NEW BRITAIN – HARTFORD BUSWAY

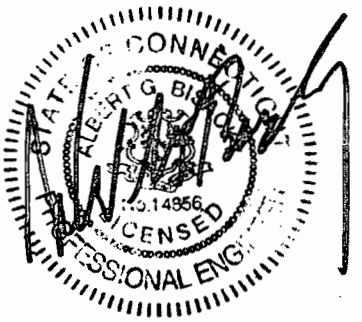
WEST HARTFORD, CT

PRELIMINARY DRAINAGE DESIGN SUBMISSION

DECEMBER 4, 2009

ELMWOOD STATION

State Project No. 88-H039



S E A

S E A CONSULTANTS INC.
Scientists/Engineers/Architects

1. Introduction

1.0. Project Description

This project involves the design of eleven transit stations along an exclusive bus rapid transit (BRT) line. The BRT alignment and stations are within New Britain, Newington, West Hartford, and Hartford, Connecticut. Each site involves the design and construction of pedestrian and vehicular facilities for the busway operation. The site locations are typically urban sites that have been previously developed.

1.1. Purpose of Report

This report presents the preliminary drainage design for the BRT station sites. It provides information regarding the coordination with the proposed mainline drainage systems and data for use in preparing permitting applications.

1.2. Data Collection

In accordance with the Connecticut Department of Transportation Drainage Manual, the communities were solicited for input on existing drainage issues and concerns about the station drainage designs. Letters were sent to the Department of Public Works Directors and Town/City engineers in New Britain, Newington, West Hartford, and Hartford. A response was not received from Hartford. A request will be sent again.

2. Analysis Methodology

2.0. Design Criteria

The drainage design of the station sites was prepared in accordance with the 2000 Connecticut Department of Transportation Drainage Manual. Additional criteria of the Connecticut Department of Environmental Protection 2004 Stormwater Quality Manual was also considered.

The storm drainage systems were designed for the 10-year storm event. The rational method was used to calculate peak flows within the station sites. The hydraulic grade lines (HGLs) and pipe capacities were analyzed with StormCAD software. The Intensity/Duration/Frequency (IDF) curves used in the hydrologic analyses was from the Connecticut Department of Transportation Drainage Manual (Table B-2.1).

The inlets within the station sites were designed in accordance with the above mentioned manuals. A clogging factor of 50 percent was assumed for all basins located within a sag.

The CTDOT Drainage Manual specifies a minimum pipe velocity of 3 feet per second. When feasible, this velocity was achieved. However, given the nature of the site designs and the desire to eliminate nuisance flows to reduce icing conditions,

not all pipes were able to be designed to meet this criterion. In general, this condition only exists in the upper reaches of the drainage systems.

For station sites where proposed drainage will be discharged into systems designed by others, drainage reports and calculations were provided to S E A Consultants for use in the station designs. References to these designs are included herein.

2.1. Design Methodology

StormCAD V8 XM software by Bentley was utilized to conduct the drainage calculations for this report. In addition, the rational method was used to compare the existing drainage at and surrounding the site to the proposed drainage design. Design points were selected around the site to accurately represent the change in flow from existing to proposed. Weighted C values were chosen to represent surface types.

2.2. Assumptions

Drainage areas were delineated using project area mapping provided by the Department. Areas tributary to the station sites from the mainline busway were received from those project designers. Provided flow rates and areas were assumed accurate in these instances.

Runoff coefficients were determined based on land cover. Two types were identified within the station limits paved are grassed areas. The runoff coefficients were determined as 0.9 and 0.3, respectively. Due to the small size of the station sites and small proposed drainage collection areas, the time of concentration of all on-site drainage sub-areas was assumed to be five minutes. Detailed time of concentration calculations were performed for off-site areas draining to the site systems, when applicable.

Tailwater elevations were determined based on available data. Where this information was unavailable, confirmative assumptions were made as outlined in the following report sections.

3. Station Analysis and Summaries

3.0. Elmwood Station

3.0.1. Existing Condition

The station site is located on three adjacent lots on the northeast corner of New Park Avenue and New Britain Avenue in the Town of West Hartford. The majority of the site is paved and approximately 79.3% impervious. Generally, storm runoff flows across the site from west to east onto New Park Avenue. A ridgeline is located within the site that directs approximately one-third of the site to the south and two-thirds of the site to the north. Existing storm drain systems in the streets carry the flow away from the site. A portion of the site drains to yard drains located at the northern end of the site. One appears to be plugged and one is connected directly to Trout Brook.

The site drainage area tributary to the New Britain Avenue drain line totals 0.92 acres. The existing discharge to this system, Catch Basins A and B, is summarized, as follows:

Storm Frequency	Q (cfs)
2-year	3.00
10-year	3.92
25-year	4.37
100-year	5.09

The site drainage area tributary to the New Park Avenue drainage system totals 0.69 acres. The existing discharge to this system, Catch Basins C and D, is summarized, as follows:

Storm Frequency	Q (cfs)
2-year	2.79
10-year	3.64
25-year	4.06
100-year	4.73

A portion of the site directly outlets to Trout Brook, Design Point E. This area totals 1.17 acres. (See Exhibit 3.5-A.) The discharge is summarized, as follows:

3.0.2. Proposed Condition

The proposed drainage design at Elmwood Station continues to collect and direct stormwater to New Britain Avenue, New Park Avenue, and Trout Brook. The site is 58% impervious. The majority of the site stormwater will be collected and directed to a bioretention basin and discharge to Trout Brook. An existing catch basin will be replaced and act as an overflow to convey water from the basin to an existing 18-inch pipe through the existing flood wall.

The on-site storm drain system consists of several area drains and catch basins to collect surface runoff through a series of 12-inch reinforced concrete pipes. The proposed drainage area collected by this system totals approximately 0.54 acres. The discharge at the reinforced concrete culvert end outlet structure is summarized, as follows:

Storm Frequency	Q (cfs)
2-year	1.97
10-year	2.53
25-year	2.81
100-year	3.21

The bioretention basin is designed for the discharge from the site and System No. 7 of Contract No. 93-H046. Based on the 100% Drainage Design Submission of Contract No. 93-H046, revised November 2009, the busway contribution to the basin is approximately 1.0 acre discharging 4.34 cfs during the 10-year storm event.

