Valley Regional
Refuse Disposal District
Mt. Carberry Landfill
Phase IIIA Development

Stage 15 Filling Interim Grades

drawing no. *4*

sheet: *4* of *5*

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Legend:

- Existing 2' Contour
- 1380 — Existing 10' Contour
- Existing Anchor Trench
- Proposed Anchor Trench
- Proposed 2' Contour
- 1380 — Proposed 10' Contour
- Limit of Fill

Notes:

1. Existing conditions and topography is a compilation from a field survey of the entire landfill area performed on full landfill October 4, 2019, at which time there was no active area. Topography is based on NGVD83.
2. Proposed topography shown represents the final closure shape for Phase IIIA.
3. Filling schedule assumes a utilization rate of 305,500 cubic yards per year.

Phase IIIA - Full Stage 15
Stage 15 Volume = 1,758,000 CY
Stage 15 Life Span = 5.8 Years

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State of New Hampshire — Paul D. Schmidt — No. 9525 — Licensed Professional Engineer

date: April 2020	designed by: PDS
project no: 777	drawn by: PDS/SJE
file name: 777-Filing Sequence20200129.dwg	approved by: PDS
scale: 1" = 120'	0 120' 240'

Androscoggin Valley Regional Refuse Disposal District

Mt. Carberry Landfill Phase IIIA Development

Final Phase IIIA Development

drawing no. 5

sheet: 5 of 5

Part XIV

Revised Closure Plan

Androscoggin Valley Regional Refuse Disposal District
Permit Number: DES-SW-88-029

MT. CARBERRY SECURE LANDFILL
CLOSURE PLAN

Approved on: February 25, 2019

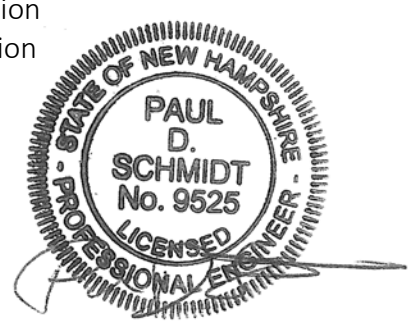
Revised for Stage 12: February 2020
Revised for Phase IIIA: April 2020

Prepared for:

Androscoggin Valley Regional Refuse Disposal District
3 Twelfth Street
Berlin, NH 03570

for Submittal to:

NHDES Waste Management Division
Permitting & Design Review Section
29 Hazen Drive
Concord, NH 03302-0095



Prepared by:

CMA Engineers, Inc.
Civil and Environmental Engineers
35 Bow Street
Portsmouth, NH 03801

ANDROSCOGGIN VALLEY REGIONAL
REFUSE DISPOSAL DISTRICT
MT. CARBERRY SECURE LANDFILL
CLOSURE PLAN

TABLE OF CONTENTS

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1.0	Facility Identification	1
2.0	Closure Schedule	1
3.0	Waste Identification	2
4.0	Notifications	3
5.0	Closure Requirements	3
6.0	Post Closure Requirements	3
7.0	Record Keeping and Reporting	5
8.0	Other Permits	5
9.0	Closure Cost Estimate	5

Figure 1 – Approved 1988 Closure Plan

Appendix A – Closure Drawings
Appendix B – Closure and Post Closure Cost Estimates

1.0 Facility Identification

Facility Name:	Mt. Carberry Secure Landfill
Facility Mailing Address:	3 Twelfth Street Berlin, NH 03570-0336
Facility Physical Location:	Bean Brook Road, Success, New Hampshire
Permit #:	DES-SW-88-029

2.0 Closure Schedule

As of this closure revision, approximately 36.5 acres of the 67-acre footprint are covered with temporary HDPE geomembrane. No areas of the landfill are permanently capped. Temporary cover is removed and deployed as filling progresses and repairs are made as necessary.

It is anticipated that the closure of the landfill will take place in multiple construction phases. Construction of the active gas collection system will progress as to expand coverage into recently placed waste as lifts are completed. ~~Gas~~As gas wells~~, which~~ fail over time, they will be replaced as necessary.

