PROJECT NARRATIVE

Project Description

The subject parcel consists of City of Concord Tax Map 781Z Lot 31, with 173-feet of frontage on the southern side of Manchester Street, and 170-feet of frontage on the northern side of Black Hill Road. The subject parcel is 0.94-acres and within the Gateway Performance (GWP) zoning district. The parcel is currently home to an Enterprise Rent-A-Car, a personal car rental facility containing a 900 square foot building with 360 square foot attached garage. The site also contains marked parking spaces and additional unmarked parking areas for vehicle inventory display and storage. The facility is accessed through an existing curb cut along the Manchester Street frontage and the Black Hill Road frontage.

The existing facility is connected to municipal water and sewer utilities. An onsite stormwater management system, approved by the City of Concord in 2003, collects onsite stormwater runoff for detention and releases into the municipal system through a standard drain manhole with 18" concrete outlet pipe.

The proposed improvements are associated with the removal of the existing one bay garage and replacement with a two-bay garage to facilitate greater efficiency of all season cleaning of the rental vehicles. The proposed condition will create an additional 950 SF of impervious area in the form of pavement and roof area. This project also proposes improvements to the existing stormwater infrastructure on site. These improvements are the addition of pre-treatment forebays and infiltration basins within the two existing grass swales located along the east and west pavement boundaries.

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Waiver Request Form – Site Plan Regulations

Instructions:

1. List the section for which the waiver is being requested, along with a brief explanation of the request.
2. Explain how the waiver request complies with each criterion.

Section 36.08 *Waivers: Where the Planning Board finds that extraordinary hardships or practical difficulties may result from strict compliance with these regulations and/or the purposes of these regulations may be served to a greater extent by an alternative proposal, it may approve waivers to these subdivision regulations so that substantial justice may be done and the public interest secured, provided that such waiver shall not have the effect of nullifying the intent and purpose of these regulations…*

Waiver from Section Section 15.04(26) - Lighting Plan

A waiver to allow a minor site plan application to omit a lighting plan.

and further provided the Planning Board shall not approve waivers unless it shall make findings based upon the evidence presented to it in each specific case that:

(1) The granting of the waiver will not be detrimental to the public safety, health, or welfare or injurious to other property; This project does not remove any of the approved existing lighting fixtures from the project site nor does this project propose the addition of lighting fixtures. Additionally, there is no requirement for lighting in parking and loading areas. Neither safety, health, welfare, nor abutting properties will be detrimentally impacted by allowing this waiver.

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(2) *The conditions upon which the request for a waiver is based are unique to the property for which the waiver is sought and are not applicable generally to other property;* The proposed improvement plan has no change to existing approved lighting nor additional proposed lighting fixtures.

(3) *Because of the particular physical surroundings, shape, or topographical conditions of the specific property involved, a particular and unnecessary hardship to the owner would result, as distinguished from a mere inconvenience, if the strict letter of these regulations are carried out;* The intent of the improvement plan is to not impact the approved existing lighting of the property with the removal or addition of lighting fixtures.

(4) *Specific circumstances relative to the subdivision or conditions of the land in such subdivision indicate that the waiver will property carry out, or not be contrary to, the spirit and intent of the regulations; and* Allowing the waiver is not contrary to the spirit and intent of the regulation because the Site Plan Regulations do not contain a requirement for parking and loading area illumination.

(5) *The waiver will not in any manner vary the provisions of the Zoning Ordinance, Master Plan Reports, or Official Map.* Allowing this waiver will not distort the provisions of the Zoning Ordinance, Master Plan Reports, or Official Maps. This waiver only pertains to inclution of a lighting plan as part of a minor site plan application.

Finally, note if the waiver complies with RSA 674:44(III)(e)(1) or (2) below and explain how.

(1) Strict conformity would pose an unnecessary hardship to the applicant and waiver would not be contrary to the spirit and intent of the regulations

OR

(2) Specific circumstances relative to the site plan, or conditions of the land in such site plan, indicate that the waiver will properly carry out the spirit and intent of the regulations Allowing the waiver will preserve the spirit and intent of the regulation by maintaining the existing approved lighting plan.

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2. Explain how the waiver request complies with each criterion.

Section 36.08 *Waivers: Where the Planning Board finds that extraordinary hardships or practical difficulties may result from strict compliance with these regulations and/or the purposes of these regulations may be served to a greater extent by an alternative proposal, it may approve waivers to these subdivision regulations so that substantial justice may be done and the public interest secured, provided that such waiver shall not have the effect of nullifying the intent and purpose of these regulations…*

Waiver from Section *Section 18.10 - Driveway Width*

A Waiver to permit the continued use of an existing 36-ft wide driveway, where 28-ft is the maximum width allowed.

and further provided the Planning Board shall not approve waivers unless it shall make findings based upon the evidence presented to it in each specific case that:

(1) The granting of the waiver will not be detrimental to the public safety, health, or welfare or injurious to other property; The waiver is to allow an existing driveway onto Manchester Street to remain unaltered as part of the expansion of the garage structure on the subject property. The current approved entrance has allowed operation for many years without impact to public safety, health, or welfare of the other properties.

(2) *The conditions upon which the request for a waiver is based are unique to the property for which the waiver is sought and are not applicable generally to other property;* This project disturbs approximately 6,500 sf of the subject parcel none of which is in the vicinity of the existing driveway onto Manchester Street nor a city right of way. This project combined with the layout of the property will have minimal impact to neighboring properties as well as minimal impacts to the city right of way on Manchester Street during construction.

(3) *Because of the particular physical surroundings, shape, or topographical conditions of the specific property involved, a particular and unnecessary hardship to the owner would result, as distinguished from a mere inconvenience, if the strict letter of these regulations are carried out;* As part of the overall plan it is the projects intenet to not impact the existing parking, driveways, or drive isles of this site. If the letter of the regulation were carried out this significantly increase; the area of disturbed land, the duration of the construction, impacts to the Manchester Street right of way, and the total cost of the project.

(4) *Specific circumstances relative to the subdivision or conditions of the land in such subdivision indicate that the waiver will property carry out, or not be contrary to, the spirit and intent of the regulations; and* The spirit and intent of the regulation will be met by allowing the existing approved driveway to not be impacted by the improvements proposed as part of the minor site plan application.

(5) *The waiver will not in any manner vary the provisions of the Zoning Ordinance, Master Plan Reports, or Official Map.*

Accepting this waiver will not distort the provisions of the Zoning Ordinance, Master Plan, or Offfical Maps, as it is currently an existing condition.

Finally, note if the waiver complies with RSA 674:44(III)(e)(1) or (2) below and explain how.

(1) Strict conformity would pose an unnecessary hardship to the applicant and waiver would not be contrary to the spirit and intent of the regulations

OR

(2) Specific circumstances relative to the site plan, or conditions of the land in such site plan, indicate that the waiver will properly carry out the spirit and intent of the regulations

Allowing the waiver will preserve the spirit and intent of the regulation by containing all construction activities associated with the minor site plan to within the property boundaries of the subject site. Improving safety to the public by significantly reducing the impact to the Manchester Street right of way during construction.

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Waiver Request Form – Site Plan Regulations

Instructions:

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2. Explain how the waiver request complies with each criterion.

Section 36.08 *Waivers: Where the Planning Board finds that extraordinary hardships or practical difficulties may result from strict compliance with these regulations and/or the purposes of these regulations may be served to a greater extent by an alternative proposal, it may approve waivers to these subdivision regulations so that substantial justice may be done and the public interest secured, provided that such waiver shall not have the effect of nullifying the intent and purpose of these regulations…*

Waiver from Section Section 19.05 - Interconnected Parking Lots

A waiver to allow the applicant to not provide an interconnection between parking areas with adjacent parcels.

and further provided the Planning Board shall not approve waivers unless it shall make findings based upon the evidence presented to it in each specific case that:

(1) The granting of the waiver will not be detrimental to the public safety, health, or welfare or injurious to other property; This waiver is to not provide an interconnection between parking areas of adjacent parcels along an arterial street. The subject site has driveway access to Black Hill Road and can be used as a connection between adjacent non-residential properties. Granting this waiver would not be detrimental to public safety, health, or welfare of other properties.

(2) *The conditions upon which the request for a waiver is based are unique to the property for which the waiver is sought and are not applicable generally to other property;*

The subject site contains existing driveway access to Black Hill Road. Black Hill Road acts as an access road to future adjacent commercial properties as development continues in the area. This eliminates the need for a dedicated parking area connection

(3) *Because of the particular physical surroundings, shape, or topographical conditions of the specific property involved, a particular and unnecessary hardship to the owner would result, as distinguished from a mere inconvenience, if the strict letter of these regulations are carried out;*

The subject site contains existing driveway access to Black Hill Road. Black Hill Road acts as an access road to future adjacent commercial properties as development continues in the area. This eliminates the need for a dedicated parking area connection

(4) *Specific circumstances relative to the subdivision or conditions of the land in such subdivision indicate that the waiver will property carry out, or not be contrary to, the spirit and intent of the regulations; and*

The subject site contains existing driveway access to Black Hill Road. Black Hill Road acts as an access road to future adjacent commercial properties as development continues in the area. This eliminates the need for a dedicated parking area connection.

(5) *The waiver will not in any manner vary the provisions of the Zoning Ordinance, Master Plan Reports, or Official Map.* Accepting this waiver will not distort the provisions of the Zoning Ordinance, Master Plan, or any Official Maps as an existing access is available from Black Hill Road

Finally, note if the waiver complies with RSA 674:44(III)(e)(1) or (2) below and explain how.

(1) Strict conformity would pose an unnecessary hardship to the applicant and waiver would not be contrary to the spirit and intent of the regulations

OR

(2) Specific circumstances relative to the site plan, or conditions of the land in such site plan, indicate that the waiver will properly carry out the spirit and intent of the regulations The subject site contains existing driveway access to Black Hill Road. Black Hill Road acts as an access road to future adjacent commercial properties as development in the area continues. This eliminates the need for a dedicated parking area connection

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Waiver Request Form – Site Plan Regulations

Instructions:

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2. Explain how the waiver request complies with each criterion.

Section 36.08 *Waivers: Where the Planning Board finds that extraordinary hardships or practical difficulties may result from strict compliance with these regulations and/or the purposes of these regulations may be served to a greater extent by an alternative proposal, it may approve waivers to these subdivision regulations so that substantial justice may be done and the public interest secured, provided that such waiver shall not have the effect of nullifying the intent and purpose of these regulations…*

Waiver from Section Section 15.04(2) - Abutting Property Labels on Site Plan

A waiver from the requirement that the Proposed Site Plan display all abutting properties.

and further provided the Planning Board shall not approve waivers unless it shall make findings based upon the evidence presented to it in each specific case that:

(1) The granting of the waiver will not be detrimental to the public safety, health, or welfare or injurious to other property; The missing display of some abutting properties on the proposed site plan is not detrimental to the public safety, health, or welfare or injurious to other property.

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(2) *The conditions upon which the request for a waiver is based are unique to the property for which the waiver is sought and are not applicable generally to other property;*

This is a minor site plan application displaying the proposed site plan sheet at 1":20'. At this scale the details are most legible however the abutting properties located on the northern portion of Manchester Street are not visible on the site plan.

(3) *Because of the particular physical surroundings, shape, or topographical conditions of the specific property involved, a particular and unnecessary hardship to the owner would result, as distinguished from a mere inconvenience, if the strict letter of these regulations are carried out;*

The regulation does not materially affect the building or the site.

(4) *Specific circumstances relative to the subdivision or conditions of the land in such subdivision indicate that the waiver will property carry out, or not be contrary to, the spirit and intent of the regulations; and*

Granting this waiver will not be contrary to the spirit and intent of the regulation.

The abutting properties are displayed on the cover sheet as well as the existing conditions plan.

(5) *The waiver will not in any manner vary the provisions of the Zoning Ordinance, Master Plan Reports, or Official Map.*

This waiver will not vary the provisions of the zoning ordinance, master plan reports or official maps.

Finally, note if the waiver complies with RSA 674:44(III)(e)(1) or (2) below and explain how.

(1) Strict conformity would pose an unnecessary hardship to the applicant and waiver would not be contrary to the spirit and intent of the regulations

OR

(2) Specific circumstances relative to the site plan, or conditions of the land in such site plan, indicate that the waiver will properly carry out the spirit and intent of the regulations

Due to the small size of the proposed project a smaller scale is necessary to easily convey all required information for proper construction. Granting this waiver will properly carry out the spirit and intent of the regulation.

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Waiver Request Form – Site Plan Regulations

Instructions:

1. List the section for which the waiver is being requested, along with a brief explanation of the request.
2. Explain how the waiver request complies with each criterion.

Section 36.08 *Waivers: Where the Planning Board finds that extraordinary hardships or practical difficulties may result from strict compliance with these regulations and/or the purposes of these regulations may be served to a greater extent by an alternative proposal, it may approve waivers to these subdivision regulations so that substantial justice may be done and the public interest secured, provided that such waiver shall not have the effect of nullifying the intent and purpose of these regulations…*

Waiver from Section Section 15.04(13) - Municipal Sewer on Site Plan

A waiver from the requirement that the Proposed Site Plan display information relating to the municipal sewer.

and further provided the Planning Board shall not approve waivers unless it shall make findings based upon the evidence presented to it in each specific case that:

(1) The granting of the waiver will not be detrimental to the public safety, health, or welfare or injurious to other property; The display of the municipal sewer on the proposed site plan is not detrimental to the public safety, health, or welfare or injurious to other property. This information can be found on the grading and drainage plan.

(2) *The conditions upon which the request for a waiver is based are unique to the property for which the waiver is sought and are not applicable generally to other property;*

This is a minor site plan application displaying the proposed site plan sheet at 1":20'. At this scale the details are most legible however the municipal sewer is not shown to reduce clutter on the site plan. This information is shown on the grading and drainage plan.

(3) *Because of the particular physical surroundings, shape, or topographical conditions of the specific property involved, a particular and unnecessary hardship to the owner would result, as distinguished from a mere inconvenience, if the strict letter of these regulations are carried out;*

The regulation does not materially affect the building or the site.

(4) *Specific circumstances relative to the subdivision or conditions of the land in such subdivision indicate that the waiver will property carry out, or not be contrary to, the spirit and intent of the regulations; and*

Granting this waiver will not be contrary to the spirit and intent of the regulation. The relevant information is displayed on the grading and drainage plan.

(5) *The waiver will not in any manner vary the provisions of the Zoning Ordinance, Master Plan Reports, or Official Map.*

This waiver will not vary the provision of the zoning ordinance, master plan reports or official maps.

Finally, note if the waiver complies with RSA 674:44(III)(e)(1) or (2) below and explain how.

(1) Strict conformity would pose an unnecessary hardship to the applicant and waiver would not be contrary to the spirit and intent of the regulations

OR

(2) Specific circumstances relative to the site plan, or conditions of the land in such site plan, indicate that the waiver will properly carry out the spirit and intent of the regulations

Due to the small size of the proposed project, a smaller scale is necessary to easily convey all required information for proper construction. Granting this waiver will properly carry out the spirit and intent of the regulation.

The relevant information can be found on the grading and drainage plan.

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Section 36.08 *Waivers: Where the Planning Board finds that extraordinary hardships or practical difficulties may result from strict compliance with these regulations and/or the purposes of these regulations may be served to a greater extent by an alternative proposal, it may approve waivers to these subdivision regulations so that substantial justice may be done and the public interest secured, provided that such waiver shall not have the effect of nullifying the intent and purpose of these regulations…*

Waiver from Section Section 15.04(14) - Drainage and Erosion Control on Site Plan

A waiver from the requirement that the Proposed Site Plan display information relating to drainage and erosion control.

and further provided the Planning Board shall not approve waivers unless it shall make findings based upon the evidence presented to it in each specific case that:

(1) The granting of the waiver will not be detrimental to the public safety, health, or welfare or injurious to other property; The display of drainage and erosion control on the proposed site plan is not detrimental to the public safety, health, or welfare or injurious to other property. This information can be found on the grading and drainage plan and the erosion control plan.

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(2) *The conditions upon which the request for a waiver is based are unique to the property for which the waiver is sought and are not applicable generally to other property;*

This is a minor site plan application displaying the proposed site plan sheet at 1":20'. At this scale the details are most legible however the drainage and erosion control elements are not shown to reduce clutter on the site plan. This information is shown on the grading and drainage plan and the erosion control plan.

(3) *Because of the particular physical surroundings, shape, or topographical conditions of the specific property involved, a particular and unnecessary hardship to the owner would result, as distinguished from a mere inconvenience, if the strict letter of these regulations are carried out;*

The regulation does not materially affect the building or the site.

(4) *Specific circumstances relative to the subdivision or conditions of the land in such subdivision indicate that the waiver will property carry out, or not be contrary to, the spirit and intent of the regulations; and*

Granting this waiver will not be contrary to the spirit and intent of the regulation. The relevant information is displayed on the grading and drainage plan and the erosion control plan.

(5) *The waiver will not in any manner vary the provisions of the Zoning Ordinance, Master Plan Reports, or Official Map.*

This waiver will not vary the provisions of the zoning ordinance, master plan reports or official maps.

Finally, note if the waiver complies with RSA 674:44(III)(e)(1) or (2) below and explain how.

(1) Strict conformity would pose an unnecessary hardship to the applicant and waiver would not be contrary to the spirit and intent of the regulations

OR

(2) Specific circumstances relative to the site plan, or conditions of the land in such site plan, indicate that the waiver will properly carry out the spirit and intent of the regulations

Due to the small size of the proposed project a small scale is necessary to easily convey all required information for proper construction. Granting this waiver will properly carry out the spirit and intent of the regulation.

The pertinent information is contained within in the plan set on the grading and drainage plan and the erosion control plan.

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Waiver from Section Section 15.04(17) - Municipal Water Supply on Site Plan

A waiver from the requirement that the Proposed Site Plan display information relating to the municipal water supply.

and further provided the Planning Board shall not approve waivers unless it shall make findings based upon the evidence presented to it in each specific case that:

(1) The granting of the waiver will not be detrimental to the public safety, health, or welfare or injurious to other property; The display of the municipal water supply on the proposed site plan is not detrimental to the public safety, health, or welfare or injurious to other property. This information can be found on the grading and drainage plan.

(2) *The conditions upon which the request for a waiver is based are unique to the property for which the waiver is sought and are not applicable generally to other property;*

This is a minor site plan application displaying the proposed site plan sheet at 1":20'. At this scale the details are most legible however the municipal water supply is not shown to reduce clutter on the site plan. This information is shown on the grading and drainage plan.

(3) *Because of the particular physical surroundings, shape, or topographical conditions of the specific property involved, a particular and unnecessary hardship to the owner would result, as distinguished from a mere inconvenience, if the strict letter of these regulations are carried out;*

The regulation does not materially affect the building or the site.

(4) *Specific circumstances relative to the subdivision or conditions of the land in such subdivision indicate that the waiver will property carry out, or not be contrary to, the spirit and intent of the regulations; and*

Granting this waiver will not be contrary to the spirit and intent of the regulation. The relevant information is displayed on the grading and drainage plan.

(5) *The waiver will not in any manner vary the provisions of the Zoning Ordinance, Master Plan Reports, or Official Map.*

This waiver will not vary the provisions of the zoning ordinance, master plan reports or official maps.

Finally, note if the waiver complies with RSA 674:44(III)(e)(1) or (2) below and explain how.

(1) Strict conformity would pose an unnecessary hardship to the applicant and waiver would not be contrary to the spirit and intent of the regulations

OR

(2) Specific circumstances relative to the site plan, or conditions of the land in such site plan, indicate that the waiver will properly carry out the spirit and intent of the regulations

Due to the small size of the proposed project a smaller scale is necessary to easily convey all required information for proper construction. Granting this waiver will properly carry out the spirit and intent of the regulation.

The relevant information is displayed on the grading and drainage plan.

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Section 36.08 *Waivers: Where the Planning Board finds that extraordinary hardships or practical difficulties may result from strict compliance with these regulations and/or the purposes of these regulations may be served to a greater extent by an alternative proposal, it may approve waivers to these subdivision regulations so that substantial justice may be done and the public interest secured, provided that such waiver shall not have the effect of nullifying the intent and purpose of these regulations…*

Waiver from Section Section 16.02(15) & 27.03 - Landscape Plans

A waiver to allow a minor site plan application to omit a stamped landscape plan showing the location of existing, required, and proposed landscaping, a plant schedule showing all proposed plant material, and landscape construction details.

and further provided the Planning Board shall not approve waivers unless it shall make findings based upon the evidence presented to it in each specific case that:

(1) The granting of the waiver will not be detrimental to the public safety, health, or welfare or injurious to other property; The purpose of the landscape plan as stated in section 27.01 is to "enhance visual quality of Concord's street scape, provide effective buffers, and better integrate the built and natural environment." This project is does not impact the existing approved landscape where the property interfaces with the public right of way. Any impacts to the existing approved landscape plan have been needed to facilitate the infiltration and peak flow reduction of storm water runoff. Neither safety, health, welfare, nor abutting properties will be detrimentally impacted by allowing this waiver.

(2) *The conditions upon which the request for a waiver is based are unique to the property for which the waiver is sought and are not applicable generally to other property;* The proposed site plan associated with this minor site plan application minimizes the impact to approved existing landscape plan. The trees that are to be removed and are part of the approved existing landscape plan are being removed to facilitate groundwater recharge and off site stormwater peak flow reduction.

(3) *Because of the particular physical surroundings, shape, or topographical conditions of the specific property involved, a particular and unnecessary hardship to the owner would result, as distinguished from a mere inconvenience, if the strict letter of these regulations are carried out;* If the letter of the law were to be carried out the required landscaping would only alter the existing approved landscaping due to other impervious areas of the site containing stormwater management infrastructure.

(4) *Specific circumstances relative to the subdivision or conditions of the land in such subdivision indicate that the waiver will property carry out, or not be contrary to, the spirit and intent of the regulations; and* Allowing the waiver is not contrary to the spirit and intent of the regulation because the subject site's existing approved landscape plan is only being altered to better facilitate stormwater management and groundwater recharge for the proposed site improvements.

(5) *The waiver will not in any manner vary the provisions of the Zoning Ordinance, Master Plan Reports, or Official Map.* Allowing this waiver will not distort the provisions of the Zoning Ordinance, Master Plan Reports, or Official Maps as this waiver is in keeping with the spirit and intent of the master plan and has no impact on the official map nor zoning ordinance.

Finally, note if the waiver complies with RSA 674:44(III)(e)(1) or (2) below and explain how.

(1) Strict conformity would pose an unnecessary hardship to the applicant and waiver would not be contrary to the spirit and intent of the regulations

OR

(2) Specific circumstances relative to the site plan, or conditions of the land in such site plan, indicate that the waiver will properly carry out the spirit and intent of the regulations Allowing the waiver will preserve the spirit and intent of the regulation by maintaining the existing approved landscape plan as much as practicable. Most notably in the vacinaty of the property boundry with the Manchester Street right of way, where the public most interfaces with the improvements on the property.

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Waiver Request Form – Site Plan Regulations

Instructions:

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2. Explain how the waiver request complies with each criterion.

Section 36.08 *Waivers: Where the Planning Board finds that extraordinary hardships or practical difficulties may result from strict compliance with these regulations and/or the purposes of these regulations may be served to a greater extent by an alternative proposal, it may approve waivers to these subdivision regulations so that substantial justice may be done and the public interest secured, provided that such waiver shall not have the effect of nullifying the intent and purpose of these regulations…*

Waiver from Section Section 16.03(3) - Bar Scale

A waiver from the requirement that the proposed building elevations be prepared with a bar scale be included on the plan.

and further provided the Planning Board shall not approve waivers unless it shall make findings based upon the evidence presented to it in each specific case that:

(1) The granting of the waiver will not be detrimental to the public safety, health, or welfare or injurious to other property; The proposed structure is a 24.5'x 34' garage for the preparation of vehicles prior to rental. The proposed architectural drawings have been provided by the client without a bar scale. The lack of a bar scale is not detrimental to to public safety, health or welfare nor injurious to other property.

(2) *The conditions upon which the request for a waiver is based are unique to the property for which the waiver is sought and are not applicable generally to other property;*

The proposed addition is simple stick framed garage and drawings have been provided by the client, from a third party, without a bar scale.

(3) *Because of the particular physical surroundings, shape, or topographical conditions of the specific property involved, a particular and unnecessary hardship to the owner would result, as distinguished from a mere inconvenience, if the strict letter of these regulations are carried out;*

The regulation does not materially affect the building or the site.

(4) *Specific circumstances relative to the subdivision or conditions of the land in such subdivision indicate that the waiver will property carry out, or not be contrary to, the spirit and intent of the regulations; and*

The proposed addition is simple stick framed garage and drawings have been provided by the client, from a third party, without a bar scale. Granting this waiver will not be contrary to the spirit and intent of the regulation

(5) *The waiver will not in any manner vary the provisions of the Zoning Ordinance, Master Plan Reports, or Official Map.*

This waiver will not vary the provisions of the zoning ordinance, master plan reports or official maps.

Finally, note if the waiver complies with RSA 674:44(III)(e)(1) or (2) below and explain how.

(1) Strict conformity would pose an unnecessary hardship to the applicant and waiver would not be contrary to the spirit and intent of the regulations

Conformity would impose an unnecessary economic hardship by requiring a bar scale that is not necessary and will not materially affect the proposal.

OR

(2) Specific circumstances relative to the site plan, or conditions of the land in such site plan, indicate that the waiver will properly carry out the spirit and intent of the regulations

AnneMarie Skinner, AICP
City Planner

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Zoning Board of Adjustment

June 4, 2025

Northpoint Engineering, LLC
119 Storrs St, Unit 201
Concord, NH 03301

RE: Notice of Decision – ZBA 0273-2025

Dear Mr. Lewis:

At a meeting of the Concord Zoning Board of Adjustment, held on June 4, 2025, the Board voted on the following:

Northpoint Engineering, LLC, on behalf of Skuffy's, LLC and Enterprise Mobility, requests approval for a variance from Section 28-4-1(d) *Minimum Yard Requirements*/(h) *Table of Dimensional Regulations*, to permit a minimum 18-foot side setback where 25 feet is the minimum side setback required, for the expansion of the existing garage, at Tax Map Lot 781Z 31, addressed as 28 Manchester St, in the Gateway Performance (GWP) District. Not a development of regional impact. (ZBA 0273-2025)

With a vote of 3 in favor (Perkins, Carley, Monahan) to 0 opposed, the Board granted the variance from Section 28-4-1(d) Minimum Yard Requirements/(h) Table of Dimensional Regulations to permit a minimum 18-foot side setback where 25 feet is the minimum side setback required at the address of 28 Manchester St, because all of the criteria under RSA 674:33 have been met based on the record before the Board, and the Board adopted the applicant's findings as the Board's findings of fact.

Adopted Findings of Fact:

1. *The variance will not be contrary to the public interest.* "This project allows the existing vehicle rental facility on the subject site to continue to offer their vital services in a convenient and walkable location, while making the task of washing and vacuuming their rental fleet safter, easier, and faster for their employees. In addition, this project is not expected to increase the amount of traffic generated by the subject property."

2. *The spirit of the ordinance is observed by granting the variance.* "The expansion of the non-conforming use is contained to the side-yard area of the parcel and is not significantly visible from Manchester Street. This maintains the existing approved appearance of the property from the public R.O.W., ensuring the spirit of the ordinance is observed."

3. *Substantial justice will be done by granting the variance.* "The purpose of the expanded garage area allows employees of the rental car business to clean and wash their inventory of vehicles in a more ergonomic and efficient way. This project will reduce the injuries and/or stresses to the employees related to the cleaning of vehicles and improve the work environment for employees of the business."

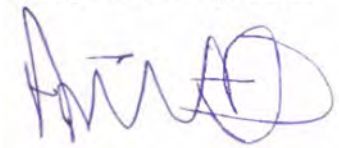
4. *The values of surrounding properties will not be diminished.* "This project does not significantly alter the physical appearance of the property when viewed from the public street. The existing structure and landscaping will screen the majority of the garage expansion. In addition, this project is not expected to impact the amount of traffic generated by the subject property. This project focuses on providing faster service and improved working conditions for the employees of the car rental business while maintaining the existing appearance of the subject property when viewed from the public R.O.W."

5. *Denial of the variance would result in unnecessary hardship because*: "Prior to 2003, the majority of the property had been located within the floodway, thus, any buildings or structures built on the property were confined to approximately 8,500-sf of the northeast corner of the parcel located outside of the floodway. Therefore, the property developer used the parcel's available buildable land to design and construct the site, to the best of their ability, as it currently exists. Today, the FEMA Flood Maps indicate the subject property is no longer located within the floodway. The redrawing of the floodway boundary allows for greater flexibility in building size and location on the property. If the floodway boundary, as it currently exists, had existed in 2003, when the last site improvements occurred, larger buildings would have been constructed in more suitable locations within the parcel, at that time. This garage expansion makes reasonable use of this greater flexibility in order to provide better working conditions for employees and faster service for any customers who are waiting for a car to be prepared prior to renting the vehicle."

If there is a significant change at any time in the future, you are hereby advised to discuss any proposed changes with the City Planner. If the use or construction authorized by this approval has not commenced within the two-year anniversary date of the original decision (or by **June 4, 2027**), it shall be deemed to have expired and authorization shall be considered null and void as specified in Section 28-9-3(b)(5) of the Zoning Ordinance.

Granting of a variance does not authorize construction or use prior to the application for and approval of site plan review, architectural design review, and/or subdivision review, as applicable. Granting of a variance does not authorize construction or use prior to the application for and issuance of a building permit, if applicable.

Zoning Board of Adjustment



AnneMarie Skinner, City Planner

Cc: Enterprise
Region 10DD Administrative Office
10 Navigator Road
Londonderry, NH 03053

Skuffy's LLC
48 Curtisville Road
Concord, NH 03301

AnneMarie Skinner, AICP
City Planner

CITY OF CONCORD

New Hampshire's Main Street™

Community Development Department

Zoning Board of Adjustment

June 4, 2025

Northpoint Engineering, LLC
119 Storrs St, Unit 201
Concord, NH 03301

RE: Notice of Decision – ZBA 0274-2025, ZBA 0281-2025

Dear Mr. Lewis:

At a meeting of the Concord Zoning Board of Adjustment, held on June 4, 2025, the Board voted on the following:

Northpoint Engineering, LLC, on behalf of Skuffy's, LLC and Enterprise Mobility, requests approval for a variance from Section 28-8-4(a)(1) *Continuation of a Nonconforming Use or Nonconforming Characteristics of a Use/*Section 28-8-4(c)(1) *Expansion of a Nonconforming Use* to allow for the expansion of a nonconforming use and continuation of said nonconforming use in said expansion, where such expansion and continuation are not otherwise permitted, at Tax Map Lot 781Z 31, addressed as 28 Manchester St, in the Gateway Performance (GWP) District. Not a development of regional impact. (ZBA 0274-2025, ZBA 0281-2025)

With a vote of 3 in favor (Carley, Monahan, Perkins) to 0 opposed, the Board granted the variance from Section 28-8-4(a)(1) *Continuation of a Nonconforming Use or Nonconforming Characteristics of a Use/*Section 28-8-4(c)(1) *Expansion of a Nonconforming Use* to allow for the expansion of a nonconforming use and continuation of said nonconforming use in said expansion at the address of 28 Manchester St, because all of the criteria under RSA 674:33 have been met based on the record before the Board, and the Board adopted the applicant's findings as the Board's findings of fact.

Adopted Findings of Fact:

1. *The variance will not be contrary to the public interest.* "This project allows the existing vehicle rental facility on the subject site to continue to offer their vital services in a convenient and walkable location, while making the task of washing and vacuuming their rental fleet safer, easier, and faster for their employees. In addition, this project is not expected to increase the amount of traffic generated by the subject property."

2. *The spirit of the ordinance is observed by granting the variance.* "The expansion of the non-conforming use is contained to the side-yard area of the parcel and is not significantly visible from Manchester Street. This maintains the existing approved appearance of the property from the public R.O.W., ensuring the spirit of the ordinance is observed.."

3. *Substantial justice will be done by granting the variance.* "The purpose of the expanded garage area allows employees of the rental car business to clean and wash their inventory of vehicles in a more ergonomic and efficient way. This project will reduce the injuries and/or stresses to the employees related to the maintenance of vehicles and improve the work environment for employees of the business.."

4. *The values of surrounding properties will not be diminished.* "This project does not significantly alter the physical appearance of the property when viewed from the public street. The existing structure and landscaping will screen the majority of the garage expansion. In addition, this project is not expected to impact the amount of traffic generated by the subject property. This project focuses on providing faster service and improved working conditions for the employees of the car rental business while maintaining the existing appearance of the subject property when viewed from the public R.O.W."

5. *Denial of the variance would result in unnecessary hardship because*: "Prior to 2003, the majority of the property had been located within the floodway, thus, any buildings or structures built on the property were confined to approximately 8,500-sf of the northeast corner of the parcel located outside of the floodway. Therefore, the property developer used the parcel's available buildable land to design and construct the site, to the best of their ability, as it currently exists. Today, the FEMA Flood Maps indicate the subject property is no longer located within the floodway. The redrawing of the floodway boundary allows for greater flexibility in building size and location on the property. If the floodway boundary, as it currently exists, had existed in 2003, when the last site improvements occurred, larger buildings would have been constructed in more suitable locations within the parcel, at that time. This garage expansion makes reasonable use of this greater flexibility in order to provide better working conditions for employees and faster service for any customers who are waiting for a car to be prepared prior to renting the vehicle."

If there is a significant change at any time in the future, you are hereby advised to discuss any proposed changes with the City Planner. If the use or construction authorized by this approval has not commenced within the two-year anniversary date of the original decision (or by **June 4, 2027**), it shall be deemed to have expired and authorization shall be considered null and void as specified in Section 28-9-3(b)(5) of the Zoning Ordinance.

Granting of a variance does not authorize construction or use prior to the application for and approval of site plan review, architectural design review, and/or subdivision review, as applicable. Granting of a variance does not authorize construction or use prior to the application for and issuance of a building permit, if applicable.

Zoning Board of Adjustment

AnneMarie Skinner, City Planner

Cc: Enterprise
Region 10DD Administrative Office
10 Navigator Road
Londonderry, NH 03053

Skuffy's LLC
48 Curtisville Road
Concord, NH 03301

CITY OF CONCORD

New Hampshire's Main Street™

Community Development Department

Zoning Board of Adjustment

AnneMarie Skinner, AICP
City Planner

June 4, 2025

Northpoint Engineering, LLC
119 Storrs St, Unit 201
Concord, NH 03301

RE: Notice of Decision – ZBA 0275-2025

Dear Mr. Lewis:

At a meeting of the Concord Zoning Board of Adjustment, held on June 4, 2025, the Board voted on the following:

Northpoint Engineering, LLC, on behalf of Skuffy's, LLC, and Enterprise Mobility, requests approval for a variance from Section 28-4-1(c) *Minimum Lot Frontage*/(h) *Table of Dimensional Regulations*, to permit 171.98 feet of frontage where 300 feet is required, at Tax Map Lot 781Z 31, addressed as 28 Manchester St, in the Gateway Performance (GWP) District. Not a development of regional impact. (ZBA 0275-2025)

With a vote of 3 in favor (Carley, Monahan, Perkins) to 0 opposed, the Board granted the variance from Section 28-4-1(c) *Minimum Lot Frontage*/(h) *Table of Dimensional Regulations* to permit 171.98 feet of frontage where 300 feet is required at the address of 28 Manchester St, because all of the criteria under RSA 674:33 have been met based on the record before the Board, and the Board adopted the applicant's findings as the Board's findings of fact.

Adopted Findings of Fact:

1. *The variance will not be contrary to the public interest.* "The lot is an existing non-conforming lot of record and is not currently contrary to the public interest. No change in lot frontage is proposed thus the lot frontage will remain as not currently contrary to the public interest."

2. *The spirit of the ordinance is observed by granting the variance.* "The lot is an existing non-conforming lot of record and is currently observing the spirit of the ordinance. No change in lot frontage is proposed thus the lot frontage will remain observance of the spirit of the ordinance.

3. *Substantial justice will be done by granting the variance.* "The lot is an existing non-conforming lot of record and requiring an additional 120.02 feet of frontage to be acquired from the abutting properties, neither of which currently meet the frontage standards, is an undue burden that would render this property non-buildable. Justice would be done by allowing this lot to continue to provide valuable commercial space for business owners operating within Concord."

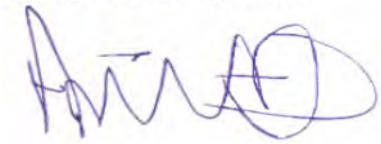
4. *The values of surrounding properties will not be diminished.* "None of the abutting properties along Manchester Street meet the minimum lot frontage requirement. The subject lot with current dimensions fits cohesively among surrounding properties within the commercial neighborhood without diminishing their property values."

5. *Denial of the variance would result in unnecessary hardship because*: "This existing non-conforming lot abuts properties on all sides that do not comply with this ordinance. Requiring this lot to conform would require either the acquisition of frontage from abutting properties, bringing those lots further from compliance with this ordinance or merging of lots that reduce the number of commercial lots available for development within the City of Concord. This project is focused on providing a larger working area to improve working conditions for employees at the rental car business, which is a reasonable use for the property."

If there is a significant change at any time in the future, you are hereby advised to discuss any proposed changes with the City Planner. If the use or construction authorized by this approval has not commenced within the two-year anniversary date of the original decision (or by **June 4, 2027**), it shall be deemed to have expired and authorization shall be considered null and void as specified in Section 28-9-3(b)(5) of the Zoning Ordinance.

Granting of a variance does not authorize construction or use prior to the application for and approval of site plan review, architectural design review, and/or subdivision review, as applicable. Granting of a variance does not authorize construction or use prior to the application for and issuance of a building permit, if applicable.

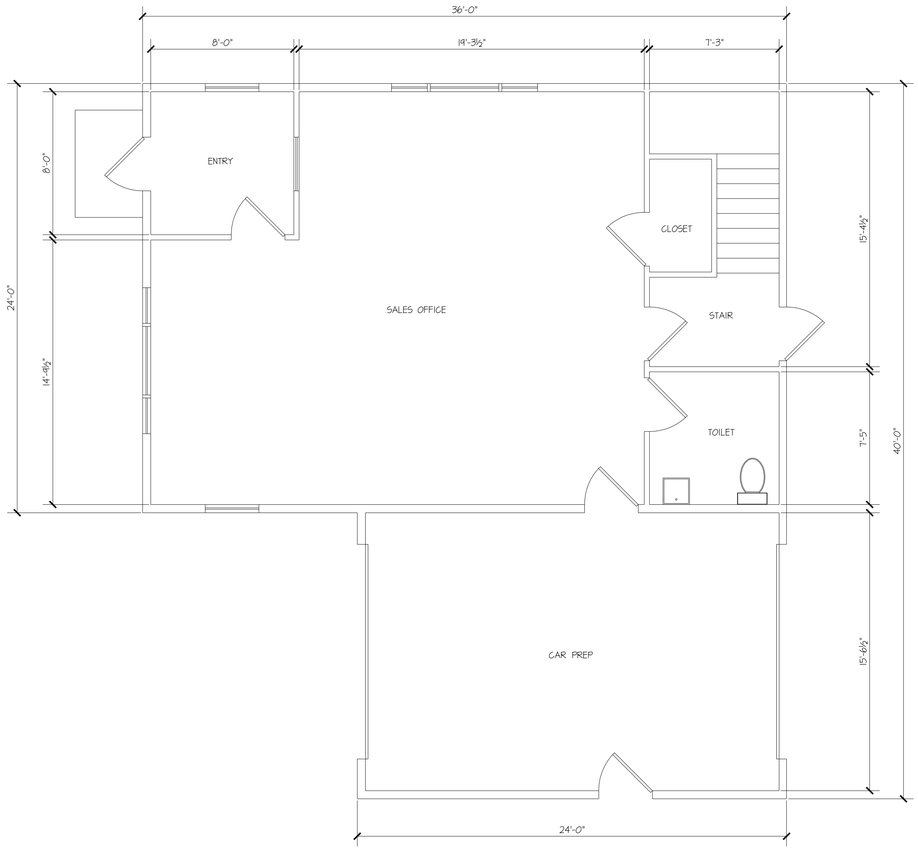
Zoning Board of Adjustment



AnneMarie Skinner, City Planner

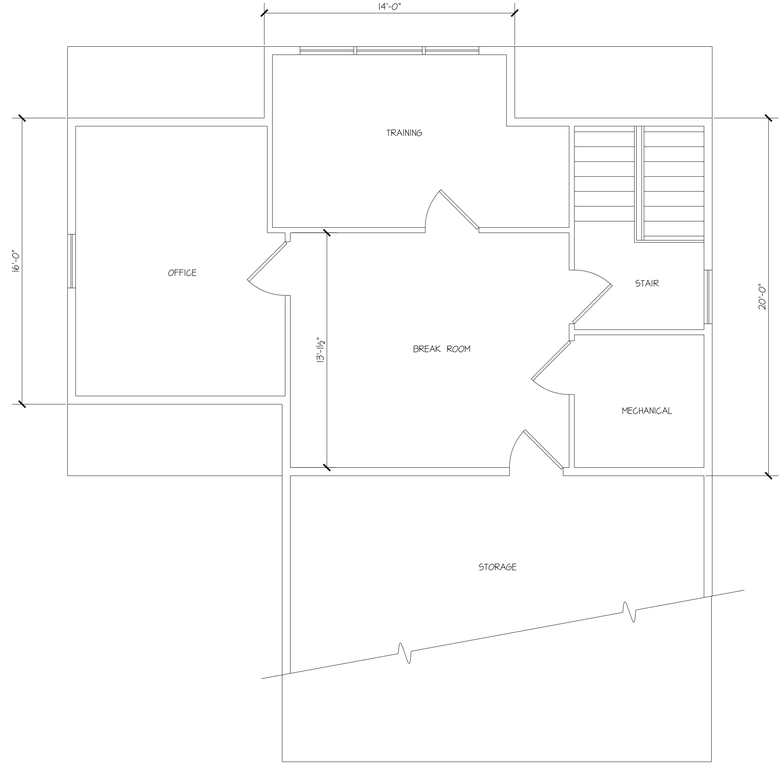
Cc: Enterprise
Region 10DD Administrative Office
10 Navigator Road
Londonderry, NH 03053

Skuffy's LLC
48 Curtisville Road
Concord, NH 03301



1 EXISTING MAIN LEVEL PLAN

SCALE: 1/4" = 1'-0"



2 EXISTING UPPER LEVEL PLAN

SCALE: 1/4" = 1'-0"

Enterprise Holdings, Inc.