The station site contribution to the basin includes the open grass area adjacent to the basin. The calculations assume this area to be impervious for potential future parking.

Hydraulic calculations were performed using HydroCad to determine the ponding depth of the water quality volume within the bioretention basin.

The total peak discharge from the station site, the bioretention basin, and System No. 7 of Contract No. 88-H046 to Trout Brook, Design Point E, and the change from existing to proposed conditions is summarized, as follows:

Storm Frequency	Q_{PRE} (cfs)	Q_{POST} (cfs)	ΔQ (cfs)
2-year	4.04	6.25	2.21
10-year	5.27	8.62	3.35
25-year	5.88	N/A	N/A
100-year	6.84	11.62	4.78

StormCAD was used to confirm adequate capacity in the existing 18-inch pipe. This methodology assumes no storage in the bioretention basin.

The stormwater directed toward New Britain Ave. consists of two inlets on the south end of the site to connect into existing systems. Through site improvements, turf establishment, and grading of the site, the stormwater area tributary to the existing drain lines in New Britain Avenue will be reduced. Note that the following catch basin summary tables include the drainage from the existing street areas as well as the station site. The flow proposed to the catch basins on New Britain Avenue is summarized, as follows:

Storm Frequency	Q_{PRE} (cfs)	Q_{POST} (cfs)	ΔQ (cfs)
2-year	3.00	0.80	-2.20
10-year	3.92	1.02	-2.90
25-year	4.37	1.11	-3.26
100-year	5.09	1.27	-3.82

The minimum slope and velocity requirements for the connection of the proposed inlets to the existing catch basins with in New Britain Avenue could not be met. The cover requirement is also not met. Both pipes will be Class V.

Stormwater for a portion of the site will continue to discharge to New Park Ave. Flow proposed to the existing catch basin, delineated as design point C and D, located to on New Park Ave. is summarized, as follows:

Storm Frequency	Q_{PRE} (cfs)	Q_{POST} (cfs)	ΔQ (cfs)
2-year	2.79	1.99	-0.80
10-year	3.64	2.59	-1.05
25-year	4.06	2.89	-1.17
100-year	4.73	3.37	-1.36

3.0.3. Environmental Issues and Stormwater Treatment

No Department flagged wetland areas are located within the station site boundaries. No impacts are proposed.

The station site drainage design includes provisions for a bioretention basin. This basin provides primary treatment for the majority of the station along with a section of the busway (State Project No. 93-H046). The bioretention basin design follows the guidelines set forth by the Connecticut Stormwater Quality Manual, 2004.

3.0.4. Soil Erosion and Sedimentation Control

The soil erosion and sedimentation control design complies with the Department of Environmental Protection 2002 Connecticut Guidelines for Soil Erosion and

Sediment Control. The design contains provisions for silt fences along with inlet protection.

4. Appendix A: Design Checklist

Project No.	88-H039
Roadway	ELMWOOD STATION
Town	WEST HARTFORD
Date	10/13/2009
Designed By	SEA CONSULTANTS
Signature of Engineer	

Drainage Design Checklist (Plans 50% Complete)

Allow a 6-8 week review time

See ***Note*** below.

Semi-Final Design Checklist (Plans 60% to 70% Complete)

Allow a 5-6 week review time

Note: A separate, earlier drainage submission (at approximately 50% completion) may be required if the drainage design is particularly complicated, requires significant right of way and/or otherwise might jeopardize the schedule of the project. **This checklist MUST accompany both of these submissions.**

Indicate which submission this checklist is for and include the following information:

☐ *Drainage Design Submission* ☒ *Semi-Final Design Submission*

a. Draft Drainage Report

1. Disposition of Preliminary Design/Drainage Design Submission comments with written responses justifying comments not incorporated.
   ☒ Included ☐ Not Included ☐ Not Applicable
2. A condition survey of the existing drainage pipes and structures that are to remain in use should be investigated for structural adequacy and documented. (See Section 3.6.3.)
   ☐ Included ☒ Not Included ☐ Not Applicable
3. The condition of existing ditches that are to remain in use should be field inspected, analyzed and results documented to verify their stability and the need for cleaning and reshaping.
   ☐ Included ☐ Not Included ☒ Not Applicable
4. The condition of the outlet at the existing discharge points should be investigated and documented to ensure no erosion or sediment problems exist. If outlet protection is required, it should be incorporated into the project and computations submitted.
   ☐ Included ☐ Not Included ☒ Not Applicable