Phases I & II have been constructed and are operational. Phase IIIA is anticipated to be~~ing~~ constructed~~ioned~~ion in 2022 and begin operation in 2025. Based on the current permitted ~~maximum~~average filling rate of 305,500 cy/year, Phases I & II inclusive of Stage 1 through Stage 12, will reach full capacity in ~~2023~~mid 2026 and Phase IIIA will reach full capacity in mid 2041. The landfill is currently permitted through Phase III from the original permit in 1988. B~~, b~~oth parts of Phase III require additional permitting to meet current standards. Phase III A&B will reach full capacity in ~~2049~~2052 based on the same filling rate. The Phase III final closure grades, ~~which were~~which were permitted in 1988 and include Phase IIIA&B, are shown in Figure 1.

Disposal operations will cease when the landfill is filled to final grades. Prior to that time, the gas management system will be ~~expanded and final~~ expanded through newly filled areas. Final cover will be constructed over ~~those~~ areas ~~which~~that have ~~not yet received final cover~~reached final closure grades and have an active gas management system installed. It is anticipated that each phase of cap construction will take place in accordance with the schedule outlined below.

	Work Item	Time Frame (in weeks)
1	NHDES Closure Permit	6
2	NHDES review and approval	4~~2~~6
3	Gas collection system expansion (Includes installation of gas wells and associated well heads, laterals, header piping and valves)	~~8~~10
4	Fine grade intermediate cover	2~~1~~

5	Placement of Gas Transmission Layer	~~2~~3
6	Installation of geomembrane, drainage geocomposite and drainage layer	14~~0~~
7	Placement of moisture retention layer, topsoil, and hydroseeding	6~~4~~

3.0 Waste Identification

Waste materials that have been accepted for disposal in the Mt. Carberry Secure Landfill are identified in Section 2.1 of the Operating Plan and include: ~~municipal, residential, commercial, and industrial solid waste, demolition debris, and non-hazardous wastes from the paper and pulp mills in the area. Asbestos wastes have been accepted for disposal and placed within designated areas. Special non-hazardous solid wastes may also be disposed at the facility following receipt of NHDES approval for acceptance of such wastes. The list of accepted waste, as found in the Operating Plan, are as follows:~~

- Non-mill Wastes:
  - Municipal solid wastes (MSW), as defined in Env-SW 103.47;
  - Construction and demolition debris (C&D), as defined in Env-SW 102.42;
  - Auto Shredder and Metal Shredder Residue;
  - Bulky wastes, as defined in Env-SW 102.33;
  - Wastewater treatment plant sludge from the Town of Gorham and the City of Berlin and other towns approved by the District. Any sludge not previously approved will have a Special Waste Review (See Operating Plan);
  - Asbestos, as defined in Env-SW 102.14;
  - Infectious wastes, as defined in Env-SW 103.28 treated to the standards specified in Env-SW 904.03(a);
  - Ash, as defined in Env-SW 102.22 for bottom ash and in Env-SW 103.07 for fly ash;
  - Soils and other absorbent media with contamination ~~(see definition in section 2.2 below);~~;
  - Approved alternative daily cover materials listed below ~~(also see Section 3 and Appendix E);~~;
    - Waste Derived Product #6 – C&D and Soil or Sludge (maximum 50% wood mixture);
    - Waste Derived Product #9 – Auto Shredder Residue & Kiln Dust;
    - Waste Derived Product #10 – Wood-fired Boiler Bottom Ash;
    - Waste Derived Product #13 – Biosolids Incinerator Ash (bottom ash); and
    - Waste Derived Product #14 – Metal Shredder Residue.
- Gorham Paper & Tissue Mill (GPT) generated mill wastes:
  - Lime waste;
  - Wastewater Treatment Plant Sludge from Gorham Paper Mill;
  - Grit;
  - Mill trash;
  - Off-spec mill products;
  - Asbestos; and
  - Demolition debris.

4.0 Notifications

Those users with waste disposal contracts with the facility will be notified by registered mail at least 60 days prior to the time when it is anticipated that the facility will cease accepting waste. The Waste Management Division is to be notified with the filing of a Notice of Intent to Close. The Notice is to contain the information required by Env-Sw 1106.02 including, the date the facility intends to stop receiving waste, a reference to the approved Closure Plan, and the date the facility intends to commence closure activities.