28 Manchester Street
Concord, NH

Renovation / Addition

J Ferrera Associates Inc.

2 Fern Lane - Sterling, MA 01564
tel:(978) 407-8848
email: jaferrera@comcast.net

JOHN A. FERRERA JR. No. 3684 — LICENSED ARCHITECT — THE STATE OF NEW HAMPSHIRE

PROGRESS PRINT

FOR PROGRESS REVIEW AND ESTIMATING PURPOSES ONLY

NO.	DATE	DESCRIPTION

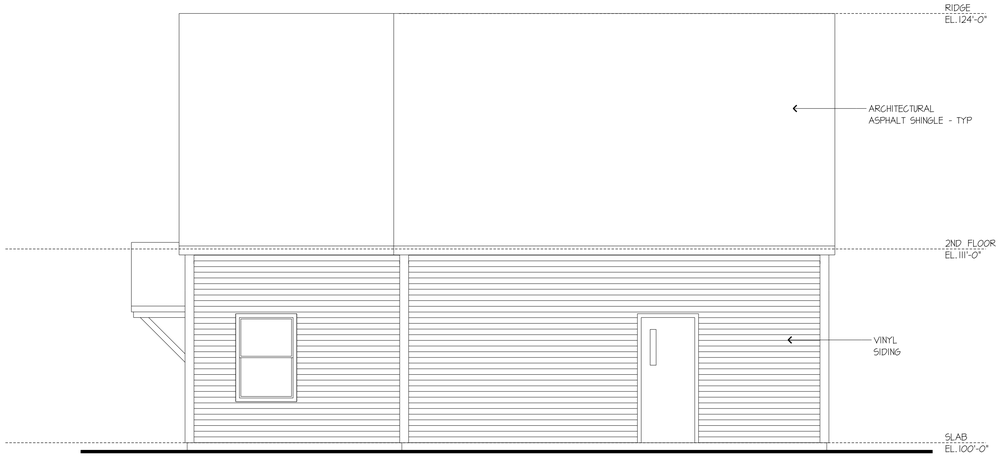
SHEET TITLE:

EXISTING CONDITION FLOOR PLANS

Job No.:	**25100**
FILE:	
DRAWN:	
SCALE :	**AS NOTED**
DATE:	**08/12/2025**

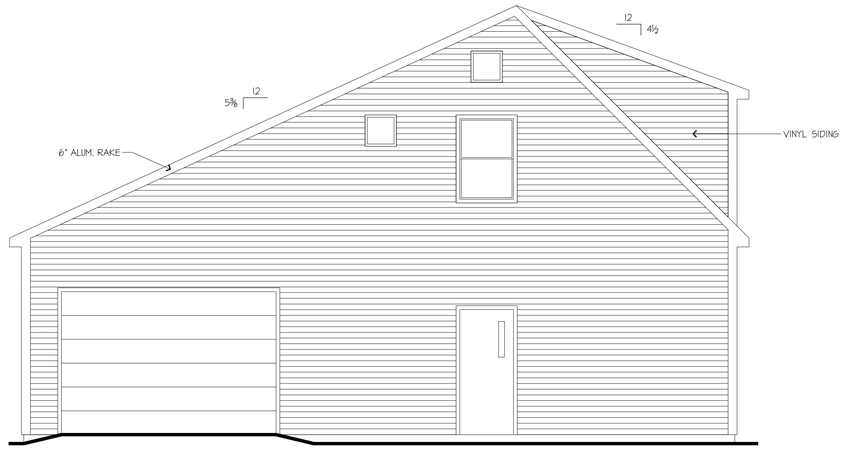
SHEET IDENTIFICATION:

A-101



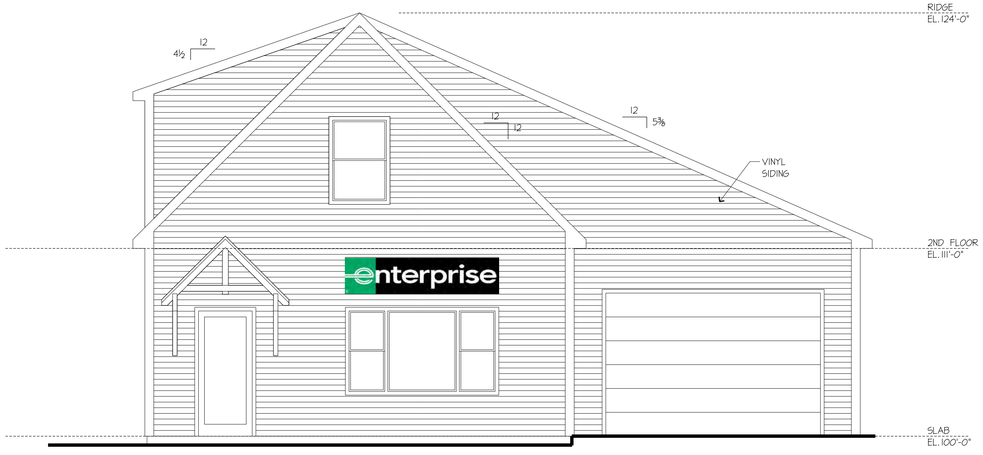
3 EXISTING SOUTH ELEVATION

SCALE: 1/4" = 1'-0"



4 EXISTING EAST ELEVATION

SCALE: 1/4" = 1'-0"



1 EXISTING WEST ELEVATION

SCALE: 1/4" = 1'-0"

2 EXISTING NORTH ELEVATION

SCALE: 1/4" = 1'-0"

Enterprise Holdings, Inc.

28 Manchester Street
Concord, NH

Renovation / Addition

J FERRERA ASSOCIATES INC.

2 Fern Lane - Sterling, MA 01564
tel:(978) 407-8848
email: jaferrera@comcast.net

JOHN A. FERRERA JR. No. 3684 — LICENSED ARCHITECT — THE STATE OF NEW HAMPSHIRE

PROGRESS PRINT

FOR PROGRESS REVIEW AND ESTIMATING PURPOSES ONLY

NO.	DATE	DESCRIPTION

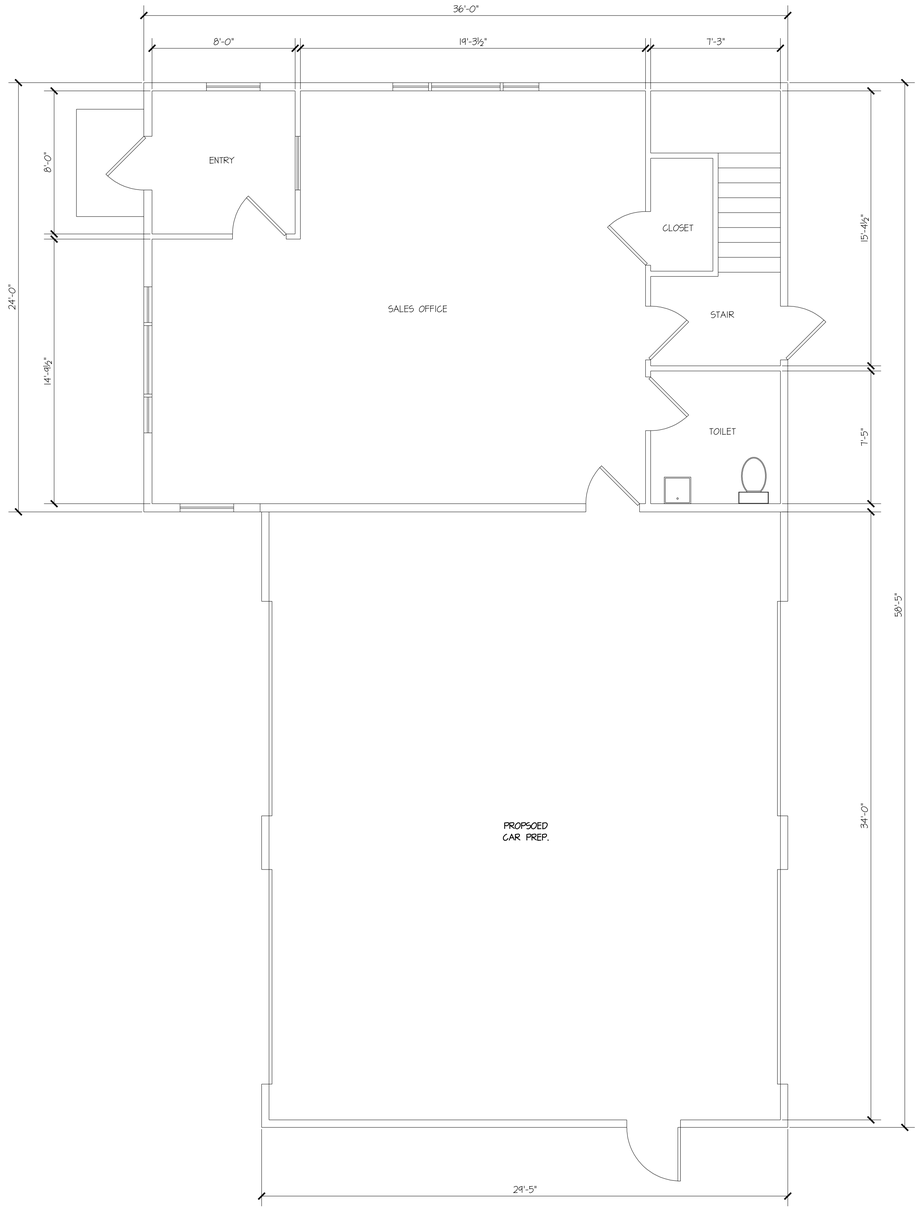
SHEET TITLE:

EXISTING CONDITION ELEVATIONS

Job No.:	**25100**
FILE:	
DRAWN:	
SCALE :	**1/4" = 1'-0"**
DATE:	**08/12/2025**

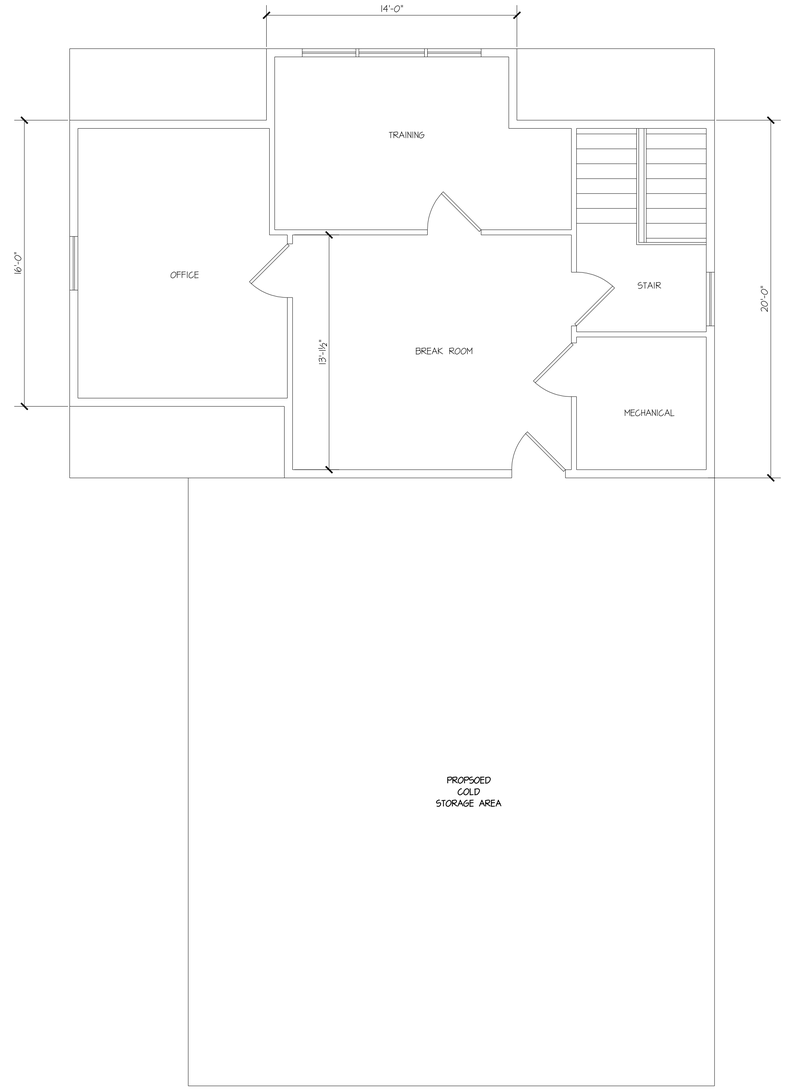
SHEET IDENTIFICATION:

A-102



1 PROPOSED MAIN LEVEL PLAN

SCALE: 1/4" = 1'-0"



2 PROPOSED UPPER LEVEL PLAN

SCALE: 1/4" = 1'-0"

Enterprise Holdings, Inc.

28 Manchester Street
Concord, NH

Renovation / Addition

J FERRERA ASSOCIATES INC.

2 Fern Lane - Sterling, MA 01564
tel:(978) 407-8848
email: jaferrera@comcast.net

JOHN A. FERRERA JR. No. 3654 — LICENSED ARCHITECT — THE STATE OF NEW HAMPSHIRE

PROGRESS PRINT

FOR PROGRESS REVIEW AND ESTIMATING PURPOSES ONLY

NO.	DATE	DESCRIPTION

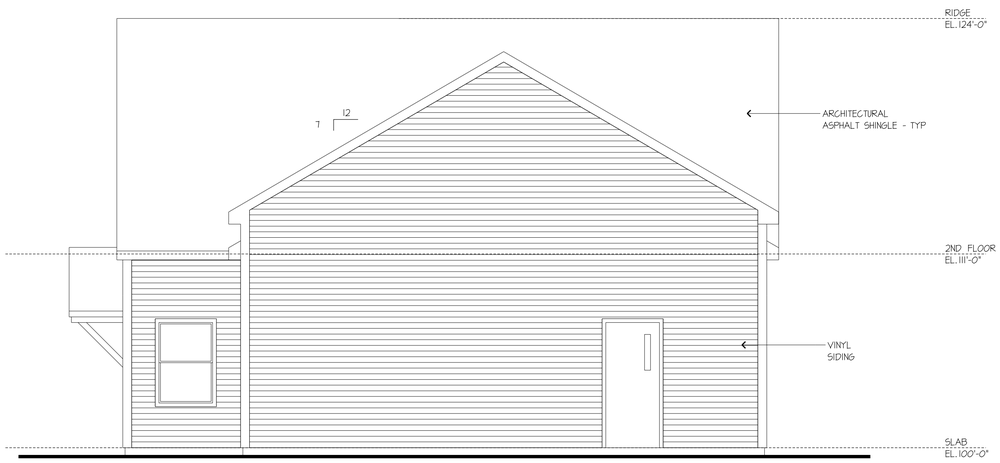
SHEET TITLE:

PROPOSED FLOOR PLANS

Job No.:	25100
FILE:	
DRAWN:	
SCALE :	AS NOTED
DATE:	08/12/2025

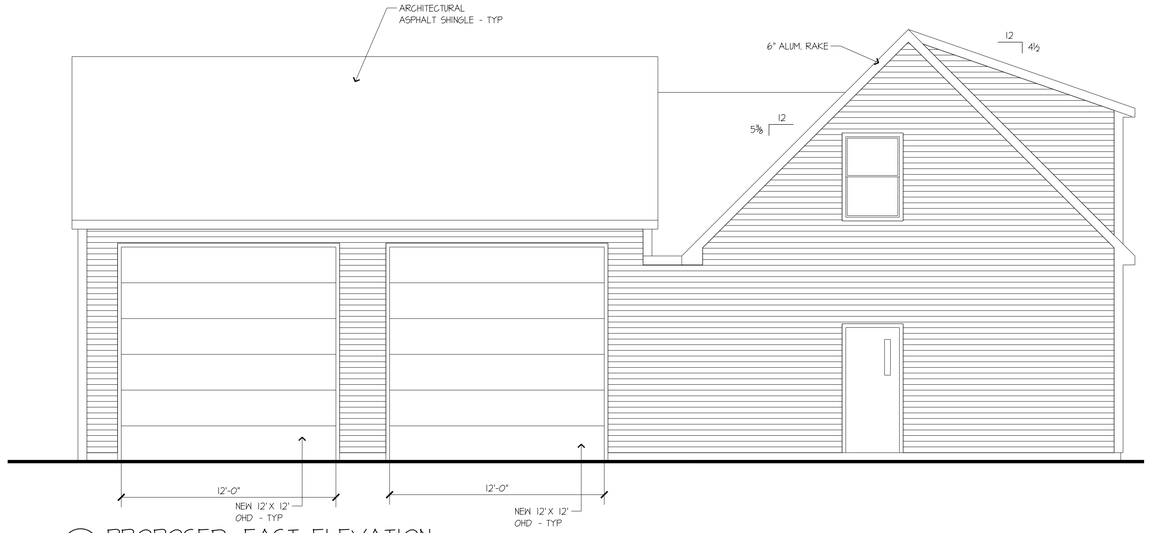
SHEET IDENTIFICATION:

A-201



3 PROPOSED SOUTH ELEVATION

SCALE: 1/4" = 1'-0"



4 PROPOSED EAST ELEVATION

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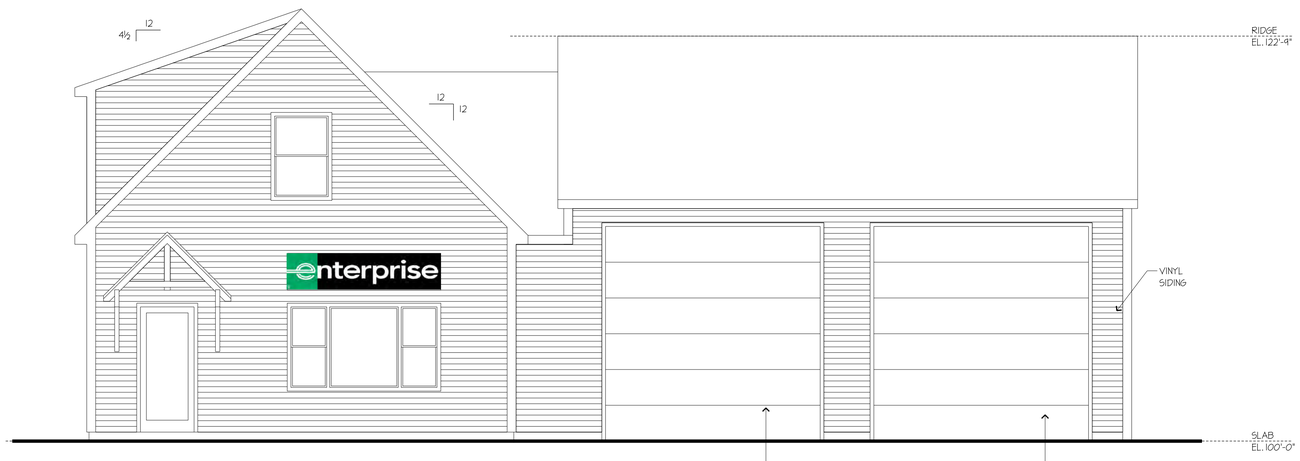


1 EXISTING WEST ELEVATION

SCALE: 1/4" = 1'-0"

2 EXISTING NORTH ELEVATION

SCALE: 1/4" = 1'-0"

Enterprise Holdings, Inc.

28 Manchester Street
Concord, NH

Renovation / Addition

J Ferrera Associates Inc.

2 Fern Lane - Sterling, MA 01564
tel:(978) 407-8848
email: jaferrera@comcast.net

LICENSED ARCHITECT
JOHN A FERRERA JR. No. 3684
THE STATE OF NEW HAMPSHIRE

PROGRESS PRINT

FOR PROGRESS REVIEW AND ESTIMATING PURPOSES ONLY

NO.	DATE	DESCRIPTION

SHEET TITLE:

PROPOSED ELEVATIONS

Job No.:	25100
FILE:	
DRAWN:	
SCALE :	1/4" = 1'-0"
DATE:	08/12/2025

SHEET IDENTIFICATION:

A-202

EXISTING ST. MARY'S BANK
(FACING ERAC BUILDING)

EXISTING ST. MARY'S BANK
(FACING MANCHESTER ST.)

EXISTING VACANT LOT
(FACING ERAC BUILDING)

EXISTING PYLON SIGNAGE

EXISTING ENDICOTT FURNITURE
(ACROSS THE STREET)

EXISTING SUNOCO
(ACROSS THE STREET)

EXISTING GREENLANDS OUTDOORS
(ACROSS THE STREET)

EXISTING WEST ELEVATION

EXISTING EAST ELEVATION

EXISTING SOUTH ELEVATION

EXISTING NORTH ELEVATION

Enterprise Holdings, Inc.

28 Manchester Street
Concord, NH

Renovation / Addition

J Ferrera Associates Inc.
2 Fern Lane - Sterling, MA 01564
tel:(978) 407-8848
email: jaferrera@comcast.net

JOHN A FERRERA JR. No. 3684 LICENSED ARCHITECT THE STATE OF NEW HAMPSHIRE

PROGRESS PRINT

FOR PROGRESS REVIEW AND ESTIMATING PURPOSES ONLY

NO.	DATE	DESCRIPTION

SHEET TITLE:

EXISTING BUILDING & ADJACENT PROPERTIES PHOTOGRAPHS

Job No.:	25100
FILE:	
DRAWN:	
SCALE :	AS NOTED
DATE:	08/12/2025

SHEET IDENTIFICATION:

A-301

NORTH / EAST ELEVATION RENDERING

WEST ELEVATION RENDERING

Enterprise Holdings, Inc.

28 Manchester Street
Concord, NH

Renovation / Addition

J Ferrera Associates Inc.
2 Fern Lane - Sterling, MA 01564
tel:(978) 407-8848
email: jaferrera@comcast.net

LICENSED ARCHITECT
JOHN A. FERRERA JR. No. 3684
THE STATE OF NEW HAMPSHIRE

PROGRESS PRINT

FOR PROGRESS REVIEW AND ESTIMATING PURPOSES ONLY

NO.	DATE	DESCRIPTION

SHEET TITLE:

EXTERIOR RENDERING

Job No.:	25100
FILE:	
DRAWN:	
SCALE :	AS NOTED
DATE:	08/12/2025

SHEET IDENTIFICATION:

A-302

STORMWATER MANAGEMENT REPORT

Prepared For

ENTERPRISE RENT-A-CAR
28 MANCHESTER STREET
MAP 781Z LOT 31
CONCORD, NEW HAMPSHIRE

AUGUST 20, 2025

Prepared for:

Enterprise Mobility
Region 10DD Administrative Office
10 Navigator Road
Londonderry, NH 03301

Prepared By:

NORTHPOINT ENGINEERING, LLC
Civil Engineering ◢ Land Planning ◢ Construction Services

119 Storrs Street, Suite 201
Concord, NH 03301
Tel 603-226-1166
Fax 603-226-1160
www.northpointeng.com

Project No. 25009

TABLE OF CONTENTS

I. PROJECT NARRATIVE

Project Description

The subject parcel consists of City of Concord Tax Map 781Z Lot 31, with 173-feet of frontage on the southern side of Manchester Street, and 170-feet of frontage on the northern side of Black Hill Road. The subject parcel is 0.94-acres and within the Gateway Performance (GWP) zoning district. The parcel is currently home to an Enterprise Rent-A-Car, a personal car rental facility containing a 900 square foot building with 360 square foot attached garage. The site also contains marked parking spaces and additional unmarked parking areas for vehicle inventory display and storage. The facility is accessed through an existing curb cut along the Manchester Street frontage and the Black Hill Road frontage.

The existing facility is connected to municipal water and sewer utilities. An onsite stormwater management system, approved by the City of Concord in 2003, collects onsite stormwater runoff for detention and releases into the municipal system through a standard drain manhole with 18" concrete outlet pipe.

The proposed improvements are associated with the expansion of the existing attached garage to facilitate greater efficiency of all season cleaning of the rental vehicles. The proposed condition will create an additional 950 SF of impervious area in the form of pavement and roof area.

Methodology

In accordance with the provisions and requirements of the City of Concord Site Plan Regulations for Minor Impact Site Plans, the 2 and 10-year, (24-hour) return frequency storms were used in all aspects of analysis and design for stormwater management improvements at the subject site, as further documented in this report.

The methodology of the U.S.D.A–S.C.S publication Urban Hydrology for Small Watersheds – Technical Release No. 55 (TR-55) and Computer Program – Project Formulation Hydrology (TR-20) was selected for use in the design of segments of the drainage system in order to estimate peak stormwater discharge volumes. In implementing the methodology of TR-55 and TR-20 a HYDROCAD (Version 10.00) stormwater modeling, hydrograph generating, and routing computer program was utilized.

Estimates for Time of Concentration, used in the analysis were made using the methodology contained within U.S.D.A–S.C.S publication Urban Hydrology for Small Watersheds – Technical Release No. 55 (TR-55). In implementing the TR-55 Method, a minimum Time of Concentration of 5 minutes was utilized for urbanized areas.

All design and analysis calculations performed using the referenced methodologies are attached to this report. These calculations document the subcatchment area, breakdown of surface type, time of concentration, rainfall intensity, peak discharge volume, peak velocity, and other descriptive design data for each watershed and pipe segment evaluated. In addition, the attached "Drainage Areas Plans" graphically define and illustrate the real extent of each watershed or subcatchment area investigated.

The USDA-NRCS Web Soils Survey was utilized in identifying soil types of the subject parcel and any contributing drainage area.

Existing Drainage Conditions

The subject site is developed as a rental car facility with approximately 78% of the site consisting of impervious areas in the form of pavement and rooftop. These impervious area sheet drains into two separate grassy areas. These grassed areas form swales leading to 2-ft diameter storm grates connected to drain manholes. No areas for pre-treatment nor infiltration exist on site. This is confirmed by the approved 2003 drainage plan showing no stormwater infiltration in the approved design.

One Point of Comparison (POC) is identified as 1P. POC #, listed on the plan set at CB 11445, represents the outflow of stormwater generated from the subject site into offsite structures. Outflows from POC #1 enter the existing municipal stormwater system at DMH 11444.

Catch basin 1P accepts stormwater directly from the western grassed swale (1AP). This grassed swale accepts flows from the southwestern portion of the paved and landscaped areas of the subject site as well as some of the stormwater from the eastern portion of the western abutting property consisting of driveway, rooftop, wooded and grassed areas. This catch basin also receives water through 15" pipe from catch basin 1608 (2P). CB 1608 receives stormwater from a grassed swale. This swale accepts flows from the northeastern portion of the site as well as wooded portions of the eastern abutting property.

Post-Development Drainage Conditions

Overview:

The proposed Site improvements involve the construction of 950 square feet of new impervious surface area. The new impervious surface area consists of expanded garage building and paved vehicle circulation areas.

The existing stormwater management system will be modified to ensure no increase in peak off-site stormwater flows as well as to ensure runoff from new impervious surfaces will be infiltrated.

This modification consists of regrading the existing grassed swales to create a pre-treatment basin overflowing into a shallow infiltration basin. No structures, grate/rim elevations, nor pipes will be modified in any way.

The Point of Comparison identified in the above section was analyzed in the post-developed condition to ensure that there would not be any adverse effects experienced by the downstream closed municipal stormwater system. The following sections describe in greater detail the treatment methods, groundwater recharge requirements, channel protection criteria and peak runoff control criteria.

Stormwater Treatment:

The site has been designed to provide permanent stormwater treatment in compliance with the City of Concord Site Plan Regulation for the runoff generated from the proposed site improvements. Stormwater runoff will be collected in a series of pre-treatment basins leading to infiltration basins that overflow into a closed drainage system outletting into the closed municipal stormwater system in the Black Hill Road right of way.

Pretreatment of the collected runoff will be provided by the pre-treatment forebays contained within each grassed swale. Permanent stormwater treatment is then accomplished by infiltration through the infiltration basin, prior to overflowing into the existing onsite closed stormwater system.

Infiltration Treatment is in compliance with Env-Wq 1508.06 for the water quality volume (WQV) of new impervious surface created by this project.

Groundwater Recharge:

As a result of the proposed development, the impervious surface area on the subject parcel will increase from 28,720-sf to 29,668-sf. All of the new impervious surface area will displace undisturbed HSG "B" soils. This correlates to a required Groundwater Recharge Volume (GRV) of 27-cf. The proposed SWMB's (infiltration basins) will provide well in excess of this required amount. The volume of the infiltration basins, below the lowest outlet elevation (at 227.94 feet for CB#11445 and 228.56 feet for CB#1608), is 1016-cf. All of this volume will be infiltrated. Therefore, the site far exceeds the groundwater recharge requirements of Env-Wq 1507.04.

Volume of groundwater infiltration has increased from previous conditions

Peak Runoff Control:

The site has been designed to provide Peak Runoff Control in accordance with Env-Wq 1507.06 through the implementation of the infiltration SWMB's. The Point of Comparison was analyzed to demonstrate compliance with the peak runoff control requirements. The site has been designed such that the 2-year and 10-year, 24-hour post-developed peak flow rates do not exceed those of the existing condition at the Point of Comparison, thus ensuring that downstream infrastructure will not be adversely affected by the development. See Table 2 in the Summary of Results below for calculated values.

Design Infiltration Rate:

The infiltration rate was determined using the Default Values method described in Env-Wq 1504.13 (NHDES Alteration of Terrain Administrative Rules).

According to the USDA-NRCS Web Soils Survey, the subject parcel is located within native material identified as Pootatuck Soils. This was confirmed during the onsite soil survey through test pitting and observations by the Certified Soil Scientist. This soil type has a saturated hydraulic conductivity rate (Ksat) that is generally between 6.0 and 20.0 inches per hour in the C-horizon per the published document '*Ksat Values for New Hampshire Soils, Society of Soil Scientists of Northern New England (SSSNNE), Special Publication No. 5, September 2009'*.

The Ksat value was tested using an amoozemeter and determined the Ksat values are different from those listed in the SSSNNE. The Ksat value for the eastern infiltration basin was determined to have a Ksat of 4.27 in/hr and the western infiltration basin was determined to have a Ksat of 1.51 in/hr. Applying a factor of safety of 0.5 archives the design infiltration rate of **2.13 in/hr** and **0.72 in/hr** respectively.

Summary of Results

Table 1. Peak Runoff Control Summary

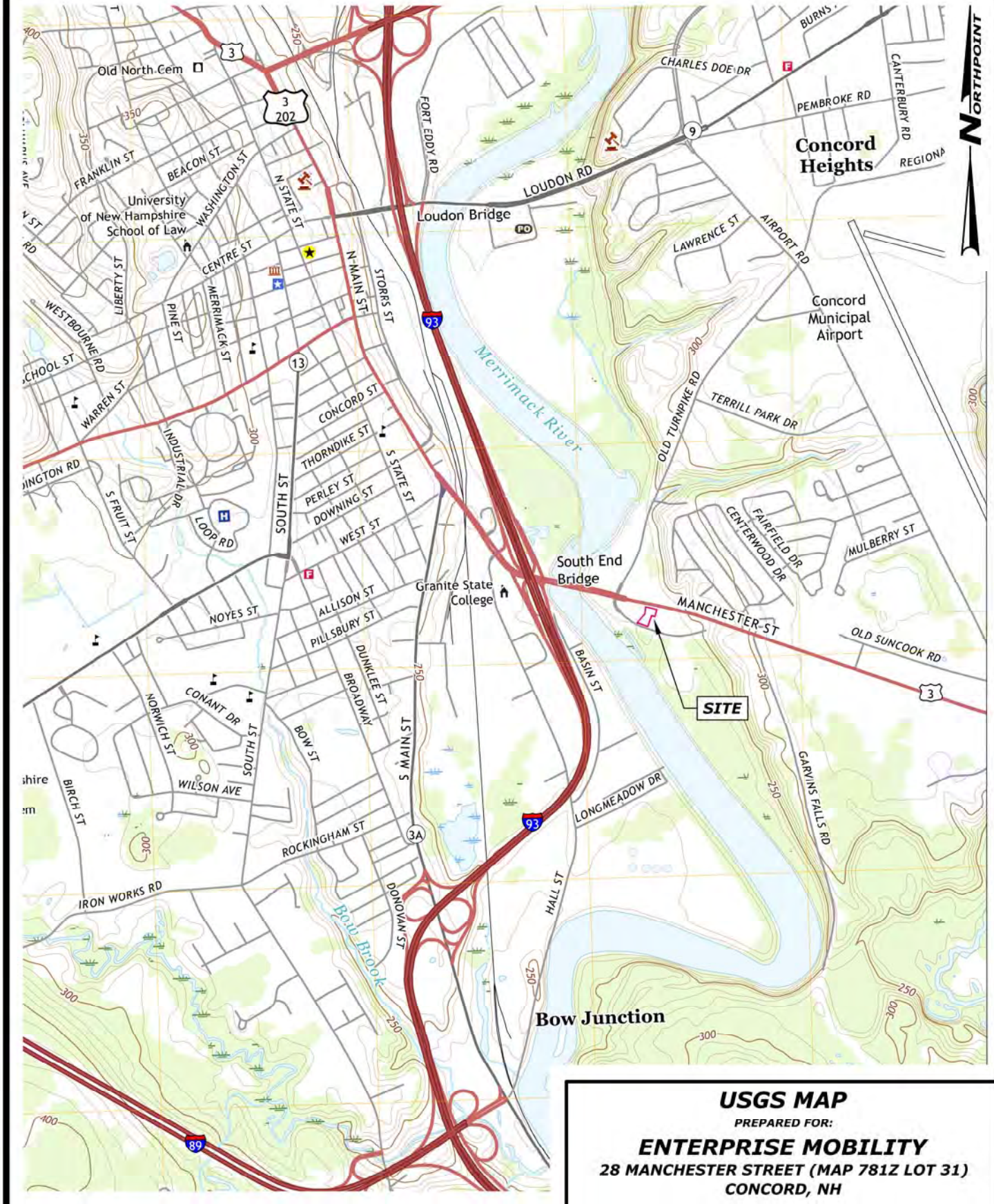
	(2-Year, 24-Hour)		(10-Year, 24-Hour)	
	Pre	Post	Pre	Post
1P (POC1)	1.60 cfs	0.12 cfs	3.26 cfs	2.79 cfs

Table 2. Runoff Volume Control Summary

		Runoff Volume at Study Points **(City of Concord)**	
		(10-Year, 24-Hour)	
Study Point	Node	Pre	Post
POC 1	1P	10,372 cf	2,636 cf

II. USGS MAP EXHIBIT

FILE: G:_PROJECTS\25009\dwg\25009_EXHIBITS.dwg BY: ian DATE: 06 Aug 2025 - 3:58pm



USGS MAP

PREPARED FOR:

ENTERPRISE MOBILITY

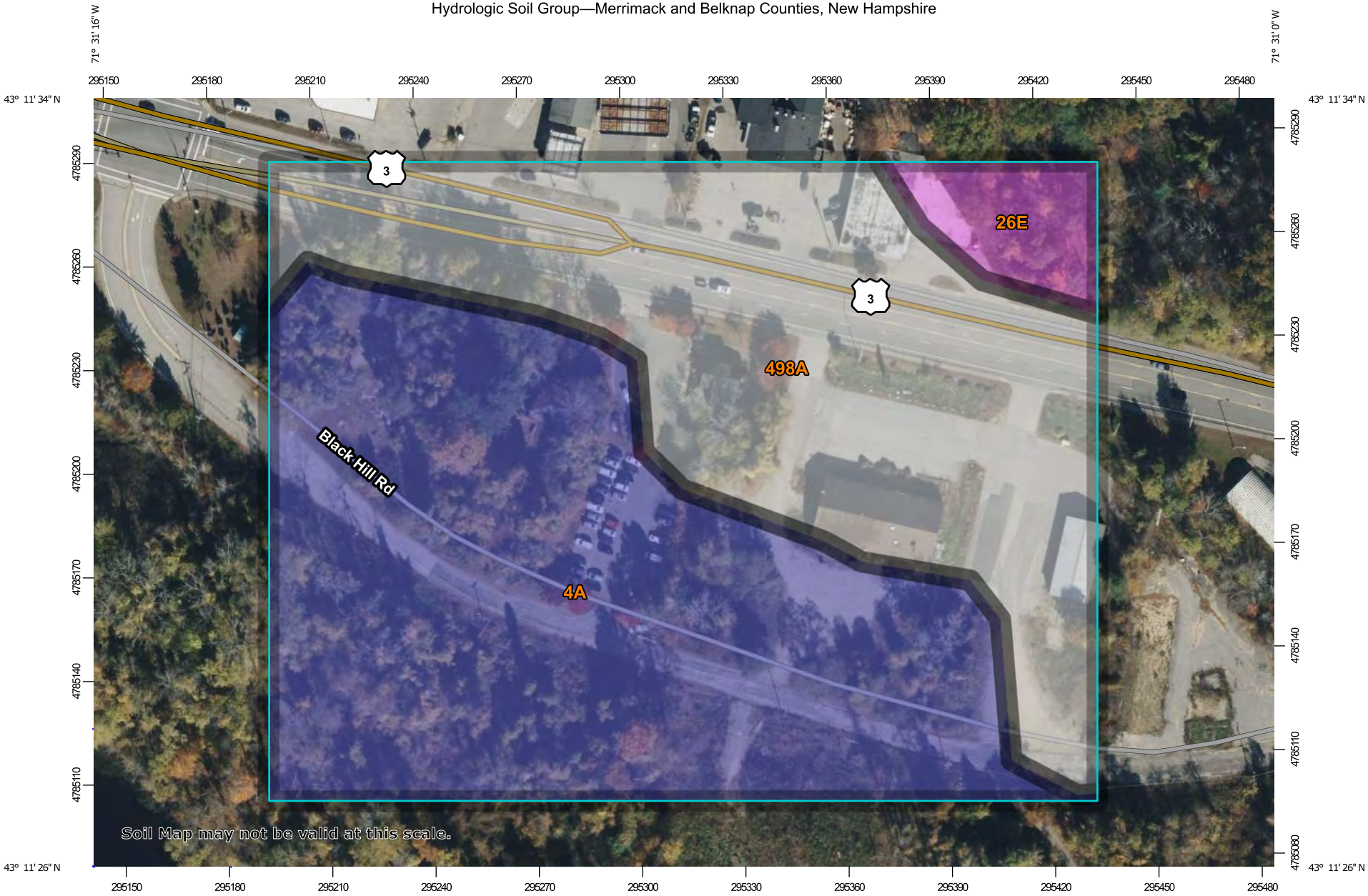
28 MANCHESTER STREET (MAP 781Z LOT 31)
CONCORD, NH

NORTHPOINT ENGINEERING, LLC
Civil Engineering ◢ Land Planning ◢ Construction Services

119 Storrs St, Ste 201
Concord, NH 03301
Tel 603-226-1166
Fax 603-226-1160
www.northpointeng.com

SCALE: 1"=2000'	DATE: JUN. 2025
PROJ.: 25009	SHEET: 1 OF 1

III. Web Soil Survey Map



Map Scale: 1:1,570 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

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.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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: Merrimack and Belknap Counties, New Hampshire
Survey Area Data: Version 30, Sep 3, 2024

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

Date(s) aerial images were photographed: Oct 6, 2022—Oct 22, 2022

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
4A	Pootatuck very fine sandy loam, 0 to 3 percent slopes, occasionally flooded	B	5.9	53.4%
26E	Windsor loamy sand, 15 to 60 percent slopes	A	0.5	4.3%
498A	Urban land-Pootatuck complex, 0 to 3 percent slopes		4.7	42.3%
Totals for Area of Interest			**11.0**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

IV. Aerial Photograph Exhibits

FILE: G:_PROJECTS\25009\dwg\25009_EXHIBITS.dwg BY: ian DATE: 07 Aug 2025 - 3:07pm

AERIAL VIEW

PREPARED FOR:

ENTERPRISE MOBILITY

28 MANCHESTER STREET (MAP 781Z LOT 31)
CONCORD, NH

NORTHPOINT ENGINEERING, LLC
Civil Engineering ◢ Land Planning ◢ Construction Services

119 Storrs St, Ste 201
Concord, NH 03301
Tel 603-226-1166
Fax 603-226-1160
www.northpointeng.com

SCALE: 1"=300'	DATE: JUN. 2025
PROJ.: 25009	SHEET: 1 OF 1

V. Inspection and Maintenance Manual

STORM WATER MANAGEMENT SYSTEM

INSPECTION & MAINTENANCE MANUAL

For:

ENTERPRISE RENT-A-CAR
28 MANCHESTER STREET
MAP 781Z LOT 31
CONCORD, NEW HAMPSHIRE

August 20, 2025

Prepared for:

Enterprise Mobility
Region 10DD Administrative Office
10 Navigator Road
Londonderry, NH 03353

Prepared By:

NORTHPOINT ENGINEERING, LLC
Civil Engineering ◢ Land Planning ◢ Construction Services

119 Storrs Street, Suite 201
Concord, NH 03301
Tel 603-226-1166
Fax 603-226-1160
www.northpointeng.com

Project No. 25009

STORM WATER MANAGEMENT SYSTEM
INSPECTION & MAINTENANCE MANUAL

Prepared For

ENTERPRISE RENT-A-CAR
28 MANCHESTER STREET
CONCORD, NEW HAMPSHIRE

This document is to ensure that the Storm Water Management System for Enterprise Rent A Car facility at 28 Manchester Street in Concord, NH is maintained in perpetuity by the owner or their assigned heirs after construction is completed. A description of the stormwater management facilities, along with long-term operation and maintenance procedures, is presented in this plan. The owner shall designate an operator of the storm water management facilities who shall be responsible for overseeing all maintenance procedures identified in this plan.