5. A condition survey report including items 2, 3, and 4 above. (See Appendix A and B, Chapter 4)
   ☐ Included ☒ Not Included ☐ Not Applicable
6. Drainage design computations should include gutter flow analysis, storm sewer design, and hydraulic gradeline (HGL). The hydraulic gradeline should be analyzed to ensure 0.3m (1 ft) freeboard is maintained at drainage structures. This analysis should consider all friction, entrance, junction, exit and bend losses. Designer to verify that the proposed drainage will not adversely impact the existing downstream storm system or property owners. (See Chapter 11, Storm Drainage Systems.)
   ☒ Included ☐ Not Included ☐ Not Applicable
7. Drainage computations should identify structures by station and offset rather than by a numerical identifier. If station and offset is not feasible for the computations then include an index with the location of the structure corresponding to its numerical identifier. The watershed map should be prepared accordingly.
   ☒ Included ☐ Not Included ☐ Not Applicable
8. Existing drainage systems shall be analyzed for hydraulic adequacy to meet the proposed conditions and, if found inadequate, an upgrade will be designed in conformance with the criteria established in the Drainage Manual.
   ☐ Included ☐ Not Included ☒ Not Applicable
9. All roadway drainage systems should be brought to a suitable outlet.
   ☒ Included ☐ Not Included ☐ Not Applicable
10. If upgrading of pipes downstream of the project is necessary, then additional rights may need to be acquired.
    ☐ Included ☐ Not Included ☒ Not Applicable
11. The need for temporary drainage should be addressed. Temporary drainage computations should be prepared in accordance with criteria in the Drainage Manual. (See Section 3.6.11.)
    ☐ Included ☐ Not Included ☒ Not Applicable
12. Proposed swales, ditches and channels should be designed in accordance with HEC-15 for discharges 1.42 m^3/s (50 ft^3/s) and less or HEC-11 for discharges in excess of 1.42 m^3/s (50 ft^3/s). (See Chapter 7, Channels.)
    ☐ Included ☐ Not Included ☒ Not Applicable
13. Minor and small cross culvert design computations with culvert data sheet. (See Chapter 8, Culverts.)
    ☐ Included ☐ Not Included ☒ Not Applicable
14. Topographic mapping with watershed area delineated for each inlet and/or cross culverts as required to perform the drainage calculations. The flow path used in the time of concentration calculation and coefficient of imperviousness should be shown for each area. (See Chapter 6, Hydrology.)
    ☒ Included ☐ Not Included ☐ Not Applicable
15. Diversion identified.
    ☐ Included ☐ Not Included ☒ Not Applicable
16. All plans, computations and reports identify the responsible engineers who prepared and checked the work.
    ☒ Included ☐ Not Included ☐ Not Applicable

b. Plans, Profiles and Cross Sections

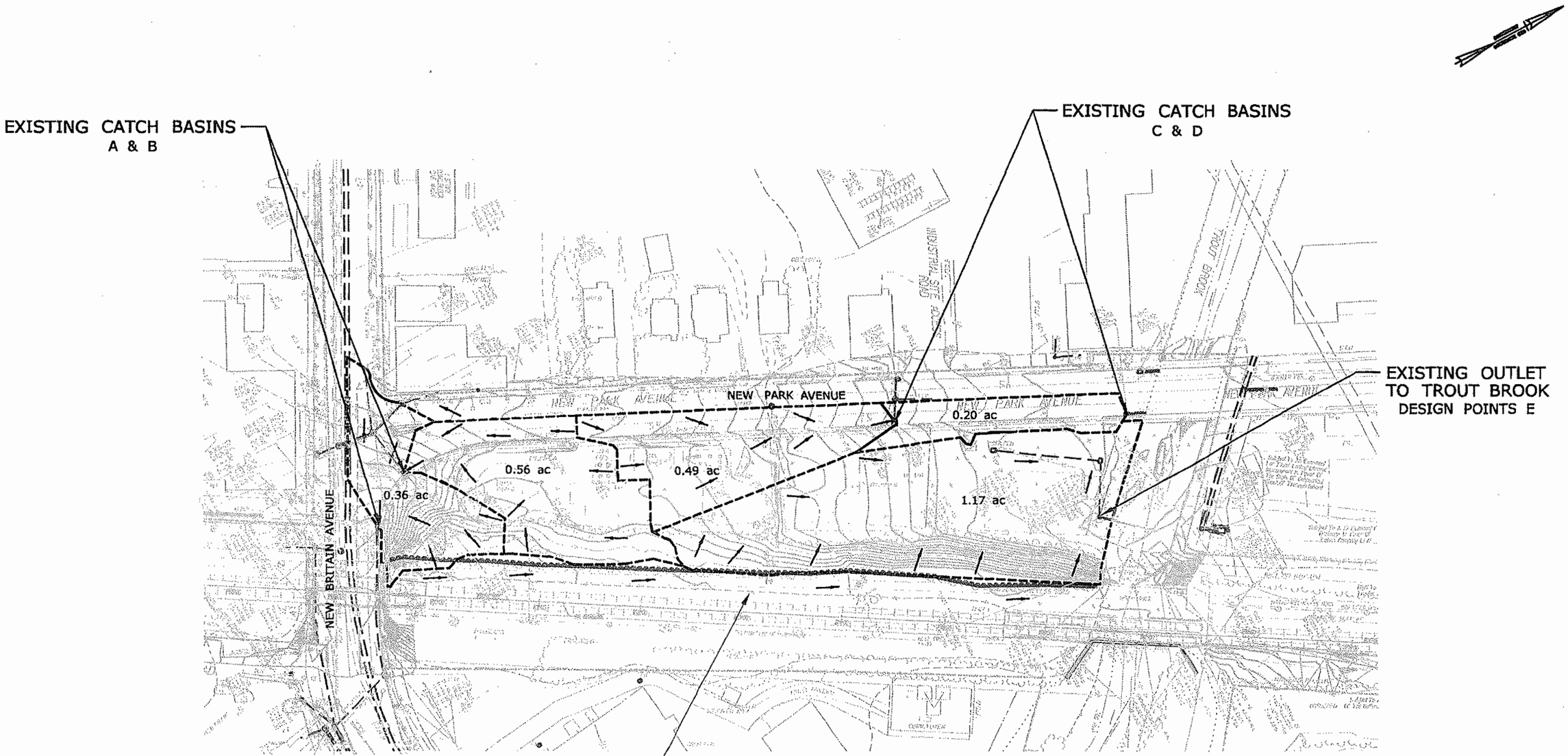
1. The existing and proposed storm drainage shown to their outlets.
   ☒ Included ☐ Not Included ☐ Not Applicable
2. Size and type of existing drainage pipes/structures and disposition of pipes/structures to be abandoned.
   ☐ Included ☐ Not Included ☒ Not Applicable
3. Properties affected by diversions should be shown on the plans so that proper rights can be acquired.
   ☒ Included ☐ Not Included ☐ Not Applicable
4. Drainage Rights and Easements.
   ☒ Included ☐ Not Included ☐ Not Applicable
5. Outlet Protection shown on plans and details provided.
   ☐ Included ☐ Not Included ☒ Not Applicable
6. Intersection grading plans to ensure inlets are located at the low points to alleviate ponding/icing conditions. Top of frame elevation should be shown.
   ☒ Included ☐ Not Included ☐ Not Applicable
7. In areas where cross culverts are being extended, replaced, or where outlet protection is proposed a profile or cross section of the natural ground should be provided to show how the inverts will tie into the existing topography.
   ☐ Included ☐ Not Included ☒ Not Applicable
8. The top of frame and invert elevations for each storm drainage structure shown. Proposed drainage structures shall be identified by station and offset on cross sections.
   ☒ Included ☐ Not Included ☐ Not Applicable
9. Existing and proposed drainage patterns (flow arrows) of pipes, ditches, channel and swales.
   ☒ Included ☐ Not Included ☐ Not Applicable
10. Details for any special drainage structures not found in the Standard Drawings.
    ☒ Included ☐ Not Included ☐ Not Applicable
11. The direction of flow should be shown by arrows to 61m (200 ft.) beyond any drainage outlet, or shown to terminate by dissipation or entrance into a watercourse or body of water.
    ☒ Included ☐ Not Included ☐ Not Applicable