5.0 Closure Requirements

Major work tasks required for facility closure are listed under the closure schedule in Section 2. The following is a description of each task

1. Closure Permitting – The District will prepare and submit to the NHDES the required permitting documents for closure which includes closure design plans, construction technical specifications, and any revisions to the operating or closure plan.

2. NHDES Review & Approval – The District will address any NHDES comments or provide additional information for closure approval.

3. Gas Collection System – The landfill gas collection system in the proposed closure area will be expanded or improvements will be made to provide collection following closure.

4. Fine Grading – The proposed closure area will be graded as necessary to reach permitted grades, to promote even settlement, and provide adequate drainage. Granular borrow or other intermediate cover materials may be used to cover waste and fill in low areas as to provide a level surface free of protruding objects.

5. Gas Transmission Layer – The gas transmission layer consists of select sand and is installed just beneath the geomembrane cap. Work required includes placing select sand over granular borrow or intermediate cover.

6. Installation of Geomembrane, Geocomposite, and Drainage Layer – This work item includes deployment, welding, and test of the geomembrane cap. Also included is the installation of the drainage geocomposite and ~~¾" crushed stone~~select sand for stormwater runoff management.

7. Placement of Moisture Retention Layer, Topsoil, and Hydroseeding – Lastly, ~~glacial till~~moisture retention soil and topsoil are to be installed above the ~~crushed stone~~select sand drainage layer. The finished grades are to be hydroseeded and stabilized as to prevent erosion. This work will also include constructing the intermediate drainage benches, which manage the capping system stormwater.

6.0 Post-Closure Requirements

Following facility closure, post-closure monitoring is to be performed. The purpose of post-closure monitoring is to observe that the physical integrity of the site is maintained and to perform groundwater and landfill gas monitoring. Formal inspections of facility systems are to be performed no less than twice each year. The report following each formal inspection is to be submitted to NHDES. Observations of site conditions are also to be made during routine

monitoring. Items not performing as intended are to be repaired in a timely manner to maintain the integrity of the closed landfill. Post-closure monitoring is to be performed in accordance with applicable law. Reductions in monitoring frequency for various post-closure tasks may be requested if data demonstrates the item is stabilizing.

Post-closure monitoring will involve:

- Review of the site perimeter to assure that access to the site is restricted. A fence will be provided around the facility to restrict access to the site. Access to the property will be maintained via the main gate to permit post-closure monitoring;
- Inspection of the stormwater management system, including culverts, swales, catch basins and the detention ponds. The stormwater detention ponds will be cleaned to assure that they function as intended. Culverts will be checked to see that they are clear and sediments that have accumulated in swales will be removed. Catch basins will be cleared of sediment, debris, and any blockage;
- Inspection of landfill cap to note that vegetation is well established and has been mowed as required to prevent trees and shrubs from growing on the cap and to look for evidence of settlement or damage due to erosion. The surface of the landfill will be monitored for settlement. Benchmarks and control points have been established at the site to provide survey control for topographic surveys of the final cap;
- Settlement identified during the post-closure inspections which results in ponding or impedes drainage will be repaired. In the event there is erosion of the cover soils, the damage is to be repaired and the cause investigated and eliminated to the extent practical;
- Monitoring the perimeter berm for evidence of erosion. Any damage noted is to be repaired and the cause determined and addressed;
- Inspection of the gas management system in accordance with the requirements outlined in the Gas System Operation and Maintenance Manual;
- Inspection of the leachate collection system appurtenances to include checking cleanouts, leachate sewer manholes, the storage pond, valves, and flume to determine that they are functioning properly. Primary leachate is sampled and analyzed quarterly in accordance with the City Leachate Agreement and as outlined in Env-Sw *806.08(d)5.* A consistent and abnormal increase in the rate of leachate removed from the facility is to be investigated to assess the cause;
- Reviewing the performance of the leak detection system by monitoring flows in the secondary leachate collection system. In the event the flow steadily increases above historic levels, an investigation as to the cause is to be conducted;
- Groundwater and surface water quality monitoring in accordance with the Groundwater Permit for the facility. Groundwater monitoring wells will be checked during each sampling round. Damage to a well or its protective casing will be repaired to facilitate continued usage of the well; and
- Landfill gas monitoring will be conducted in accordance with the current Gas Monitoring Plan.