OPERATOR:

Enterprise Rent A Car will act as both the owner and operator of the Storm Water Management System for this facility. Enterprise Rent A Car shall be responsible for the long-term operation and maintenance of the stormwater management facilities.

Enterprise Rent A Car
28 Manchester Street
Concord NH 03301

Contact: William Fridlington
William.J.Fridlington@em.com
603-235-0403

Enterprise Rent A Car shall be legally responsible for the long-term operation and maintenance of this Storm Water Management System as outlined in this Inspection & Maintenance Manual. When ownership of the stormwater management system changes, the succeeding owner will be presented with this Manual and supporting attachments at or before the legal conveyance of ownership. Enterprise Rent A Car will establish an annual Storm Water Management System Inspection and Maintenance budget to ensure ongoing compliance with this Manual.

STORMWATER MANAGEMENT FACILITIES:

The Storm Water Management System for Enterprise Rent-A-Car is specified on the design plans entitled "Site Improvement Plans prepared for: "Enterprise Rent-A-Car"; (Tax Map 781Z Lot 31); 28 Manchester Street; Concord, NH" prepared by Northpoint Engineering, LLC. The Storm Water Management System specified on said plans collects storm water runoff from the onsite development. Attached to this I&M Manual is an *I&M Site Plan Exhibit* that provides an overview of the entire property and each of the stormwater management practices.

Storm Water Conveyance:
Stormwater sheet flows from rooftop and pavement areas through curb cuts along the perimeter of the paved area throughout the subject site. Stormwater then flows though the grassed swales to reach the forebay and overflows into the infiltration basins, as depicted on the attached *I&M Site Plan Exhibit*, and as further described in the following sections.

Stormwater Management Basins:
Two stormwater management basins (SWMB) will be constructed to collect, retain, and infiltrate stormwater runoff. These SMWB are both infiltration basins and are located in the southwestern area of the property and along the eastern property line respectively. The easterly SWMB outlets to an existing catch basin that flows downstream to the catch basin acting as the outlet structure for southwestern SWMB. The combined flows from these catch basins flow off site to discharge into the existing municipal stormwater infrastructure along Black Hill Road. The SWMB's are depicted on the attached *I&M Site Plan Exhibit*.

POST-CONSTRUCTION OPERATION AND MAINTENANCE:

The following standards will be met after construction is complete:

Compliance Statement:
The Storm Water Management System will be inspected immediately after construction by a professional engineer. A Compliance Statement shall be prepared and certified by the inspecting party that the site has been inspected, is stabilized from erosion, and that the stormwater management system has been constructed as designed and approved. This statement shall identify the party responsible for implementing this Inspection & Maintenance Manual and reconfirm (as stated above) that all future responsible parties will be notified of their continuing legal obligation to carry out this Inspection & Maintenance Manual. A copy of the Compliance Statement shall be submitted to the City of Concord.

Maintenance Contract:
The owner shall contract with a third party or other qualified professional with knowledge of erosion and stormwater control. The contractor will be responsible for inspecting and removing accumulated sediments, oils, and debris from the entire Storm Water Management System as outlined in this Inspection & Maintenance Manual.

Maintenance Log:
A Maintenance Log will be kept summarizing inspections, maintenance, and any corrective actions taken. The log will include the date on which each inspection or maintenance task was performed, a brief description of the inspection findings or maintenance completed, and the name of the inspector or maintenance personnel performing the task. Copies of completed inspection checklists should be attached to the Maintenance Log as well. A maintenance log form is included as part of this Manual. The maintenance log shall be made accessible to the City of Concord.

Snow Storage and Removal
Multiple areas on the site have been identified as being reserved for snow storage during winter months. The facility owner will provide all snow removal activities on the site. Designated snow storage areas will be utilized to store snow accumulation. Snow will not be stored or piled in any location that will block the flow of stormwater runoff through the onsite stormwater management basins.

Snow will not be stored or piled in an area where snow melt will drain directly into stormwater treatment areas, where sediment and debris could clog the infiltration basin. Snow melt will be directed into onsite catch basins or sediment forebays upstream of treatment areas.

When the storage capacity of any one area on site is exceeded, the excess snow will be moved to a different designated storage area. When/if the storage capacity of the entire site is exceeded, excess snow will be removed from the site and disposed of properly.

Spring maintenance will include removing debris and accumulated sediment from snow storage areas and sweeping paved areas to remove accumulated fine sediment.

Deicing Log:
A Deicing Log will be maintained by the owner to track the frequency, amount, and type of deicing materials that are applied to the site. A Deicing Log form is included as part of this Manual. The deicing log shall be made accessible to the City of Concord, and a copy shall be provided to them upon request.

Inspection and Maintenance Frequency and Corrective Measures:
The following areas, facilities, and measures will be inspected, and the identified deficiencies will be corrected. Clean-out must include the removal and legal disposal of any accumulated sediments and debris. A Storm Water Management System Inspection & Maintenance Checklist is included as part of this manual that summarizes the following actions:

<u>Catch Basins:</u>
Inspect catch basins twice annually (preferably in Spring and Fall) to ensure that the catch basins are working in their intended fashion and that they are free of debris.

- Remove any accumulated debris from grates, inlets, outlets, and weirs.
- Inspect catch basin snouts and remove debris or repair as needed.
- Clean sumps when sediment depths reach 12-inches from invert of outlet.
- Remove any floating debris and hydrocarbons at the time of the inspection.

- Inspect for damaged or missing brick and mortar and repair as necessary.

Infiltration Basins:

- Removal of debris from inlet and outlet structures.
- Removal of accumulated sediment.
- Inspection and repair of outlet structures and appurtenances
- Inspection of infiltration components at least twice annually, and following any rainfall event exceeding 2.5 inches in a 24 hour period, with maintenance or rehabilitation conducted as warranted by such inspection.
- Periodic mowing of embankments.
- Removal of woody vegetation from embankments.
- If an infiltration system does not drain within 72-hours following a rainfall event, then a qualified professional should assess the condition of the facility to determine measures required to restore infiltration function, including but not limited to removal of accumulated sediments or reconstruction of the infiltration basin.

Parking and Impervious Surfaces:

- Deicing: All deicing activities shall be documented in the Deicing Log. (See Attached)
- A copy of the completed seasonal Deicing Log should be added to the official Maintenance Log.
- All snow storage areas will be located in areas that drain to the site's stormwater management system. Snow will not be stored in stormwater management basins. See attached *I&M Site Plan Exhibit* for locations of snow storage areas. Sediment from snow melt will be captured by catch basin sumps and SWMB sediment forebays. Stored snow will be removed and properly disposed of off-site if it exceeds the capacity of the snow storage areas.
- Debris and accumulated sediment will be removed from snow storage areas in spring. Paved areas will be swept to remove accumulated fine sediment.

Invasive Species:

- All storm water management areas shall be periodically checked for the presence of any invasive plant species.

- If any invasive species are identified, or potentially identified, contact the NHDES Exotic Species Program for consultation on properly identifying the species and appropriately managing it.

Inspection Checklist:

- A Stormwater Management System Inspection & Maintenance Checklist shall be completed during each inspection and a copy shall be added to the official Maintenance Log.

Stormwater Management Inspection Checklist
For
Enterprise Rent-A-Car
Concord, New Hampshire

Inspector's Name (& Company): _____ Date of Inspection:_____

An inspection checklist shall be filled out during each inspection of the stormwater management system. A copy of the completed checklist shall be submitted to the Operator for inclusion within the official Maintenance Log.

Catch Basins	**Y**	**N**	**Notes**
Remove debris from grates, inlets, outlets, and weirs:…..			
Check Depth of Sediment in Sumps (Remove):…….			
Removal of floating debris:……			
Inspect bricks & mortar:…….			

Infiltration Basin	**Y**	**N**	**Notes**
Outlet Structures: Remove debris from grates, inlets, outlets, and weirs (including floating debris & hydrocarbons)….....			
Removal of accumulated sediment …….			
Inspection of infiltration capacity (i.e. no standing water) ……..			
Check for any apparent invasive species…….			
Periodic mowing of embankments & removal of woody vegetation…….			

Invasive Species	**Y**	**N**	**Notes**
Check for any apparent invasive species and document actions taken…….			

Other Observations and/or Actions taken:

Deicing Log	**Y**	**N**	**Notes**
All deicing activities shall be documented in the Deicing Log……..			
A copy of the completed seasonal Deicing Log was added to the official Maintenance Log…….……			

Maintenance Log	**Y**	**N**	**Notes**
A copy of this completed Inspection Checklist has been added to the Official Maintenance Log……..…			

STORMWATER MANAGEMENT MAINTENANCE LOG

Enterprise Rent-A-Car - 28 Manchester Street, Concord, New Hampshire

Sheet ___ of ___

Date	Name of Inspector and/or Maintenance Personnel	Brief Description of Inspection, Maintenance and/or Corrective Actions taken	Checklist Completed (Y or N)

DEICING LOG

Enterprise Rent-A-Car - 28 Manchester Street, Concord , New Hampshire

Sheet ___ of ___

Date	Amount and Type of Deicing Materials applied to the site

VI. Drainage Analysis

- Extreme Precipitation Tables

- HydroCAD Output Data – Pre-Developed
    - Drainage Diagram
    - Area Listing and Soil Listing
    - Node List: 2-year and 10-year
    - Full Summary: 10-year

- HydroCAD Output Data – Post-Developed
    - Drainage Diagram
    - Area Listing and Soil Listing
    - Node List: 2-year and 10-year
    - Full Summary: 10-year

- BMP Worksheet – Infiltration Practice

- Amoozemeter Results and Data Sheets

- Test Pit Report – August 8th , 2025

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Metadata for Point	
Smoothing	Yes
State	New Hampshire
Location	New Hampshire, United States
Latitude	43.192 degrees North
Longitude	71.519 degrees West
Elevation	70 feet
Date/Time	Thu Jul 24 2025 14:28:24 GMT-0400 (Eastern Daylight Time)

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.26	0.39	0.49	0.64	0.80	1.00	**1yr**	0.69	0.98	1.16	1.47	1.86	2.36	2.57	**1yr**	2.09	2.47	2.89	3.59	4.12	**1yr**
2yr	0.31	0.48	0.60	0.79	1.00	1.25	**2yr**	0.86	1.15	1.45	1.81	2.26	2.82	3.15	**2yr**	2.49	3.03	3.51	4.19	4.79	**2yr**
5yr	0.37	0.58	0.73	0.98	1.25	1.58	**5yr**	1.08	1.44	1.83	2.29	2.84	3.51	4.00	**5yr**	3.11	3.84	4.44	5.21	5.91	**5yr**
10yr	0.42	0.66	0.84	1.14	1.48	1.89	**10yr**	1.28	1.71	2.19	2.73	3.38	4.15	4.79	**10yr**	3.68	4.60	5.30	6.15	6.93	**10yr**
25yr	0.50	0.79	1.01	1.39	1.85	2.38	**25yr**	1.60	2.15	2.77	3.45	4.25	5.19	6.08	**25yr**	4.59	5.85	6.71	7.65	8.55	**25yr**
50yr	0.57	0.91	1.17	1.63	2.19	2.84	**50yr**	1.89	2.55	3.31	4.12	5.06	6.14	7.29	**50yr**	5.44	7.01	8.03	9.03	10.03	**50yr**
100yr	0.65	1.05	1.35	1.91	2.60	3.39	**100yr**	2.25	3.03	3.96	4.93	6.03	7.28	8.74	**100yr**	6.44	8.41	9.61	10.67	11.77	**100yr**
200yr	0.74	1.21	1.57	2.24	3.09	4.04	**200yr**	2.67	3.60	4.73	5.88	7.17	8.63	10.49	**200yr**	7.63	10.09	11.50	12.61	13.82	**200yr**
500yr	0.89	1.47	1.91	2.77	3.88	5.11	**500yr**	3.35	4.52	5.98	7.43	9.03	10.81	13.37	**500yr**	9.57	12.85	14.60	15.74	17.10	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.20	0.32	0.39	0.52	0.64	0.88	**1yr**	0.55	0.86	1.05	1.37	1.59	2.02	2.43	**1yr**	1.79	2.33	2.66	3.29	3.86	**1yr**
2yr	0.30	0.47	0.58	0.78	0.96	1.15	**2yr**	0.83	1.12	1.31	1.72	2.19	2.75	3.05	**2yr**	2.43	2.94	3.41	4.08	4.66	**2yr**
5yr	0.34	0.53	0.66	0.91	1.15	1.37	**5yr**	0.99	1.34	1.54	2.00	2.56	3.29	3.71	**5yr**	2.91	3.57	4.13	4.88	5.56	**5yr**
10yr	0.38	0.58	0.72	1.01	1.31	1.55	**10yr**	1.13	1.52	1.75	2.25	2.87	3.77	4.30	**10yr**	3.34	4.14	4.77	5.58	6.35	**10yr**
25yr	0.44	0.67	0.83	1.18	1.56	1.81	**25yr**	1.35	1.77	2.06	2.61	3.34	4.52	5.22	**25yr**	4.00	5.02	5.72	6.67	7.58	**25yr**
50yr	0.48	0.74	0.92	1.32	1.77	2.03	**50yr**	1.53	1.99	2.35	2.94	3.75	5.18	6.05	**50yr**	4.58	5.82	6.56	7.63	8.65	**50yr**
100yr	0.54	0.82	1.03	1.48	2.03	2.30	**100yr**	1.75	2.25	2.68	3.30	4.22	5.94	7.01	**100yr**	5.25	6.74	7.54	8.74	9.89	**100yr**
200yr	0.60	0.90	1.15	1.66	2.31	2.58	**200yr**	2.00	2.52	3.04	3.71	4.75	6.81	8.11	**200yr**	6.03	7.80	8.64	10.02	11.30	**200yr**
500yr	0.70	1.04	1.34	1.94	2.76	3.00	**500yr**	2.38	2.94	3.62	4.35	5.57	8.17	9.84	**500yr**	7.23	9.47	10.29	12.03	13.53	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.29	0.45	0.54	0.73	0.90	1.08	**1yr**	0.78	1.06	1.19	1.59	1.99	2.50	2.74	**1yr**	2.21	2.64	3.14	3.81	4.34	**1yr**
2yr	0.33	0.50	0.62	0.84	1.03	1.24	**2yr**	0.89	1.21	1.39	1.83	2.32	2.90	3.25	**2yr**	2.57	3.13	3.63	4.32	4.94	**2yr**
5yr	0.41	0.63	0.78	1.07	1.36	1.57	**5yr**	1.17	1.54	1.78	2.28	2.91	3.74	4.30	**5yr**	3.31	4.13	4.75	5.54	6.27	**5yr**
10yr	0.49	0.75	0.93	1.29	1.67	1.91	**10yr**	1.44	1.87	2.16	2.72	3.46	4.55	5.31	**10yr**	4.02	5.11	5.87	6.69	7.56	**10yr**
25yr	0.62	0.95	1.18	1.68	2.21	2.48	**25yr**	1.91	2.43	2.77	3.40	4.34	5.88	7.04	**25yr**	5.21	6.77	7.74	8.60	9.65	**25yr**
50yr	0.74	1.13	1.40	2.02	2.72	3.03	**50yr**	2.34	2.96	3.34	4.06	5.15	7.16	8.72	**50yr**	6.34	8.38	9.56	10.41	11.66	**50yr**
100yr	0.90	1.36	1.70	2.45	3.37	3.70	**100yr**	2.90	3.62	4.04	4.83	6.13	8.72	10.81	**100yr**	7.72	10.40	11.83	12.60	14.05	**100yr**
200yr	1.08	1.62	2.05	2.97	4.15	4.52	**200yr**	3.58	4.42	4.88	5.75	7.29	10.62	13.40	**200yr**	9.40	12.89	14.65	15.26	16.91	**200yr**
500yr	1.39	2.06	2.66	3.86	5.49	5.91	**500yr**	4.73	5.78	6.27	7.25	9.20	13.80	17.83	**500yr**	12.21	17.15	19.47	19.67	21.64	**500yr**

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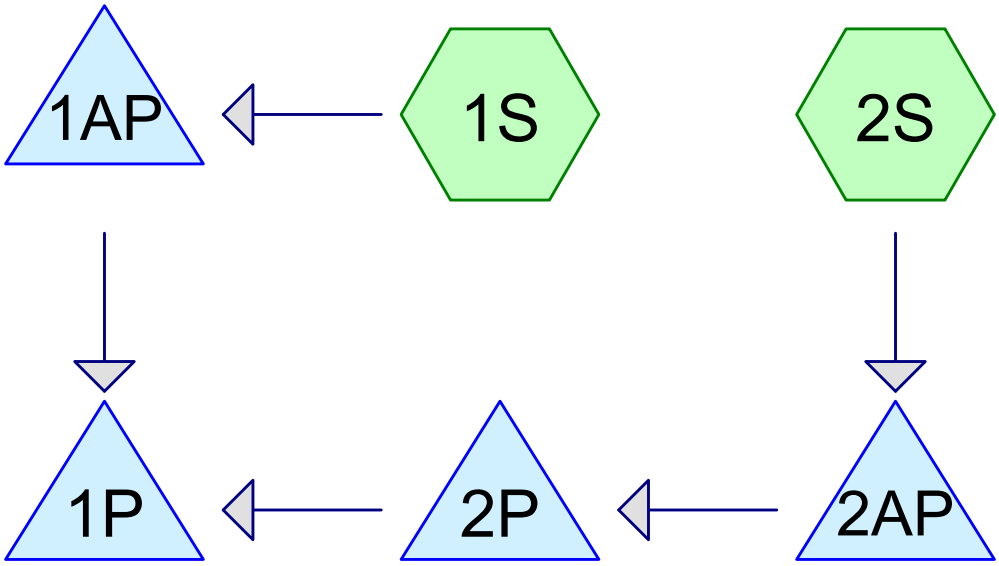


POC #1

Subcat Reach Pond Link

Routing Diagram for 25009_Pre-Drain
Prepared by Northpoint Engineering, LLC., Printed 8/19/2025

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
34,025	HSG B	1S, 2S
0	HSG C	
0	HSG D	
28,720	Other	1S, 2S
62,745		**TOTAL AREA**

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=43,840 sf 58.22% Impervious Runoff Depth=1.24"
Tc=5.0 min CN=82 Runoff=1.45 cfs 4,526 cf

Subcatchment 2S: Runoff Area=18,905 sf 16.90% Impervious Runoff Depth=0.46"
Tc=0.0 min CN=66 Runoff=0.19 cfs 727 cf

Pond 1AP: Peak Elev=230.90' Storage=0 cf Inflow=1.45 cfs 4,526 cf
Outflow=1.45 cfs 4,526 cf

Pond 1P: POC #1 Peak Elev=228.38' Storage=9 cf Inflow=1.62 cfs 5,253 cf
15.0" Round Culvert n=0.012 L=158.0' S=0.0050 '/' Outflow=1.60 cfs 5,253 cf

Pond 2AP: Peak Elev=230.54' Storage=1 cf Inflow=0.19 cfs 727 cf
Outflow=0.19 cfs 727 cf

Pond 2P: Peak Elev=226.87' Storage=3 cf Inflow=0.19 cfs 727 cf
18.0" Round Culvert n=0.012 L=122.0' S=0.0050 '/' Outflow=0.19 cfs 727 cf

Total Runoff Area = 62,745 sf Runoff Volume = 5,253 cf Average Runoff Depth = 1.00"
54.23% Pervious = 34,025 sf 45.77% Impervious = 28,720 sf

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=43,840 sf 58.22% Impervious Runoff Depth=2.33"
Tc=5.0 min CN=82 Runoff=2.75 cfs 8,519 cf

Subcatchment 2S: Runoff Area=18,905 sf 16.90% Impervious Runoff Depth=1.18"
Tc=0.0 min CN=66 Runoff=0.63 cfs 1,854 cf

Pond 1AP: Peak Elev=230.90' Storage=0 cf Inflow=2.75 cfs 8,519 cf
Outflow=2.75 cfs 8,519 cf

Pond 1P: POC #1 Peak Elev=228.74' Storage=14 cf Inflow=3.26 cfs 10,372 cf
15.0" Round Culvert n=0.012 L=158.0' S=0.0050 '/' Outflow=3.26 cfs 10,372 cf

Pond 2AP: Peak Elev=230.58' Storage=5 cf Inflow=0.63 cfs 1,854 cf
Outflow=0.63 cfs 1,854 cf

Pond 2P: Peak Elev=227.05' Storage=5 cf Inflow=0.63 cfs 1,854 cf
18.0" Round Culvert n=0.012 L=122.0' S=0.0050 '/' Outflow=0.63 cfs 1,854 cf

Total Runoff Area = 62,745 sf Runoff Volume = 10,372 cf Average Runoff Depth = 1.98"
54.23% Pervious = 34,025 sf 45.77% Impervious = 28,720 sf

Summary for Subcatchment 1S:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 2.75 cfs @ 12.08 hrs, Volume= 8,519 cf, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10- Year Storm Rainfall=4.15"

	Area (sf)	CN	Description
*	22,165	98	Paved Parking & Roofs
*	3,360	98	Paved Roads w/curb
	14,675	61	>75% Grass cover, Good, HSG B
	3,640	55	Woods, Good, HSG B
	43,840	82	Weighted Average
	18,315		41.78% Pervious Area
	25,525		58.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 2S:

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.63 cfs @ 12.01 hrs, Volume= 1,854 cf, Depth= 1.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10- Year Storm Rainfall=4.15"

	Area (sf)	CN	Description
*	875	98	Paved Roads w/curbs & Sewers
*	2,320	98	Paved Parking & Roofs
	3,635	55	Woods, Good, HSG B
	12,075	61	>75% Grass cover, Good, HSG B
	18,905	66	Weighted Average
	15,710		83.10% Pervious Area
	3,195		16.90% Impervious Area

Summary for Pond 1AP:

AREA ABOVE CB-1

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 43,840 sf, 58.22% Impervious, Inflow Depth = 2.33" for 10- Year Storm event
Inflow = 2.75 cfs @ 12.08 hrs, Volume= 8,519 cf
Outflow = 2.75 cfs @ 12.08 hrs, Volume= 8,519 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.75 cfs @ 12.08 hrs, Volume= 8,519 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 230.90' @ 12.08 hrs Surf.Area= 27 sf Storage= 0 cf

Plug-Flow detention time= 0.0 min calculated for 8,507 cf (100% of inflow)
Center-of-Mass det. time= 0.0 min (823.3 - 823.3)

Volume	Invert	Avail.Storage	Storage Description
#1	230.90'	183 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
230.90	20	0	0
231.00	345	18	18
231.40	480	165	183

Device	Routing	Invert	Outlet Devices
#1	Primary	230.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=6.67 cfs @ 12.08 hrs HW=230.90' (Free Discharge)
1=Orifice/Grate (Weir Controls 6.67 cfs @ 2.07 fps)

Summary for Pond 1P: POC #1

[81] Warning: Exceeded Pond 2P by 1.75' @ 12.10 hrs

Inflow Area = 62,745 sf, 45.77% Impervious, Inflow Depth = 1.98" for 10- Year Storm event
Inflow = 3.26 cfs @ 12.07 hrs, Volume= 10,372 cf
Outflow = 3.26 cfs @ 12.07 hrs, Volume= 10,372 cf, Atten= 0%, Lag= 0.1 min
Primary = 3.26 cfs @ 12.07 hrs, Volume= 10,372 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 228.74' @ 12.07 hrs Surf.Area= 13 sf Storage= 14 cf

Plug-Flow detention time= 0.2 min calculated for 10,358 cf (100% of inflow)
Center-of-Mass det. time= 0.2 min (831.0 - 830.8)

Volume	Invert	Avail.Storage	Storage Description
#1	227.70'	42 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
227.70	13	0	0
230.90	13	42	42

Device	Routing	Invert	Outlet Devices
#1	Primary	227.70'	**15.0" Round Culvert** L= 158.0' Ke= 0.500 Inlet / Outlet Invert= 227.70' / 226.91' S= 0.0050 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf

Primary OutFlow Max=3.15 cfs @ 12.07 hrs HW=228.72' (Free Discharge)
1=Culvert (Barrel Controls 3.15 cfs @ 4.00 fps)

Summary for Pond 2AP:

Inflow Area = 18,905 sf, 16.90% Impervious, Inflow Depth = 1.18" for 10- Year Storm event
Inflow = 0.63 cfs @ 12.01 hrs, Volume= 1,854 cf
Outflow = 0.63 cfs @ 12.01 hrs, Volume= 1,854 cf, Atten= 1%, Lag= 0.2 min
Primary = 0.63 cfs @ 12.01 hrs, Volume= 1,854 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 230.58' @ 12.01 hrs Surf.Area= 104 sf Storage= 5 cf

Plug-Flow detention time= 0.1 min calculated for 1,851 cf (100% of inflow)
Center-of-Mass det. time= 0.1 min (864.8 - 864.7)

Volume	Invert	Avail.Storage	Storage Description
#1	230.50'	684 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
230.50	20	0	0
231.00	525	136	136
231.60	1,300	547	684

Device	Routing	Invert	Outlet Devices
#1	Primary	230.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.60 cfs @ 12.01 hrs HW=230.58' (Free Discharge)
1=Orifice/Grate (Weir Controls 0.60 cfs @ 0.93 fps)

Summary for Pond 2P:

CB-2

Inflow Area = 18,905 sf, 16.90% Impervious, Inflow Depth = 1.18" for 10- Year Storm event
Inflow = 0.63 cfs @ 12.01 hrs, Volume= 1,854 cf
Outflow = 0.63 cfs @ 12.02 hrs, Volume= 1,854 cf, Atten= 0%, Lag= 0.1 min
Primary = 0.63 cfs @ 12.02 hrs, Volume= 1,854 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 227.05' @ 12.02 hrs Surf.Area= 13 sf Storage= 5 cf

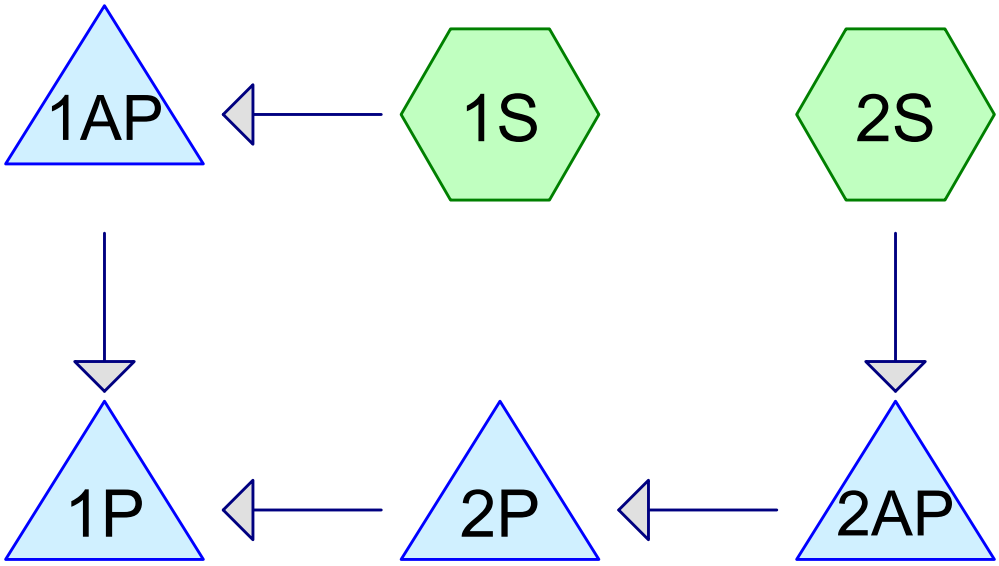
Plug-Flow detention time= 0.5 min calculated for 1,851 cf (100% of inflow)
Center-of-Mass det. time= 0.5 min (865.3 - 864.8)

Volume	Invert	Avail.Storage	Storage Description
#1	226.66'	50 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
226.66	13	0	0
230.50	13	50	50

Device	Routing	Invert	Outlet Devices
#1	Primary	226.66'	**18.0" Round Culvert** L= 122.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 226.66' / 226.05' S= 0.0050 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=0.60 cfs @ 12.02 hrs HW=227.04' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 0.60 cfs @ 2.57 fps)



POC #1

Subcat Reach Pond Link

Routing Diagram for 25009_Post-Drain
Prepared by Northpoint Engineering, LLC., Printed 8/19/2025

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
25,802	61	>75% Grass cover, Good, HSG B (1S, 2S)
25,433	98	Paved Parking & Roofs (1S, 2S)
3,360	98	Paved Roads w/curb (1S)
875	98	Paved Roads w/curbs & Sewers (2S)
7,275	55	Woods, Good, HSG B (1S, 2S)
62,745	**78**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
33,077	HSG B	1S, 2S
0	HSG C	
0	HSG D	
29,668	Other	1S, 2S
62,745		**TOTAL AREA**

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=44,154 sf 58.52% Impervious Runoff Depth=1.24"
Tc=5.0 min CN=82 Runoff=1.46 cfs 4,558 cf

Subcatchment 2S: Runoff Area=18,591 sf 20.60% Impervious Runoff Depth=0.50"
Tc=5.0 min CN=67 Runoff=0.19 cfs 772 cf

Pond 1AP: Peak Elev=227.96' Storage=334 cf Inflow=1.46 cfs 4,558 cf
Discarded=0.76 cfs 4,543 cf Primary=0.06 cfs 15 cf Outflow=0.82 cfs 4,558 cf

Pond 1P: POC #1 Peak Elev=227.88' Storage=2 cf Inflow=0.14 cfs 288 cf
15.0" Round Culvert n=0.012 L=158.0' S=0.0050 '/' Outflow=0.12 cfs 288 cf

Pond 2AP: Peak Elev=228.59' Storage=150 cf Inflow=0.19 cfs 772 cf
Discarded=0.01 cfs 499 cf Primary=0.15 cfs 273 cf Outflow=0.16 cfs 772 cf

Pond 2P: Peak Elev=226.85' Storage=2 cf Inflow=0.15 cfs 273 cf
18.0" Round Culvert n=0.012 L=122.0' S=0.0050 '/' Outflow=0.14 cfs 273 cf

Total Runoff Area = 62,745 sf Runoff Volume = 5,330 cf Average Runoff Depth = 1.02"
52.72% Pervious = 33,077 sf 47.28% Impervious = 29,668 sf

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=44,154 sf 58.52% Impervious Runoff Depth=2.33"
Tc=5.0 min CN=82 Runoff=2.77 cfs 8,580 cf

Subcatchment 2S: Runoff Area=18,591 sf 20.60% Impervious Runoff Depth=1.24"
Tc=5.0 min CN=67 Runoff=0.58 cfs 1,918 cf

Pond 1AP: Peak Elev=228.13' Storage=410 cf Inflow=2.77 cfs 8,580 cf
Discarded=0.76 cfs 7,277 cf Primary=2.24 cfs 1,303 cf Outflow=3.00 cfs 8,580 cf

Pond 1P: POC #1 Peak Elev=228.64' Storage=12 cf Inflow=2.77 cfs 2,636 cf
15.0" Round Culvert n=0.012 L=158.0' S=0.0050 '/' Outflow=2.79 cfs 2,636 cf

Pond 2AP: Peak Elev=228.64' Storage=159 cf Inflow=0.58 cfs 1,918 cf
Discarded=0.01 cfs 585 cf Primary=0.60 cfs 1,333 cf Outflow=0.61 cfs 1,918 cf

Pond 2P: Peak Elev=227.05' Storage=5 cf Inflow=0.60 cfs 1,333 cf
18.0" Round Culvert n=0.012 L=122.0' S=0.0050 '/' Outflow=0.61 cfs 1,333 cf

Total Runoff Area = 62,745 sf Runoff Volume = 10,498 cf Average Runoff Depth = 2.01"
52.72% Pervious = 33,077 sf 47.28% Impervious = 29,668 sf

Summary for Subcatchment 1S:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 2.77 cfs @ 12.08 hrs, Volume= 8,580 cf, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10- Year Storm Rainfall=4.15"

	Area (sf)	CN	Description
*	22,479	98	Paved Parking & Roofs
*	3,360	98	Paved Roads w/curb
	14,675	61	>75% Grass cover, Good, HSG B
	3,640	55	Woods, Good, HSG B
	44,154	82	Weighted Average
	18,315		41.48% Pervious Area
	25,839		58.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 2S:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.58 cfs @ 12.09 hrs, Volume= 1,918 cf, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10- Year Storm Rainfall=4.15"

	Area (sf)	CN	Description
*	875	98	Paved Roads w/curbs & Sewers
*	2,954	98	Paved Parking & Roofs
	3,635	55	Woods, Good, HSG B
	11,127	61	>75% Grass cover, Good, HSG B
	18,591	67	Weighted Average
	14,762		79.40% Pervious Area
	3,829		20.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Pond 1AP:

AREA ABOVE CB-1

[88] Warning: Qout>Qin may require smaller dt or Finer Routing
[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=6)

Inflow Area = 44,154 sf, 58.52% Impervious, Inflow Depth = 2.33" for 10- Year Storm event
Inflow = 2.77 cfs @ 12.08 hrs, Volume= 8,580 cf
Outflow = 3.00 cfs @ 12.10 hrs, Volume= 8,580 cf, Atten= 0%, Lag= 1.3 min
Discarded = 0.76 cfs @ 11.85 hrs, Volume= 7,277 cf
Primary = 2.24 cfs @ 12.10 hrs, Volume= 1,303 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 228.13' @ 12.10 hrs Surf.Area= 461 sf Storage= 410 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 1.7 min (825.1 - 823.3)

Volume	Invert	Avail.Storage	Storage Description
#1	229.00'	676 cf	**Forebay (Prismatic)**Listed below (Recalc)
#2	227.00'	1,623 cf	**Infiltration basin (Prismatic)**Listed below (Recalc)
		2,299 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
229.00	52	0	0
230.00	1,299	676	676

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
227.00	265	0	0
228.00	435	350	350
229.00	630	533	883
230.00	851	741	1,623

Device	Routing	Invert	Outlet Devices
#1	Primary	227.94'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Discarded	227.00'	**0.76 cfs Exfiltration at all elevations**

Discarded OutFlow Max=0.76 cfs @ 11.85 hrs HW=227.06' (Free Discharge)
2=Exfiltration (Exfiltration Controls 0.76 cfs)

Primary OutFlow Max=2.23 cfs @ 12.10 hrs HW=228.13' (Free Discharge)
1=Orifice/Grate (Weir Controls 2.23 cfs @ 1.44 fps)

Summary for Pond 1P: POC #1

[88] Warning: Qout>Qin may require smaller dt or Finer Routing
[81] Warning: Exceeded Pond 1AP by 0.51' @ 12.10 hrs
[81] Warning: Exceeded Pond 2P by 1.63' @ 12.10 hrs

Inflow Area = 62,745 sf, 47.28% Impervious, Inflow Depth = 0.50" for 10- Year Storm event
Inflow = 2.77 cfs @ 12.10 hrs, Volume= 2,636 cf
Outflow = 2.79 cfs @ 12.10 hrs, Volume= 2,636 cf, Atten= 0%, Lag= 0.1 min
Primary = 2.79 cfs @ 12.10 hrs, Volume= 2,636 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 228.64' @ 12.10 hrs Surf.Area= 13 sf Storage= 12 cf

Plug-Flow detention time= 0.3 min calculated for 2,632 cf (100% of inflow)
Center-of-Mass det. time= 0.3 min (774.2 - 774.0)

Volume	Invert	Avail.Storage	Storage Description
#1	227.70'	42 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
227.70	13	0	0
230.90	13	42	42

Device	Routing	Invert	Outlet Devices
#1	Primary	227.70'	**15.0" Round Culvert** L= 158.0' Ke= 0.500 Inlet / Outlet Invert= 227.70' / 226.91' S= 0.0050 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf

Primary OutFlow Max=2.78 cfs @ 12.10 hrs HW=228.64' (Free Discharge)
1=Culvert (Barrel Controls 2.78 cfs @ 3.89 fps)

Summary for Pond 2AP:

[88] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area =	18,591 sf,	20.60% Impervious,	Inflow Depth =	1.24"	for 10- Year Storm event
Inflow =	0.58 cfs @	12.09 hrs, Volume=	1,918 cf		
Outflow =	0.61 cfs @	12.07 hrs, Volume=	1,918 cf,	Atten= 0%,	Lag= 0.0 min
Discarded =	0.01 cfs @	12.05 hrs, Volume=	585 cf		
Primary =	0.60 cfs @	12.07 hrs, Volume=	1,333 cf		

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 228.64' @ 12.05 hrs Surf.Area= 210 sf Storage= 159 cf

Plug-Flow detention time= 68.4 min calculated for 1,918 cf (100% of inflow)
Center-of-Mass det. time= 68.2 min (934.4 - 866.2)

Volume	Invert	Avail.Storage	Storage Description
#1	229.50'	92 cf	**Forebay (Prismatic)** Listed below (Recalc) -Impervious
#2	227.50'	562 cf	**Infiltration Basin (Prismatic)** Listed below
		654 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
229.50	108	0	0
230.00	259	92	92

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
227.50	45	0	0
228.00	110	39	39
229.00	267	189	227
230.00	402	335	562

Device	Routing	Invert	Outlet Devices
#1	Primary	228.56'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Discarded	227.50'	**2.130 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 12.05 hrs HW=228.64' (Free Discharge)
2=Exfiltration (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.55 cfs @ 12.07 hrs HW=228.64' (Free Discharge)
1=Orifice/Grate (Weir Controls 0.55 cfs @ 0.90 fps)

Summary for Pond 2P:

CB-2

[88] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area = 18,591 sf, 20.60% Impervious, Inflow Depth = 0.86" for 10- Year Storm event
Inflow = 0.60 cfs @ 12.07 hrs, Volume= 1,333 cf
Outflow = 0.61 cfs @ 12.07 hrs, Volume= 1,333 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.61 cfs @ 12.07 hrs, Volume= 1,333 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 227.05' @ 12.07 hrs Surf.Area= 13 sf Storage= 5 cf

Plug-Flow detention time= 0.4 min calculated for 1,331 cf (100% of inflow)
Center-of-Mass det. time= 0.4 min (817.5 - 817.1)

Volume	Invert	Avail.Storage	Storage Description
#1	226.66'	50 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
226.66	13	0	0
230.50	13	50	50

Device	Routing	Invert	Outlet Devices
#1	Primary	226.66'	**18.0" Round Culvert** L= 122.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 226.66' / 226.05' S= 0.0050 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=0.55 cfs @ 12.07 hrs HW=227.02' (Free Discharge)
1=Culvert (Barrel Controls 0.55 cfs @ 2.51 fps)

INFILTRATION PRACTICE CRITERIA
(Env-Wq 1508.07)

Type/Node Name: 1S

Enter the type of infiltration practice (such as basin, trench) and the node name in the drainage analysis, if applicable.

		Have you reviewed Env-Wq 1508.07(a) to ensure that infiltration is allowed?	← yes
1.01	ac	A = Area draining to the practice	
0.59	ac	A_I = Impervious area draining to the practice	
0.58	decimal	I = Percent impervious area draining to the practice, in decimal form	
0.58	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.58	ac-in	WQV= 1" x Rv x A	
2,111	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
528	cf	25% x WQV (check calc for sediment forebay volume)	
		Method of pretreatment? (not required for clean or roof runoff)	
676	cf	V_{SED} = Sediment forebay volume, if used for pretreatment	≥ 25%WQV
883	cf	V = Volume[1] (attach a stage-storage table)	≥ WQV
265	sf	A_{SA} = Surface area of the bottom of the pond	
0.76	iph	$Ksat_{DESIGN}$ = Design infiltration rate[2]	
125.8	hours	T_{DRAIN} = Drain time = V / (A_{SA} * I_{DESIGN})	≤ 72-hrs
227.00	feet	E_{BTM} = Elevation of the bottom of the basin	
222.00	feet	E_{SHWT} = Elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
222.00	feet	E_{ROCK} = Elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
5.00	feet	D_{SHWT} = Separation from SHWT	≥ *[3]
5.0	feet	D_{ROCK} = Separation from bedrock	≥ *[3]
	ft	D_{amend} = Depth of amended soil, if applicable due high infiltation rate	≥ 24"
	ft	D_T = Depth of trench, if trench proposed	4 - 10 ft
	Yes/No	If a trench or underground system is proposed, has observation well been provided?	←yes
		If a trench is proposed, does material meet Env-Wq 1508.07(k)(2) requirements.[4]	← yes
yes	Yes/No	If a basin is proposed, Is the perimeter curvilinear, and basin floor flat?	← yes
3.0	:1	If a basin is proposed, pond side slopes.	≥3:1
228.02	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
230.00	ft	Elevation of the top of the practice (if a basin, this is the elevation of the berm)	
YES		10 peak elevation ≤ Elevation of the top of the trench?[5]	← yes
-		If a basin is proposed, 50-year peak elevation ≤ Elevation of berm?	← yes

1. Volume below the lowest invert of the outlet structure and excludes forebay volume
2. $Ksat_{DESIGN}$ includes a factor of safety. See Env-Wq 1504.14 for requirements for determining the infiltr. rate
3. 1' separation if treatment not required; 4' for treatment in GPAs & WSIPAs; & 3' in all other areas.
4. Clean, washed well graded diameter of 1.5 to 3 inches above the in-situ soil.
5. If 50-year peak elevation exceeds top of trench, the overflow must be routed in HydroCAD as secondary discharge.