c. Structures with drainage areas > 2.59 km^2 (1 mi^2)

1. Draft hydraulic design report.
   ☐ Included ☐ Not Included ☒ Not Applicable
2. Draft scour report when the proposed structure spans the waterway.
   ☐ Included ☐ Not Included ☒ Not Applicable
3. Draft floodway report.
   ☐ Included ☐ Not Included ☒ Not Applicable
4. Draft SCEL report.
   ☐ Included ☐ Not Included ☒ Not Applicable
5. Draft scour report if required.
   ☐ Included ☐ Not Included ☒ Not Applicable

Provide justification for items **Not Included**. Justification should correspond to letter and number.

5. Appendix B: Watershed Mapping and Exhibits

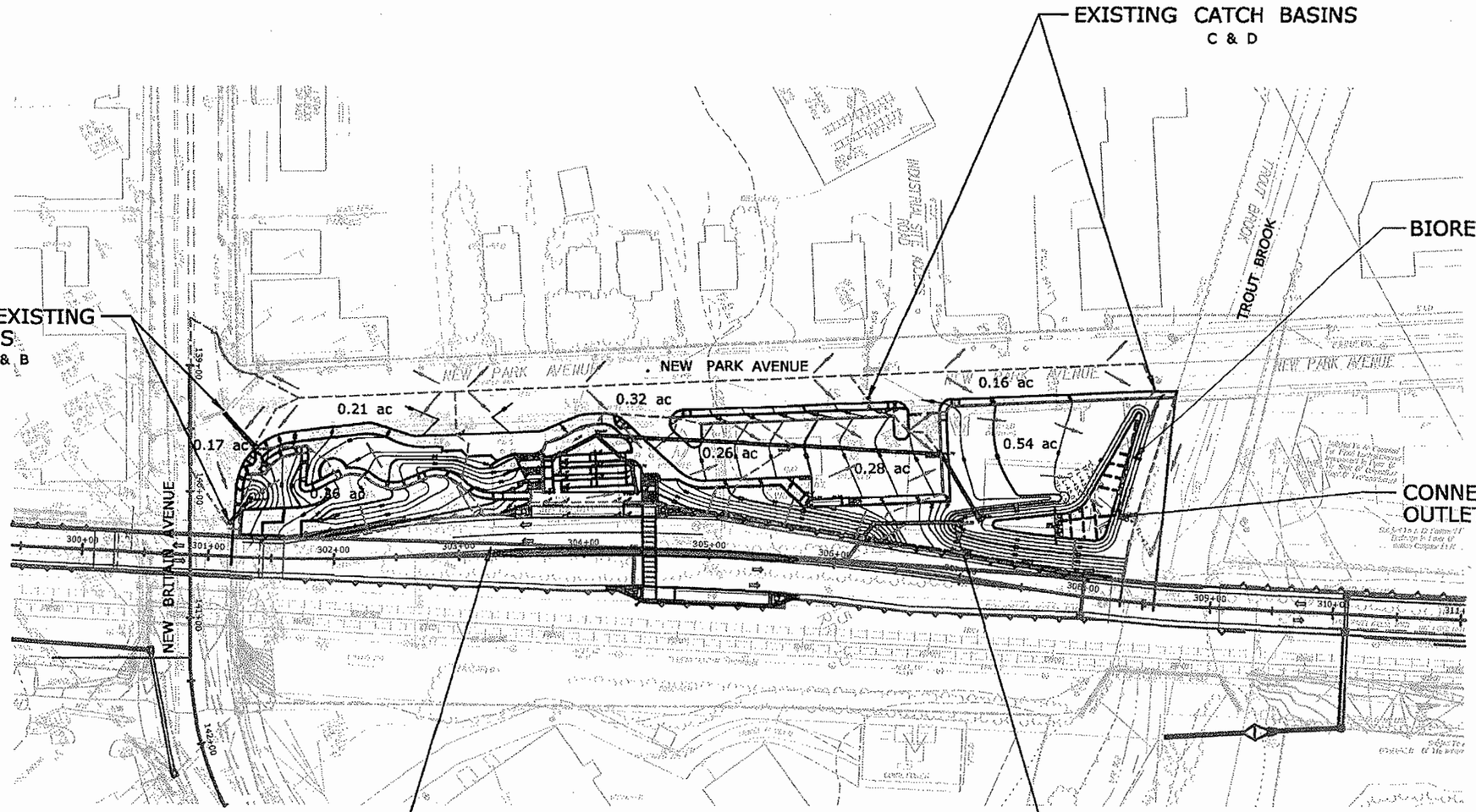


EXISTING CONDITIONS

SCALE 1" = 100'

200 100 0 200

STATE PROJECT NO.: 88-H039 COUNTY: HARTFORD CITY/TOWN: WEST HARTFORD	APPLICATION BY: STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION	OFFICE OF ENGINEERING SCALE1=100	DATE: NOVEMBER 2009 SITE: ELMWOOD STATION EXHIBIT: 3.5-A



PROPOSED CONDITIONS

SCALE 1" = 100'