7.0 Record Keeping and Reporting

Within 30 days following each inspection, a report is to be provided in duplicate to the Waste Management Division of NHDES signed by a person duly authorized to sign for and on behalf of the District. Both copies of the report are to bear an original signature. In addition to the inspection reports, an annual report is to be filed for the facility containing the information outlined in Env- Sw 1105.14 including an evaluation of environmental monitoring data and other information pertaining to facility conditions. The report is to include a statement by a Professional Engineer identifying whether the facility is achieving post-closure performance expectations and whether adjustments to the post closure monitoring and maintenance provisions are recommended in light of the performance evaluation.

Following closure, facility records are to be maintained at the District office. Records are not to be moved or destroyed unless such action is approved by NHDES pursuant to a Type V Permit Modification.

8.0 Other Permits

A Type II Permit Modification is required prior to closure construction. At this time it is not anticipated that any post-closure permits will be required. Permits such as the facility's Groundwater Release Detection Permit will be renewed as required.

9.0 Closure Cost Estimate

A closure cost estimate calculated assuming a third party performs closure and post-closure activities in accordance with this Closure Plan is attached. The costs incorporated are based on bid prices for similar projects and the District's experience at this facility. Post-closure costs have been calculated for a 30-year post-closure period and presented in present ~~2019~~2020 dollars in Attachment B. The closure cost estimate is to be updated as appropriate to reflect modifications to the Closure Plan, or as new landfill phases are developed or portions of the facility are closed.

Androscoggin Valley Regional Refuse Disposal District
Mt. Carberry Secure Landfill
Phase IIIA Closure Drawings

April 2020

Sheet Index

Sheet 1 - Cover Sheet

Sheet 2 - Phase IIIA - Proposed Final Waste Grades

Sheet 4 - Closure Details

Sheet 5 - Closure Details



Facility Permit: DES-SW-88-029



Locus Plan

Prepared For:

Androscoggin Valley Regional Refuse Disposal District
3 Twelfth Street
Berlin, New Hampshire 03570

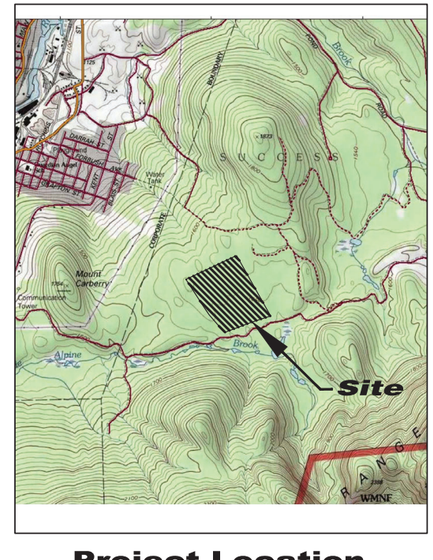
Prepared By:

CMA ENGINEERS
CIVIL /ENVIRONMENTAL ENGINEERS

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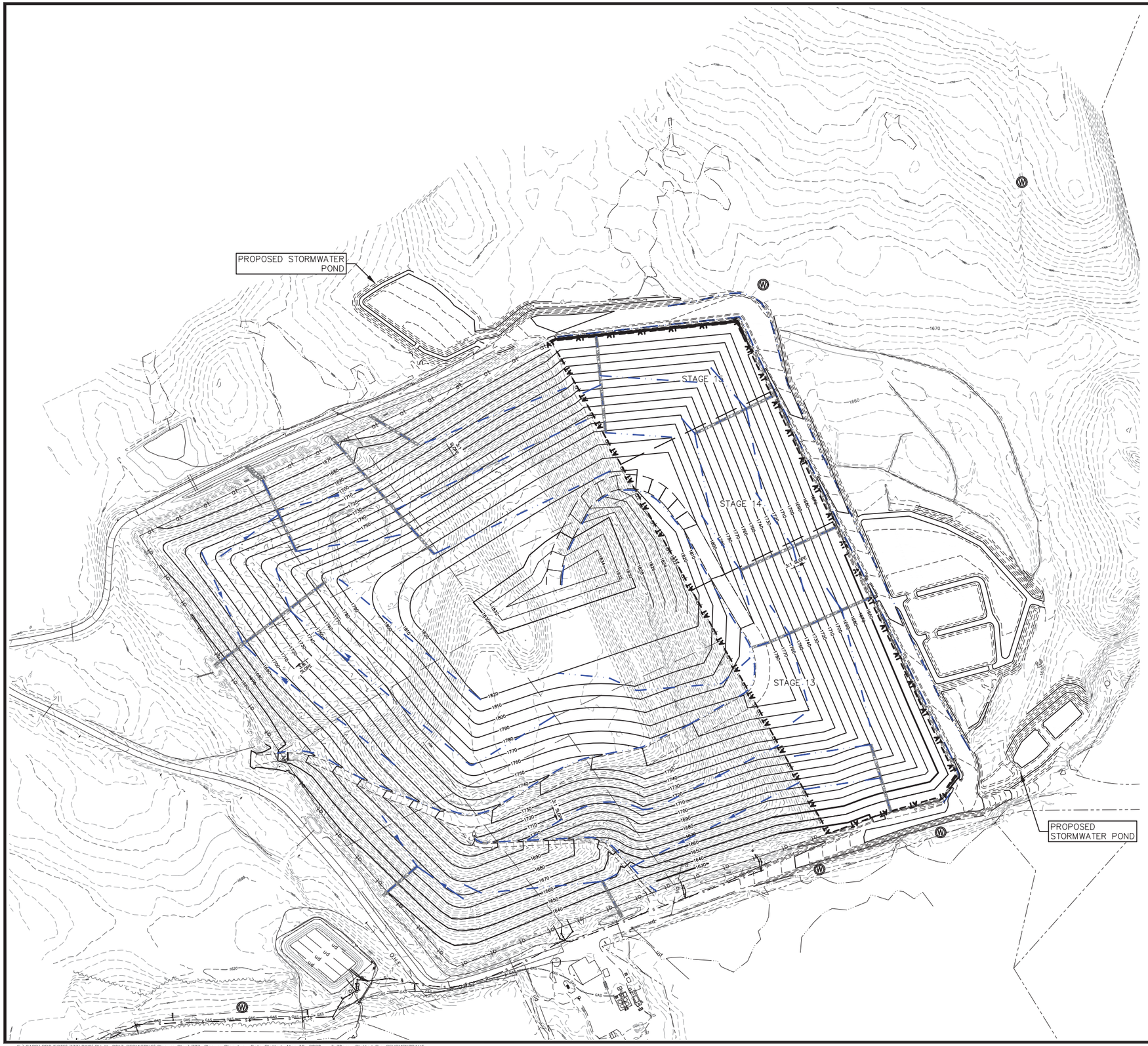
1 Sundial Avenue
Suite 510N
Manchester, New Hampshire 03103
Phone: 603/627-0708
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10 Free Street
Second Floor
Portland, Maine 04101
Phone: 207/541-4223
Fax: 207/541-4225



Project Location
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Notes:

1. Existing conditions and topography is a compilation from a field survey of the entire landfill area performed on full landfill October 4, 2019, at which time there was no active area. Topography is based on NGVD83.
2. Proposed grades represent top of waste.
3. The approximate Stage 12 capacity is 4,948,000 CY and is the air capacity above the permitted grades of Stage 5&6 and Stage 11&12.

Legend:

- Existing 2' Contour
- 1700 — Existing 10' Contour
- Existing Edge of Gravel Road
- at — at — at — Anchor Trench
- Cell Division
- Stage 10 & 11 Horizontal Limit
- CMW-202 — Existing Groundwater Monitoring Well
- P-06-07 — Existing Piezometer
- GW27 — Existing Gas Well
- Proposed Monitoring Wells
- Existing Cleanout
- Stage 12 Top of Waste 2 'Contour
- 1700 — Stage 12 Top of Waste 10 'Contour
- Proposed Gravel Access Road
- Proposed Intermediate Drainage Swale
- Proposed Rip Rap Dropchute

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c m a e n g i n e e r s . c o m