Designer's Notes: This worksheet represents all of the existing and proposed impervious area within the subcathment draining into the infiltration basin. For this reason, only the volume of the pre-treatment forebay is is used as design parameter

INFILTRATION PRACTICE CRITERIA
(Env-Wq 1508.07)

Type/Node Name: **2S**

Enter the type of infiltration practice (such as basin, trench) and the node name in the drainage analysis, if applicable.

		Have you reviewed Env-Wq 1508.07(a) to ensure that infiltration is allowed?	← yes
0.43	ac	A = Area draining to the practice	
0.09	ac	A_I = Impervious area draining to the practice	
0.21	decimal	I = Percent impervious area draining to the practice, in decimal form	
0.24	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.10	ac-in	WQV= 1" x Rv x A	
365	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
91	cf	25% x WQV (check calc for sediment forebay volume)	
		Method of pretreatment? (not required for clean or roof runoff)	
92	cf	V_{SED} = Sediment forebay volume, if used for pretreatment	≥ 25%WQV
133	cf	V = Volume[1] (attach a stage-storage table)	≥ WQV
45	sf	A_{SA} = Surface area of the bottom of the pond	
2.13	iph	$Ksat_{DESIGN}$ = Design infiltration rate[2]	
45.7	hours	T_{DRAIN} = Drain time = V / (A_{SA} * I_{DESIGN})	≤ 72-hrs
227.50	feet	E_{BTM} = Elevation of the bottom of the basin	
222.00	feet	E_{SHWT} = Elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
222.00	feet	E_{ROCK} = Elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
5.50	feet	D_{SHWT} = Separation from SHWT	≥ *[3]
5.5	feet	D_{ROCK} = Separation from bedrock	≥ *[3]
	ft	D_{amend} = Depth of amended soil, if applicable due high infiltation rate	≥ 24"
	ft	D_T = Depth of trench, if trench proposed	4 - 10 ft
	Yes/No	If a trench or underground system is proposed, has observation well been provided?	←yes
		If a trench is proposed, does material meet Env-Wq 1508.07(k)(2) requirements.[4]	← yes
Yes	Yes/No	If a basin is proposed, Is the perimeter curvilinear, and basin floor flat?	← yes
3.0	:1	If a basin is proposed, pond side slopes.	≥3:1
228.58	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
230.00	ft	Elevation of the top of the practice (if a basin, this is the elevation of the berm)	
YES		10 peak elevation ≤ Elevation of the top of the trench?[5]	← yes
-		If a basin is proposed, 50-year peak elevation ≤ Elevation of berm?	← yes

1. Volume below the lowest invert of the outlet structure and excludes forebay volume
2. $Ksat_{DESIGN}$ includes a factor of safety. See Env-Wq 1504.14 for requirements for determining the infiltr. rate
3. 1' separation if treatment not required; 4' for treatment in GPAs & WSIPAs; & 3' in all other areas.
4. Clean, washed well graded diameter of 1.5 to 3 inches above the in-situ soil.
5. If 50-year peak elevation exceeds top of trench, the overflow must be routed in HydroCAD as secondary discharge.

Designer's Notes: This worksheet represents all of the existing and proposed impervious area within the subcathment draining into the infiltration basin. For this reason, only the volume of the pre-treatment forebay is is used as design parameter

INFILTRATION PRACTICE CRITERIA
(Env-Wq 1508.07)

Type/Node Name: 1S

Enter the type of infiltration practice (such as basin, trench) and the node name in the drainage analysis, if applicable.

		Have you reviewed Env-Wq 1508.07(a) to ensure that infiltration is allowed?	← yes
1.01	ac	A = Area draining to the practice	
0.02	ac	A_I = Impervious area draining to the practice	
0.02	decimal	I = Percent impervious area draining to the practice, in decimal form	
0.07	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.07	ac-in	WQV= 1" x Rv x A	
249	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
62	cf	25% x WQV (check calc for sediment forebay volume)	
		Method of pretreatment? (not required for clean or roof runoff)	
676	cf	V_{SED} = Sediment forebay volume, if used for pretreatment	≥ 25%WQV
883	cf	V = Volume[1] (attach a stage-storage table)	≥ WQV
265	sf	A_{SA} = Surface area of the bottom of the pond	
0.76	iph	$Ksat_{DESIGN}$ = Design infiltration rate[2]	
14.8	hours	T_{DRAIN} = Drain time = V / (A_{SA} * I_{DESIGN})	≤ 72-hrs
227.00	feet	E_{BTM} = Elevation of the bottom of the basin	
222.00	feet	E_{SHWT} = Elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
222.00	feet	E_{ROCK} = Elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
5.00	feet	D_{SHWT} = Separation from SHWT	≥ *[3]
5.0	feet	D_{ROCK} = Separation from bedrock	≥ *[3]
	ft	D_{amend} = Depth of amended soil, if applicable due high infiltation rate	≥ 24"
	ft	D_T = Depth of trench, if trench proposed	4 - 10 ft
	Yes/No	If a trench or underground system is proposed, has observation well been provided?	←yes
		If a trench is proposed, does material meet Env-Wq 1508.07(k)(2) requirements.[4]	← yes
yes	Yes/No	If a basin is proposed, Is the perimeter curvilinear, and basin floor flat?	← yes
3.0	:1	If a basin is proposed, pond side slopes.	≥3:1
282.02	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
230.00	ft	Elevation of the top of the practice (if a basin, this is the elevation of the berm)	
NO		10 peak elevation ≤ Elevation of the top of the trench?[5]	← yes
-		If a basin is proposed, 50-year peak elevation ≤ Elevation of berm?	← yes

1. Volume below the lowest invert of the outlet structure and excludes forebay volume
2. $Ksat_{DESIGN}$ includes a factor of safety. See Env-Wq 1504.14 for requirements for determining the infiltr. rate
3. 1' separation if treatment not required; 4' for treatment in GPAs & WSIPAs; & 3' in all other areas.
4. Clean, washed well graded diameter of 1.5 to 3 inches above the in-situ soil.
5. If 50-year peak elevation exceeds top of trench, the overflow must be routed in HydroCAD as secondary discharge.

Designer's Notes: This worksheet represents only the new impervious area added to the subcatchment draining to the infiltration basin. For this reason only the WQV below the lowest orriface is used as a design parameter

INFILTRATION PRACTICE CRITERIA
(Env-Wq 1508.07)

Type/Node Name: 2S

Enter the type of infiltration practice (such as basin, trench) and the node name in the drainage analysis, if applicable.

		Have you reviewed Env-Wq 1508.07(a) to ensure that infiltration is allowed?	← yes
0.43	ac	A = Area draining to the practice	
0.01	ac	A_I = Impervious area draining to the practice	
0.02	decimal	I = Percent impervious area draining to the practice, in decimal form	
0.07	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.03	ac-in	WQV= 1" x Rv x A	
110	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
28	cf	25% x WQV (check calc for sediment forebay volume)	
		Method of pretreatment? (not required for clean or roof runoff)	
92	cf	V_{SED} = Sediment forebay volume, if used for pretreatment	≥ 25%WQV
133	cf	V = Volume[1] (attach a stage-storage table)	≥ WQV
45	sf	A_{SA} = Surface area of the bottom of the pond	
2.13	iph	$Ksat_{DESIGN}$ = Design infiltration rate[2]	
13.8	hours	T_{DRAIN} = Drain time = V / (A_{SA} * I_{DESIGN})	≤ 72-hrs
227.50	feet	E_{BTM} = Elevation of the bottom of the basin	
222.00	feet	E_{SHWT} = Elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
222.00	feet	E_{ROCK} = Elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
5.50	feet	D_{SHWT} = Separation from SHWT	≥ *[3]
5.5	feet	D_{ROCK} = Separation from bedrock	≥ *[3]
	ft	D_{amend} = Depth of amended soil, if applicable due high infiltation rate	≥ 24"
	ft	D_T = Depth of trench, if trench proposed	4 - 10 ft
	Yes/No	If a trench or underground system is proposed, has observation well been provided?	←yes
		If a trench is proposed, does material meet Env-Wq 1508.07(k)(2) requirements.[4]	← yes
yes	Yes/No	If a basin is proposed, Is the perimeter curvilinear, and basin floor flat?	← yes
3.0	:1	If a basin is proposed, pond side slopes.	≥3:1
228.58	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
230.00	ft	Elevation of the top of the practice (if a basin, this is the elevation of the berm)	
YES		10 peak elevation ≤ Elevation of the top of the trench?[5]	← yes
-		If a basin is proposed, 50-year peak elevation ≤ Elevation of berm?	← yes

1. Volume below the lowest invert of the outlet structure and excludes forebay volume
2. $Ksat_{DESIGN}$ includes a factor of safety. See Env-Wq 1504.14 for requirements for determining the infiltr. rate
3. 1' separation if treatment not required; 4' for treatment in GPAs & WSIPAs; & 3' in all other areas.
4. Clean, washed well graded diameter of 1.5 to 3 inches above the in-situ soil.
5. If 50-year peak elevation exceeds top of trench, the overflow must be routed in HydroCAD as secondary discharge.

Designer's Notes: This worksheet represents only the new impervious area added to the subcatchment draining to the infiltration basin. For this reason only the WQV below the lowest orriface is used as a design parameter.

Stage-Area-Storage for Pond 1AP:

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
227.00	0	228.06	376	229.12	975
227.02	5	228.08	385	229.14	992
227.04	11	228.10	394	229.16	1,010
227.06	16	228.12	404	229.18	1,029
227.08	22	228.14	413	229.20	1,048
227.10	27	228.16	422	229.22	1,068
227.12	33	228.18	431	229.24	1,088
227.14	39	228.20	441	229.26	1,109
227.16	45	228.22	450	229.28	1,131
227.18	50	228.24	460	229.30	1,153
227.20	56	228.26	470	229.32	1,176
227.22	62	228.28	479	229.34	1,199
227.24	68	228.30	489	229.36	1,223
227.26	75	228.32	499	229.38	1,248
227.28	81	228.34	509	229.40	1,273
227.30	87	228.36	519	229.42	1,298
227.32	94	228.38	529	229.44	1,325
227.34	100	228.40	540	229.46	1,352
227.36	106	228.42	550	229.48	1,379
227.38	113	228.44	560	229.50	1,407
227.40	120	228.46	571	229.52	1,436
227.42	126	228.48	581	229.54	1,465
227.44	133	228.50	592	229.56	1,495
227.46	140	228.52	603	229.58	1,525
227.48	147	228.54	613	229.60	1,556
227.50	154	228.56	624	229.62	1,587
227.52	161	228.58	635	229.64	1,620
227.54	168	228.60	646	229.66	1,652
227.56	175	228.62	657	229.68	1,686
227.58	182	228.64	668	229.70	1,720
227.60	190	228.66	680	229.72	1,754
227.62	197	228.68	691	229.74	1,789
227.64	204	228.70	702	229.76	1,825
227.66	212	228.72	714	229.78	1,861
227.68	220	228.74	725	229.80	1,898
227.70	227	228.76	737	229.82	1,935
227.72	235	228.78	749	229.84	1,973
227.74	243	228.80	760	229.86	2,012
227.76	250	228.82	772	229.88	2,051
227.78	258	228.84	784	229.90	2,091
227.80	266	228.86	796	229.92	2,131
227.82	274	228.88	808	229.94	2,172
227.84	283	228.90	820	229.96	2,214
227.86	291	228.92	833	229.98	2,256
227.88	299	228.94	845	230.00	**2,299**
227.90	307	228.96	857		
227.92	316	228.98	870		
227.94	324	229.00	883		
227.96	333	229.02	896		
227.98	341	229.04	911		
228.00	350	229.06	926		
228.02	359	229.08	942		
228.04	368	229.10	958		

Stage-Area-Storage for Pond 2AP:

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
227.50	45	0
227.55	52	4
227.60	58	8
227.65	65	12
227.70	71	15
227.75	78	19
227.80	84	23
227.85	90	27
227.90	97	31
227.95	103	35
228.00	110	39
228.05	118	48
228.10	126	58
228.15	134	67
228.20	141	76
228.25	149	86
228.30	157	95
228.35	165	105
228.40	173	114
228.45	181	124
228.50	189	133
228.55	196	142
228.60	204	152
228.65	212	161
228.70	220	171
228.75	228	180
228.80	236	190
228.85	243	199
228.90	251	208
228.95	259	218
229.00	267	227
229.05	274	244
229.10	280	261
229.15	287	277
229.20	294	294
229.25	301	311
229.30	308	328
229.35	314	344
229.40	321	361
229.45	328	378
229.50	335	395
229.55	341	417
229.60	348	440
229.65	355	464
229.70	361	489
229.75	368	515
229.80	375	541
229.85	382	568
229.90	389	596
229.95	395	624
230.00	**402**	**654**

PROJECT	NPE 25009	28 Manchester Street - Enterprise Rent-A-Car							
	8/07/25	RJS/HK/IM							
SWMB # AND TEST PIT #	Permeability Test	V - Drop in Water Level (cm)	A - Outflow Chamber (cm2)	Elapes Time (min/hr)	Outflow Q = AxV	Coeff A	Ksat = Q* coeff A (cm/hr)	Ksat (in/hour)	
West	1	0.6	105	0.033	1909.09	0.001007	1.9225	0.76	
	2	1.5	105	0.017	9264.71	0.001007	9.3296	3.67	
	3	0.1	105	0.033	286.36	0.001007	0.2884	0.11	
	1-AVG							1.51	
East	1	1.0	105	0.017	6176.47	0.001007	6.2197	2.45	
	2	1.6	105	0.017	9882.35	0.001007	9.9515	3.92	
	3	2.6	105	0.017	16244.12	0.001007	16.3578	6.44	
	2-AVG							4.27	

Appendix 9.2 Constant Head Well Permeameter, Amoozemeter

Appendix 9.2.3 Amoozemeter Data Sheet

Date:
Location: ENTERPRISE MANCHESTOR
EAST 1

Permeameter #:
Air temp (°F) initial: 81 °F
Air temp (°F) final:

Map unit component (or series) PODATUCK / URBAN
Pedon number:
Horizon: C HORIZON

"Water" source & modifications:
Soil moisture content (%):

Set-Up Calculation

Hole depth (cm):	52 cm
Distance from bottom of bubble tube to soil surface (cm:)	+ 10?
Desired water depth in hole (cm):	- 15?
= CHT Tube setting (cm):	47

Actual water level in hole (cm)
Initial: 10.5
Final: 15.5

15,5

Outflow chamber(s) used:
Associated Conversion Factor:
(see column 2 below)

Small ("1 on"): (=20.0 cm^2)

Both ("2 on"): (=105.0 cm^2)

Drop in Water level	Outflow chamber	Clock time	Elapsed time		Outflow (Q)	Saturated hydraulic conductivity (K_{sat})	
(cm)	*(C.F.)*	*(hr:min)*	*(min)*	*(min/hr)*	*(cm^3/hr)*	*(cm/hr)*	*(in/hr)*
Ex: 4.9	20.0	10:17	15	0.2500	392.0	0.4139	0.1629
25.8 Start (0)	105						
24.8 1.0	105		2	0.033			
23.7 1.1	105		2	0.0333			
22.7 1.0	105		2	0.0333			
21.7 1.0	105		2				
20.7 1.0	105		2				
					Mean K_{sat}:		
					Standard dev.		
					Saturated hydraulic conductivity class:		

Appendix 9.2 Constant Head Well Permeameter, Amoozemeter

Appendix 9.2.3 Amoozemeter Data Sheet

Date: 8/7/25
Location: ~~ENTER??~~ 28 MANCHESTER ST EAST BASIN 2

Permeameter #: 1882
Air temp (°F) initial: 87
Air temp (°F) final: 83

Map unit component (or series) PODTATVLK URBAN
Pedon number:
Horizon: B

"Water" source & modifications:
Soil moisture content (%): DRY

Set-Up Calculation

Hole depth (cm):	
Distance from bottom of bubble tube to soil surface (cm:)	+ 10?
Desired water depth in hole (cm):	- 15?
= CHT Tube setting (cm):	

Actual water level in hole (cm)
Initial: 15
Final: 15

Outflow chamber(s) used:
Associated Conversion Factor: (see column 2 below)
Small ("1 on"): (=20.0 cm^2)
Both ("2 on"): (=105.0 cm^2)

	Drop in Water level	Outflow chamber	Clock time	Elapsed time		Outflow (Q)	Saturated hydraulic conductivity (K_{sat})	
	(cm)	(C.F.)	(hr:min)	(min)	(min/hr)	(cm^3/hr)	(cm/hr)	(in/hr)
36.3	Ex: 4.9	20.0	10:17	15	0.2500	392.0	0.4139	0.1629
34.6	Start (0)	105	13:24	1				
33	1.7	"	13:25	1				
31.5	1.3	"	13:26	1				
30.0	1.5	"	13:27	1				
	1.5	"	13:28	1				
28.6	1.4	"	13:29	1				
27.1	1.5	"	13:29	1				
25.9	1.2	"	13:30	1				
24.5	1.4	"	13:31	1				
23.1	1.4	"	13:32	1				

Mean K_{sat}:
Standard dev.
Saturated hydraulic conductivity class:

-36.3
-34.6
-33.0
-31.5
-30.0
-28.6
-27.1
-25.9
-24.5
-23.1

Appendix 9.2 Constant Head Well Permeameter, Amoozemeter

Appendix 9.2.3 Amoozemeter Data Sheet

Date: 8/7/25
Location: 28 MANCHESTER ST CONCORD NH EAST BASIN #3

Permeameter #: 1882
Air temp (°F) initial: 83
Air temp (°F) final: 83

Map unit component (or series) POOTATUCK URBAN
Pedon number:
Horizon: B

"Water" source & modifications: TAP
Soil moisture content (%): DR

Set-Up Calculation

Hole depth (cm):	45
Distance from bottom of bubble tube to soil surface (cm:)	+ 10?
Desired water depth in hole (cm):	- 15?
= CHT Tube setting (cm):	40

Actual water level in hole (cm)
Initial: 16"
Final: 16"

Outflow chamber(s) used:
Associated **C**onversion **F**actor: (see column 2 below)
Small ("1 on"): (=20.0 cm^2)
Both ("2 on"): (=105.0 cm^2)

Drop in Water level	Outflow chamber	Clock time	Elapsed time		Outflow (Q)	Saturated hydraulic conductivity (K_{sat})	
(cm)	*(C.F.)*	*(hr:min)*	*(min)*	*(min/hr)*	*(cm^3/hr)*	*(cm/hr)*	*(in/hr)*
Ex: 4.9	20.0	10:17	15	0.2500	392.0	0.4139	0.1629
Start (0)	105	13:42					
2.6	"	13:43					
2.6	"	13:44					
2.5	"	13:45					
2.7	"	13:46					
2.4	"	13:47					
2.5	"	13:48					
2.6	"	13:49					
2.5	"	13:50					

Mean K_{sat}:
Standard dev.
Saturated hydraulic conductivity class:

34.1
31.5
28.9
26.4
23.7
21.3
18.8
16.2
13.9

-34.1
-31.5
-28.9
-26.4
-23.7
-21.3
-18.8
-16.2
-13.8

5 f
4 h

Appendix 9.2 Constant Head Well Permeameter, Amoozemeter

Appendix 9.2.3 Amoozemeter Data Sheet

Date: 8-07-25
Location: 28 MANCHESTER STREET
WEST 1

Permeameter #: 1892
Air temp (°F) initial: 75°
Air temp (°F) final: 80°

Map unit component (or series) POOTATUCK
Pedon number:
Horizon: C

"Water" source & modifications: TAP
Soil moisture content (%):

Set-Up Calculation

Hole depth (cm):	36
Distance from bottom of bubble tube to soil surface (cm:)	+ 10?
Desired water depth in hole (cm):	- 15?
= CHT Tube setting (cm):	31

Actual water level in hole (cm)
Initial: 16
Final: 16

Outflow chamber(s) used:
Associated Conversion Factor: (see column 2 below)
Small ("1 on"): (=20.0 cm²)
Both ("2 on"): (=105.0 cm²)

Drop in Water level	Outflow chamber	Clock time	Elapsed time		Outflow (Q)	Saturated hydraulic conductivity (K_{sat})	
(cm)	(C.F.)	(hr:min)	(min)	(min/hr)	(cm^3/hr)	(cm/hr)	(in/hr)
Ex: 4.9	20.0	10:17	15	0.2500	392.0	0.4139	0.1629
40.8 Start (0)	105	0	—				
40.2 0.6	"	2	2				
39.5 0.7	"	4	2				
38.8 0.7	"	6	2				
38.3 0.5	"	8	2				
37.8 0.5	"	10	2				
37.1 0.7	"	12	2				
36.6 0.5	"	14	2				
36.1 0.5	"	16	2				

Mean K_{sat}:
Standard dev.
Saturated hydraulic conductivity class:

WEST #1
2" HOLE DEPTH 19"
NITE 8.7.25 1892 EJS/MSH/IEH
11 40.8
-40.2
-39.5
-38.8
-38.3
-37.8
-37.1
-36.6
-36.1

Appendix 9.2 Constant Head Well Permeameter, Amoozemeter

Appendix 9.2.3 Amoozemeter Data Sheet

Date: 8/07/25
Location: 28 MANCHESTER ST
WEST 2

Permeameter #: NIPE
Air temp (°F) initial: 75
Air temp (°F) final: 75

Map unit component (or series) POOTATUCK
Pedon number:
Horizon: C

"Water" source & modifications: TAP
Soil moisture content (%):

Set-Up Calculation

Hole depth (cm):	40
Distance from bottom of bubble tube to soil surface (cm:)	+ 10?
Desired water depth in hole (cm):	- 15?
= CHT Tube setting (cm):	35

Actual water level in hole (cm)
Initial: 15.5
Final: 15.5

Outflow chamber(s) used:
Associated **C**onversion **F**actor:
(see column 2 below)

Small ("1 on"): (=20.0 cm^2)

Both ("2 on"): (=105.0 cm^2)

	Drop in Water level	Outflow chamber	Clock time	Elapsed time		Outflow (Q)	Saturated hydraulic conductivity (K_{sat})	
	(cm)	(C.F.)	(hr:min)	(min)	(min/hr)	(cm^3/hr)	(cm/hr)	(in/hr)
	Ex: 4.9	20.0	10:17	15	0.2500	392.0	0.4139	0.1629
20.3	Start (0)	105	11:09	-				
17.5	2.8	"	11:11	2				
15.8	1.7	"	11:12	1				
14.4	1.4	"	11:13	1				
13.2	1.2	"	11:14	1				
11.9	1.3	"	11:15	1				
10.5	1.4	"	11:16	1				
9.0	1.5	"	11:17	1				
7.4	1.6	"	11:18	1				
6.4	1.0	"	11:19	1				

Mean K_{sat}: _____
Standard dev. _____
Saturated hydraulic conductivity class: _____

NIPE AMOOZ 1882 8-7-25 RJS/MSH/IEM

20.3 - 17.5 = 2.8 1 min
17.5 - 15.8 = 1.7 1 min
15.8 - 14.4 = 1.4 1 min
14.4 - 13.2 = 1.2 1 min
13.2 - 11.9 = 1.3 1 min
11.9 - 10.5 = 1.4 1 min
10.5 - 9.0 = 1.5 1 min
9.0 - 7.4 = 1.6 1 min
7.4 - 6.4 = 1.0 1 min

Appendix 9.2 Constant Head Well Permeameter, Amoozemeter
Appendix 9.2.3 Amoozemeter Data Sheet

Date: 8-7-25
Location: ENTERPRISE 28 MANCHESTER ST CONCORD WEST BASIN #3

Permeameter #: 1882
Air temp (°F) initial: 79
Air temp (°F) final: 79

Map unit component (or series) PODUNK
Pedon number:
Horizon: C - EXCAVATED SWALE

"Water" source & modifications: DRY
Soil moisture content (%):

Set-Up Calculation

Hole depth (cm):	40 cm
Distance from bottom of bubble tube to soil surface (cm:)	+ 10?
Desired water depth in hole (cm):	- 15?
= CHT Tube setting (cm):	35

Actual water level in hole (cm)
Initial: 15.5
Final: 15.5

15.5

Outflow chamber(s) used:
Associated Conversion Factor:
(see column 2 below)

Small ("1 on"): (=20.0 cm^2)

Both ("2 on"): (=105.0 cm^2)

Drop in Water level	Outflow chamber	Clock time	Elapsed time		Outflow (Q)	Saturated hydraulic conductivity (K_{sat})	
(cm)	(C.F.)	(hr:min)	(min)	(min/hr)	(cm^3/hr)	(cm/hr)	(in/hr)
Ex: 4.9	20.0	10:17	15	0.2500	392.0	0.4139	0.1629
36.9 Start (0)	105		=				
36.0 0.9	105		2				
35.1 0.9	"		2				
34.2 0.9	"		2				
33.3 0.9	"	11:55	2				
32.4							
					Mean K_{sat}:		
					Standard dev.		
					Saturated hydraulic conductivity class:		

GROUNDWATER RECHARGE VOLUME (GRV)
(Env-Wq 1504.12)

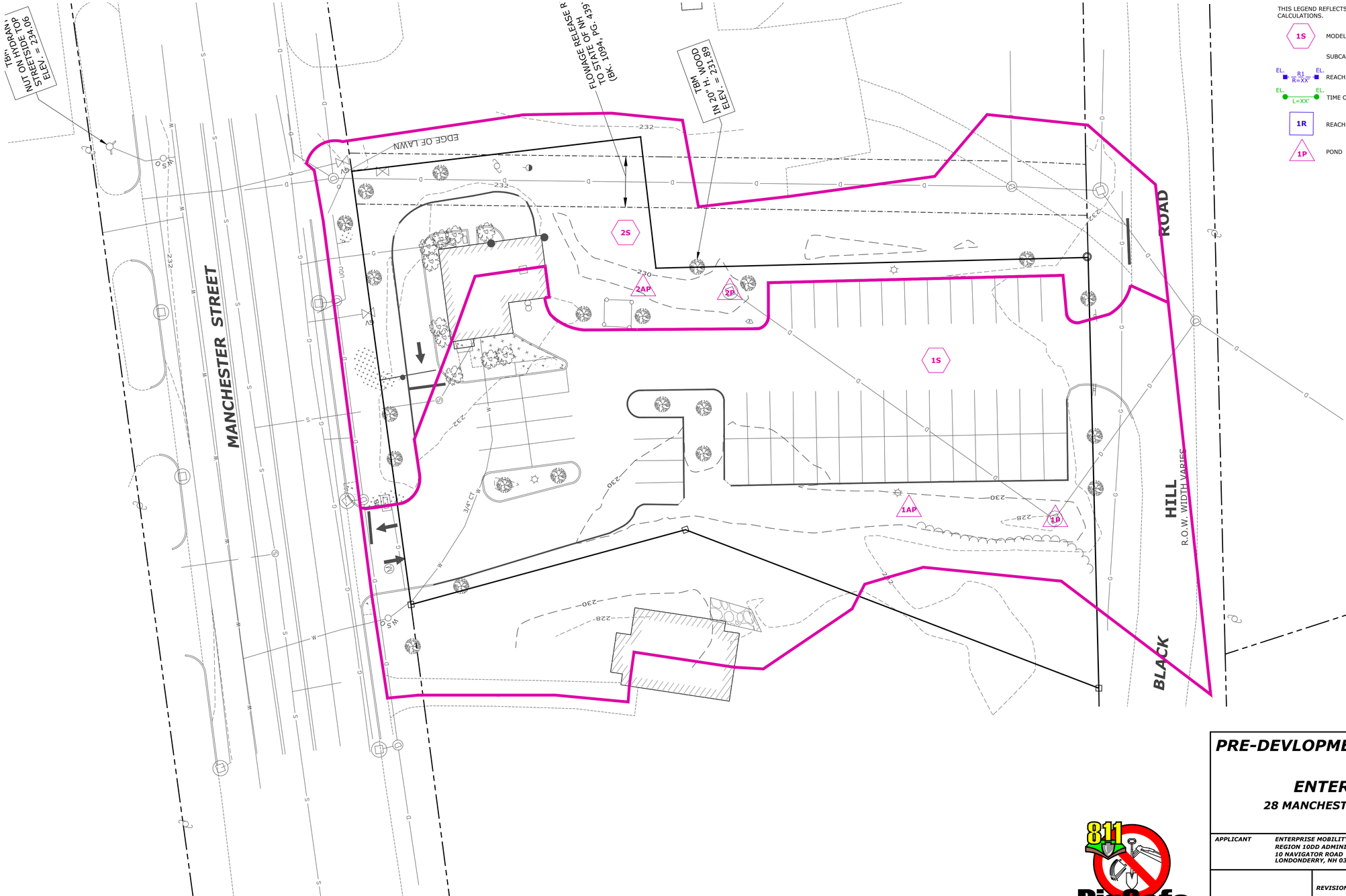
	ac	Area of HSG A soil that was replaced by impervious cover	0.40"
0.03	ac	Area of HSG B soil that was replaced by impervious cover	0.25"
	ac	Area of HSG C soil that was replaced by impervious cover	0.10"
	ac	Area of HSG D soil or impervious cover that was replaced by impervious cover	0.0"
0.25	inches	Rd = Weighted groundwater recharge depth	
0.0075	ac-in	GRV = AI * Rd	
27	cf	GRV conversion (ac-in x 43,560 sf/ac x 1ft/12”)	
Y	← Y/N	Is a stage-storage table attached showing that the GRV can be stored below the lowest invert of the outlet structure (if applicable)? Multiple stormwater control measures may be used to meet the GRV requirements.	

Provide calculations/discussion below showing that the project meets the groundwater recharge requirements (Env-Wq 1507.04):

stage storage tables show 1016 CF will be infiltrated

VII. Drainage Area Plans

- Pre-Developed Drainage Area Plan
- Post-Developed Drainage Area Plan



PRE-DRAINAGE LEGEND:

THIS LEGEND REFLECTS THE HYDROCAD MODEL USED FOR DRAINAGE CALCULATIONS.

- 1S — MODELED AS EXISTING SUBCATCHMENT
- SUBCATCHMENT BOUNDARIES
- EL. RI R=XX' EL. — REACH PATH
- EL. L=XX' EL. — TIME OF CONCENTRATION
- 1R — REACH
- 1P — POND

811 DigSafe MA . ME . NH . RI . VT

GRAPHIC SCALE

20 0 10 20 40 60

(IN FEET)

1 inch = 20 ft.

PRE-DEVLOPMENT DRAINAGE AREA PLAN

PREPARED FOR:

ENTERPRISE MOBILITY

28 MANCHESTER STREET (MAP 781Z LOT 31)
CONCORD, NH

APPLICANT	OWNER
ENTERPRISE MOBILITY REGION 10DD ADMINISTRATIVE OFFICE 10 NAVIGATOR ROAD LONDONDERRY, NH 03053	SKUFFY'S LLC. 48 CURTISVILLE ROAD CONCORD, NH 03301 OWNER CITY, ST

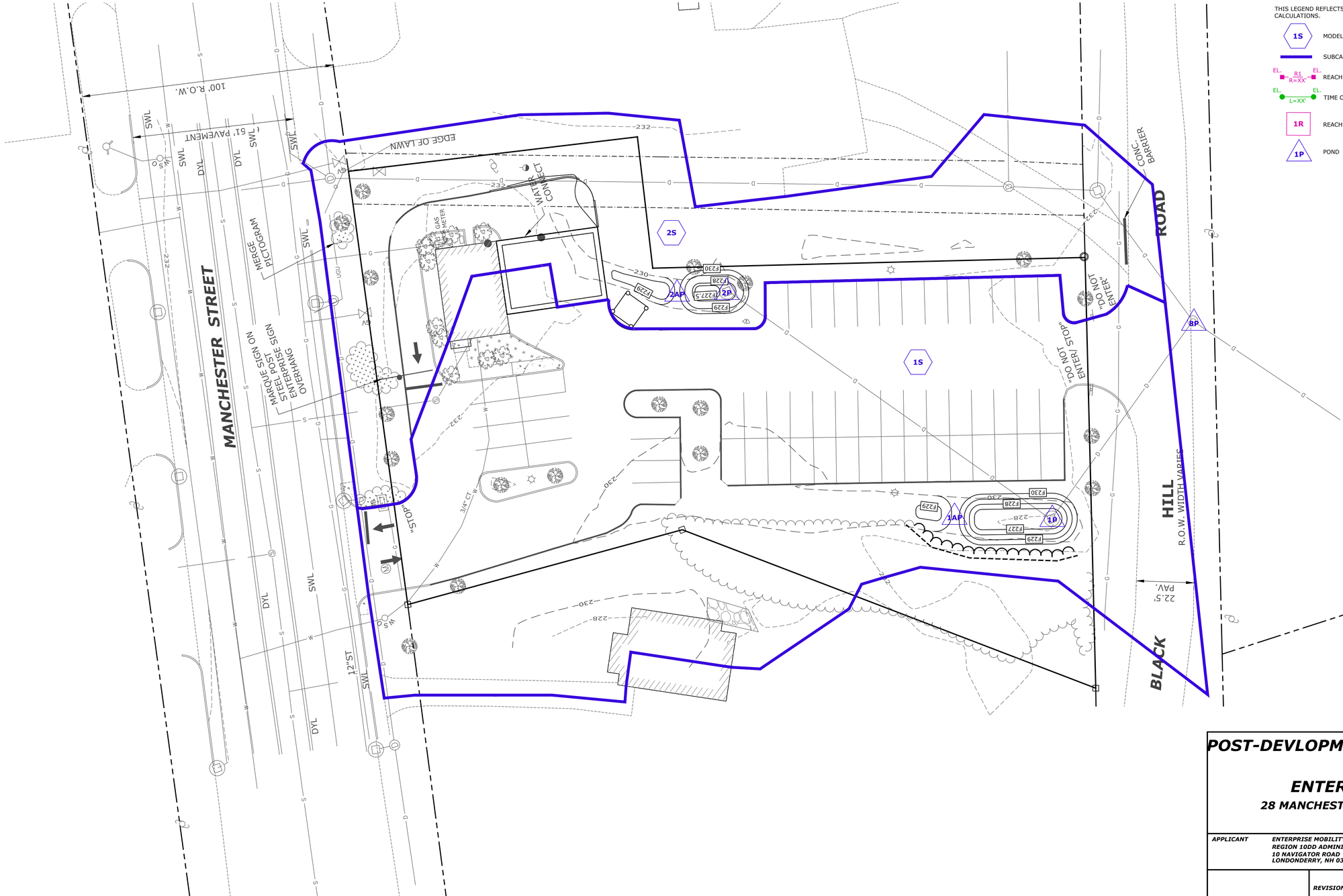
REVISIONS:

NO.	DATE	DESCRIPTION

NORTHPOINT ENGINEERING, LLC
Civil Engineering ◢ Land Planning ◢ Construction Services
119 Storrs St, Ste 201
Concord, NH 03301
Tel 603-226-1166
Fax 603-226-1160
www.northpointeng.com

DATE: JUN. 2025
PROJ.: 25009
SCALE: 1"=20'
SHEET: 1 OF 2

FILE: G:_PROJECTS\25009\dwg\25009_HYDROLOGY.dwg BY: Ian DATE: 14 Aug 2025 - 12:41pm



POST-DRAINAGE LEGEND:

THIS LEGEND REFLECTS THE HYDROCAD MODEL USED FOR DRAINAGE CALCULATIONS.

- 1S — MODELED AS PROPOSED SUBCATCHMENT
- SUBCATCHMENT BOUNDARIES
- EL. — R1 R=XX' — EL. — REACH PATH
- EL. — L=XX' — EL. — TIME OF CONCENTRATION
- 1R — REACH
- 1P — POND

GRAPHIC SCALE

0 ## ## ###

(IN FEET)

1 inch = ## ft.

POST-DEVLOPMENT DRAINAGE AREA PLAN

PREPARED FOR:

ENTERPRISE MOBILITY

28 MANCHESTER STREET (MAP 781Z LOT 31)
CONCORD, NH

APPLICANT	OWNER
ENTERPRISE MOBILITY REGION 10DD ADMINISTRATIVE OFFICE 10 NAVIGATOR ROAD LONDONDERRY, NH 03053	SKUFFY'S LLC. 48 CURTISVILLE ROAD CONCORD, NH 03301 OWNER CITY, ST

REVISIONS:

NO.	DATE	DESCRIPTION

NORTHPOINT ENGINEERING, LLC
Civil Engineering ◢ Land Planning ◢ Construction Services
119 Storrs St, Ste 201
Concord, NH 03301
Tel 603-226-1166
Fax 603-226-1160
www.northpointeng.com

DATE: JUN. 2025
PROJ.: 25009
SCALE: 1"=##'
SHEET: 2 OF 2

FILE: G:_PROJECTS\25009\dwg\25009_HYDROLOGY.dwg BY: Ian DATE: 14 Aug 2025 - 12:42pm

VIII. 2003 Approved Drainage Area Plan

SUBLIME
CIVIL CONSULTANTS, INC.

Drainage Report

Proposed Site Plan
Enterprise Rent-A-Car
Manchester Street (Route 3), Concord, NH

Prepared for:

Mark Carrier Construction, Inc.
120 River Front Drive
Manchester, NH 03102

July 30, 2003

Revised: September 3, 2003
Revised: October 29, 2003

STATE OF NEW HAMPSHIRE
TODD D. CONNORS No. 9746
LICENSED PROFESSIONAL ENGINEER
11-503

phone 603·437·5777 fax 603·437·6977 6 West Broadway Derry, NH 03038
SCCI

Table of Contents

Revision Statement

Revisions to the original report text are shown in bold print. The following is a summary of the changes that have occurred as a result of site plan revisions made to address engineering review comments:

- **Drainage Area Plans have been updated based on an additional field inspection.**
- **Calculations have been revised to account for the various site-specific design changes that are discussed within the report and the addition of off-site base flows from Manchester Street.**
- **An analysis of performance at the CB-7 control point as it relates to the peak flows from Manchester Street and the addition of peak flows from the site.**

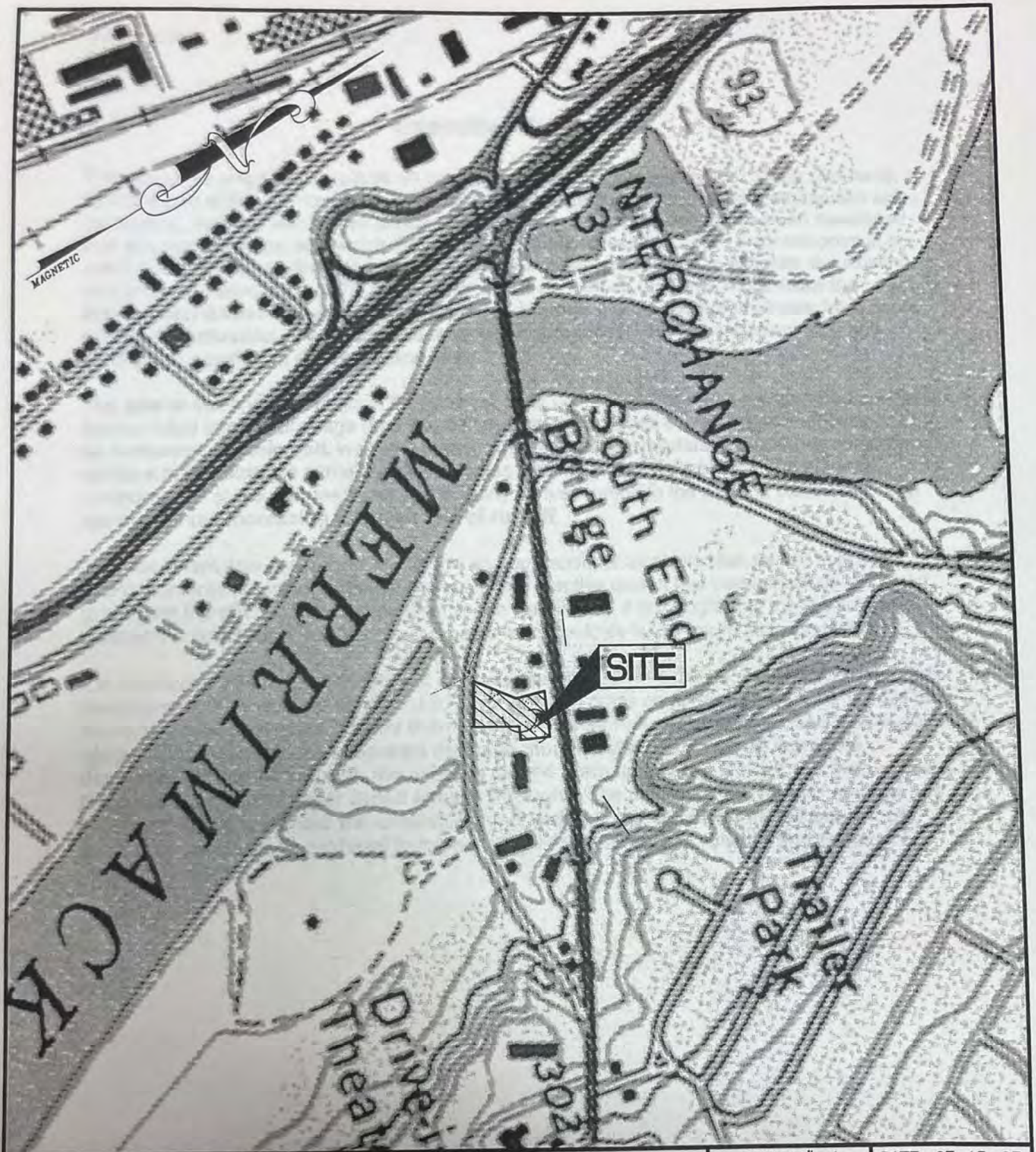
Introduction

Sublime Civil Consultants, Inc. (SCCI) was contracted by Mark Carrier Construction, Inc. to prepare a drainage analysis and design for a proposed rental car facility on Manchester Street (Route 3) in Concord, New Hampshire. This proposed construction is a redesign and expansion of an existing rental car facility. This report has been provided to support an application to the City of Concord Planning Board for Site Plan Approval and to address state and local standards for controlling runoff from developing sites.