200 100 0 200

STATE PROJECT NO.: 88-H039	APPLICATION BY: STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION	OFFICE OF ENGINEERING	DATE: NOVEMBER 2009
COUNTY: HARTFORD			SITE: ELMWOOD STATION
CITY/TOWN: WEST HARTFORD		SCALE1=100	EXHIBIT: 3.5-B

6. Appendix C: Hydrologic and Hydraulic Calculations

SEA Consultants, Inc.
Scientists/Engineers/Architects
200 Corporate Place
Rocky Hill, Connecticut 06067

PROJECT:	New Britain - Hartford Bus Rapid Transit Stations			
PROJECT NO.	88-H039	SHEET NO.	1	
CALCULATED BY:	KSR	DATE:	10/26/2009	
CHECKED BY:	EAD	DATE:	11/10/2009	

Runoff Calculations for the 2, 10, 25, 100 Year Storms
Elmwood Station

System: New Britain Avenue Catch Basins

Pre- Development

Catch Basin	Area (Acres)	C Value	2yr Rainfall (in/hr)	10yr Rainfall (in/hr)	25yr Rainfall (in/hr)	100yr Rainfall (in/hr)	Q_{2yr} (cfs)	Q_{10yr} (cfs)	Q_{25yr} (cfs)	Q_{100yr} (cfs)
A	0.56	0.78	4.60	6.00	6.70	7.80	2.01	2.62	2.93	3.41
B	0.36	0.60	4.60	6.00	6.70	7.80	0.99	1.30	1.45	1.68
						Total Q =	3.00	3.92	4.37	5.09

Post- Development

Catch Basin	Area (Acres)	C Value	2yr Rainfall (in/hr)	10yr Rainfall (in/hr)	25yr Rainfall (in/hr)	100yr Rainfall (in/hr)	Q_{2yr} (cfs)	Q_{10yr} (cfs)	Q_{25yr} (cfs)	Q_{100yr} (cfs)
A	Calculations from StormCad						0.49	0.60	0.65	0.73
B	Calculations from StormCad & Rational Method Calculations						0.31	0.42	0.46	0.54
	0.17	0.90	4.60	6.00	6.70	7.80	0.70	0.92	1.03	1.19
						Total Q =	0.80	1.02	1.11	1.27
						Delta =	-2.20	-2.90	-3.26	-3.82

System: New Park Avenue Catch Basins

Pre- Development

Catch Basin	Area (Acres)	C Value	2yr Rainfall (in/hr)	10yr Rainfall (in/hr)	25yr Rainfall (in/hr)	100yr Rainfall (in/hr)	Q_{2yr} (cfs)	Q_{10yr} (cfs)	Q_{25yr} (cfs)	Q_{100yr} (cfs)
C	0.49	0.87	4.60	6.00	6.70	7.80	1.96	2.56	2.86	3.33
D	0.20	0.90	4.60	6.00	6.70	7.80	0.83	1.08	1.21	1.40
						Total Q =	2.79	3.64	4.06	4.73

Post- Development

Catch Basin	Area (Acres)	C Value	2yr Rainfall (in/hr)	10yr Rainfall (in/hr)	25yr Rainfall (in/hr)	100yr Rainfall (in/hr)	Q_{2yr} (cfs)	Q_{10yr} (cfs)	Q_{25yr} (cfs)	Q_{100yr} (cfs)
C	0.32	0.90	4.60	6.00	6.70	7.80	1.32	1.73	1.93	2.25
D	0.16	0.90	4.60	6.00	6.70	7.80	0.66	0.86	0.96	1.12
						Total Q =	1.99	2.59	2.89	3.37
						Delta =	-0.80	-1.05	-1.17	-1.36

System: Outlet to Trout Brook (Station Plus Busway Contribution)

Pre- Development

Design Point	Area (Acres)	C Value	2yr Rainfall (in/hr)	10yr Rainfall (in/hr)	25yr Rainfall (in/hr)	100yr Rainfall (in/hr)	Q_{2yr} (cfs)	Q_{10yr} (cfs)	Q_{25yr} (cfs)	Q_{100yr} (cfs)
E	1.17	0.75	4.60	6.00	6.70	7.80	4.04	5.27	5.88	6.84
						Total Q =	4.04	5.27	5.88	6.84