PAUL D. SCHMIDT No. 9625 Licensed Professional Engineer — State of New Hampshire

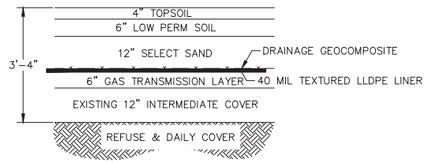
designed by: PDS
drawn by: PDS/SJE
approved by: PDS
date: April 2020
project no: 777
file name: 777-Closure Plan.dwg
scale: 100' 200' Scale: 1" = 100'

Androscoggin Valley Regional Refuse Disposal District
Mt. Carberry Landfill

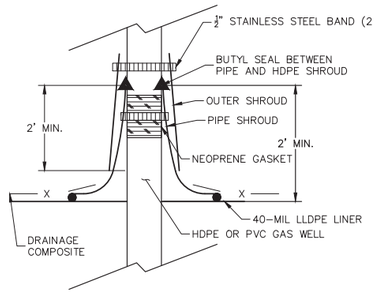
Phase IIIA Development
Proposed Final Grading Plan

drawing no. 2
sheet: 2 of 4

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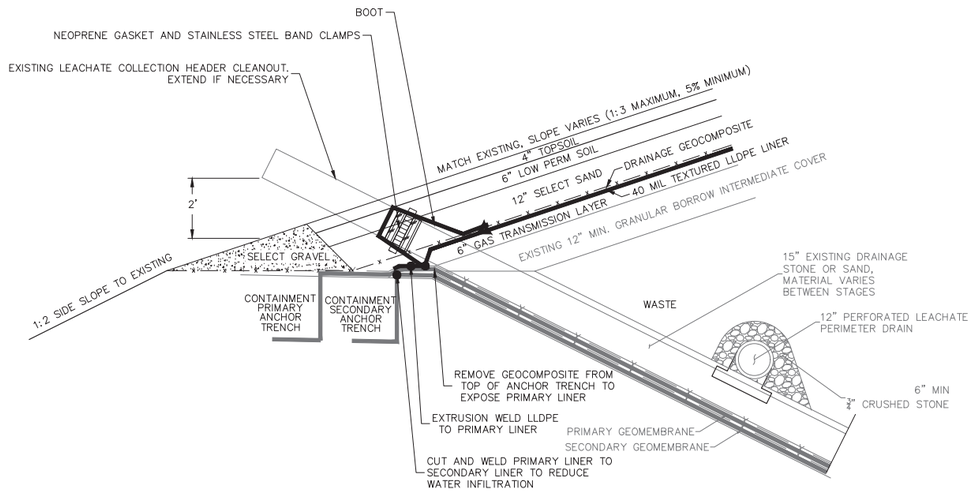