The intent of the drainage design is to minimize and mitigate the impact of this project on surrounding property and natural resources with a combination of open and closed drainage. The site is located within **a watershed that is characterized by a large closed drainage system that collects run-off from Manchester Street and overland flows from surrounding properties. The project site is located at the bottom of this watershed in close proximity to the last catch basin (CB-7) before the system outlets under Black Hill Road toward the** Merrimack River. This report analyzes the effect of the project at **CB-7 as a** control point **in** the watershed, considers the effect of erosion, and also develops design specifications to manage peak flows in a form accepted by the City of Concord.

The original drainage analysis was embellished to include a model of the Manchester Street watershed and peak flows at CB-7, which is the connection and control point for run-off from the proposed site development. This allows for a more thorough analysis of both the existing conditions and the effect of site development.

The following pages include information that describes the project, an evaluation of watershed models, resulting calculations, and a discussion of factors taken into account during the design of the project. Drainage calculations and design have been coordinated with the construction design plans and include typical details for the various drainage improvements.



SUBLIME CIVIL CONSULTANTS, INC. 6 West Broadway Derry, NH 03038 ph: (603) 437-5777 fax: (603) 437-6977	**MAP & LOT** **USGS LOCUS PLAN** **ENTERPRISE RENT-A-CAR** MANCHESTER STREET (U.S. ROUTE 3) CONCORD, NH PREPARED FOR: **MARK CURRIER CONSTRUCTION, INC.** 121 RIVER FRONT DRIVE MANCHESTER, NH 03102	SHEET #: 1	DATE: 07-15-03
		SCALE: 1"=500'	JOB #: 03357
		REVISIONS:	

P:\scci-projects\03357\acadfile\plots\LOCUS.DWG 07/30/2003 07:53:54 AM EDT

FIG. C1

October 29, 2003

Executive Summary

This project is proposed on a 0.94 +/- acre property located on Manchester Street (Route 3), which is part of the Merrimack River watershed. The subject property is bounded on two sides by existing roadway with closed drainage systems. A project watershed has been developed that encompasses the site, which drains away from Manchester Street to a control point at a catch basin **(CB-7)** on Black Hill Road. Models have been developed to estimate the existing and proposed conditions of the **project** watershed **as well as the base flows from the Manchester Street closed drainage system. Including the base flows allows for a more accurate evaluation of both project impacts on the closed drainage system and** any increase in runoff from the developing site.

The type of soil and vegetation in the area are fairly uniform across the sub-watershed and were incorporated into the drainage model to better account for actual conditions and analyze design performance. **To this end, we have prepared two separate models for existing conditions at the site to compare actual peak flow rates with intended flow rates.** The primary consideration of the site design was to properly convey run-off to the existing closed drainage system without **increasing the peak rate of run-off**.

This document was assembled to support an application for local site plan permit approvals. The documentation included within demonstrates that this project has been carefully designed to mitigate the effect of development within the watershed. It is thought that these materials support the conclusion that this project meets the guidelines for an approvable project.

It is concluded that this project will not increase peak runoff. In essence, the change due to site development from wooded conditions to pavement and grass areas **generates a peak rate of run-off that occurs more quickly than that from the Manchester Street closed drainage system. As existing and proposed drainage models reflect, the run-off from site development routes through the existing closed drainage system before the higher peak flow rate from Manchester Street passes through. The design of the on-site system has been revised to eliminate the detention pond and spillway structure as the benefit of such a system was considered marginal after evaluation of the routing and timing of peak flow rates.**

Project Description

This project is located on a 0.94+/- acre parcel, in a residential and commercial area of town. The portion of the existing subcatchment area that was modeled includes forested areas, as well as lawn and some existing houses. The neighborhood consists of a variety of low and medium density residential property, but is quickly being built up into larger commercial sites. This site will be served by a municipal water supply and municipal sewerage, which is consistent with the balance of the neighborhood. The existing subcatchment includes about 0.7 acres of woods, 0.5 acres of grassed area, and 0.3 acres of impervious area.

The proposed project includes the construction of a new rental car facility and associated parking and drainage improvements. The proposed construction includes the design of open and closed drainage systems to remove flow from ponded areas resulting from the site construction. **The flows from the entire site, as well as portions of abutting sites, are directed into a new closed drainage system, which connects to the existing closed drainage system in the vicinity of CB-7.**

Methodology

The project watershed was developed in order to take various characteristics and physical properties into account when preparing a model of actual conditions. To better manage the numerous values and specific information for each watershed, computer aided design software was used. HydroCAD (v6.0) software was able to model the specific watershed area and provides a complete set of calculations to demonstrate the performance of this area under a variety of conditions. The software is based on the widely accepted and practiced SCS TR-20 model and is used to develop peak rates of runoff, perform stage-storage-discharge calculations, and other hydraulic analysis for various rainfall events.

The existing project model includes a single watershed, which forms the baseline of proposed conditions at the site and measures the flow to a single control point at the southern catch basin outlet (CB-7). **In the final drainage analysis peak flow rates were compared at the control point with existing flow out of CB-7 and the proposed flow entering the municipal system at new manhole structure DMH-8 just beyond CB-7.**

Evaluation of Existing Conditions

A single existing subcatchment was modeled because the proposed site is a small area that includes the area of proposed development. **Field inspection suggests that the project watershed is flowing to a topographic low spot and infiltrating the ground due to the elevation of the rim at CB-7. However, the placement of this structure outside the shoulder of an uncurbed section of Black Hill Road in the vicinity of the low spot suggests that it was intended to collect flow from this area. This assumption is consistent with the layout of the Manchester Street drainage system, which provides access via catch basin to properties along the road. Furthermore, the grade of both Manchester Street and Black Hill Road are such that this area is ponded without a positive outfall, the location of which would be consistent with CB-7 prior to construction of Black Hill Road and the outlet of the Manchester Street system.**

Generally, existing areas in this subcatchment are wooded, with the exception of some existing homes and businesses, as well as some public roadways. Soils included in the subcatchment are fairly uniform, being entirely of the "Pootatuck" Series. This soil type was included in the model as a "B" soil as referenced by the "Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire (August, 1992)." **The hydraulic length, contour length, contour interval, and surface roughness were all measured and modeled to determine the Time of Concentration and establish a basis for analysis.**

Two separate sets of calculations for the existing conditions model have been included with this report. While it is apparent that flow from the existing site is not currently entering the closed drainage system at CB-7, it is believed that the original intent of this basin was to drain the area of this site as explained above. As a result, two models were developed – one that does not allow flow from the site to enter CB-7, and one that includes a theoretical connection for flow to CB-7.

Evaluation of Developed Conditions

The subcatchment area was modified to account for lot development from wooded and grass conditions on native soil to grass surfaces and impervious surface (roadway, driveway, and roof) for the entire site. Wooded areas of "B" soils will be impacted as the development of the site occurs.

The design intent was to allow overland flows around the property either to sheet directly off the paved surface **into open drainage swales or to run along the curb line with all flows eventually entering the proposed closed drainage system. The on-site drainage system is extended into Black Hill Road where it is discharged into the Manchester Street system at a new manhole structure, DMH-8, located immediately after the existing control point CB-7.**

As previously mentioned, a model of the Manchester Street drainage system was prepared and linked to both the existing and developed calculations to give a real time base flow through the control point. It was determined that the system is close to capacity during the 25-year storm event, but does not surcharge through the grate.

When flows from the proposed site development were analyzed, it was apparent that the site peaks ahead of the Manchester Street system.

Under the assumed existing conditions, the peak flow from the site is estimated at 1.8 cfs, but runs off more slowly due to existing surface conditions (soil and vegetation). Peak flows from the developed site (4.5 cfs) discharge into the existing drainage system more quickly due to a short Time of Concentration. The Manchester Street system peaks later at 28.9 cfs when the flow from the developing site has subsided to 1.6 cfs . At the peak, the contribution from the developing site closely matches the flow from the assumed existing conditions.

Given the above analysis, it is clear that in the assumed existing conditions model, the peak from the site is coinciding with the peak from Manchester Street. However, under the developed conditions, the site peak is offset and peaks before Manchester Street. It was determined that the previously proposed detention pond was reducing the peak flow from the site to a level consistent with the existing conditions, but also coinciding with the peak of the Manchester Street system.

Based on the revised calculations with a base flow from Manchester Street, the function of the detention pond was not altogether different than a direct connection with an offset peak. Removing the detention pond also reduces the likelihood of intercepting and adding groundwater to the municipal system. Thereby, calculations for the revised drainage system design demonstrate that there will not be an increase in peak flow above the assumed existing conditions even without the detention pond.

Table 1: Summary of Flow Rates

Control Point	Existing 10-Year Storm Event (cfs) (ponded)	Existing 10-Year Storm Event (cfs) (flow to CB-7)	Proposed 10-Year Storm Event (cfs) (flow to DMH-8)	Existing 25-Year Storm Event (cfs) (ponded)	Existing 25-Year Storm Event (cfs) (flow to CB-7)	Proposed 25-Year Storm Event (cfs) (flow to DMH-8)
Control Point 1 (Reach CR)	**17.9**	**19.0**	**19.1**	**28.9**	**30.6**	**30.5**

October 29, 2003

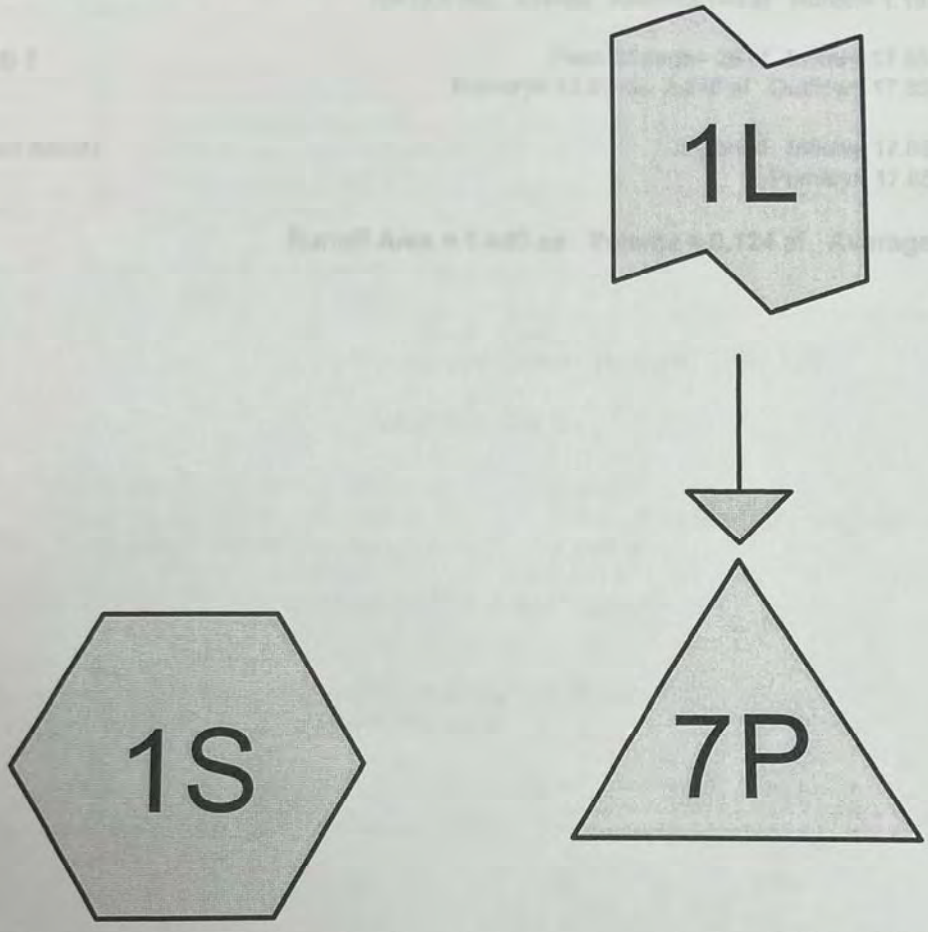
Summary

The proposed development will have minimal effect on the overall watershed. This report reviews the hydrology and dynamic characteristics of the watershed, and provides hydraulic calculations for **existing, proposed, and off-site (Manchester Street)** drainage control systems.

The calculations and details provided in this report and added to the construction plans include specific design parameters required to minimize the effect of this development on surrounding property and the watershed. Watershed topography and culverts have been subject to the stormwater model and routing calculations for both the 10-year and 25-year design storm. It is concluded that, if properly constructed, this project will have the capacity to manage stormwater flows without further stress to the existing closed drainage system. Design specific data and calculations are provided in the following sections for review and to address any design specific questions.

Calculations: Existing Conditions (10-Year Storm Summary)

(Excludes Existing Flow from Subcatchment-1)



Subcat Reach Pond Link

Drainage Diagram for EXIST10
Prepared by Sublime Civil Consultants, Inc. 10/23/2003
HydroCAD® 6.00 s/n 001784 © 1986-2001 Applied Microcomputer Systems

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Type III 24-hr Rainfall=4.20"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: SUBCATCHMENT 1
Tc=19.8 min CN=65 Area=62,740 sf Runoff= 1.18 cfs 0.124 af

Pond 7P: CB 7
Peak Storage= 28 cf Inflow= 17.85 cfs 2.248 af
Primary= 17.85 cfs 2.248 af Outflow= 17.85 cfs 2.248 af

Link 1L: (new node)
Imported Inflow= 17.85 cfs 2.248 af
Primary= 17.85 cfs 2.248 af

Runoff Area = 1.440 ac Volume = 0.124 af Average Depth = 1.03"

Subcatchment 1S: SUBCATCHMENT 1

Runoff = 1.18 cfs @ 12.31 hrs, Volume= 0.124 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=4.20"

Area (sf)	CN	Description
8,240	98	Paved parking & roofs
4,235	98	Paved roads w/curbs & sewers
20,065	61	>75% Grass cover, Good, HSG B
30,200	55	Woods, Good, HSG B
62,740	65	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	140	0.0200	0.1		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.85"

Pond 7P: CB 7

Inflow = 17.85 cfs @ 12.37 hrs, Volume= 2.248 af
Outflow = 17.85 cfs @ 12.37 hrs, Volume= 2.248 af, Atten= 0%, Lag= 0.0 min
Primary = 17.85 cfs @ 12.37 hrs, Volume= 2.248 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 228.25' Storage= 28 cf
Plug-Flow detention time= 0.1 min calculated for 2.241 af (100% of inflow)
Storage and wetted areas determined by Conic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
226.12	13	0	0	13
233.42	13	95	95	106

Primary OutFlow (Free Discharge)
↑—1=Culvert

#	Routing	Invert	Outlet Devices
1	Primary	226.12'	**30.0" x 50.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 225.87' S= 0.0050 '/' n= 0.010 Cc= 0.900

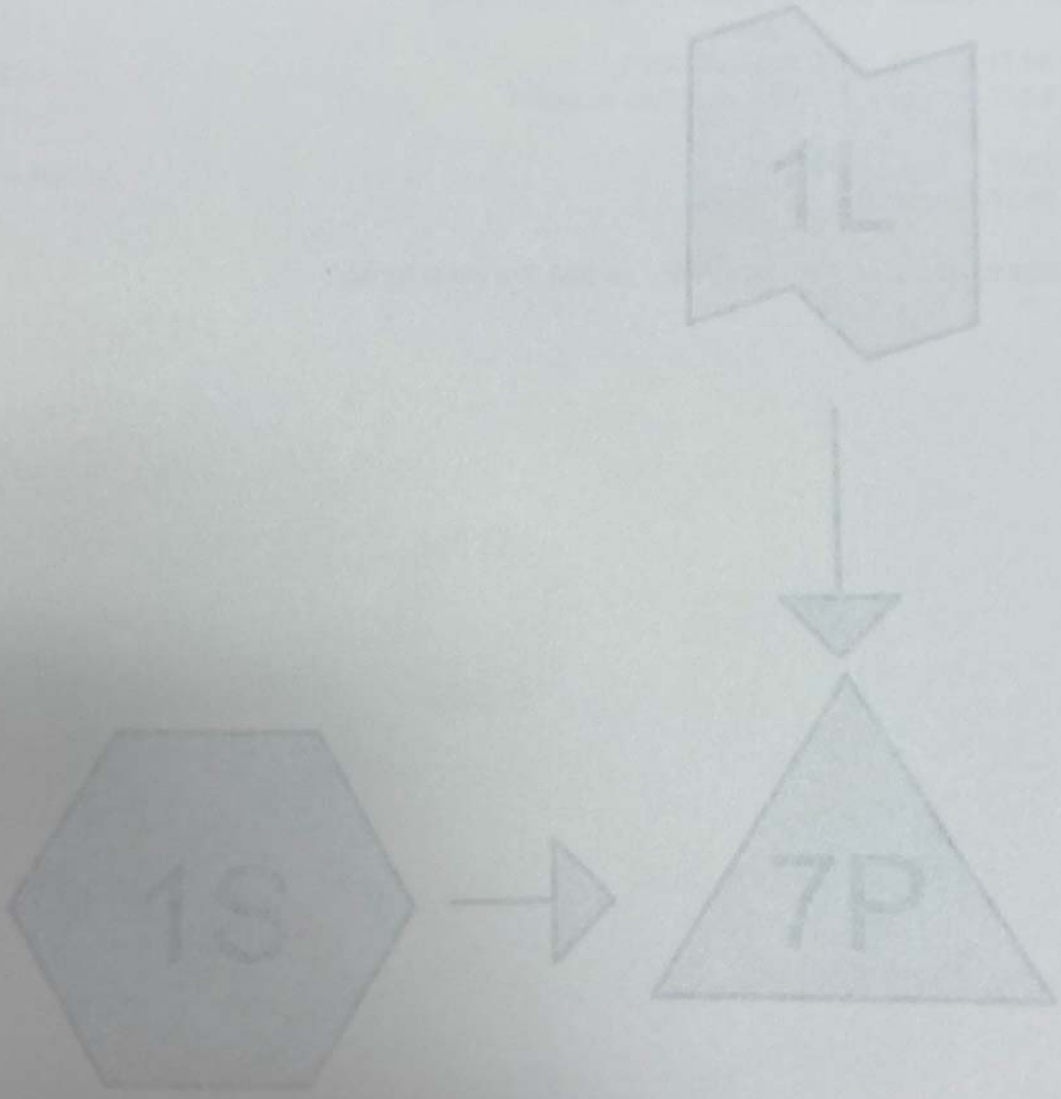
Link 1L: (new node)

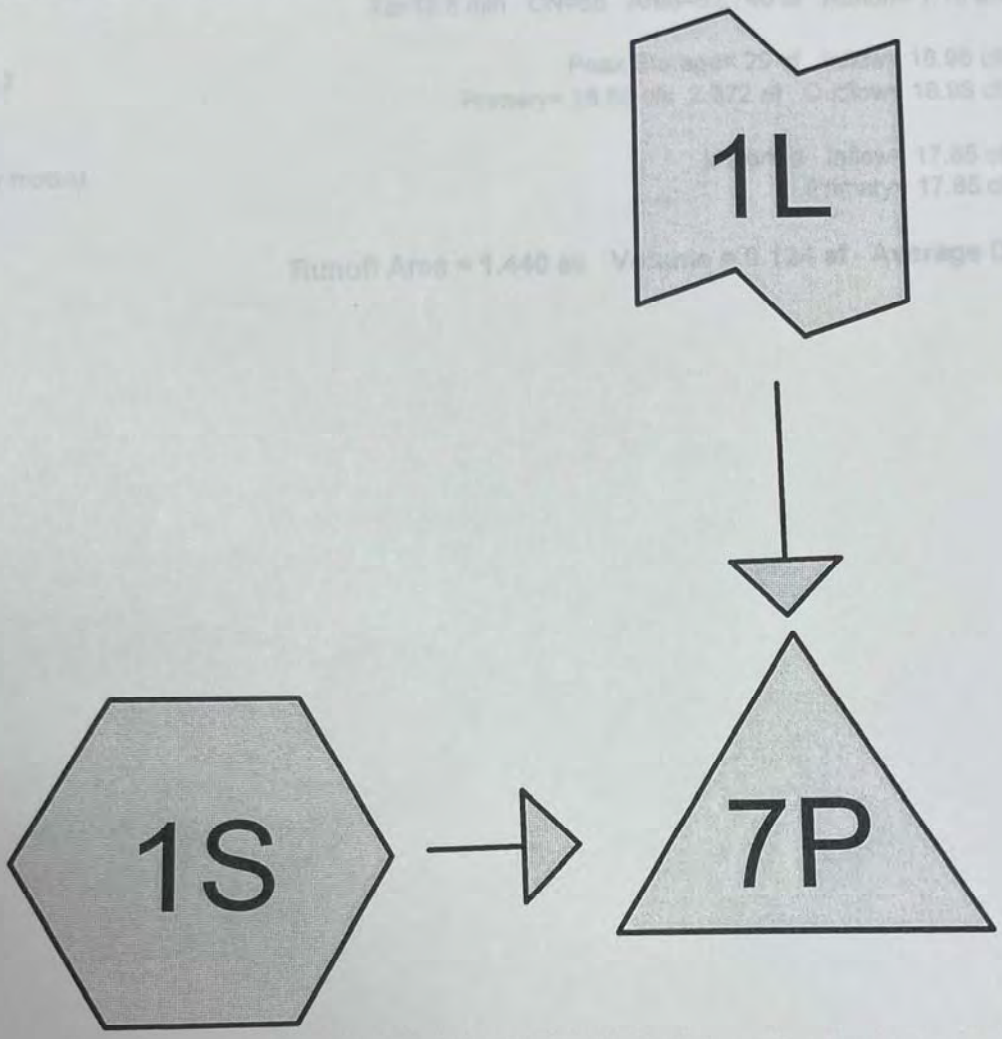
Inflow = 17.85 cfs @ 12.37 hrs, Volume= 2.248 af
Primary = 17.85 cfs @ 12.37 hrs, Volume= 2.248 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Primary Outflow Imported from HOLDEN10~Link 1L

Calculations: Existing Conditions (10-Year Storm Summary)

(Includes Existing Flow from Subcatchment-1)





Subcat Reach Pond Link

Drainage Diagram for EXIST10-2
Prepared by Sublime Civil Consultants, Inc. 10/23/2003
HydroCAD® 6.00 s/n 001784 © 1986-2001 Applied Microcomputer Systems

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Type III 24-hr Rainfall=4.20"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

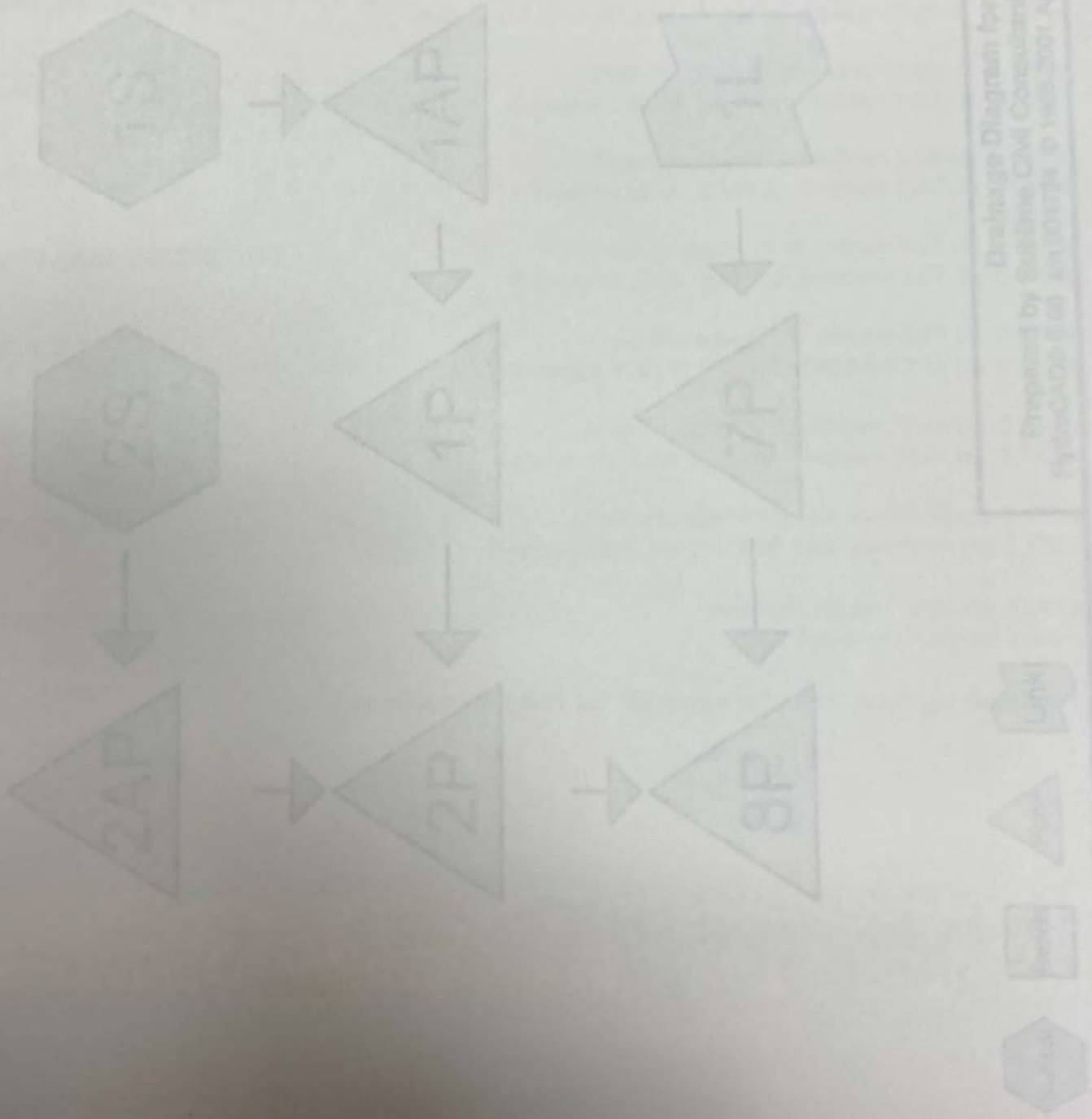
Subcatchment 1S: SUBCATCHMENT 1 Tc=19.8 min CN=65 Area=62,740 sf Runoff= 1.18 cfs 0.124 af

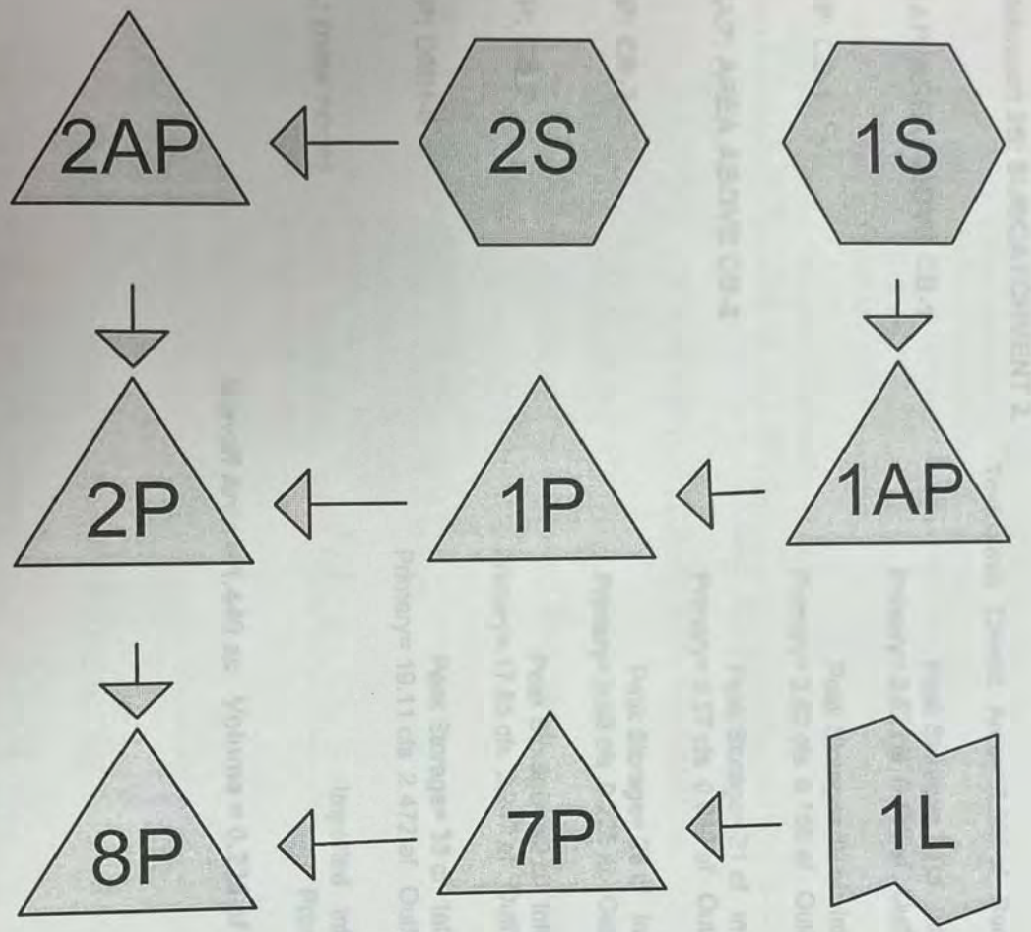
Pond 7P: CB 7 Peak Storage= 29 cf Inflow= 18.98 cfs 2.372 af
Primary= 18.98 cfs 2.372 af Outflow= 18.98 cfs 2.372 af

Link 1L: (new node) Imported Inflow= 17.85 cfs 2.248 af
Primary= 17.85 cfs 2.248 af

Runoff Area = 1.440 ac Volume = 0.124 af Average Depth = 1.03"

Calculations: Proposed Conditions (10-Year Storm Summary)





Subcat Reach Pond Link

Drainage Diagram for PROP10
Prepared by Sublime Civil Consultants, Inc. 10/24/2003
HydroCAD® 6.00 s/n 001784 © 1986-2001 Applied Microcomputer Systems

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Type III 24-hr Rainfall=4.20"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: SUBCATCHMENT 1 Tc=5.0 min CN=82 Area=43,840 sf Runoff= 2.80 cfs 0.186 af

Subcatchment 2S: SUBCATCHMENT 2 Tc=5.0 min CN=66 Area=18,905 sf Runoff= 0.57 cfs 0.040 af

Pond 1AP: AREA ABOVE CB-1 Peak Storage= 70 cf Inflow= 2.80 cfs 0.186 af
Primary= 2.82 cfs 0.186 af Outflow= 2.82 cfs 0.186 af

Pond 1P: CB-1 Peak Storage= 19 cf Inflow= 2.82 cfs 0.186 af
Primary= 2.82 cfs 0.186 af Outflow= 2.82 cfs 0.186 af

Pond 2AP: AREA ABOVE CB-2 Peak Storage= 21 cf Inflow= 0.57 cfs 0.040 af
Primary= 0.57 cfs 0.040 af Outflow= 0.57 cfs 0.040 af

Pond 2P: CB-2 Peak Storage= 28 cf Inflow= 3.39 cfs 0.225 af
Primary= 3.38 cfs 0.225 af Outflow= 3.38 cfs 0.225 af

Pond 7P: CB 7 Peak Storage= 40 cf Inflow= 17.85 cfs 2.248 af
Primary= 17.85 cfs 2.247 af Outflow= 17.85 cfs 2.247 af

Pond 8P: DMH-8 Peak Storage= 33 cf Inflow= 19.12 cfs 2.472 af
Primary= 19.11 cfs 2.472 af Outflow= 19.11 cfs 2.472 af

Link 1L: (new node) Imported Inflow= 17.85 cfs 2.248 af
Primary= 17.85 cfs 2.248 af

Runoff Area = 1.440 ac Volume = 0.226 af Average Depth = 1.88"

Subcatchment 1S: SUBCATCHMENT 1

Runoff = 2.80 cfs @ 12.08 hrs, Volume= 0.186 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=4.20"

Area (sf)	CN	Description
22,165	98	Paved parking & roofs
3,360	98	Paved roads w/curbs & sewers
14,675	61	>75% Grass cover, Good, HSG B
3,640	55	Woods, Good, HSG B
43,840	82	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, DIRECT**

Subcatchment 2S: SUBCATCHMENT 2

Runoff = 0.57 cfs @ 12.09 hrs, Volume= 0.040 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=4.20"

Area (sf)	CN	Description
875	98	Paved roads w/curbs & sewers
2,320	98	Paved parking & roofs
3,635	55	Woods, Good, HSG B
12,075	61	>75% Grass cover, Good, HSG B
18,905	66	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Pond 1AP: AREA ABOVE CB-1

Inflow = 2.80 cfs @ 12.08 hrs, Volume= 0.186 af
Outflow = 2.82 cfs @ 12.09 hrs, Volume= 0.186 af, Atten= 0%, Lag= 0.6 min
Primary = 2.82 cfs @ 12.09 hrs, Volume= 0.186 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 231.13' Storage= 70 cf
Plug-Flow detention time= 0.6 min calculated for 0.186 af (100% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
230.90	20	0	0
231.00	345	18	18
231.40	480	165	183

Primary OutFlow (Free Discharge)
↑—1=Orifice/Grate

#	Routing	Invert	Outlet Devices
1	Primary	230.90'	**2.00' x 2.00' Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Pond 1P: CB-1

Inflow	=	2.82 cfs @	12.09 hrs, Volume=	0.186 af
Outflow	=	2.82 cfs @	12.09 hrs, Volume=	0.186 af, Atten= 0%, Lag= 0.1 min
Primary	=	2.82 cfs @	12.09 hrs, Volume=	0.186 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 229.16' Storage= 19 cf
Plug-Flow detention time= 1.2 min calculated for 0.186 af (100% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
227.70	13	0	0
230.90	13	42	42

Primary OutFlow (Fixed Tailwater Elevation= 228.79')
↑—1=15" RCP

#	Routing	Invert	Outlet Devices
1	Primary	227.70'	**15.0" x 158.0' long 15" RCP** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 226.91' S= 0.0050 '/' n= 0.012 Cc= 0.900

Pond 2AP: AREA ABOVE CB-2

Inflow	=	0.57 cfs @	12.09 hrs, Volume=	0.040 af
Outflow	=	0.57 cfs @	12.10 hrs, Volume=	0.040 af, Atten= 0%, Lag= 0.5 min
Primary	=	0.57 cfs @	12.10 hrs, Volume=	0.040 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 230.58' Storage= 21 cf
Plug-Flow detention time= 1.1 min calculated for 0.039 af (100% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
230.50	20	0	0
231.00	525	136	136
231.60	1,300	547	684

Primary OutFlow (Free Discharge)
↳1=Orifice/Grate

#	Routing	Invert	Outlet Devices
1	Primary	230.50'	**2.00' x 2.00' Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Pond 2P: CB-2

Inflow	=	3.39 cfs @	12.09 hrs, Volume=	0.225 af
Outflow	=	3.38 cfs @	12.09 hrs, Volume=	0.225 af, Atten= 0%, Lag= 0.0 min
Primary	=	3.38 cfs @	12.09 hrs, Volume=	0.225 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 228.79' Storage= 28 cf
Plug-Flow detention time= 1.7 min calculated for 0.224 af (99% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
226.66	13	0	0
230.50	13	50	50

Primary OutFlow (Fixed Tailwater Elevation= 228.60')
↳1=18" RCP

#	Routing	Invert	Outlet Devices
1	Primary	226.66'	**18.0" x 122.0' long 18" RCP** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 226.05' S= 0.0050 '/' n= 0.012 Cc= 0.900

Pond 7P: CB 7

Inflow	=	17.85 cfs @	12.37 hrs, Volume=	2.248 af
Outflow	=	17.85 cfs @	12.37 hrs, Volume=	2.247 af, Atten= 0%, Lag= 0.0 min
Primary	=	17.85 cfs @	12.37 hrs, Volume=	2.247 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 229.17' Storage= 40 cf
Plug-Flow detention time= 0.3 min calculated for 2.240 af (100% of inflow)
Storage and wetted areas determined by Conic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
226.12	13	0	0	13
233.42	13	95	95	106

Primary OutFlow (Fixed Tailwater Elevation= 228.60')
↑—1=30"CMP

#	Routing	Invert	Outlet Devices
1	Primary	226.12'	**30.0" x 14.0' long 30"CMP** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 226.05' S= 0.0050 '/' n= 0.024 Cc= 0.900

Pond 8P: DMH-8

Inflow	=	19.12 cfs @	12.36 hrs, Volume=	2.472 af
Outflow	=	19.11 cfs @	12.36 hrs, Volume=	2.472 af, Atten= 0%, Lag= 0.1 min
Primary	=	19.11 cfs @	12.36 hrs, Volume=	2.472 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 228.59' Storage= 33 cf
Plug-Flow detention time= 0.1 min calculated for 2.464 af (100% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
226.03	13	0	0
234.00	13	104	104

Primary OutFlow (Free Discharge)
↑—1=30" CMP

#	Routing	Invert	Outlet Devices
1	Primary	226.03'	**30.0" x 36.0' long 30" CMP** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 225.85' S= 0.0050 '/' n= 0.024 Cc= 0.900

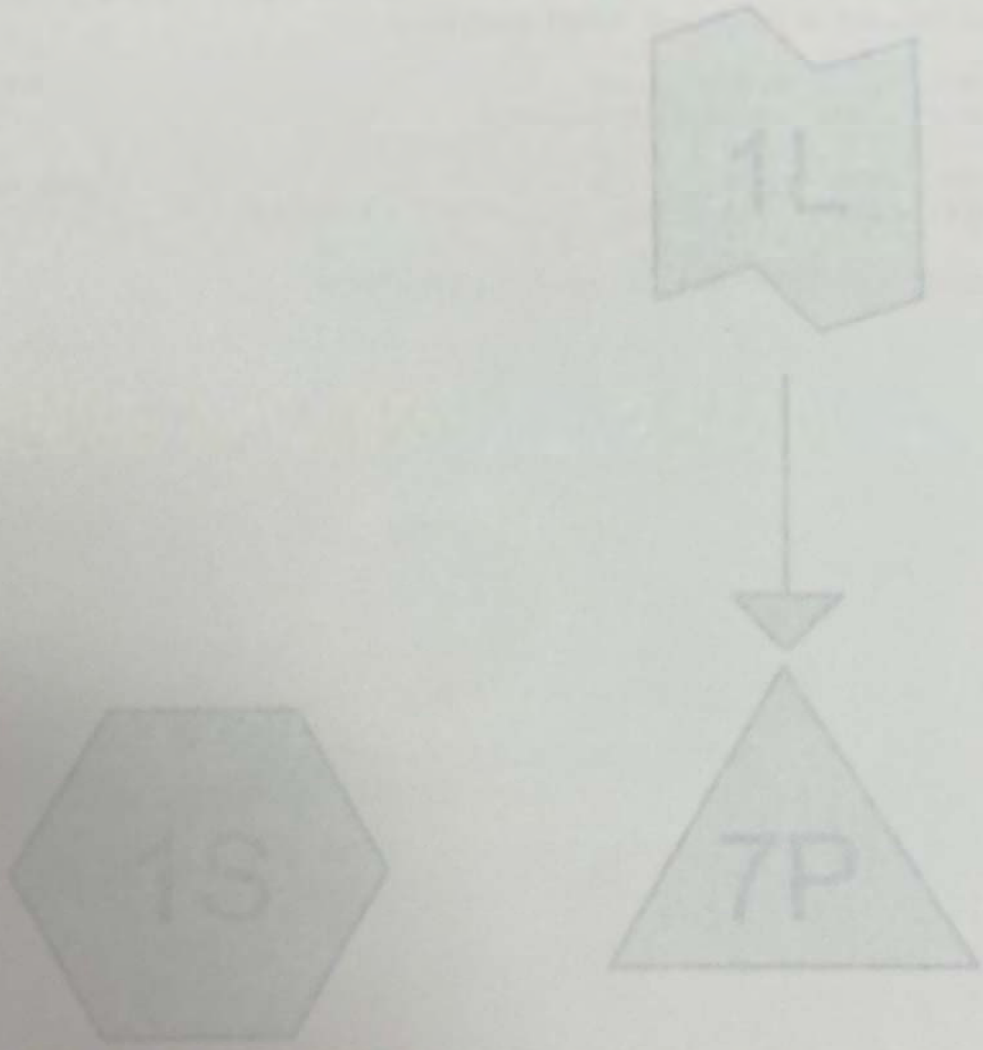
Link 1L: (new node)