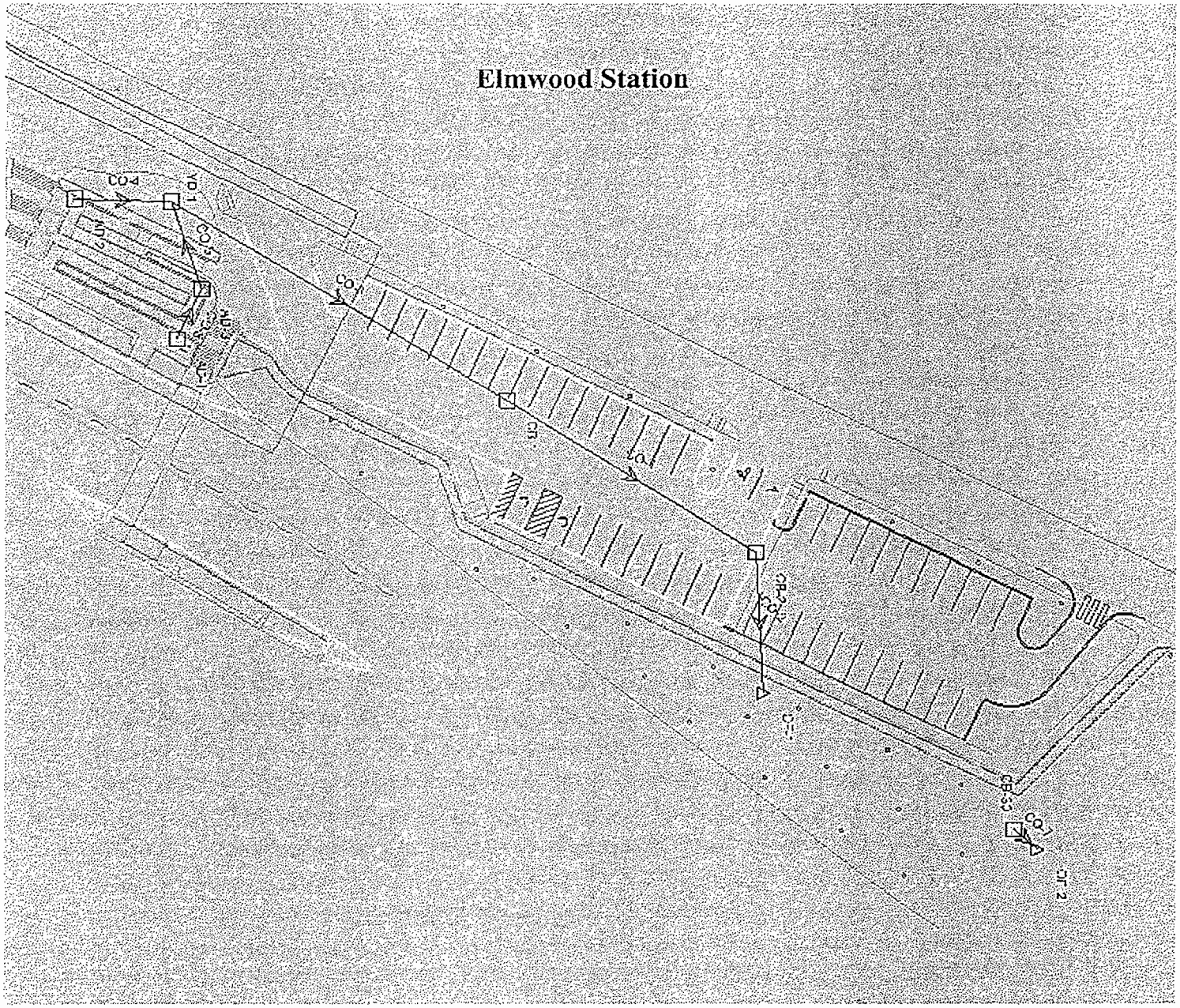
Post- Development

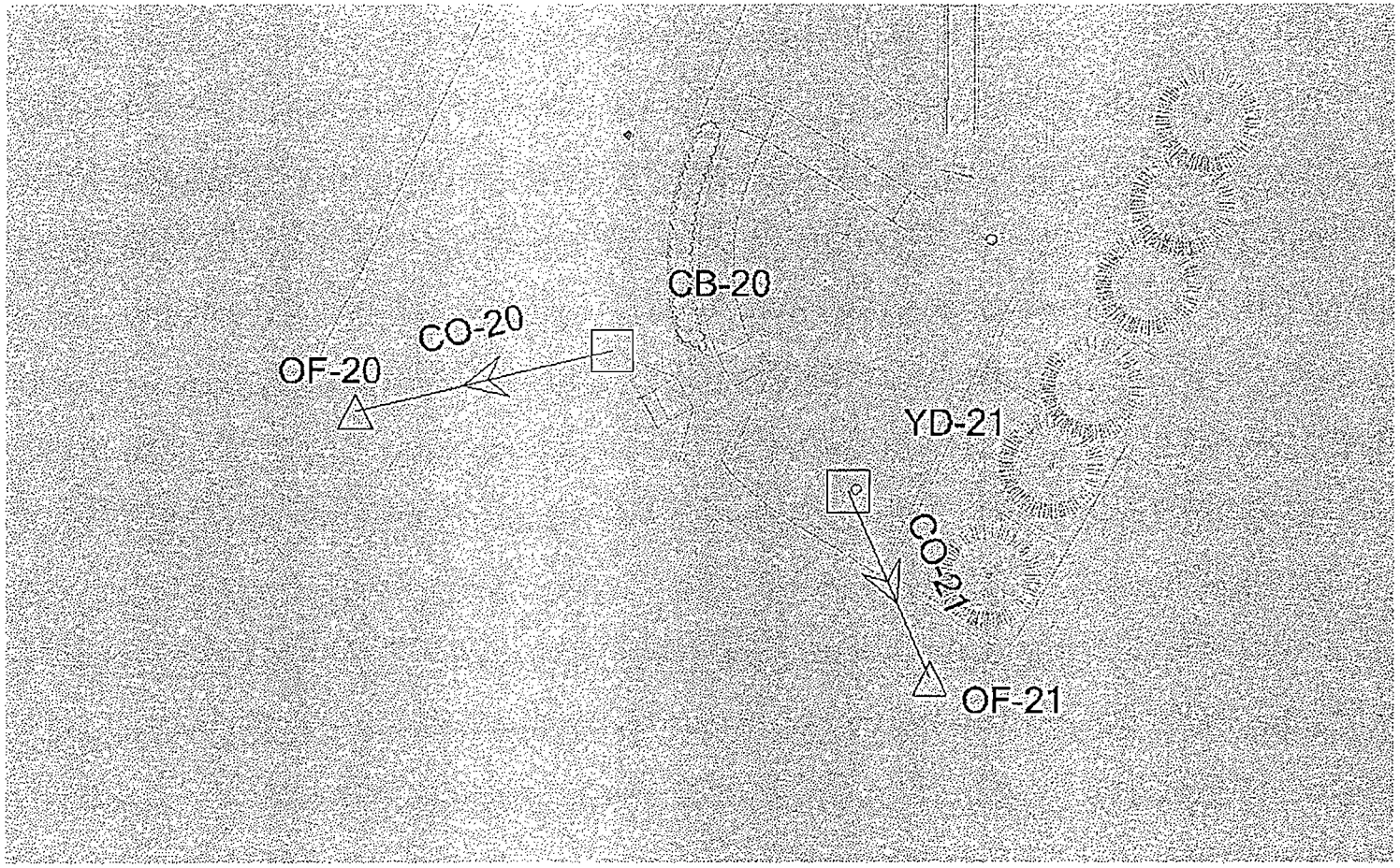
Design Point	Area (Acres)	C Value	2yr Rainfall (in/hr)	10yr Rainfall (in/hr)	25yr Rainfall (in/hr)	100yr Rainfall (in/hr)	Q_{2yr} (cfs)	Q_{10yr} (cfs)	Q_{25yr} (cfs)	Q_{100yr} (cfs)
E	0.54	0.54	4.60	6.00	6.70	7.80	1.34	1.75	1.95	2.27
	StormCad System						1.97	2.53	2.81	3.21
	Contract No. 88-H046, System 7						2.94	4.34	N/A	6.14
						Total Q =	6.25	8.62	N/A	11.62
						Delta =	2.21	3.35	N/A	4.78