Final Capping System — 1/2



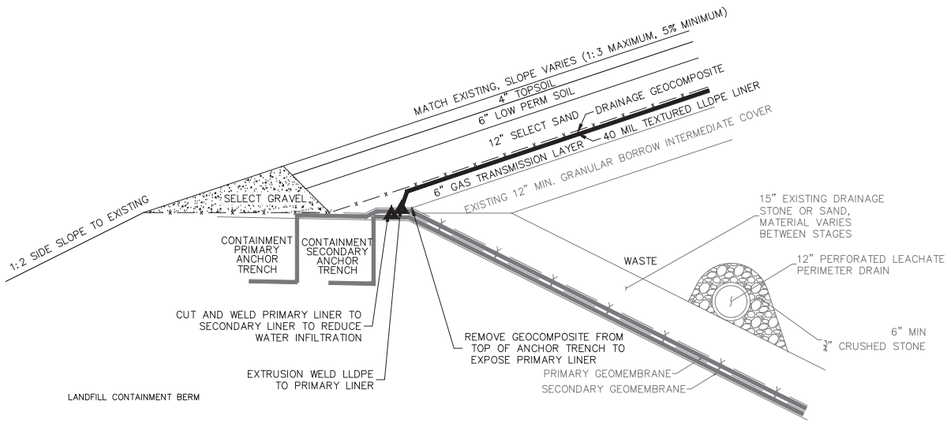
Gas Well Boot Detail — 2/-

Not to Scale



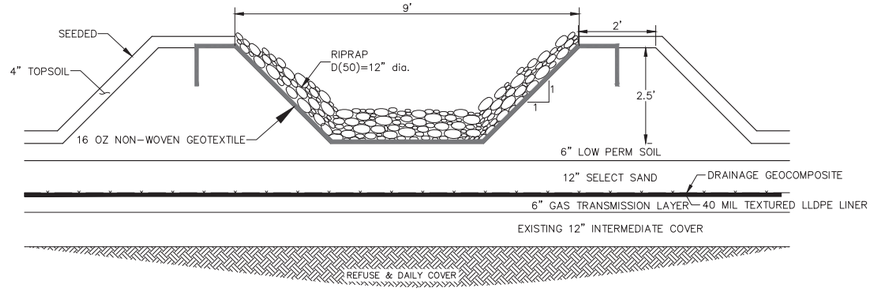
Leachate Perimeter Piping System/Clean Water Perimeter Piping System — 3/2

Not to Scale



Typical Anchor Trench — 4/2

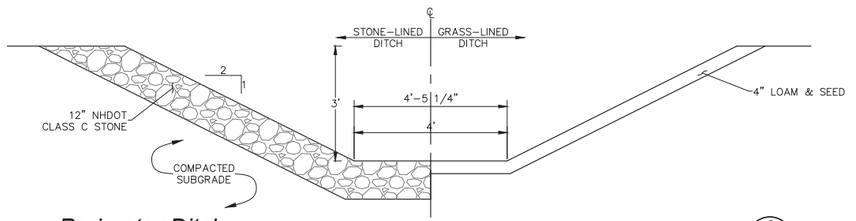
Not to Scale



Rip Rap Dropchute — 5/2

Not to Scale

NOTES:
1. PERIMETER DITCH IS EXISTING AROUND ENTIRE LANDFILL.
2. PROPOSED CAPPING SYSTEM DRAINAGE TO TIE INTO EXISTING PERIMETER DITCH.
3. PERIMETER DITCH IS EITHER STONE-LINED OR GRASS-LINED. SEE SITE PLAN FOR EXISTING LOCATIONS OF STONE-LINED DITCH AND GRASS-LINE DITCH. DITCH IS SYMMETRICAL.



Perimeter Ditch — 6/2

Not to Scale

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NEW HAMPSHIRE - PAUL D. SCHMIDT No. 8181 LICENSED PROFESSIONAL ENGINEER

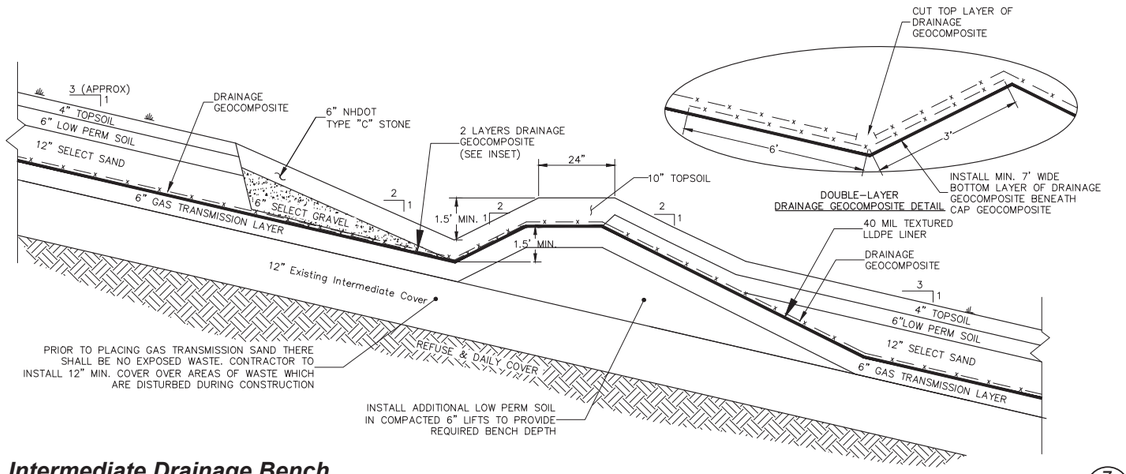
no.	revision	date	by

designed by: PDS
drawn by: PDS/SJE
approved by: PDS
date: April 2020
project no: 777
file name: 777-Closure Details-20200211.dwg
scale: 40' 20' 0 Scale 1" = 20'