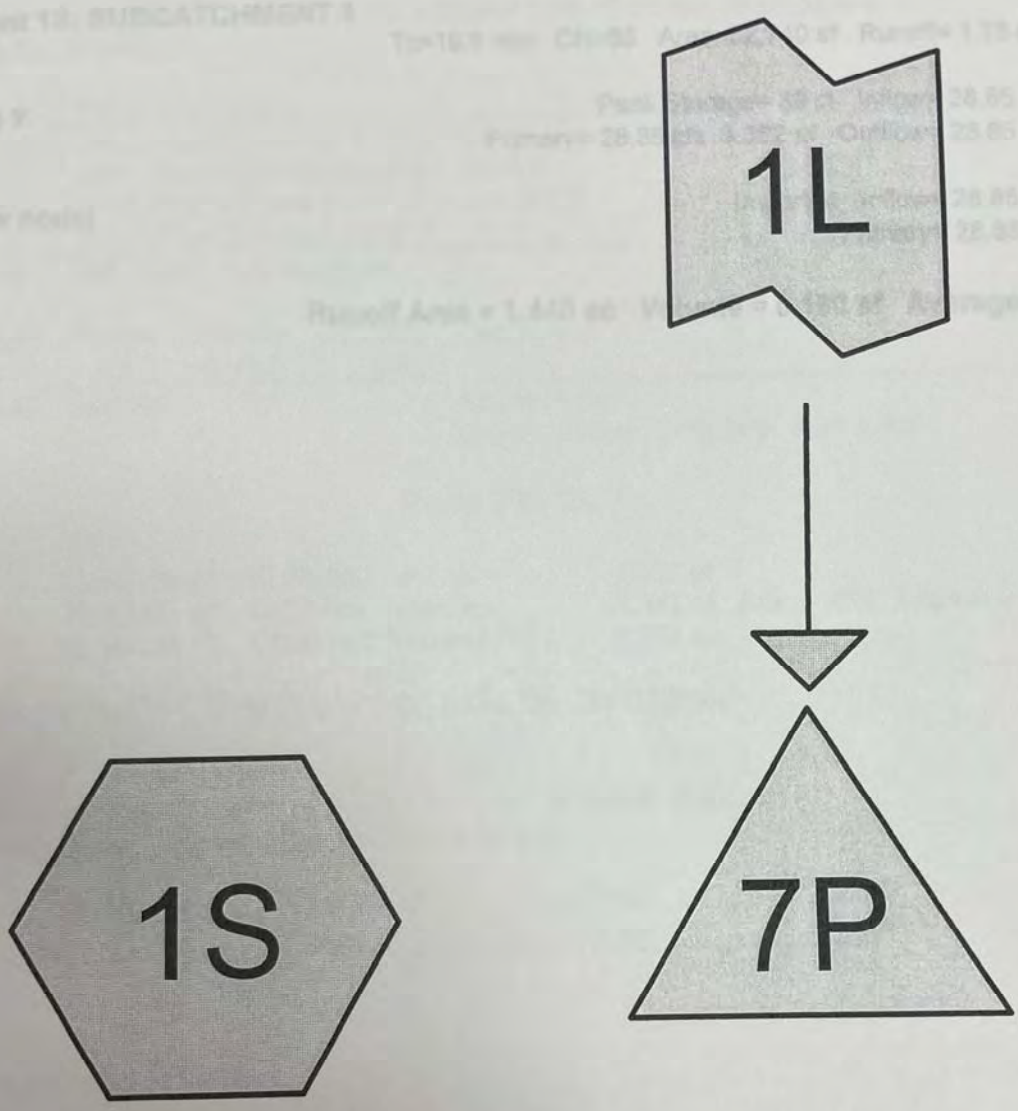
Inflow	=	17.85 cfs @	12.37 hrs, Volume=	2.248 af
Primary	=	17.85 cfs @	12.37 hrs, Volume=	2.248 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Primary Outflow Imported from HOLDEN10~Link 1L

Calculations: Existing Conditions (25-Year Storm Summary)

(Excludes Existing Flow from Subcatchment-1)





Subcat Reach Pond Link

Drainage Diagram for EXIST25
Prepared by Sublime Civil Consultants, Inc. 10/23/2003
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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Type III 24-hr Rainfall=5.00"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: SUBCATCHMENT 1 Tc=19.8 min CN=65 Area=62,740 sf Runoff= 1.78 cfs 0.180 af

Pond 7P: CB 7 Peak Storage= 39 cf Inflow= 28.85 cfs 3.362 af
Primary= 28.85 cfs 3.362 af Outflow= 28.85 cfs 3.362 af

Link 1L: (new node) Imported Inflow= 28.85 cfs 3.362 af
Primary= 28.85 cfs 3.362 af

Runoff Area = 1.440 ac Volume = 0.180 af Average Depth = 1.50"

Subcatchment 1S: SUBCATCHMENT 1

Runoff = 1.78 cfs @ 12.30 hrs, Volume= 0.180 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.00"

Area (sf)	CN	Description
8,240	98	Paved parking & roofs
4,235	98	Paved roads w/curbs & sewers
20,065	61	>75% Grass cover, Good, HSG B
30,200	55	Woods, Good, HSG B
62,740	65	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	140	0.0200	0.1		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.85"

Pond 7P: CB 7

Inflow = 28.85 cfs @ 12.36 hrs, Volume= 3.362 af
Outflow = 28.85 cfs @ 12.36 hrs, Volume= 3.362 af, Atten= 0%, Lag= 0.0 min
Primary = 28.85 cfs @ 12.36 hrs, Volume= 3.362 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 229.16' Storage= 39 cf
Plug-Flow detention time= 0.0 min calculated for 3.351 af (100% of inflow)
Storage and wetted areas determined by Conic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
226.12	13	0	0	13
233.42	13	95	95	106

Primary OutFlow (Free Discharge)
└1=Culvert

#	Routing	Invert	Outlet Devices
1	Primary	226.12'	**30.0" x 50.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 225.87' S= 0.0050 '/' n= 0.010 Cc= 0.900

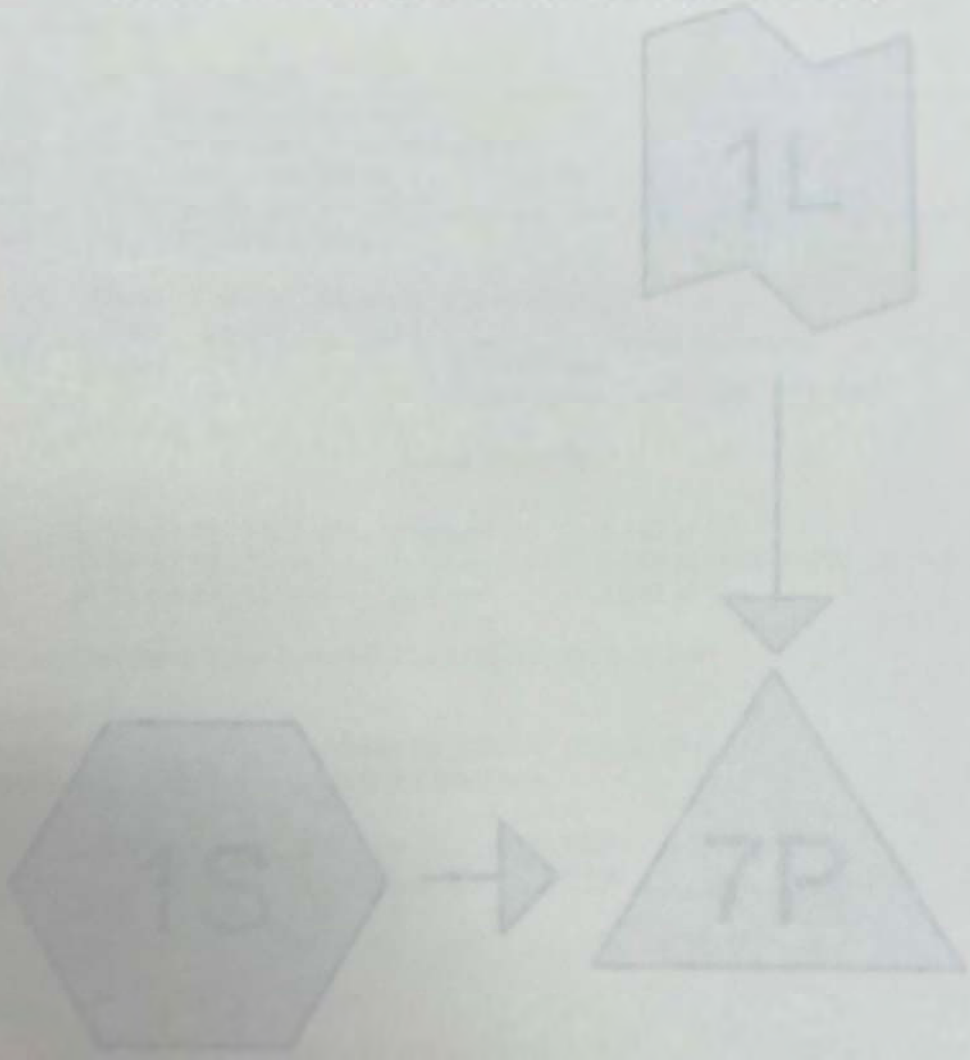
Link 1L: (new node)

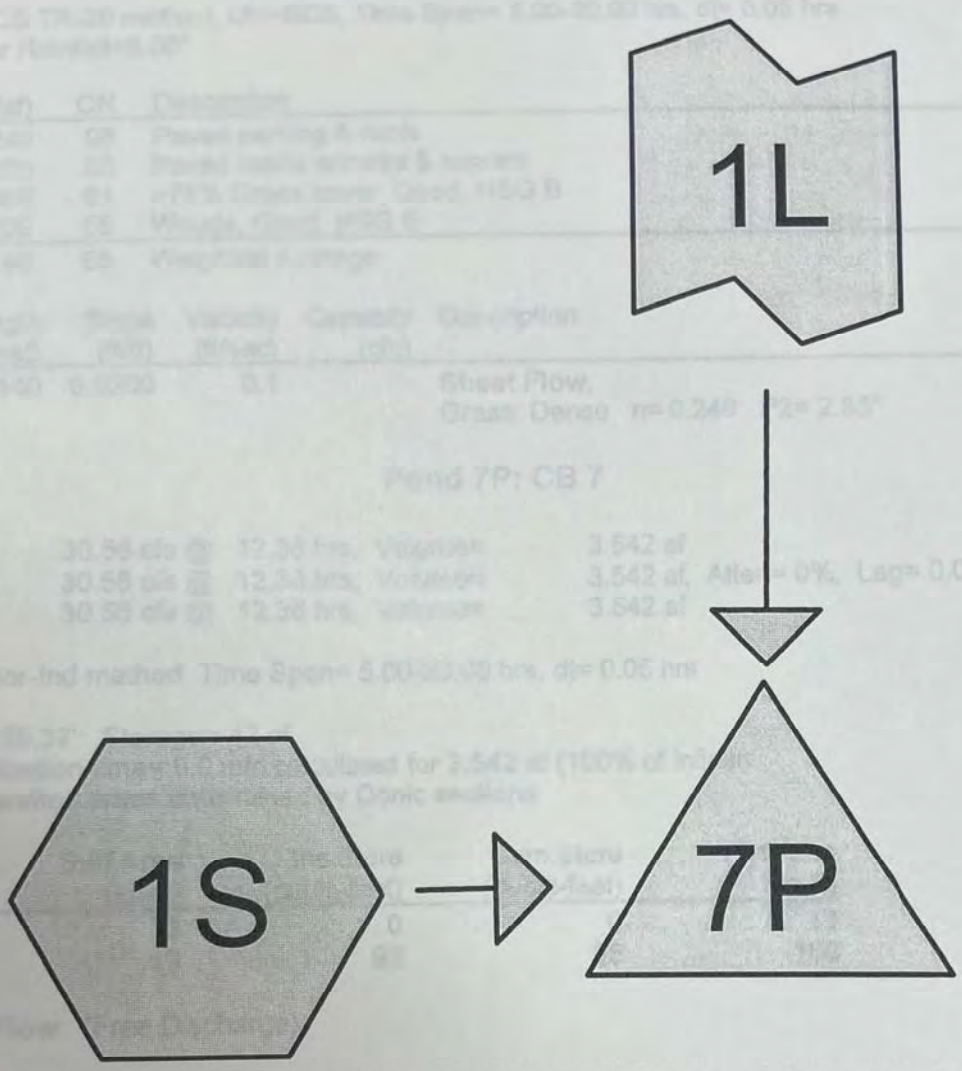
Inflow = 28.85 cfs @ 12.36 hrs, Volume= 3.362 af
Primary = 28.85 cfs @ 12.36 hrs, Volume= 3.362 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Primary Outflow Imported from HOLDEN25~Link 1L

Calculations: Existing Conditions (25-Year Storm Summary)

(Includes Existing Flow from Subcatchment-1)





Subcat Reach Pond Link

Drainage Diagram for EXIST25-2
Prepared by Sublime Civil Consultants, Inc. 10/23/2003
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Subcatchment 1S: SUBCATCHMENT 1

Runoff = 1.78 cfs @ 12.30 hrs, Volume= 0.180 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.00"

Area (sf)	CN	Description
8,240	98	Paved parking & roofs
4,235	98	Paved roads w/curbs & sewers
20,065	61	>75% Grass cover, Good, HSG B
30,200	55	Woods, Good, HSG B
62,740	65	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	140	0.0200	0.1		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.85"

Pond 7P: CB 7

Inflow = 30.56 cfs @ 12.36 hrs, Volume= 3.542 af
Outflow = 30.56 cfs @ 12.36 hrs, Volume= 3.542 af, Atten= 0%, Lag= 0.0 min
Primary = 30.56 cfs @ 12.36 hrs, Volume= 3.542 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 229.37' Storage= 42 cf
Plug-Flow detention time= 0.0 min calculated for 3.542 af (100% of inflow)
Storage and wetted areas determined by Conic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
226.12	13	0	0	13
233.42	13	95	95	106

Primary OutFlow (Free Discharge)
└1=Culvert

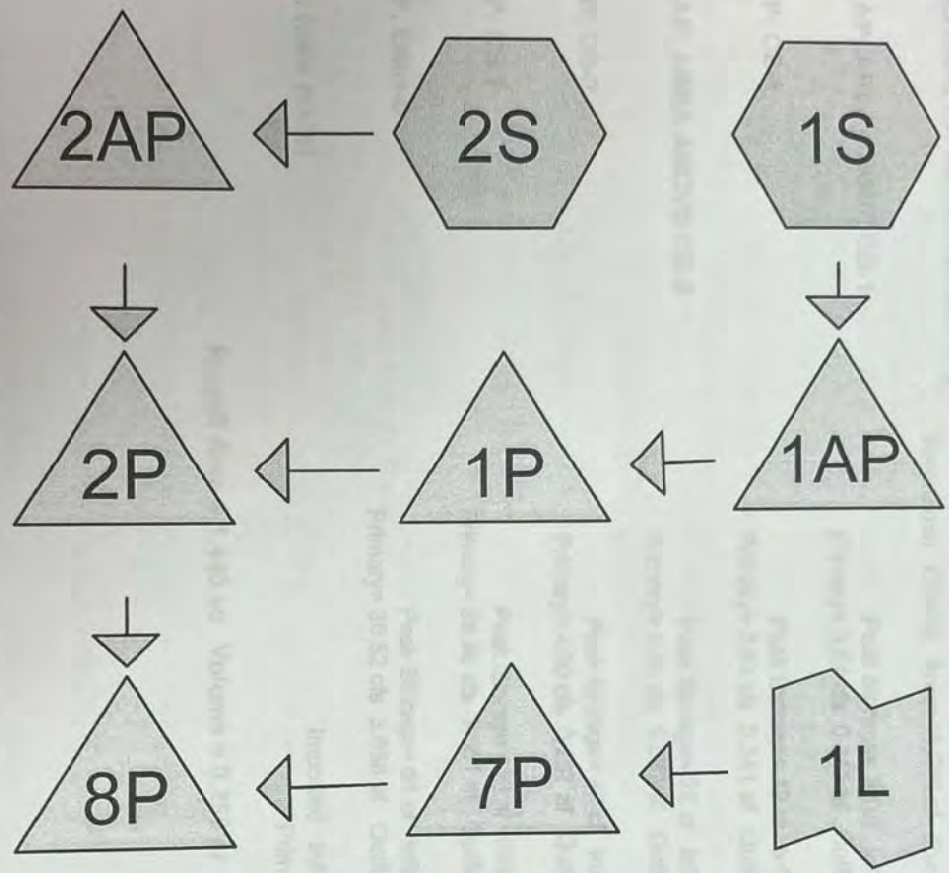
#	Routing	Invert	Outlet Devices
1	Primary	226.12'	**30.0" x 50.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 225.87' S= 0.0050 '/' n= 0.010 Cc= 0.900

Link 1L: (new node)

Inflow = 28.85 cfs @ 12.36 hrs, Volume= 3.362 af
Primary = 28.85 cfs @ 12.36 hrs, Volume= 3.362 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Primary Outflow Imported from HOLDEN25~Link 1L

Calculations: Proposed Conditions (25-Year Storm Summary)



Subcat Reach Pond Link

Drainage Diagram for PROP25
Prepared by Sublime Civil Consultants, Inc. 10/24/2003
HydroCAD® 6.00 s/n 001784 © 1986-2001 Applied Microcomputer Systems

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Type III 24-hr Rainfall=5.00"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: SUBCATCHMENT 1
Tc=5.0 min CN=82 Area=43,840 sf Runoff= 3.62 cfs 0.242 af

Subcatchment 2S: SUBCATCHMENT 2
Tc=5.0 min CN=66 Area=18,905 sf Runoff= 0.85 cfs 0.057 af

Pond 1AP: AREA ABOVE CB-1
Peak Storage= 88 cf Inflow= 3.62 cfs 0.242 af
Primary= 3.64 cfs 0.242 af Outflow= 3.64 cfs 0.242 af

Pond 1P: CB-1
Peak Storage= 42 cf Inflow= 3.64 cfs 0.242 af
Primary= 3.64 cfs 0.241 af Outflow= 3.64 cfs 0.241 af

Pond 2AP: AREA ABOVE CB-2
Peak Storage= 28 cf Inflow= 0.85 cfs 0.057 af
Primary= 0.85 cfs 0.057 af Outflow= 0.85 cfs 0.057 af

Pond 2P: CB-2
Peak Storage= 47 cf Inflow= 4.49 cfs 0.298 af
Primary= 4.50 cfs 0.297 af Outflow= 4.50 cfs 0.297 af

Pond 7P: CB 7
Peak Storage= 69 cf Inflow= 28.85 cfs 3.362 af
Primary= 28.86 cfs 3.361 af Outflow= 28.86 cfs 3.361 af

Pond 8P: DMH-8
Peak Storage= 51 cf Inflow= 30.54 cfs 3.658 af
Primary= 30.52 cfs 3.658 af Outflow= 30.52 cfs 3.658 af

Link 1L: (new node)
Imported Inflow= 28.85 cfs 3.362 af
Primary= 28.85 cfs 3.362 af

Runoff Area = 1.440 ac Volume = 0.299 af Average Depth = 2.49"

Subcatchment 1S: SUBCATCHMENT 1

Runoff = 3.62 cfs @ 12.08 hrs, Volume= 0.242 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.00"

Area (sf)	CN	Description
22,165	98	Paved parking & roofs
3,360	98	Paved roads w/curbs & sewers
14,675	61	>75% Grass cover, Good, HSG B
3,640	55	Woods, Good, HSG B
43,840	82	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, DIRECT**

Subcatchment 2S: SUBCATCHMENT 2

Runoff = 0.85 cfs @ 12.09 hrs, Volume= 0.057 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.00"

Area (sf)	CN	Description
875	98	Paved roads w/curbs & sewers
2,320	98	Paved parking & roofs
3,635	55	Woods, Good, HSG B
12,075	61	>75% Grass cover, Good, HSG B
18,905	66	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Pond 1AP: AREA ABOVE CB-1

Inflow = 3.62 cfs @ 12.08 hrs, Volume= 0.242 af
Outflow = 3.64 cfs @ 12.08 hrs, Volume= 0.242 af, Atten= 0%, Lag= 0.6 min
Primary = 3.64 cfs @ 12.08 hrs, Volume= 0.242 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 231.17' Storage= 88 cf
Plug-Flow detention time= 0.5 min calculated for 0.241 af (100% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
230.90	20	0	0
231.00	345	18	18
231.40	480	165	183

Primary OutFlow (Fixed Tailwater Elevation= 229.10')
↑—1=Orifice/Grate

#	Routing	Invert	Outlet Devices
1	Primary	230.90'	**2.00' x 2.00' Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Pond 1P: CB-1

Inflow = 3.64 cfs @ 12.08 hrs, Volume= 0.242 af
Outflow = 3.64 cfs @ 12.09 hrs, Volume= 0.241 af, Atten= 0%, Lag= 0.1 min
Primary = 3.64 cfs @ 12.09 hrs, Volume= 0.241 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 230.90' Storage= 42 cf
Plug-Flow detention time= 2.2 min calculated for 0.241 af (100% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
227.70	13	0	0
230.90	13	42	42

Primary OutFlow (Fixed Tailwater Elevation= 230.27')
↑—1=15" RCP

#	Routing	Invert	Outlet Devices
1	Primary	227.70'	**15.0" x 158.0' long 15" RCP** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 226.91' S= 0.0050 '/' n= 0.012 Cc= 0.900

Pond 2AP: AREA ABOVE CB-2

Inflow = 0.85 cfs @ 12.09 hrs, Volume= 0.057 af
Outflow = 0.85 cfs @ 12.09 hrs, Volume= 0.057 af, Atten= 0%, Lag= 0.5 min
Primary = 0.85 cfs @ 12.09 hrs, Volume= 0.057 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 230.60' Storage= 28 cf
Plug-Flow detention time= 1.0 min calculated for 0.057 af (100% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
230.50	20	0	0
231.00	525	136	136
231.60	1,300	547	684

Primary OutFlow (Fixed Tailwater Elevation= 229.02')
↳1=Orifice/Grate

#	Routing	Invert	Outlet Devices
1	Primary	230.50'	**2.00' x 2.00' Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Pond 2P: CB-2

Inflow	=	4.49 cfs @	12.09 hrs, Volume=	0.298 af
Outflow	=	4.50 cfs @	12.09 hrs, Volume=	0.297 af, Atten= 0%, Lag= 0.0 min
Primary	=	4.50 cfs @	12.09 hrs, Volume=	0.297 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 230.27' Storage= 47 cf
Plug-Flow detention time= 2.2 min calculated for 0.297 af (100% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
226.66	13	0	0
230.50	13	50	50

Primary OutFlow (Fixed Tailwater Elevation= 229.93')
↳1=18" RCP

#	Routing	Invert	Outlet Devices
1	Primary	226.66'	**18.0" x 122.0' long 18" RCP** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 226.05' S= 0.0050 '/' n= 0.012 Cc= 0.900

Pond 7P: CB 7

Inflow	=	28.85 cfs @	12.36 hrs, Volume=	3.362 af
Outflow	=	28.86 cfs @	12.36 hrs, Volume=	3.361 af, Atten= 0%, Lag= 0.0 min
Primary	=	28.86 cfs @	12.36 hrs, Volume=	3.361 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 231.42' Storage= 69 cf
Plug-Flow detention time= 0.3 min calculated for 3.361 af (100% of inflow)
Storage and wetted areas determined by Conic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
226.12	13	0	0	13
233.42	13	95	95	106

Primary OutFlow (Fixed Tailwater Elevation= 229.93')
↑—1=30"CMP

#	Routing	Invert	Outlet Devices
1	Primary	226.12'	**30.0" x 14.0' long 30"CMP** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 226.05' S= 0.0050 '/' n= 0.024 Cc= 0.900

Pond 8P: DMH-8

Inflow	=	30.54 cfs @	12.35 hrs, Volume=	3.658 af
Outflow	=	30.52 cfs @	12.35 hrs, Volume=	3.658 af, Atten= 0%, Lag= 0.0 min
Primary	=	30.52 cfs @	12.35 hrs, Volume=	3.658 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 229.93' Storage= 51 cf
Plug-Flow detention time= 0.1 min calculated for 3.646 af (100% of inflow)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
226.03	13	0	0
234.00	13	104	104

Primary OutFlow (Free Discharge)
↑—1=30" CMP

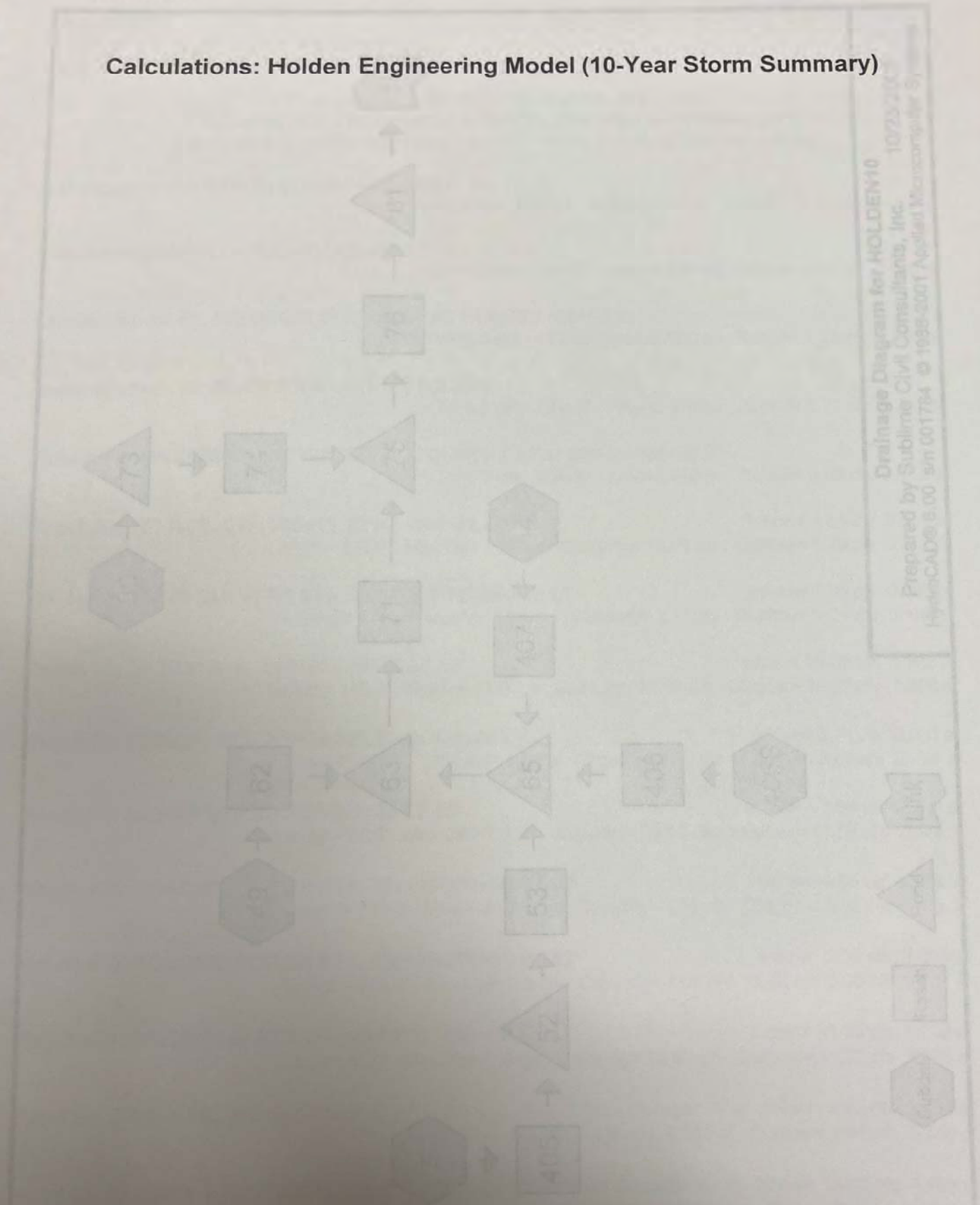
#	Routing	Invert	Outlet Devices
1	Primary	226.03'	**30.0" x 36.0' long 30" CMP** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 225.85' S= 0.0050 '/' n= 0.024 Cc= 0.900

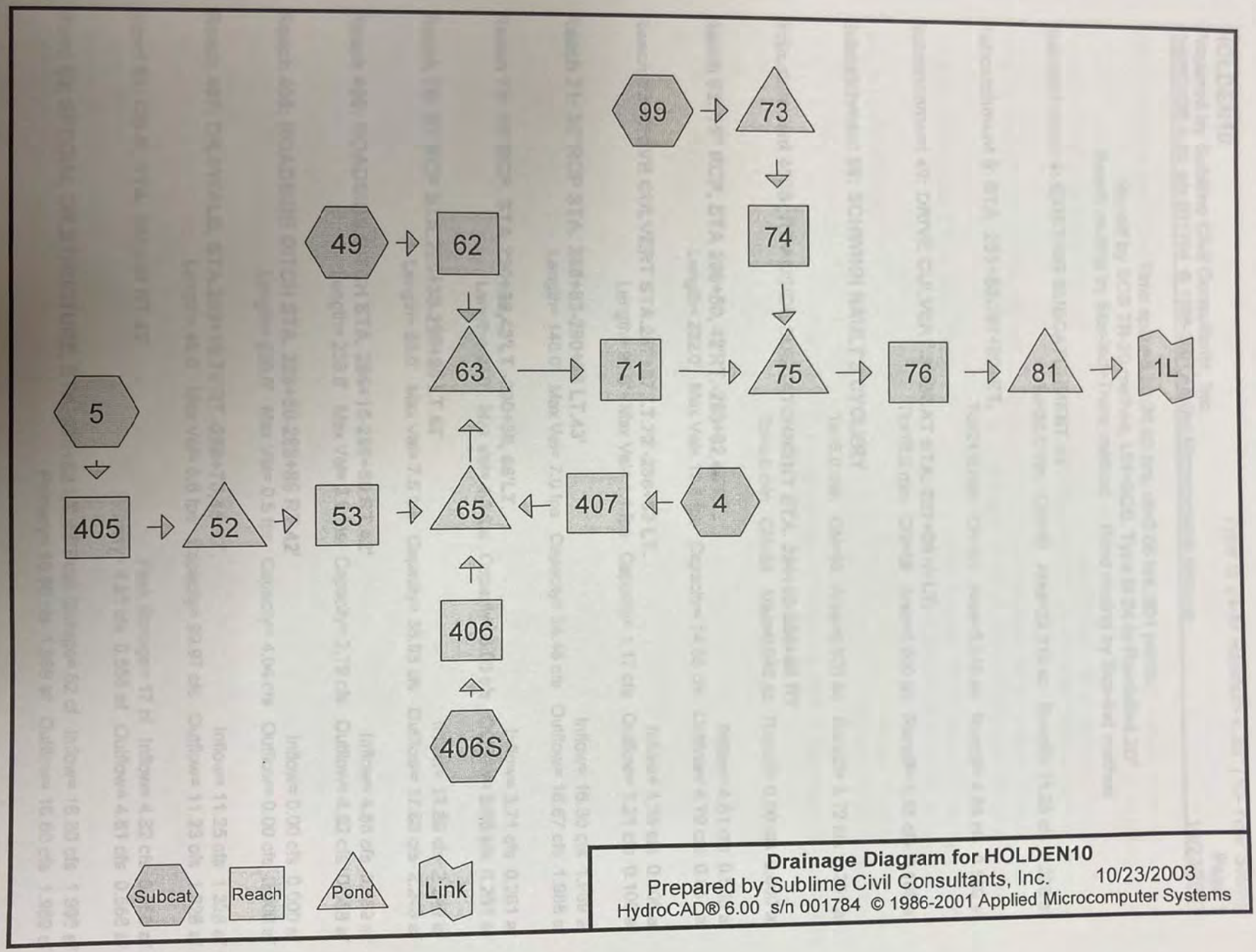
Link 1L: (new node)

Inflow	=	28.85 cfs @	12.36 hrs, Volume=	3.362 af
Primary	=	28.85 cfs @	12.36 hrs, Volume=	3.362 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Primary Outflow Imported from HOLDEN25~Link 1L

Calculations: Holden Engineering Model (10-Year Storm Summary)

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Reach
Pond
Link
Drainage Diagram for HOLDEN10
Prepared by Sublime Civil Consultants, Inc. 10/23/2003
HydroCAD® 6.00 s/n 001784 © 1986-2001 Applied Microcomputer Systems

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Type III 24-hr Rainfall=4.20"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 4: EXISTING SUBCATCHMENT #4
Tc=20.0 min CN=59 Area=22.310 ac Runoff= 11.25 cfs 1.328 af

Subcatchment 5: STA. 283+50-287+00, RT.
Tc=21.0 min CN=61 Area=8.240 ac Runoff= 4.88 cfs 0.559 af

Subcatchment 49: DRIVE CULVERT SUBCAT STA. 287+00+/- LT.
Tc=10.0 min CN=69 Area=1.000 ac Runoff= 1.35 cfs 0.106 af

Subcatchment 99: SCHWINN NAULT'S CYCLERY
Tc=5.0 min CN=93 Area=0.970 ac Runoff= 3.72 cfs 0.261 af

Subcatchment 406S: ROADSIDE SUBCATCHMENT STA. 286+50-288+85 RT.
Tc=4.0 min CN=34 Area=0.940 ac Runoff= 0.00 cfs 0.000 af

Reach 53: 15" RCP, STA 286+50, 42'RT.-288+82,46'RT. Inflow= 4.81 cfs 0.558 af
Length= 232.0' Max Vel= 10.8 fps Capacity= 14.85 cfs Outflow= 4.79 cfs 0.557 af

Reach 62: DRIVE CULVERT STA.287+97,LT.72'-288+83 LT. Inflow= 1.35 cfs 0.106 af
Length= 90.0' Max Vel= 1.1 fps Capacity= 1.17 cfs Outflow= 1.21 cfs 0.106 af

Reach 71: 30"RCP STA. 288+83-290+38 LT.43' Inflow= 16.80 cfs 1.989 af
Length= 148.0' Max Vel= 7.0 fps Capacity= 34.46 cfs Outflow= 16.67 cfs 1.988 af

Reach 74: 15"RCP, STA.290+38,43'LT.-290+38, 66'LT. Inflow= 3.71 cfs 0.261 af
Length= 19.0' Max Vel= 4.5 fps Capacity= 5.08 cfs Outflow= 3.68 cfs 0.261 af

Reach 76: 30"RCP STA.290+38-290+98 LT.43' Inflow= 17.89 cfs 2.249 af
Length= 55.0' Max Vel= 7.5 fps Capacity= 36.93 cfs Outflow= 17.86 cfs 2.248 af

Reach 405: ROADSIDE DITCH STA. 284+15-286+50 RT.42' Inflow= 4.88 cfs 0.559 af
Length= 238.0' Max Vel= 3.6 fps Capacity= 2.79 cfs Outflow= 4.82 cfs 0.558 af

Reach 406: ROADSIDE DITCH STA. 286+50-288+86 RT.42' Inflow= 0.00 cfs 0.000 af
Length= 236.0' Max Vel= 0.5 fps Capacity= 4.04 cfs Outflow= 0.00 cfs 0.000 af

Reach 407: DR.SWALE, STA.289+16.79'RT.-288+75,45'RT. Inflow= 11.25 cfs 1.328 af
Length= 45.0' Max Vel= 5.6 fps Capacity= 99.97 cfs Outflow= 11.23 cfs 1.328 af

Pond 52: CB-E, STA. 286+50 RT.42' Peak Storage= 17 cf Inflow= 4.82 cfs 0.558 af
Primary= 4.81 cfs 0.558 af Outflow= 4.81 cfs 0.558 af

Pond 63: SPECIAL DR.STRUCTURE, STA. 288+83 LT.43' Peak Storage= 62 cf Inflow= 16.80 cfs 1.990 af
Primary= 16.80 cfs 1.989 af Outflow= 16.80 cfs 1.989 af

Pond 65: AREA IN FRONT OF HDR STA. 288+89,44'RT. Peak Storage= 337 cf Inflow= 15.95 cfs 1.885 af
Primary= 15.92 cfs 1.884 af Outflow= 15.92 cfs 1.884 af

Pond 73: CB-E STA.290+38 LT.66' Peak Storage= 13 cf Inflow= 3.72 cfs 0.261 af
Primary= 3.71 cfs 0.261 af Outflow= 3.71 cfs 0.261 af

Pond 75: DMH (5' DIA.), STA 290+38,LT.43' Peak Storage= 37 cf Inflow= 17.90 cfs 2.249 af
Primary= 17.89 cfs 2.249 af Outflow= 17.89 cfs 2.249 af

Pond 81: DMH (5'DIA), STA.290+98 LT. 43' Peak Storage= 60 cf Inflow= 17.86 cfs 2.248 af
Primary= 17.85 cfs 2.248 af Outflow= 17.85 cfs 2.248 af

Link 1L: DMH TO CB7 Inflow= 17.85 cfs 2.248 af
Primary= 17.85 cfs 2.248 af

Runoff Area = 33.460 ac Volume = 2.254 af Average Depth = 0.81"

Subcatchment 4: EXISTING SUBCATCHMENT #4

Runoff = 11.25 cfs @ 12.35 hrs, Volume= 1.328 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=4.20"

Area (ac)	CN	Description
10.370	61	SOIL GROUP A, MOBILE HOME PARK
4.060	30	SOIL GROUP A, WOODS
0.630	39	SOIL GROUP A, GRASS
7.250	75	SOIL GROUP B, MOBILE HOME PARK
22.310	59	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.0					**Direct Entry,**

Subcatchment 5: STA. 283+50-287+00, RT.

Runoff = 4.88 cfs @ 12.35 hrs, Volume= 0.559 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=4.20"

Area (ac)	CN	Description
5.870	61	SOIL TYPE A, MOBILE HOMES
0.260	39	SOIL TYPE A, GRASS
0.860	82	SOIL TYPE D, FOREST
0.250	80	SOIL TYPE D, GRASS
1.000	43	SOIL TYPE A, FOREST
8.240	61	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0					**Direct Entry,**

Subcatchment 49: DRIVE CULVERT SUBCAT STA. 287+00+/- LT.

Runoff = 1.35 cfs @ 12.15 hrs, Volume= 0.106 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=4.20"

Area (ac)	CN	Description
0.500	98	ASPHALT/IMPERVIOUS
0.500	39	SOIL GROUP A, GRASS
1.000	69	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry,

Subcatchment 99: SCHWINN NAULT'S CYCLERY

Runoff = 3.72 cfs @ 12.07 hrs, Volume= 0.261 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=4.20"

Area (ac)	CN	Description
0.800	98	ASPHALT/IMPERVIOUS
0.170	68	GRASS
0.970	93	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Subcatchment 406S: ROADSIDE SUBCATCHMENT STA. 286+50-288+85 RT.

Runoff = 0.00 cfs @ 20.00 hrs, Volume= 0.000 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=4.20"

Area (ac)	CN	Description
0.550	30	SOIL GROUP A, WOODS
0.390	39	SOIL GROUP A, GRASS
0.940	34	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0					Direct Entry,

Reach 53: 15" RCP, STA 286+50, 42'RT.-288+82,46'RT.

Inflow = 4.81 cfs @ 12.39 hrs, Volume= 0.558 af
Outflow = 4.79 cfs @ 12.40 hrs, Volume= 0.557 af, Atten= 0%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 9
Max. Velocity= 10.8 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 5.9 fps, Avg. Travel Time= 0.7 min

Peak Depth= 0.49'
Capacity at bank full= 14.85 cfs
Inlet Invert= 239.95', Outlet Invert= 229.51'
15.0" Diameter Pipe n= 0.012 Length= 232.0' Slope= 0.0450 '/'

Reach 62: DRIVE CULVERT STA.287+97,LT.72'-288+83 LT.

Inflow = 1.35 cfs @ 12.15 hrs, Volume= 0.106 af
Outflow = 1.21 cfs @ 12.20 hrs, Volume= 0.106 af, Atten= 10%, Lag= 2.9 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 9
Max. Velocity= 1.1 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 0.6 fps, Avg. Travel Time= 2.7 min

Peak Depth= 1.25'
Capacity at bank full= 1.17 cfs
Inlet Invert= 239.24', Outlet Invert= 236.72'
15.0" Diameter Pipe n= 0.120 Length= 90.0' Slope= 0.0280 '/'

Reach 71: 30"RCP STA. 288+83-290+38 LT.43'

Inflow = 16.80 cfs @ 12.37 hrs, Volume= 1.989 af
Outflow = 16.67 cfs @ 12.38 hrs, Volume= 1.988 af, Atten= 1%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 9
Max. Velocity= 7.0 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.6 fps, Avg. Travel Time= 0.7 min

Peak Depth= 1.23'
Capacity at bank full= 34.46 cfs
Inlet Invert= 228.67', Outlet Invert= 227.78'
30.0" Diameter Pipe n= 0.012 Length= 148.0' Slope= 0.0060 '/'

Reach 74: 15"RCP, STA.290+38,43'LT.-290+38, 66'LT.

Inflow = 3.71 cfs @ 12.07 hrs, Volume= 0.261 af
Outflow = 3.68 cfs @ 12.07 hrs, Volume= 0.261 af, Atten= 1%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 9
Max. Velocity= 4.5 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.7 fps, Avg. Travel Time= 0.2 min

Peak Depth= 0.79'
Capacity at bank full= 5.08 cfs
Inlet Invert= 227.88', Outlet Invert= 227.78'
15.0" Diameter Pipe n= 0.012 Length= 19.0' Slope= 0.0053 '/'

Reach 76: 30"RCP STA.290+38-290+98 LT.43'

Inflow = 17.89 cfs @ 12.37 hrs, Volume= 2.249 af
Outflow = 17.86 cfs @ 12.37 hrs, Volume= 2.248 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 9
Max. Velocity= 7.5 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.0 fps, Avg. Travel Time= 0.3 min

Peak Depth= 1.23'
Capacity at bank full= 36.93 cfs
Inlet Invert= 227.53', Outlet Invert= 227.15'
30.0" Diameter Pipe n= 0.012 Length= 55.0' Slope= 0.0069 '/'

Reach 405: ROADSIDE DITCH STA. 284+15-286+50 RT.42'

Inflow = 4.88 cfs @ 12.35 hrs, Volume= 0.559 af
Outflow = 4.82 cfs @ 12.39 hrs, Volume= 0.558 af, Atten= 1%, Lag= 2.3 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 9
Max. Velocity= 3.6 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 2.3 fps, Avg. Travel Time= 1.8 min

Peak Depth= 1.41'
Capacity at bank full= 2.79 cfs
Inlet Invert= 253.38', Outlet Invert= 240.20'
0.50' x 1.00' deep channel, n= 0.050 Length= 238.0' Slope= 0.0554 '/'
Side Slope Z-value= 0.2 0.5 '/'

Reach 406: ROADSIDE DITCH STA. 286+50-288+86 RT.42'

Inflow = 0.00 cfs @ 20.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 20.00 hrs, Volume= 0.000 af, Atten= 9%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 9
Max. Velocity= 0.5 fps, Min. Travel Time= 8.6 min
Avg. Velocity = 0.5 fps, Avg. Travel Time= 8.6 min

Peak Depth= 0.00'
Capacity at bank full= 4.04 cfs
Inlet Invert= 243.65', Outlet Invert= 229.51'
0.50' x 1.00' deep channel, n= 0.036 Length= 236.0' Slope= 0.0599 '/'
Side Slope Z-value= 0.2 0.5 '/'

Reach 407: DR.SWALE, STA.289+16.79'RT.-288+75,45'RT.