Note:

1.) Calculations based on Rational Method, Q = CiA
2.) Design Points designated on Exhibits 3.5-A and 3.5-B

Elmwood Station




CB-20
CO-20
OF-20
YD-21
CO-21
OF-21

BRT Station Preliminary Drainage Design
DOT Report

Label	Node Upstream Downstream	Upstream Inlet C	Upstream CA (acres)	Ground Upstream Downstream	HGL Upstream Downstream	System Rational Flow (ft^3/s)	Length (ft)	Velocity (Average) (ft/s)	System Intensity (in/hr)
CO-1	CB-1	0.709	0.22	55.4	51.2	1.29	118	3.23	5.849
	CB-2			52.4	50.9				
CO-2	CB-2	0.672	0.44	52.4	50.68	2.53	56	7.98	5.691
	OF-1			49	48.43				
CO-3	AD-1	0.9	0.01	72.12	60.69	0.08	22	4.36	6
	AD-3			67.79	58.16				
CO-4	AD-2	0.567	0.01	63.66	58.11	0.07	39	3.66	6
	YD-1			59.8	55.29				
CO-5	AD-3	0.56	0.03	67.79	56.93	0.17	37	4.1	5.983
	YD-1			59.8	55.29				
CO-6	YD-1	0.638	0.13	59.8	55.16	0.76	157	5.04	5.953
	CB-1			55.4	51.28				
CO-7	CB-30	(N/A)	0.00	48	46.21	0	12	18.23	6
	OF-2			49	43.9				
CO-21	YD-21	0.338	0.07	51.75	49.28	0.41	30	2.25	6
	OF-21			51.08	49.28				
CO-20	CB-20	0.7	0.10	56.5	53.42	0.6	38	2.53	6
	OF-20			57.91	53.41				

BRT Station Preliminary Drainage Design
Conduit Summary

Label	Start Node	Stop Node	Invert (Upstream) (ft)	Invert (Downstream) (ft)	Section Size (in)	Flow (ft^3/s)	Length (Unified) (ft)	Slope (Calculated) (ft/ft)	Capacity (Full Flow)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Cover (Start) (ft)	Cover (Stop) (ft)	Velocity (Average) (ft/s)
CO-1	CB-1	CB-2	50.69	50.1	12 inch	1.29	118	0.005	2.52	55.4	52.4	3.71	1.3	3.23
CO-2	CB-2	OF-1	50	48	12 inch	2.55	56	0.036	6.73	52.4	49	1.4	0	7.98
CO-3	AD-1	AD-3	60.57	58.1	12 inch	0.08	22	0.112	11.94	72.12	67.79	10.55	8.69	4.36
CO-4	AD-2	YD-1	58	54.9	12 inch	0.07	39	0.079	10.04	63.66	59.8	4.66	3.9	3.66
CO-5	AD-3	YD-1	56.76	54.9	12 inch	0.17	37	0.05	7.99	67.79	59.8	10.03	3.9	4.1
CO-6	YD-1	CB-1	54.8	50.79	12 inch	0.76	157	0.026	5.69	59.8	55.4	4	3.61	5.04
CO-7	CB-30	OF-2	43.52	43.28	18 inch	8.62	12	0.02	40.57	48	49	1.43	4.22	8.72
CO-21	YD-21	OF-21	48.41	48.28	12 inch	0.41	30	0.004	2.35	51.75	51.08	2.34	1.8	2.25
CO-20	CB-20	OF-20	52.58	52.41	12 inch	0.6	38	0.004	2.38	56.5	57.91	2.92	4.5	2.53

BRT Station Preliminary Drainage Design

Catch Basin Summary

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Inlet C	Inlet	Depth (In) (ft)	Depth (Out) (ft)	Flow (Total Intercepted) (ft³/s)	Bypassed Rational Flow (ft³/s)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)	Gutter Depth (in)	Gutter Spread (ft)
CB-1	55.4	48.69	0.709	Grate Type C-L Single Grate - Grate Type A	2.59	2.51	0.56	0.35	51.28	51.2	1.4	5.6
CB-2	52.4	48	0.672	Combination Type C Double Grate - Type I - Grate Type A - Plain Curb	2.9	2.68	1.36	0.23	50.9	50.68	1.7	7
YD-1	59.8	52.8	0.638	Yard Drain	2.49	2.36	0.53	0	55.29	55.16	2.5	20.5
AD-1	72.12	58.57	0.9	Area Drain	2.12	2.12	0.08	0	60.69	60.69	0.8	6.6
AD-3	67.79	54.76	0.56	Area Drain	2.17	2.17	0.09	0	56.93	56.93	0.8	6.6
AD-2	63.66	56	0.567	Area Drain	2.11	2.11	0.07	0	58.11	58.11	0.7	5.9
CB-30	48	41.52	(N/A)	Grate Type C-G Single Grate - Grate Type A	4.64	4.64	0	0	46.21	46.21	0	0
CB-20	56.5	50.58	0.7	Combination Type C Single Grate - Grate Type A - Plain Curb	2.84	2.84	0.6	0.29	53.42	53.42	1.3	5.6
YD-21	51.75	46.41	0.338	Yard Drain	2.87	2.87	0.41	0	49.28	49.28	1.7	7.1