Androscoggin Valley Regional Refuse Disposal District
Mt. Carberry Landfill
Phase IIIA Closure Plan Details

drawing no. D-1
sheet: 3 of 4

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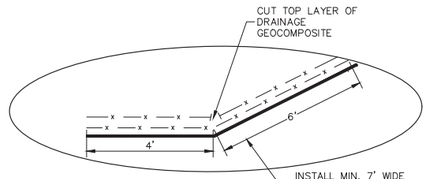
Intermediate Drainage Bench

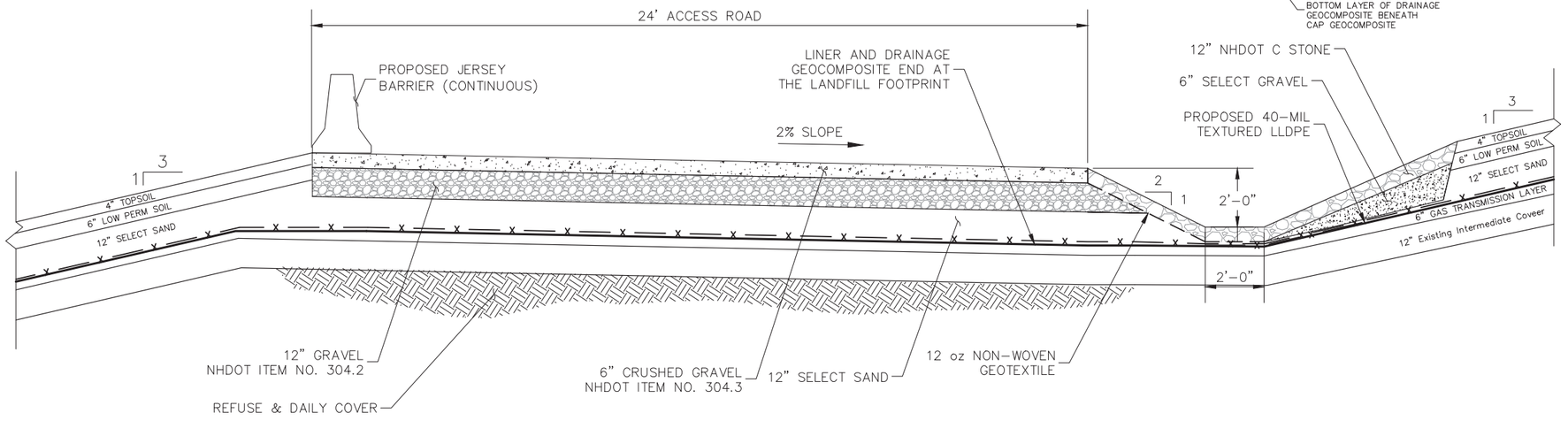
Not to Scale

7/2

NOTES:

1. DRAINAGE BENCHES SHALL BE NEWLY CONSTRUCTED AT THE SPACING SHOWN ON THE PLANS AT A MINIMUM 3% SLOPE.
2. EXISTING INTERMEDIATE COVER THICKNESS AT SWALES ARE APPROXIMATE AND NOT VERIFIED. CONTRACTOR IS RESPONSIBLE FOR VERIFYING EXISTING CONDITIONS AND RELOCATING INTERMEDIATE COVER (AS NECESSARY) TO ACHIEVE REQUIRED BENCH DEPTH AND CROSS SECTION.
3. LOW PERM SOIL FILL SHALL BE USED TO SHAPE DRAINAGE BENCH AND SHALL BE COMPACTED IN 6" LIFTS TO FORM STABLE SUBGRADE.





Typical Gravel Roadway Section - Haul Road

Not to Scale

8/2

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PAUL D. SCHMIDT No. 9825 LICENSED PROFESSIONAL ENGINEER STATE OF NEW HAMPSHIRE

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Androscoggin Valley Regional Refuse Disposal District
Mt. Carberry Landfill
Phase IIIA Closure Plan Details

drawing no. D-2
sheet: 4 of 4