Inflow = 11.25 cfs @ 12.35 hrs, Volume= 1.328 af
Outflow = 11.23 cfs @ 12.35 hrs, Volume= 1.328 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 9
Max. Velocity= 5.6 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.6 fps, Avg. Travel Time= 0.3 min

Peak Depth= 0.39'
Capacity at bank full= 99.97 cfs
Inlet Invert= 232.91', Outlet Invert= 229.51'
5.00' x 1.50' deep channel, n= 0.036 Length= 45.0' Slope= 0.0756 '/'
Side Slope Z-value= 0.5 '/'

Pond 52: CB-E, STA. 286+50 RT.42'

Inflow	=	4.82 cfs @	12.39 hrs, Volume=	0.558 af
Outflow	=	4.81 cfs @	12.39 hrs, Volume=	0.558 af, Atten= 0%, Lag= 0.1 min
Primary	=	4.81 cfs @	12.39 hrs, Volume=	0.558 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 9

Peak Elev= 241.24' Storage= 17 cf
Plug-Flow detention time= 0.1 min calculated for 0.558 af (100% of inflow)
Storage and wetted areas determined by Conic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
239.95	13	0	0	13
242.95	13	39	39	51
244.95	2	13	52	72
245.75	2	2	54	76

Primary OutFlow (Free Discharge)
↑—1=Orifice/Grate

#	Routing	Invert	Outlet Devices
1	Primary	239.95'	**15.0" Vert. Orifice/Grate** C= 0.600

Pond 63: SPECIAL DR.STRUCTURE, STA. 288+83 LT.43'

Inflow	=	16.80 cfs @	12.36 hrs, Volume=	1.990 af
Outflow	=	16.80 cfs @	12.37 hrs, Volume=	1.989 af, Atten= 0%, Lag= 0.0 min
Primary	=	16.80 cfs @	12.37 hrs, Volume=	1.989 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 9

Peak Elev= 230.44' Storage= 62 cf
Plug-Flow detention time= 0.1 min calculated for 1.983 af (100% of inflow)
Storage and wetted areas determined by Conic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
228.67	35	0	0	35
234.47	35	203	203	157

Primary OutFlow (Free Discharge)
↑—1=Orifice/Grate

#	Routing	Invert	Outlet Devices
1	Primary	228.67'	**30.0" Vert. Orifice/Grate** C= 0.600

Pond 65: AREA IN FRONT OF HDR STA. 288+89,44'RT.

Inflow	=	15.95 cfs @	12.37 hrs,	Volume=	1.885 af
Outflow	=	15.92 cfs @	12.37 hrs,	Volume=	1.884 af, Atten= 0%, Lag= 0.4 min
Primary	=	15.92 cfs @	12.37 hrs,	Volume=	1.884 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 9

Peak Elev= 231.13' Storage= 337 cf
Plug-Flow detention time= 0.7 min calculated for 1.884 af (100% of inflow)
Storage and wetted areas determined by Conic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
229.26	70	0	0	70
232.26	320	540	540	356

Primary OutFlow (Free Discharge)
↑—1=Culvert

#	Routing	Invert	Outlet Devices
1	Primary	229.26'	**15.0" x 86.0' long Culvert X 3.00** Ke= 0.600 Outlet Invert= 228.92' S= 0.0040 '/' n= 0.012 Cc= 0.900

Pond 73: CB-E STA.290+38 LT.66'

Inflow	=	3.72 cfs @	12.07 hrs,	Volume=	0.261 af
Outflow	=	3.71 cfs @	12.07 hrs,	Volume=	0.261 af, Atten= 0%, Lag= 0.0 min
Primary	=	3.71 cfs @	12.07 hrs,	Volume=	0.261 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 9

Peak Elev= 228.89' Storage= 13 cf
Plug-Flow detention time= 0.3 min calculated for 0.260 af (100% of inflow)
Storage and wetted areas determined by Conic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
227.87	13	0	0	13
231.18	13	43	43	55
233.18	2	13	56	76
233.88	2	1	58	80

Primary OutFlow (Free Discharge)
↑—1=Orifice/Grate

#	Routing	Invert	Outlet Devices
1	Primary	227.87'	**15.0" Vert. Orifice/Grate** C= 0.600

Pond 75: DMH (5' DIA.), STA 290+38,LT.43'

Inflow	=	17.90 cfs @	12.37 hrs,	Volume=	2.249 af
Outflow	=	17.89 cfs @	12.37 hrs,	Volume=	2.249 af, Atten= 0%, Lag= 0.0 min
Primary	=	17.89 cfs @	12.37 hrs,	Volume=	2.249 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 9

Peak Elev= 229.37' Storage= 37 cf
Plug-Flow detention time= 0.1 min calculated for 2.249 af (100% of inflow)
Storage and wetted areas determined by Conic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
227.53	20	0	0	20
231.24	20	74	74	79
233.24	2	19	93	106
233.94	2	1	94	110

Primary OutFlow (Free Discharge)
↑—1=Orifice/Grate

#	Routing	Invert	Outlet Devices
1	Primary	227.53'	**30.0" Vert. Orifice/Grate** C= 0.600

Pond 81: DMH (5'DIA), STA.290+98 LT. 43'

Inflow	=	17.86 cfs @	12.37 hrs,	Volume=	2.248 af
Outflow	=	17.85 cfs @	12.37 hrs,	Volume=	2.248 af, Atten= 0%, Lag= 0.1 min
Primary	=	17.85 cfs @	12.37 hrs,	Volume=	2.248 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 9

Peak Elev= 230.01' Storage= 60 cf
Plug-Flow detention time= 0.1 min calculated for 2.241 af (100% of inflow)
Storage and wetted areas determined by Conic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
227.02	20	0	0	20
230.22	20	64	64	71
232.22	2	19	83	98
233.67	2	3	86	106

Primary OutFlow (Free Discharge)
↑—1=Culvert

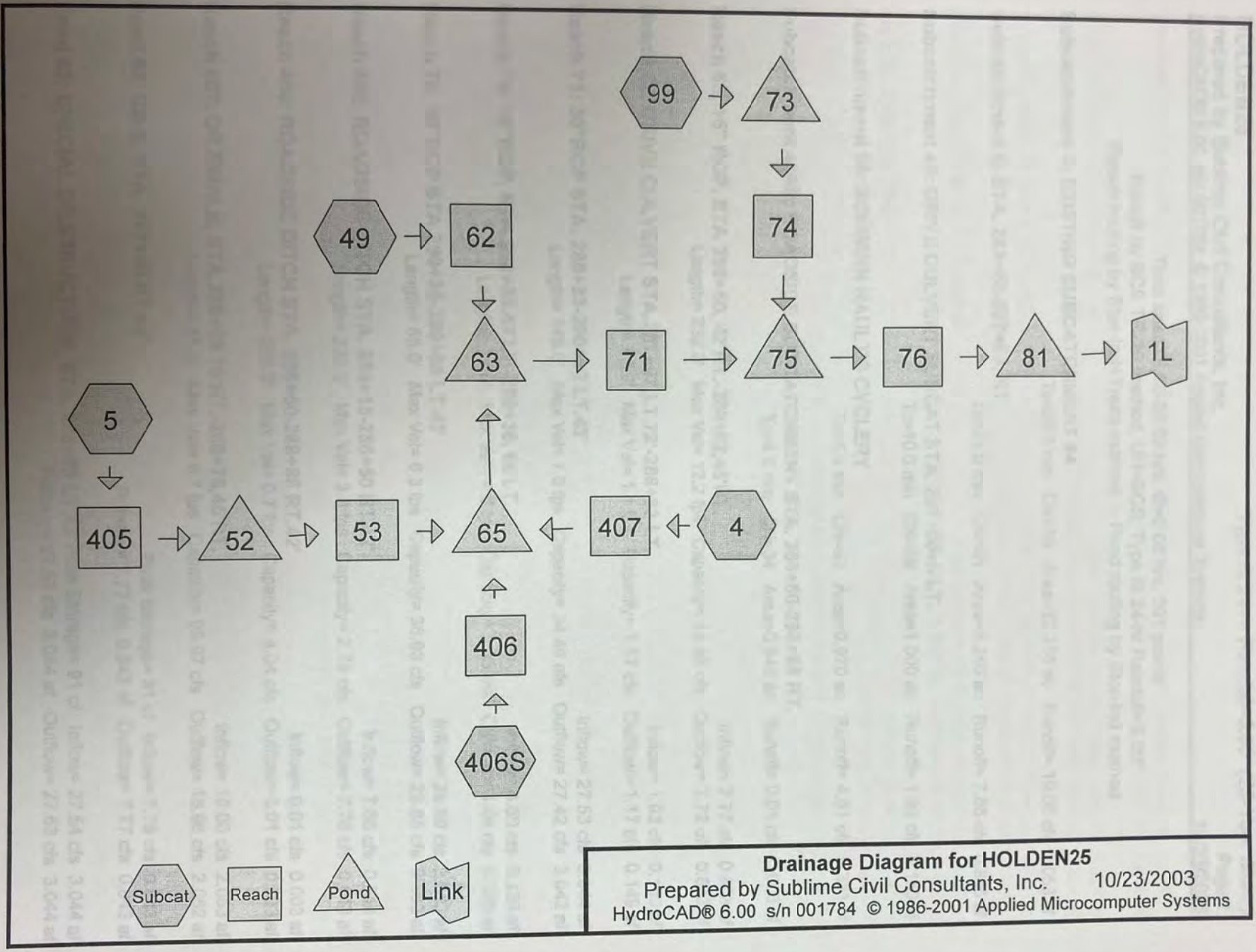
#	Routing	Invert	Outlet Devices
1	Primary	227.02'	**30.0" x 250.0' long Culvert** Ke= 0.400 Outlet Invert= 226.02' S= 0.0040 '/' n= 0.024 Cc= 0.900

Link 1L: DMH TO CB7

Inflow	=	17.85 cfs @	12.37 hrs, Volume=	2.248 af
Primary	=	17.85 cfs @	12.37 hrs, Volume=	2.248 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Calculations: Holden Engineering Model (25-Year Storm Summary)


99
73
74
49
62
63
71
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81
1L
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405
52
53
65
407
4
406
406S
Subcat
Reach
Pond
Link
Drainage Diagram for HOLDEN25
Prepared by Sublime Civil Consultants, Inc. 10/23/2003
HydroCAD® 6.00 s/n 001784 © 1986-2001 Applied Microcomputer Systems

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Type III 24-hr Rainfall=5.00"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 4: EXISTING SUBCATCHMENT #4
Tc=20.0 min CN=59 Area=22.310 ac Runoff= 19.00 cfs 2.053 af

Subcatchment 5: STA. 283+50-287+00, RT.
Tc=21.0 min CN=61 Area=8.240 ac Runoff= 7.86 cfs 0.845 af

Subcatchment 49: DRIVE CULVERT SUBCAT STA. 287+00+/- LT.
Tc=10.0 min CN=69 Area=1.000 ac Runoff= 1.93 cfs 0.150 af

Subcatchment 99: SCHWINN NAULT'S CYCLERY
Tc=5.0 min CN=93 Area=0.970 ac Runoff= 4.51 cfs 0.321 af

Subcatchment 406S: ROADSIDE SUBCATCHMENT STA. 286+50-288+85 RT.
Tc=4.0 min CN=34 Area=0.940 ac Runoff= 0.01 cfs 0.003 af

Reach 53: 15" RCP, STA 286+50, 42'RT.-288+82,46'RT. Inflow= 7.77 cfs 0.843 af
Length= 232.0' Max Vel= 12.2 fps Capacity= 14.85 cfs Outflow= 7.72 cfs 0.843 af

Reach 62: DRIVE CULVERT STA.287+97,LT.72'-288+83 LT. Inflow= 1.93 cfs 0.150 af
Length= 90.0' Max Vel= 1.1 fps Capacity= 1.17 cfs Outflow= 1.17 cfs 0.149 af

Reach 71: 30"RCP STA. 288+83-290+38 LT.43' Inflow= 27.53 cfs 3.044 af
Length= 148.0' Max Vel= 7.8 fps Capacity= 34.46 cfs Outflow= 27.42 cfs 3.042 af

Reach 74: 15"RCP, STA.290+38,43'LT.-290+38, 66'LT. Inflow= 4.50 cfs 0.320 af
Length= 19.0' Max Vel= 4.6 fps Capacity= 5.08 cfs Outflow= 4.46 cfs 0.320 af

Reach 76: 30"RCP STA.290+38-290+98 LT.43' Inflow= 28.89 cfs 3.363 af
Length= 55.0' Max Vel= 8.3 fps Capacity= 36.93 cfs Outflow= 28.85 cfs 3.362 af

Reach 405: ROADSIDE DITCH STA. 284+15-286+50 RT.42' Inflow= 7.86 cfs 0.845 af
Length= 238.0' Max Vel= 3.8 fps Capacity= 2.79 cfs Outflow= 7.78 cfs 0.843 af

Reach 406: ROADSIDE DITCH STA. 286+50-288+86 RT.42' Inflow= 0.01 cfs 0.003 af
Length= 236.0' Max Vel= 0.7 fps Capacity= 4.04 cfs Outflow= 0.01 cfs 0.003 af

Reach 407: DR.SWALE, STA.289+16.79'RT.-288+75,45'RT. Inflow= 19.00 cfs 2.053 af
Length= 45.0' Max Vel= 6.7 fps Capacity= 99.97 cfs Outflow= 18.96 cfs 2.052 af

Pond 52: CB-E, STA. 286+50 RT.42' Peak Storage= 31 cf Inflow= 7.78 cfs 0.843 af
Primary= 7.77 cfs 0.843 af Outflow= 7.77 cfs 0.843 af

Pond 63: SPECIAL DR.STRUCTURE, STA. 288+83 LT.43' Peak Storage= 91 cf Inflow= 27.54 cfs 3.044 af
Primary= 27.53 cfs 3.044 af Outflow= 27.53 cfs 3.044 af

Pond 65: AREA IN FRONT OF HDR STA. 288+89,44'RT. Peak Storage= 632 cf Inflow= 26.46 cfs 2.898 af
Primary= 26.37 cfs 2.895 af Outflow= 26.37 cfs 2.895 af

Pond 73: CB-E STA.290+38 LT.66' Peak Storage= 15 cf Inflow= 4.51 cfs 0.321 af
Primary= 4.50 cfs 0.320 af Outflow= 4.50 cfs 0.320 af

Pond 75: DMH (5' DIA.), STA 290+38,LT.43' Peak Storage= 55 cf Inflow= 28.90 cfs 3.363 af
Primary= 28.89 cfs 3.363 af Outflow= 28.89 cfs 3.363 af

Pond 81: DMH (5'DIA), STA.290+98 LT. 43' Peak Storage= 85 cf Inflow= 28.85 cfs 3.362 af
Primary= 28.85 cfs 3.362 af Outflow= 28.85 cfs 3.362 af

Link 1L: DMH TO CB7 Inflow= 28.85 cfs 3.362 af
Primary= 28.85 cfs 3.362 af

Runoff Area = 33.460 ac Volume = 3.371 af Average Depth = 1.21"

Subcatchment 4: EXISTING SUBCATCHMENT #4

Runoff = 19.00 cfs @ 12.32 hrs, Volume= 2.053 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.00"

Area (ac)	CN	Description
10.370	61	SOIL GROUP A, MOBILE HOME PARK
4.060	30	SOIL GROUP A, WOODS
0.630	39	SOIL GROUP A, GRASS
7.250	75	SOIL GROUP B, MOBILE HOME PARK
22.310	59	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.0					**Direct Entry,**

Subcatchment 5: STA. 283+50-287+00, RT.

Runoff = 7.86 cfs @ 12.33 hrs, Volume= 0.845 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.00"

Area (ac)	CN	Description
5.870	61	SOIL TYPE A, MOBILE HOMES
0.260	39	SOIL TYPE A, GRASS
0.860	82	SOIL TYPE D, FOREST
0.250	80	SOIL TYPE D, GRASS
1.000	43	SOIL TYPE A, FOREST
8.240	61	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0					**Direct Entry,**

Subcatchment 49: DRIVE CULVERT SUBCAT STA. 287+00+/- LT.

Runoff = 1.93 cfs @ 12.15 hrs, Volume= 0.150 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.00"

Area (ac)	CN	Description
0.500	98	ASPHALT/IMPERVIOUS
0.500	39	SOIL GROUP A, GRASS
1.000	69	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 99: SCHWINN NAULT'S CYCLERY

Runoff = 4.51 cfs @ 12.07 hrs, Volume= 0.321 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.00"

Area (ac)	CN	Description
0.800	98	ASPHALT/IMPERVIOUS
0.170	68	GRASS
0.970	93	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 406S: ROADSIDE SUBCATCHMENT STA. 286+50-288+85 RT.

Runoff = 0.01 cfs @ 15.45 hrs, Volume= 0.003 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.00"

Area (ac)	CN	Description
0.550	30	SOIL GROUP A, WOODS
0.390	39	SOIL GROUP A, GRASS
0.940	34	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0					**Direct Entry,**

Reach 53: 15" RCP, STA 286+50, 42'RT.-288+82,46'RT.

Inflow = 7.77 cfs @ 12.37 hrs, Volume= 0.843 af
Outflow = 7.72 cfs @ 12.38 hrs, Volume= 0.843 af, Atten= 1%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 9
Max. Velocity= 12.2 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 6.4 fps, Avg. Travel Time= 0.6 min

Peak Depth= 0.64'
Capacity at bank full= 14.85 cfs
Inlet Invert= 239.95', Outlet Invert= 229.51'
15.0" Diameter Pipe n= 0.012 Length= 232.0' Slope= 0.0450 '/'

Peak Depth= 1.66'
Capacity at bank full= 36.93 cfs
Inlet Invert= 227.53', Outlet Invert= 227.15'
30.0" Diameter Pipe n= 0.012 Length= 55.0' Slope= 0.0069 '/'

Reach 405: ROADSIDE DITCH STA. 284+15-286+50 RT.42'

Inflow = 7.86 cfs @ 12.33 hrs, Volume= 0.845 af
Outflow = 7.78 cfs @ 12.36 hrs, Volume= 0.843 af, Atten= 1%, Lag= 2.3 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 9
Max. Velocity= 3.8 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 2.4 fps, Avg. Travel Time= 1.6 min

Peak Depth= 2.00'
Capacity at bank full= 2.79 cfs
Inlet Invert= 253.38', Outlet Invert= 240.20'
0.50' x 1.00' deep channel, n= 0.050 Length= 238.0' Slope= 0.0554 '/'
Side Slope Z-value= 0.2 0.5 '/'

Reach 406: ROADSIDE DITCH STA. 286+50-288+86 RT.42'

Inflow = 0.01 cfs @ 15.45 hrs, Volume= 0.003 af
Outflow = 0.01 cfs @ 15.61 hrs, Volume= 0.003 af, Atten= 0%, Lag= 9.6 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 9
Max. Velocity= 0.7 fps, Min. Travel Time= 5.5 min
Avg. Velocity = 0.7 fps, Avg. Travel Time= 6.0 min

Peak Depth= 0.02'
Capacity at bank full= 4.04 cfs
Inlet Invert= 243.65', Outlet Invert= 229.51'
0.50' x 1.00' deep channel, n= 0.036 Length= 236.0' Slope= 0.0599 '/'
Side Slope Z-value= 0.2 0.5 '/'

Reach 407: DR.SWALE, STA.289+16.79'RT.-288+75,45'RT.

Inflow = 19.00 cfs @ 12.32 hrs, Volume= 2.053 af
Outflow = 18.96 cfs @ 12.32 hrs, Volume= 2.052 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 9
Max. Velocity= 6.7 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.0 fps, Avg. Travel Time= 0.3 min

Peak Depth= 0.54'
Capacity at bank full= 99.97 cfs
Inlet Invert= 232.91', Outlet Invert= 229.51'
5.00' x 1.50' deep channel, n= 0.036 Length= 45.0' Slope= 0.0756 '/'
Side Slope Z-value= 0.5 '/'

Pond 65: AREA IN FRONT OF HDR STA. 288+89,44'RT.

Inflow	=	26.46 cfs @	12.34 hrs, Volume=	2.898 af
Outflow	=	26.37 cfs @	12.35 hrs, Volume=	2.895 af, Atten= 0%, Lag= 0.6 min
Primary	=	26.37 cfs @	12.35 hrs, Volume=	2.895 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 9

Peak Elev= 232.77' Storage= 632 cf
Plug-Flow detention time= 0.7 min calculated for 2.886 af (100% of inflow)
Storage and wetted areas determined by Conic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
229.26	70	0	0	70
232.26	320	540	540	356

Primary OutFlow (Free Discharge)
↑—1=Culvert

#	Routing	Invert	Outlet Devices
1	Primary	229.26'	**15.0" x 86.0' long Culvert X 3.00** Ke= 0.600 Outlet Invert= 228.92' S= 0.0040 '/' n= 0.012 Cc= 0.900

Pond 73: CB-E STA.290+38 LT.66'

Inflow	=	4.51 cfs @	12.07 hrs, Volume=	0.321 af
Outflow	=	4.50 cfs @	12.07 hrs, Volume=	0.320 af, Atten= 0%, Lag= 0.0 min
Primary	=	4.50 cfs @	12.07 hrs, Volume=	0.320 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 9

Peak Elev= 229.06' Storage= 15 cf
Plug-Flow detention time= 0.3 min calculated for 0.319 af (100% of inflow)
Storage and wetted areas determined by Conic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
227.87	13	0	0	13
231.18	13	43	43	55
233.18	2	13	56	76
233.88	2	1	58	80

Primary OutFlow (Free Discharge)
↑—1=Orifice/Grate

#	Routing	Invert	Outlet Devices
1	Primary	227.87'	**15.0" Vert. Orifice/Grate** C= 0.600

Pond 75: DMH (5' DIA.), STA 290+38,LT.43'

Inflow	=	28.90 cfs @	12.35 hrs, Volume=	3.363 af
Outflow	=	28.89 cfs @	12.36 hrs, Volume=	3.363 af, Atten= 0%, Lag= 0.0 min
Primary	=	28.89 cfs @	12.36 hrs, Volume=	3.363 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 9

Peak Elev= 230.27' Storage= 55 cf
Plug-Flow detention time= 0.1 min calculated for 3.351 af (100% of inflow)
Storage and wetted areas determined by Conic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
227.53	20	0	0	20
231.24	20	74	74	79
233.24	2	19	93	106
233.94	2	1	94	110

Primary OutFlow (Free Discharge)
└1=Orifice/Grate

#	Routing	Invert	Outlet Devices
1	Primary	227.53'	**30.0" Vert. Orifice/Grate** C= 0.600

Pond 81: DMH (5'DIA), STA.290+98 LT. 43'

Inflow	=	28.85 cfs @	12.36 hrs, Volume=	3.362 af
Outflow	=	28.85 cfs @	12.36 hrs, Volume=	3.362 af, Atten= 0%, Lag= 0.0 min
Primary	=	28.85 cfs @	12.36 hrs, Volume=	3.362 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 9

Peak Elev= 233.50' Storage= 85 cf
Plug-Flow detention time= 0.1 min calculated for 3.351 af (100% of inflow)
Storage and wetted areas determined by Conic sections

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
227.02	20	0	0	20
230.22	20	64	64	71
232.22	2	19	83	98
233.67	2	3	86	106

Primary OutFlow (Free Discharge)
└1=Culvert

#	Routing	Invert	Outlet Devices
1	Primary	227.02'	**30.0" x 250.0' long Culvert** Ke= 0.400 Outlet Invert= 226.02' S= 0.0040 '/' n= 0.024 Cc= 0.900

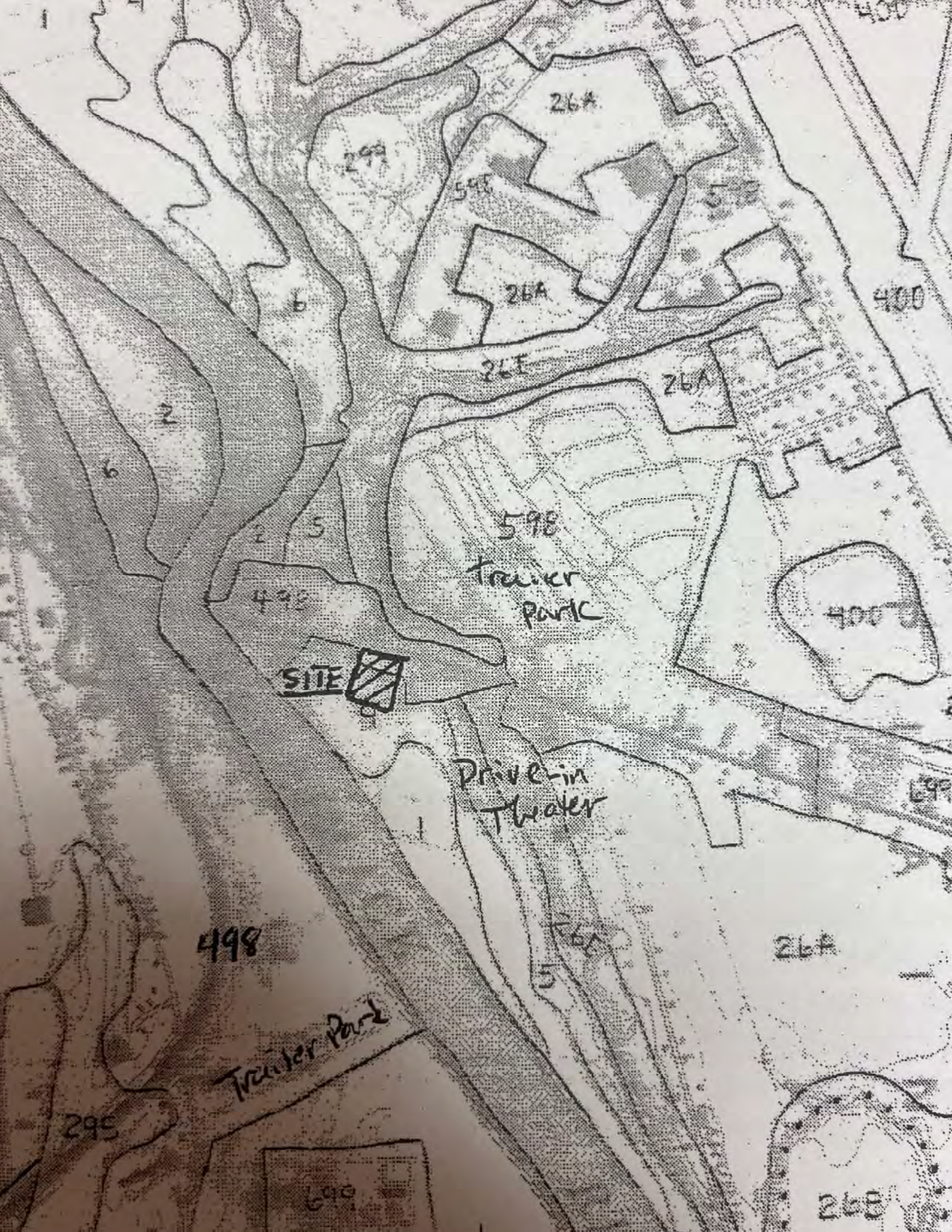
Link 1L: DMH TO CB7

Inflow	=	28.85 cfs @	12.36 hrs, Volume=	3.362 af
Primary	=	28.85 cfs @	12.36 hrs, Volume=	3.362 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Soils Information

Concord Heights
26A
400
699
2
5
4
1
26E
299
595
598
6
498
SITE
Trailer Park
Drive-in Theater
Trailer Park
97
295
699
115
513A
532B
533
26B
MERRIMACK
RIVER
26C
180C
12C
43C
43D
447B
45C
447C
250C


26A
299
595
595
26A
400
26E
26A
598
trailer
Park
400
SITE
Drive-in
Theater
498
26A
Trailer Park
295
26B

SCS Soil Descriptions

sandy soils in low spots. These soils make up as much as 10 percent of the map unit. A few areas are similar to this Suncook soil, except they have a gravelly surface layer and a very gravelly substratum. In a few areas this soil is subject to frequent flooding.

Permeability of this Suncook soil is rapid or very rapid. The available water capacity is low. Depth to bedrock is more than 60 inches. The seasonal high water table is at a depth of 3 to 6 feet from January through April. Potential frost action is low. The soil is subject to occasional flooding, generally from March through May.

Most areas of this soil are used for hay and pasture. Some areas are used for cultivated crops or are wooded. A few areas are used for residential or commercial development.

This soil is fairly suited to cultivated crops, hay, and pasture. The main limitations are droughtiness and low natural fertility. Irrigation, lime, and fertilizer are needed to improve crop production. Fertilizer applied at two or three intervals during the growing season increases yields. Cover crops and crop residue returned to the soil help to maintain the organic matter content and to control erosion during periods of flooding. A strip of permanent sod adjacent to the stream helps reduce streambank erosion. The soil warms up and dries out early in spring, and consequently can be cultivated and planted early in the growing season. Use of deep-rooted, drought-tolerant grasses and legumes for hay and pasture helps to overcome the low available water capacity.

Potential productivity of eastern white pine on this soil is high. Droughtiness causes severe seedling mortality. There are few or no limitations to forest management or logging operations.

Flooding is the main limitation to use of this soil for urban development. Local roads and streets need careful design and need to be built up above flood levels.

This soil is in capability subclass IIIs.

4—Pootatuck fine sandy loam. This is a nearly level, moderately well drained soil on flood plains. Areas of this soil are generally long and narrow and range from 3 to 20 acres in size, or they are rectangular and range from 10 to 80 acres in size. Slopes range from 0 to 3 percent but are dominantly less than 2 percent.

Typically, the surface layer is dark grayish brown fine sandy loam about 9 inches thick. The subsoil is about 19 inches thick. It is dark yellowish brown fine sandy loam that is mottled in the lower part. The substratum to a depth of 60 inches or more is dark brown very gravelly loamy sand.

Included with this soil in mapping are small areas of Suncook and Occum soils on rises and Rippowam soils in low spots. Also included are small areas of soils that are sandy or gravelly in the surface layer and in the upper part of the subsoil. These soils make up as much as 15 percent of the map unit. Some areas are similar to this Pootatuck soil, except the surface layer and the upper part of the subsoil are silt loam or the substratum is fine sandy loam. A few areas are subject to frequent flooding.

Permeability of this Pootaluck soil is moderate or moderately rapid in the solum and rapid or very rapid in the substratum. The available water capacity is moderate. Depth to bedrock is more than 60 inches. The seasonal high water table is at a depth of 1.5 to 2.5 feet from November through April. Potential frost action is moderate. In most areas the soil is subject to occasional flooding, generally from November through April.

Many areas of this soil are used for hay or cultivated crops. Some areas are used for pasture or are wooded. A few areas are used for residential, commercial, and industrial development. A few areas are in recreation use.

This soil is suited to corn, grasses, legumes, and vegetable crops. It can be cropped continuously. In some years the seasonal high water table restricts the choice of crops and delays cultivation in spring and harvest in fall. Installing tile drainage helps improve suitability of the soil for crops. Cover crops help control erosion during periods of flooding. The few areas of the soil that are subject to frequent flooding are more limited for farming. A strip of permanent sod along the stream channel helps reduce streambank erosion.

Potential productivity of eastern white pine on this soil is very high. There are few limitations to forest management or logging operations.

Flooding and the seasonal high water table severely limit use of this soil for urban development. Local roads and streets need careful design to prevent the damage caused by frost heave and need to be built up above flood levels.

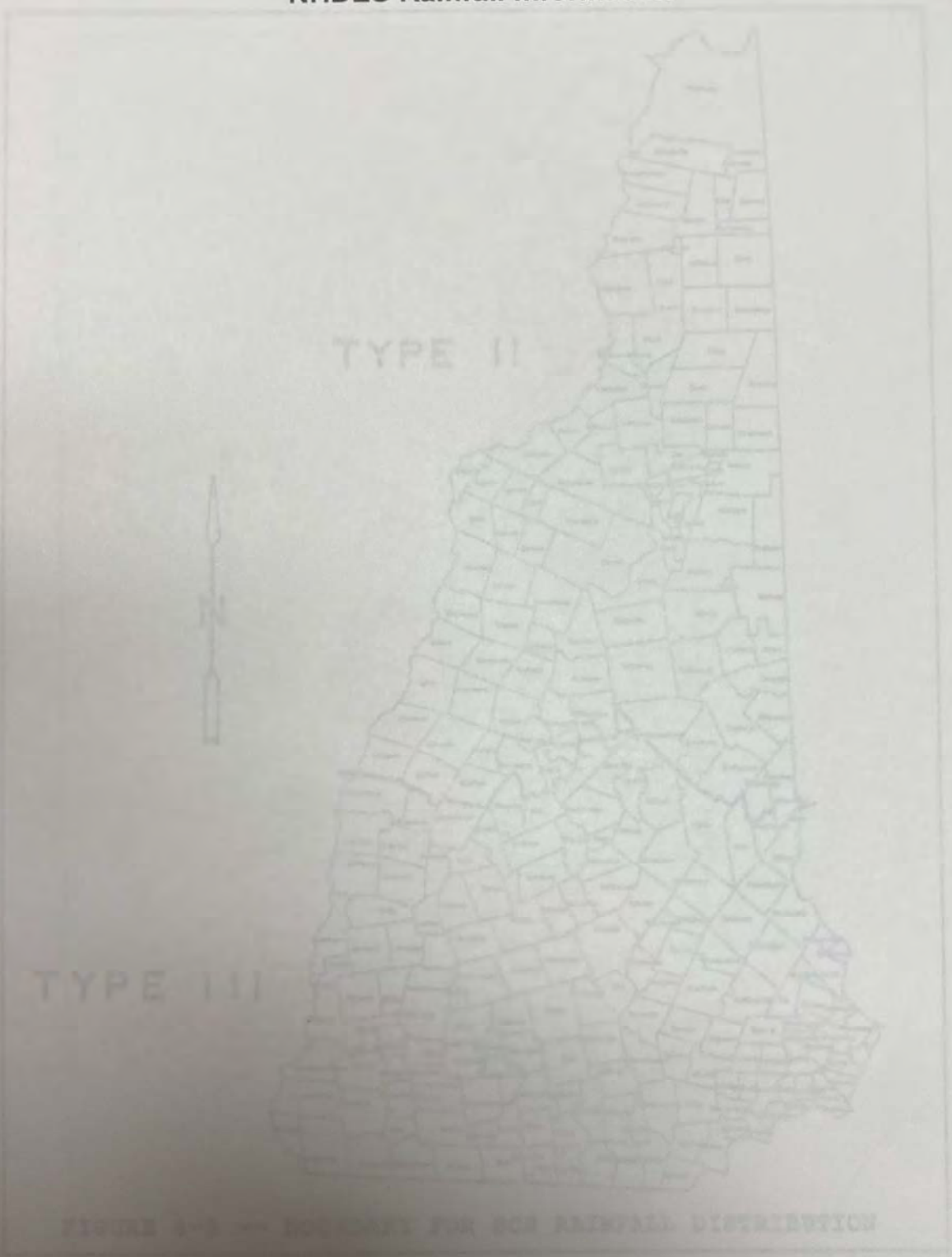
This soil is in capability subclass IIw.

5—Rippowam fine sandy loam. This is a nearly level, poorly drained soil in depressions and in low-lying areas of flood plains. Areas of this soil are long and narrow and range from 3 to 40 acres in size. Slopes range from 0 to 3 percent but are dominantly less than 2 percent.

Typically, the surface layer is very dark grayish brown and dark grayish brown fine sandy loam about 9 inches thick. The substratum to a depth of 60 inches or more is olive brown fine sandy loam, dark grayish brown fine sandy loam, olive gray sandy loam, and dark grayish brown very gravelly sand.

Included with this soil in mapping are small areas of Pootatuck and Occum soils on slight rises and Saco soils in low depressions. These soils make up as much as 10 percent of the map unit. Also included are some areas of soils that are similar to this Rippowam soil but have a thick, dark surface layer, have gravelly sand or sand in the upper part of the substratum, or have fine sandy loam in the lower part of the substratum. Also

NHDES Rainfall Information



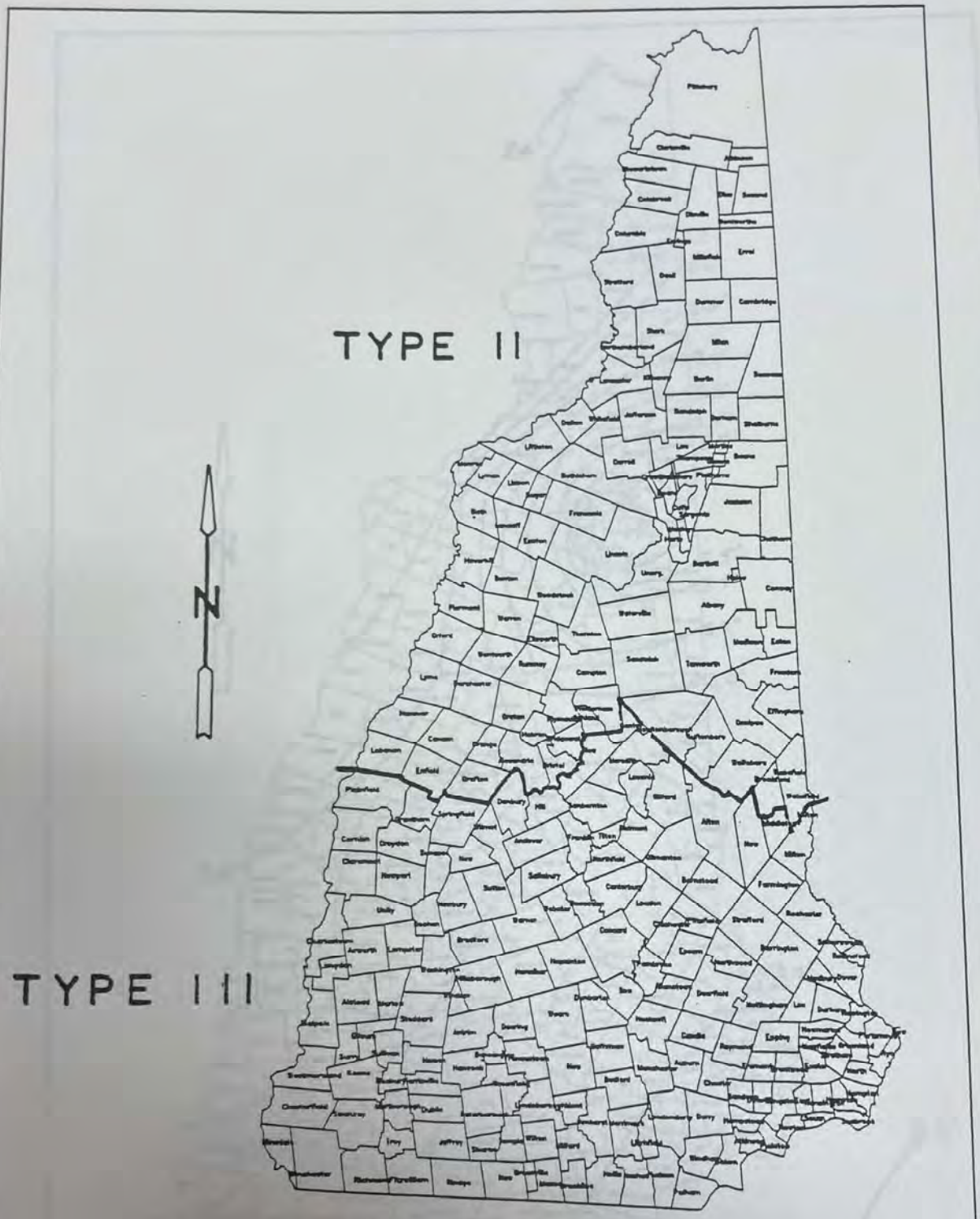


FIGURE 6-5 -- BOUNDARY FOR SCS RAINFALL DISTRIBUTION

Source: USDA Soil Conservation Service

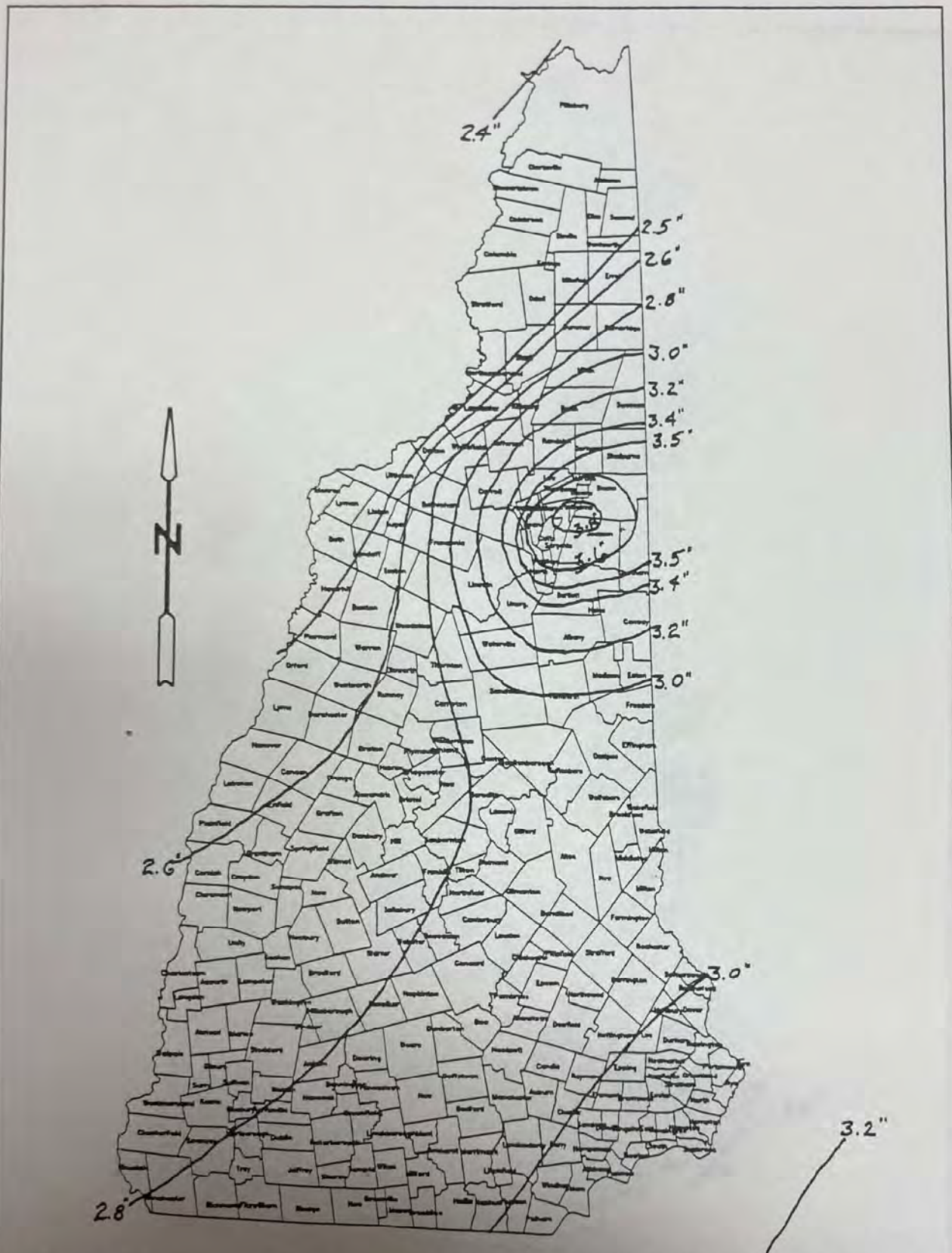


FIGURE 6-6 -- 2-YEAR FREQUENCY 24-HOUR DURATION RAINFALL

Source: USDA Soil Conservation Service

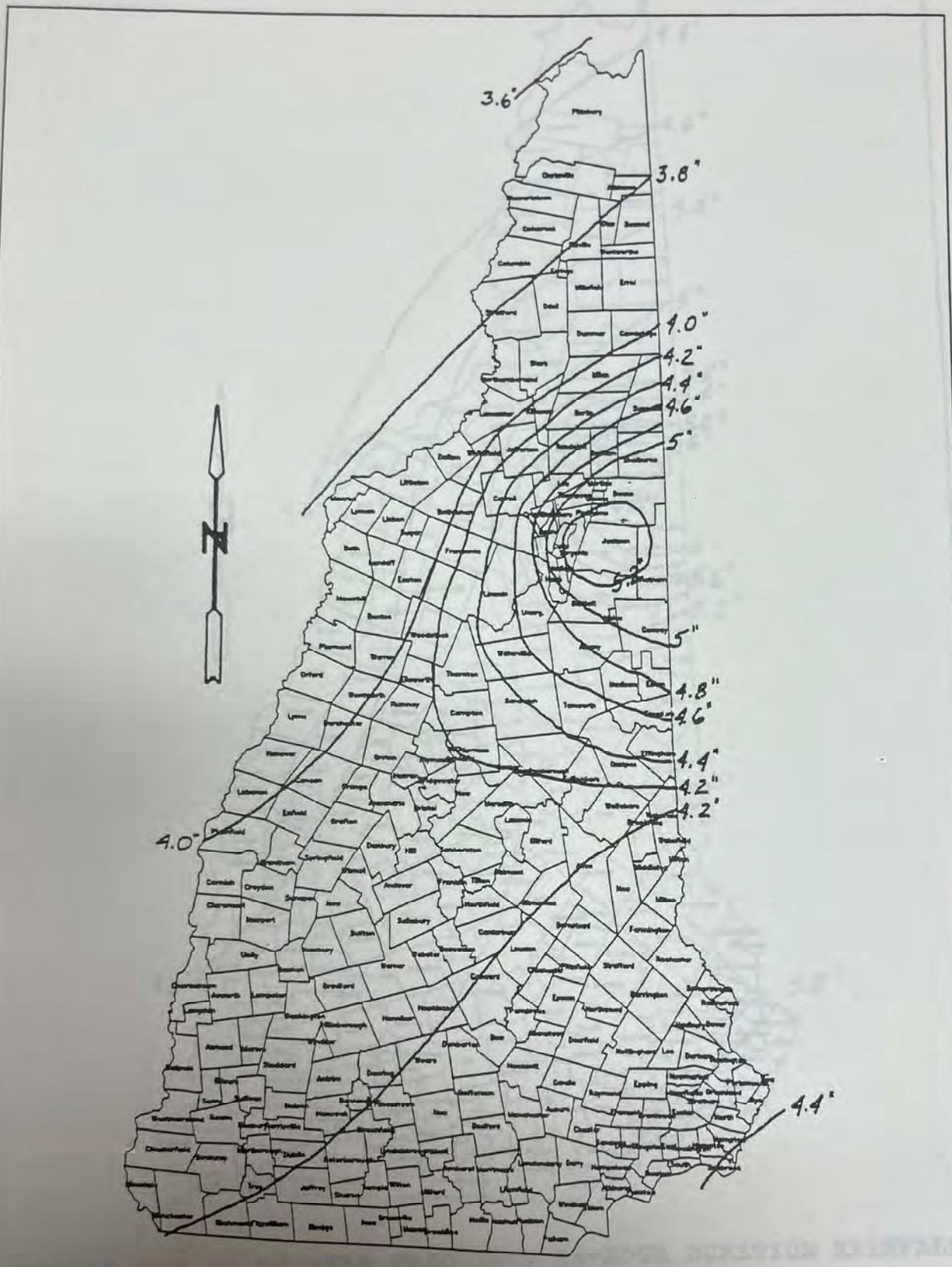


FIGURE 6-8 -- 10-YEAR FREQUENCY 24-HOUR DURATION RAINFALL

Source: USDA Soil Conservation Service

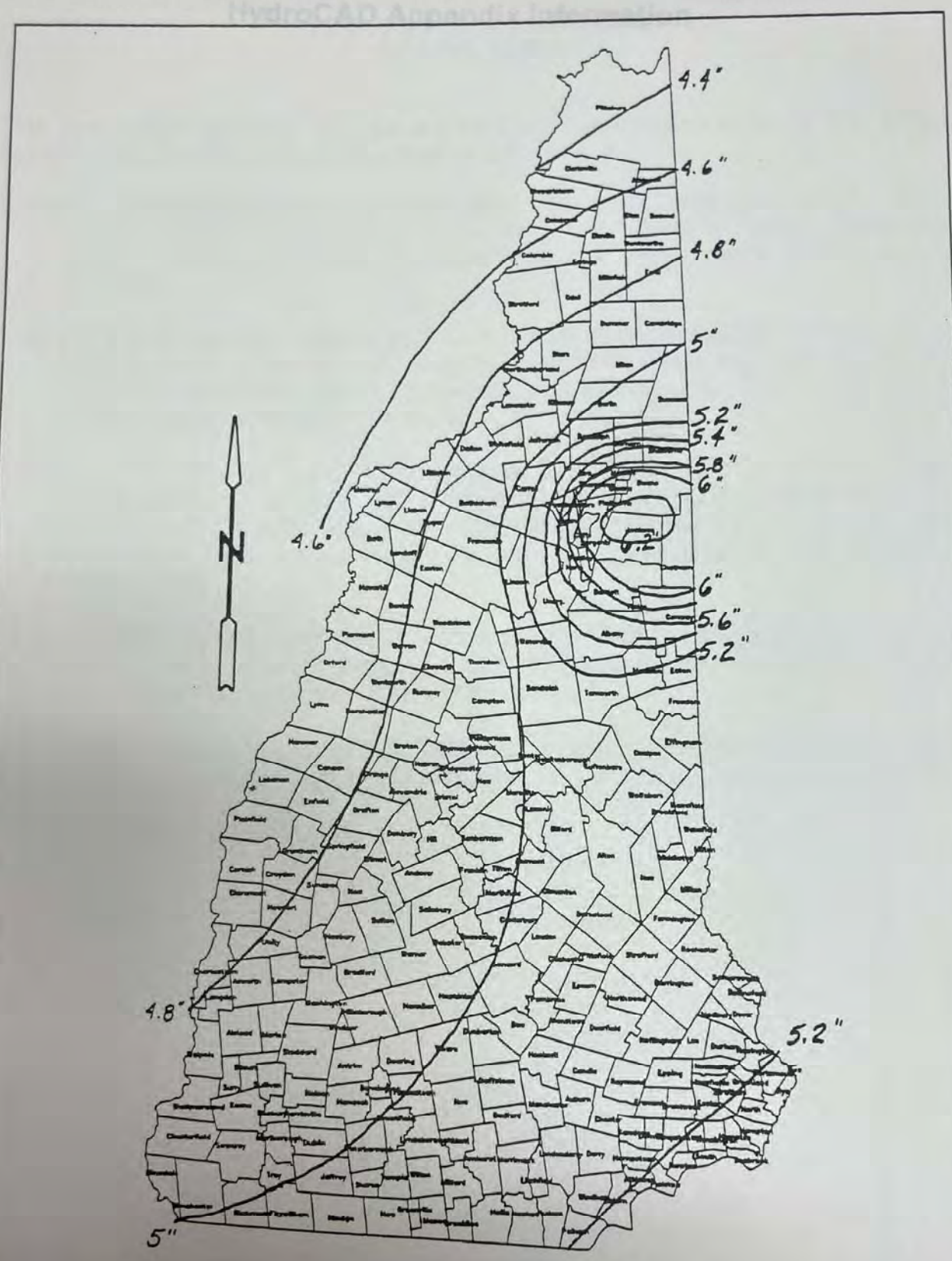


FIGURE 6-9 -- 25-YEAR FREQUENCY 24-HOUR DURATION RAINFALL

Source: USDA Soil Conservation Service

HydroCAD Appendix Information

HYDROLOGICAL SOIL GROUPS FOR DETERMINING RUNOFF IN NEW HAMPSHIRE (BY SOIL SERIES)

The hydrologic grouping of soils is based upon infiltration rates as they affect runoff. The four groups are described as follows:

Group A –Soils having high infiltration rates even when thoroughly wetted. These consist chiefly of deep, well to excessively drained sands or gravel. These soils have a high rate of water transmission and would result in low runoff potential.

Group B –Soils having moderate infiltration rates when thoroughly wetted. These consist chiefy of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission.

Group C –Soils having slow infiltration rates when thoroughly wetted. These consist chiefly of (1) soils with a layer that impedes the downward movement of water, or (2) soils with moderately fine to fine texture, or (3) soils with moderately high water tables. These soils have a slow rate of water transmission.

Group D –Soils having very slow infiltration rates when thoroughly wetted. These consist chiefly of very poorly drained mineral soils or organic soils. These soils have a very slow rate of water transmission.

Soils in dual hydrologic groups have infiltration rates dependent on depth to water table or bedrock. Onsite analysis is desirable in order to develop a representative composite RCN.

Abenaki	B	Canaan*	C
Acton	B	Canton	B
Acton Variant	C	Cardigan	B
Adams	A	Ceasar	A
Agawam	B	Charles	C
Alluvial land	C	Charlton	B
Au Gres	B	Chatfield	B
Bangor	B	Chocorua	D
Becket	C	Cohas	C
Belgrade	B	Colton	A
Berkshire	B	Croghan	B
Bernardston	C	Dartmouth	B
Bernardston Variant	C	Deerfield	B
Biddeford	D	Dixmont	C
Binghamville	D	Duane	B
Borofibrists	D	Dumps**	A
Borohemists*	D	Dutchess	B
Boxford	C	Eldridge	C
Buxton	C	Elmridge	C

Elmwood	C
Fresh Water Marsh	D
Fryeburg	B
Glebe	C
Gloucester*	A
Glover	C/D
Grange	C
Greenwood	A/D
Groveton	B
Hadley	B
Haven	B
Hermon	A
Hinckley	A
Hitchcock	B
Hollis	C/D
Hoosic	A
Houghtonville	C
Howland	B
Ipswich	D
Kearsarge	B
Kinsman	C
Leicester	C
Leicester Variant	C
Lim	C
Limerick	C
Limerick Variant	C
Lombard	C/D
Londonderry	C/D
Lovewell	B
Lyman	C/D
Lyme	C
Machias	B
Madawaska	B
Made land**	A
Marlow	C
Marsh	D
Masardis	A
Matunuck	D
Maybid	D
Medomak	D
Medomak Variant	D
Melrose	C
Merrimac	A
Metallak	B
Millis	C
Mixed Alluvial land	C
Monadnock	B
Monarda	D
Montauk	C
Moosilauke	C
Muck & Peat	A/D

Mundal	C
Naumburg	C
Newfields	B
Nicholville	C
Nicholville Variant	C
Ninigret	B
Occum	B
Ondawa	B
Ondawa Variant	B
Ossipee	D
Pawcatuck	D
Paxton	C
Peachum	D
Pemi	C
Pennichuck	B
Peru	C
Pillsbury	C
Pipestone	B
Pits, gravel	B
Pittstown	C
Pittstown Variant	C
Plaisted	C
Plaisted Variant	B
Podunk	B
Podunk Variant	B
Poocham	B
Pootatuck	B
Quarries**	D
Quonset	A
Raynham	C
Raynham Variant	C
Redstone	A
Ricker	A
Ridgebury	C
Rippowam	C
Riverwash**	C
Rock Outcrop*	D
Roundabout	C
Rubble land	A
Rumney	C
Saco	D
Saco Variant	D
Saddleback	C/D
Salmon	B
Salmon Variant	B
Saugatuck	C
Scantic*	D
Scarboro	D
Scio	B
Scitico	C
Scituate	C

Searsport	D
Sebago	D
Shapleigh	C/D
Sheepscot	B
Sisk	C
Skerry	C
Squamscot	C
Stetson	B
Stissing	C
Strafford	C
Success	A
Sudbury	B
Suffield	C
Sunapee	B
Suncook	A
Sunday	A
Surplus	C
Sutton	B
Swanton*	C/D
Thorndike	C/D
Tidal Marsh	D
Tunbridge	C
Udipsamments	A
Udorthents**	A
Unadilla	B
Unadilla Variant	B
Urban land	D
Vassalboro	D
Walpole	C
Wareham	C
Warwick	A
Waumbek	B
Westbrook	D
Whitman	D
Wilmington	D
Windsor	A
Windsor Variant	C
Winooski	B
Woodbridge	C

* See local SCS office for alternative interpretation as some areas have been updated or recorrelated.

** Evaluation of each site is required to determine hydrologic group.

Hydrologic soil groups

Soils are classified into hydrologic soil groups (HSG's) to indicate the minimum rate of infiltration obtained for bare soil after prolonged wetting. The HSG's, which are A, B, C, and D, are one element used in determining runoff curve numbers as listed on the following pages.

The infiltration rate is the rate at which water enters the soil at the soil surface. It is controlled by surface conditions. HSG also indicates the transmission rate — the rate at which the water moves through the soil. This rate is controlled by the soil profile. The four groups are defined by SCS soil scientists as follows:

Group A soils have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands and gravels, and have a high rate of water transmission (greater than 0.30 in/hr).

Group B soils have moderate infiltration rates when thoroughly wetted, and consist chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission (0.15-0.30 in/hr).

Group C soils have low infiltration rates when thoroughly wetted, and consist chiefly of soils with a layer that impedes downward movement of water, and soils with moderately fine to fine texture. These soils have a low rate of water transmission (0.05-0.15 in/hr).

Group D soils have high runoff potential. They have very low infiltration rates when thoroughly wetted, and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very low rate of water transmission (0-0.05 in/hr).

Note: Exhibit A-1 of the TR-55 manual provides a detailed list of soil types for the United States.

Disturbed soil profiles

As a result of urbanization, the soil profile may be considerably altered and the listed group classification may no longer apply. In these circumstances, use the following to determine HSG according to the texture of the new surface soil, provided that significant compaction has not occurred:

HSG	Soil Textures
A	Sand, loamy sand, or sandy loam
B	Silt loam or loam
C	Sandy clay loam
D	Clay loam, silty clay loam, sandy clay, silty clay, or clay

Runoff curve numbers for urban areas[1]

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1]Average runoff condition, and $I_a = 0.2S$.

[2]The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3]CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4]Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5]Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4, based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

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Runoff curve numbers for cultivated agricultural lands[1]

Cover description			Curve numbers for hydrologic soil group—			
Cover type	Treatment[2]	Hydrologic condition[3]	A	B	C	D
Fallow	Bare soil	–	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T + CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T + CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

[1]Average runoff condition, and $I_a = 0.2S$.

[2]*Crop residue cover* applies only if residue is on at least 5% of the surface throughout the year.

[3]Hydrologic condition is based on combination of factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes in rotations, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

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Runoff curve numbers for other agricultural lands[1]

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing.[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element.[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	430	48	65	73
Woods—grass combination (orchard or tree farm).[5]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods.[6]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	430	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

[1]Average runoff condition, and $I_a = 0.2S$.

[2]*Poor:* <50% ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: >75% ground cover and lightly or only occasionally grazed.

[3]*Poor:* <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

[4]Actual curve number is less than 30; use CN = 30 for runoff computations.

[5]CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

[6]*Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

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Runoff curve numbers for arid and semiarid rangelands[1]

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition[2]	A[3]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

[1]Average runoff condition, and $I_a = 0.2S$. For range in humid regions, use table 2-2c.

[2]*Poor:* <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: >70% ground cover.

[3]Curve numbers for group A have been developed only for desert shrub.

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Synthetic rainfall distributions

The highest peak discharges from small watersheds in the United States are usually caused by intense, brief rainfalls that may occur as distinct events or as part of a longer storm. These intense rainstorms do not usually extend over a large area and intensities vary greatly. One common practice in rainfall-runoff analysis is to develop a synthetic rainfall distribution to use in lieu of actual storm events. This distribution includes maximum rainfall intensities for the selected design frequency arranged in a sequence that is critical for producing peak runoff.

Synthetic rainfall distributions

The length of the most intense rainfall period contributing to the peak runoff rate is related to the time of concentration (T_c) for the watershed. In a hydrograph created with SCS procedures, the duration of rainfall that directly contributes to the peak is about 170 percent of the T_c. For example, the most intense 8.5-minute rainfall period would contribute to the peak discharge for a watershed with a T_c of 5 minutes; the most intense 8.5-hour period would contribute to the peak for a watershed with a 5-hour T_c.

Different rainfall distributions can be developed for each of these watersheds to emphasize the critical rainfall duration for the peak discharges. However, to avoid the use of a different set of rainfall intensities for each drainage area size, a set of synthetic rainfall distributions having "nested" rainfall intensities was developed. The set "maximizes" the rainfall intensities by incorporating selected short duration intensities within those needed for longer durations at the same probability level.

For the size of the drainage areas for which SCS usually provides assistance, a storm period of 24 hours was chosen for the synthetic rainfall distributions. The 24-hour storm, while longer than that needed to determine peaks for these drainage areas, is appropriate for determining runoff volumes. Therefore, a single storm duration and associated synthetic rainfall distribution can be used to represent not only the peak discharges but also the runoff volumes for a range of drainage area sizes.

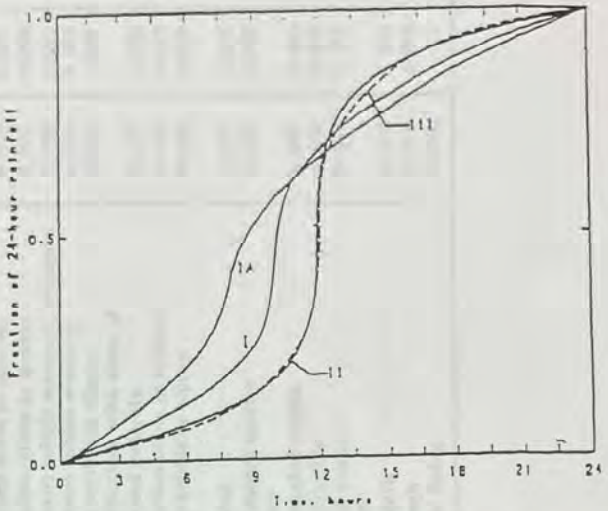

Figure B-1.—SCS 24-hour rainfall distributions.

The intensity of rainfall varies considerably during a storm as well as over geographic regions. To represent various regions of the United States, SCS developed four synthetic 24-hour rainfall distributions (I, IA, II, and III) from available National Weather Service (NWS) duration-frequency data (Hershfield 1961; Frederick et al., 1977) or local storm data. Type IA is the least intense and type II the most intense short duration rainfall. The four distributions are shown in figure B-1, and figure B-2 shows their approximate geographic boundaries.

Types I and IA represent the Pacific maritime climate with wet winters and dry summers. Type III represents Gulf of Mexico and Atlantic coastal areas where tropical storms bring large 24-hour rainfall amounts. Type II represents the rest of the country. For more precise distribution boundaries in a state having more than one type, contact the SCS State Conservation Engineer.

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VALUES OF THE ROUGHNESS COEFFICIENT n
(Boldface figures are values generally recommended in design)

Type of channel and description	Minimum	Normal	Maximum
A. CLOSED CONDUITS FLOWING PARTLY FULL			
A-1. Metal			
a. Brass, smooth	0.009	0.010	0.013
b. Steel			
1. Lockbar and welded	0.010	0.012	0.014
2. Riveted and spiral	0.013	0.016	0.017
c. Cast iron			
1. Coated	0.010	0.013	0.014
2. Uncoated	0.011	0.014	0.016
d. Wrought iron			
1. Black	0.012	0.014	0.015
2. Galvanized	0.013	0.016	0.017
e. Corrugated metal			
1. Subdrain	0.017	0.019	0.021
2. Storm drain	0.021	0.024	0.030
A-2. Nonmetal			
a. Lucite	0.008	0.009	0.010
b. Glass	0.009	0.010	0.013
c. Cement			
1. Neat, surface	0.010	0.011	0.013
2. Mortar	0.011	0.013	0.015
d. Concrete			
1. Culvert, straight and free of debris	0.010	0.011	0.013
2. Culvert with bends, connections, and some debris	0.011	0.013	0.014
3. Finished	0.011	0.012	0.014
4. Sewer with manholes, inlet, etc., straight	0.013	0.015	0.017
5. Unfinished, steel form	0.012	0.013	0.014
6. Unfinished, smooth wood form	0.012	0.014	0.016
7. Unfinished, rough wood form	0.015	0.017	0.020
e. Wood			
1. Stave	0.010	0.012	0.014
2. Laminated, treated	0.015	0.017	0.020
f. Clay			
1. Common drainage tile	0.011	0.013	0.017
2. Vitrified sewer	0.011	0.014	0.017
3. Vitrified sewer with manholes, inlet, etc.	0.013	0.015	0.017
4. Vitrified subdrain with open joint	0.014	0.016	0.018
g. Brickwork			
1. Glazed	0.011	0.013	0.015
2. Lined with cement mortar	0.012	0.015	0.017
h. Sanitary sewers coated with sewage slimes, with bends and connections	0.012	0.013	0.016
i. Paved invert, sewer, smooth bottom	0.016	0.019	0.020
j. Rubble masonry, cemented	0.018	0.025	0.030

VALUES OF THE ROUGHNESS COEFFICIENT n (continued)

Type of channel and description	Minimum	Normal	Maximum
B. LINED OR BUILT-UP CHANNELS			
B-1. Metal			
a. Smooth steel surface			
1. Unpainted	0.011	0.012	0.014
2. Painted	0.012	0.013	0.017
b. Corrugated	0.021	0.025	0.030
B-2. Nonmetal			
a. Cement			
1. Neat, surface	0.010	0.011	0.013
2. Mortar	0.011	0.013	0.015
b. Wood			
1. Planed, untreated	0.010	0.012	0.014
2. Planed, creosoted	0.011	0.012	0.015
3. Unplaned	0.011	0.013	0.015
4. Plank with battens	0.012	0.015	0.018
5. Lined with roofing paper	0.010	0.014	0.017
c. Concrete			
1. Trowel finish	0.011	0.013	0.015
2. Float finish	0.013	0.015	0.016
3. Finished, with gravel on bottom	0.015	0.017	0.020
4. Unfinished	0.014	0.017	0.020
5. Gunite, good section	0.016	0.019	0.023
6. Gunite, wavy section	0.018	0.022	0.025
7. On good excavated rock	0.017	0.020	
8. On irregular excavated rock	0.022	0.027	
d. Concrete bottom float finished with sides of			
1. Dressed stone in mortar	0.015	0.017	0.020
2. Random stone in mortar	0.017	0.020	0.024
3. Cement rubble masonry, plastered	0.016	0.020	0.024
4. Cement rubble masonry	0.020	0.025	0.030
5. Dry rubble or riprap	0.020	0.030	0.035
e. Gravel bottom with sides of			
1. Formed concrete	0.017	0.020	0.025
2. Random stone in mortar	0.020	0.023	0.026
3. Dry rubble or riprap	0.023	0.033	0.036
f. Brick			
1. Glazed	0.011	0.013	0.015
2. In cement mortar	0.012	0.015	0.018
g. Masonry			
1. Cemented rubble	0.017	0.025	0.030
2. Dry rubble	0.023	0.032	0.035
h. Dressed ashlar	0.013	0.015	0.017
i. Asphalt			
1. Smooth	0.013	0.013	
2. Rough	0.016	0.016	
j. Vegetal lining	0.030	.....	0.500

Values of the Roughness Coefficient n (*continued*)

Type of channel and description	Minimum	Normal	Maximum
C. Excavated or Dredged			
a. Earth, straight and uniform			
1. Clean, recently completed	0.016	0.018	0.020
2. Clean, after weathering	0.018	0.022	0.025
3. Gravel, uniform section, clean	0.022	0.025	0.030
4. With short grass, few weeds	0.022	0.027	0.033
b. Earth, winding and sluggish			
1. No vegetation	0.023	0.025	0.030
2. Grass, some weeds	0.025	0.030	0.033
3. Dense weeds or aquatic plants in deep channels	0.030	0.035	0.040
4. Earth bottom and rubble sides	0.028	0.030	0.035
5. Stony bottom and weedy banks	0.025	0.035	0.040
6. Cobble bottom and clean sides	0.030	0.040	0.050
c. Dragline-excavated or dredged			
1. No vegetation	0.025	0.028	0.033
2. Light brush on banks	0.035	0.050	0.060
d. Rock cuts			
1. Smooth and uniform	0.025	0.035	0.040
2. Jagged and irregular	0.035	0.040	0.050
e. Channels not maintained, weeds and brush uncut			
1. Dense weeds, high as flow depth	0.050	0.080	0.120
2. Clean bottom, brush on sides	0.040	0.050	0.080
3. Same, highest stage of flow	0.045	0.070	0.110
4. Dense brush, high stage	0.080	0.100	0.140
D. Natural Streams			
D-1. Minor streams (top width at flood stage <100 ft)			
a. Streams on plain			
1. Clean, straight, full stage, no rifts or deep pools	0.025	0.030	0.033
2. Same as above, but more stones and weeds	0.030	0.035	0.040
3. Clean, winding, some pools and shoals	0.033	0.040	0.045
4. Same as above, but some weeds and stones	0.035	0.045	0.050
5. Same as above, lower stages, more ineffective slopes and sections	0.040	0.048	0.055
6. Same as 4, but more stones	0.045	0.050	0.060
7. Sluggish reaches, weedy, deep pools	0.050	0.070	0.080
8. Very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush	0.075	0.100	0.150
b. Mountain streams, no vegetation in channel, banks usually steep, trees and brush along banks submerged at high stages			
1. Bottom: gravels, cobbles, and few boulders	0.030	0.040	0.050
2. Bottom: cobbles with large boulders	0.040	0.050	0.070
D-2. Flood plains			
a. Pasture, no brush			
1. Short grass	0.025	0.030	0.035
2. High grass	0.030	0.035	0.050
b. Cultivated areas			
1. No crop	0.020	0.030	0.040
2. Mature row crops	0.025	0.035	0.045
3. Mature field crops	0.030	0.040	0.050
c. Brush			
1. Scattered brush, heavy weeds	0.035	0.050	0.070
2. Light brush and trees, in winter	0.035	0.050	0.060
3. Light brush and trees, in summer	0.040	0.060	0.080
4. Medium to dense brush, in winter	0.045	0.070	0.110
5. Medium to dense brush, in summer	0.070	0.100	0.160
d. Trees			
1. Dense willows, summer, straight	0.110	0.150	0.200
2. Cleared land with tree stumps, no sprouts	0.030	0.040	0.050
3. Same as above, but with heavy growth of sprouts	0.050	0.060	0.080
4. Heavy stand of timber, a few down trees, little undergrowth, flood stage below branches	0.080	0.100	0.120
5. Same as above, but with flood stage reaching branches	0.100	0.120	0.160
D-3. Major streams (top width at flood stage >100 ft). The n value is less than that for minor streams of similar description, because banks offer less effective resistance.			
a. Regular section with no boulders or brush	0.025	.....	0.060
b. Irregular and rough section	0.035	.....	0.100

Appendix E: Culvert Entrance Loss Coefficients

Entrance Loss Coefficients.

Type of Structure and Design of Entrance	Coefficient k_e
Pipe, Concrete	
Projecting from fill, groove end	0.2
Projecting from fill, sq. cut end	0.5
Headwall or headwall and wingwalls	
Groove end of pipe	0.2
Square-edge	0.5
Rounded (radius = 1/12D)	0.1
Mitered to conform to fill slope	0.7
End-Section conforming to fill slope*	0.5
Pipe, or Pipe-Arch, Corrugated Metal	
Projecting from fill (no headwall)	0.9
Headwall or headwall end wingwalls	
Square-edge	0.5
Mitered to conform to fill slope	0.7
End-Section conforming to fill slope*	0.5
Box, Reinforced Concrete	
Headwall parallel to embankment (no wingwalls)	
Square-edged on 3 edges	0.5
Rounded on 3 edges to radius of 1/12 barrel dimension	0.2
Wingwalls at 30° to 75° to barrel	
Square-edged at crown	0.4
Crown edge rounded to radius of 1/12 barrel dimension	0.2
Wingwalls at 10° to 30° to barrel	
Square-edged at crown	0.5
Wingwalls parallel (extension of sides)	
Square-edged at crown	0.7

*Note: "End Section conforming to fill slope", made of either metal or concrete, are the sections commonly available from manufacturers. From limited hydraulic tests they are equivalent in operation to a headwall in both inlet and outlet control. Some end sections, incorporating a closed taper have a superior hydraulic performance.

Appendix F: Sheet Flow Roughness Coefficients

When using the TR-55 Sheet Flow procedure for calculating time of concentration [11 p.3-3], HydroCAD provides the following table of roughness coefficients. This information is taken directly from TR-55 Table 3-1, with slight abbreviation of the descriptions. If you decide to substitute other roughness coefficients, note that these values are specifically for sheet flow, and may be larger than the regular Manning's number for a comparable surface.

Surface Description	n
Smooth surfaces	.011
Fallow	.05
Cultivated: Residue<=20%	.06
Cultivated: Residue>20%	.17
Grass: Short	.15
Grass: Dense	.24
Grass: Bermuda	.41
Range	.13
Woods: Light underbrush	.40
Woods: Dense underbrush	.80

Appendix G: Velocity Factors

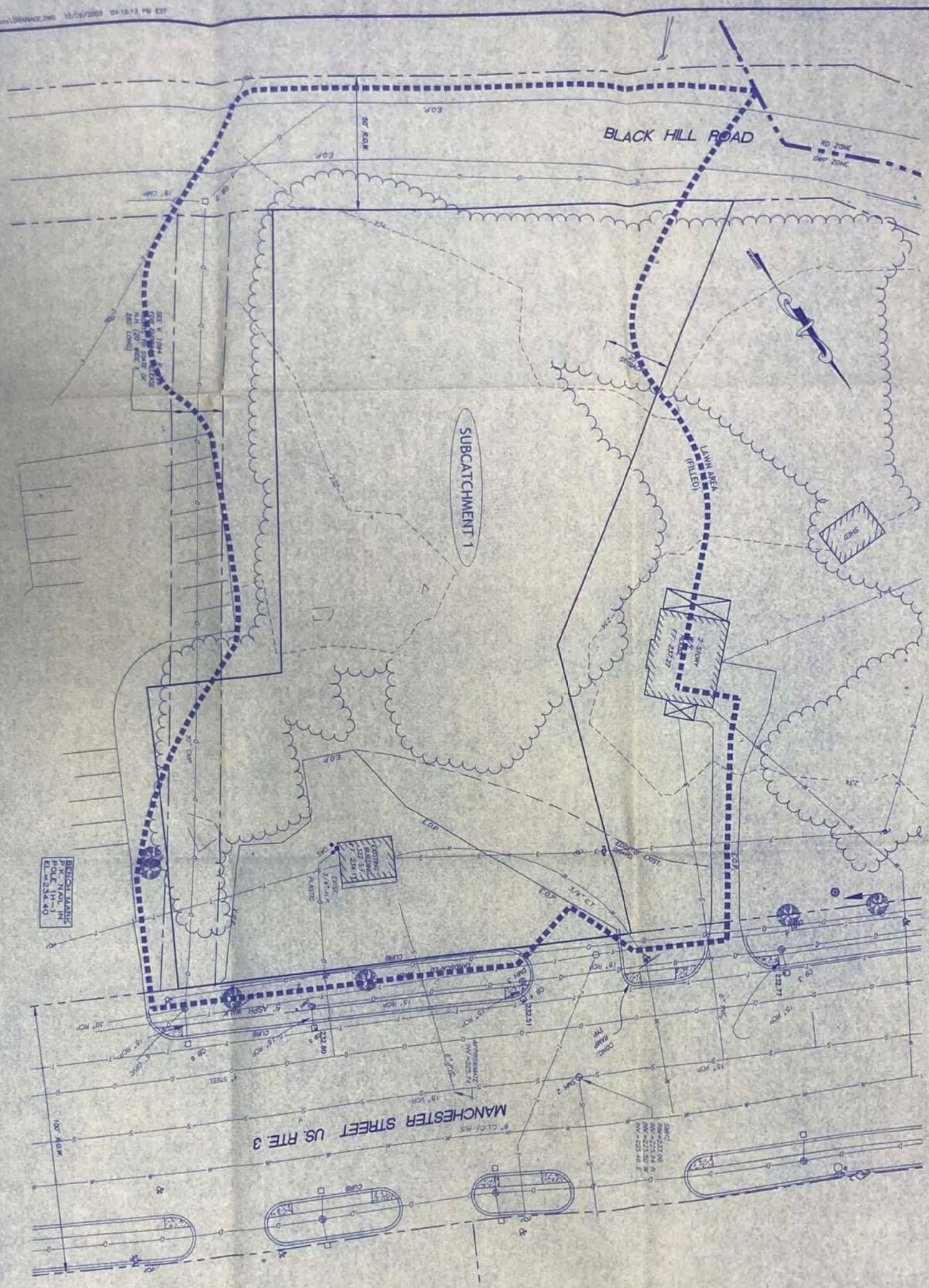
The TR-55 Shallow Concentrated Flow procedure and the NEH-4 Upland Method are both published as a chart of velocity vs. slope for various surfaces. Both charts are based on the same equation (see page 103) and make use of a *velocity factor*, K_V, determined by the surface type. HydroCAD provides the following predefined surface types for use with this equation.[50]

The first two surfaces (paved and unpaved) are the basis for TR-55 Figure 3-1, and the factors are taken from TR-55, Appendix F [11 p.F-1]. The remaining surfaces are taken from NEH-4 Figure 15.2 [10 p.15-8] with the factors derived from that chart. (Some descriptions have been abbreviated.) For other surfaces or conditions, HydroCAD also allows the direct entry of K_V.

Surface Description	K_V
Paved	20.3282
Unpaved	16.1345
Grassed Waterway	15.0
Nearly Bare & Untilled	10.0
Cultivated Straight Rows	9.0
Short Grass Pasture	7.0
Woodland	5.0
Forest w/Heavy Litter	2.5

[50] These factors are for a fractional slope (rise/run) and a velocity in feet per second.

Drainage Area Plans



PERMIT PLANS

MAP 110H BLOCK 2 LOT 10
EXISTING DRAINAGE PLAN
ENTERPRISE RENT-A-CAR
MANCHESTER STREET (U.S. RTE.3)
CONCORD, NEW HAMPSHIRE

SHEET #: DA1 | SCALE: 1"=20'

PREPARED FOR:
MARK CARRIER CONSTRUCTION, INC.
121 RIVER FRONT DRIVE
MANCHESTER, NEW HAMPSHIRE 03102

DATE: JULY 7, 2003 | JOB #: 03357

SUBLIME
CIVIL CONSULTANTS, INC.
6 West Broadway
Derry, NH 03038
ph: (603) 437-5777
fax: (603) 437-5977
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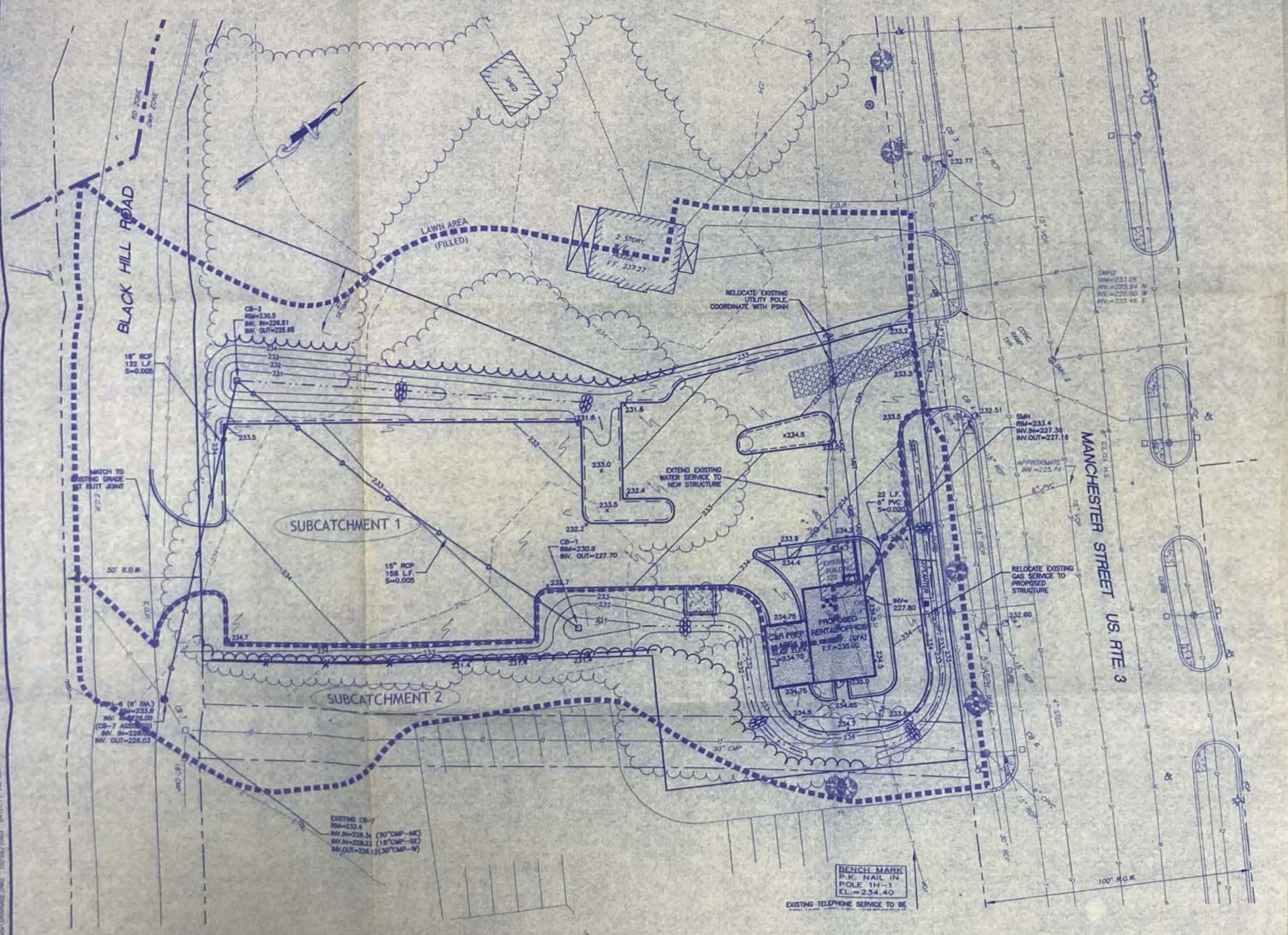
NO.	DATE	REVISION DESCRIPTION
2.	10-24-03	REVISED SUBCATCHMENT AREAS
1.	09-03-03	REVISED SUBCATCHMENT AREAS



PERMIT PLANS

MAP 110H BLOCK 2 LOT 10
PROPOSED DRAINAGE PLAN
ENTERPRISE RENT-A-CAR
MANCHESTER STREET (U.S. RTE.3)
CONCORD, NEW HAMPSHIRE

PREPARED FOR:
MARK CARRIER CONSTRUCTION, INC.
121 RIVER FRONT DRIVE
MANCHESTER, NEW HAMPSHIRE 03102

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6 West Broadway
Derry, NH 03038
ph: (603) 437-5777
fax: (603) 437-6977
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NO.	DATE	REVISION DESCRIPTION
2	10-24-03	REVISED SUBCATCHMENT AREAS
1	09-03-03	REVISED SUBCATCHMENT AREAS

SHEET #: DA2 | SCALE: 1"=20' | DATE: JULY 7, 2003 | JOB #: 03357