BRT Station Preliminary Drainage Design
Catchment Area Summary

Label	Scaled Area (acres)	Rational C	Catchment CA (acres)	Time of Concentration (min)	Outflow Node	Catchment Rational Flow (ft^3/s)
CM-1	0.02	0.9	0.02	5	CB-2	0.13
CM-1	0.04	0.3	0.012	5	CB-2	0.07
CM-9	0.17	0.9	0.15	5	CB-2	0.9
CM-11	0.13	0.9	0.116	5	CB-1	0.7
CM-12	0.068	0.3	0.02	5	CB-1	0.12
CM-13	0.077	0.3	0.023	5	CB-2	0.14
CM-14	0.03	0.3	0.01	5	YD-1	0.05
CM-15	0.01	0.9	0.01	5	AD-2	0.05
CM-16	0.07	0.9	0.06	5	YD-1	0.38
CM-17	0.011	0.9	0.01	5	AD-3	0.06
CM-18	0.015	0.9	0.014	5	AD-1	0.08
CM-19	0.02	0.9	0.01	5	CB-1	0.08
CM-20	0.009	0.3	0.003	5	AD-3	0.02
CM-21	0.005	0.3	0.002	5	AD-3	0.01
CM-22	0.01	0.3	0.00	5	AD-2	0.01
CM-23	0.006	0.3	0.002	5	AD-2	0.01
CM-25	0.031	0.3	0.009	5	YD-1	0.06
CM-26	0.008	0.9	0.007	5	YD-1	0.04
CM-1	0.18	0.3	0.05	5	YD-21	0.33
CM-2	0.013	0.9	0.012	5	YD-21	0.07
CM-3	0.01	0.3	0.003	5	YD-21	0.02
CM-4	0.01	0.9	0.01	5	CB-20	0.07
CM-5	0.03	0.9	0.03	5	CB-20	0.18
CM-6	0.09	0.9	0.09	5	CB-20	0.51
CM-7	0.07	0.3	0.021	5	CB-20	0.13

SEA Consultants, Inc.
Scientist/Engineers/Architects
200 Corporate Place
Rocky Hill, Connecticut 06067

PROJECT:	New Britain - Hartford Bus Rapid Transit Stations			
PROJECT NO.	88-H039	SHEET NO.	1 OF	2
CALCULATED BY	KRV	DATE	9/25/2009	
CHECKED BY	EAS	DATE	10/19/2009	

Station: Elmwood

Drainage Area from Contract No. 93-H046, System 7 (approx. station 300+00 thru 308+00)

Drainage Area = 1.00 ac 100% impervious
(Based on 100% Drainage Design by 93-H046 Revised November 2009)

Drainage Area from Site

Drainage Area = 1.13 ac (See Proposed Conditions Exhibit, 3.5-B)
Impervious 0.53 ac 47 % Impervious
Grass 0.60 ac

Total Drainage Area (Mainline + Site) =

Drainage Area = 2.13 ac
Impervious 1.53 ac **72%**
Grass 0.60 ac

Total Drainage Area (Acres)
Proposed = 2.13
Impervious Area = 1.53 **72.0** %

Pollutant Reduction

References
CT DEP Stormwater Quality Manual 2004 edition
Chapter 7

1 Water Quality Volume (WQV)

P = 1 inch of rainfall

a Percent proposed impervious cover, (I)
I = 72.0 %
I = percent impervious cover

b Volumetric runoff coefficient, R
R = 0.05+0.009 (I)
R = 0.70
R = volumetric runoff coefficient = 0.05+0.009(I)

c A = 2.13 acres * 0.00333 sq. miles
A = total site area in acres

d WQV = (1")R(A)/12
WQV = 0.12 ac-ft
5,395 cf
WQV= water quality volume (ac-ft)
1 acre = 0.001563 sq. miles
1 acre - ft = 43,560 cf

2 Water Quality Flow (WQF)

a Runoff depth, (Q)
Q = [WQV(ac-ft) x [12(in/ft)] / Drainage Area (acres)
Q = 0.70 in

b NRCS Runoff Curve Number (CN)
CN = 1000 / [10 + 5P + 10Q - 10(Q^2 + 1.25QP)^1/2]
CN = 96.9

c Read initial abstration, (Ia)
Ia = 0.041
Appendix B, Table 4-1, Chapter 4, TR-55, page B-2

d Compute Ia/P
Ia/P = 0.041

e Read initial abstration, (qu)
Tc = 0.083 hr.
Assumed 5 min.
qu = 650 csm/in (Type III Storm)
Appendix B, Table 4-11, Chapter 4, TR-55, page B-2

f Water quality flow (WQF)
WQF = (qu)(A)(Q)
WQF = 1.51 cfs
WQF= water quality flow (cfs)
*A = drainage area (mi^2)

SEA Consultants, Inc.
Scientist/Engineers/Architects
200 Corporate Place
Rocky Hill, Connecticut 06067

PROJECT: New Britain - Hartford Bus Rapid Transit Stations
PROJECT NO. 88-H039 SHEET NO. 1 OF 2
CALCULATED BY KRV DATE 9/25/2009
CHECKED BY _____ DATE _____

Station: Elmwood

Bioretention Capacity Summary

			WQV	
			Designed	Required
	Elevation	Area (sf)	Volume (cf)	
Swale	48	5200		
	47.5	4480	5340	5576
	46	2640		
Forebay	47.4	1300	1330	1394
	46	600		

SEA Consultants, Inc.
Scientist/Engineers/Architects
200 Corporate Place
Rocky Hill, Connecticut 06067

PROJECT: New Britain - Hartford Bus Rapid Transit Stations : Elmwood
PROJECT NO. 88-H039 SHEET NO. 1 of 1
CALCULATED BY KSR DATE 10/9/2009
CHECKED BY

OUTLET PROTECTION
Outfall 1

Given:

Qd = 2.53 cfs Tw = 0 ft
Sp = 12 inches
= 1 ft Velocity = 7.98 fps

*Discharge and velocity values from Stomcad

Q = Discharge (cfs)
Sp = max. inside diameter of non-circular pipe section (ft)
La = Length of Apron (ft)

Design Type A Riprap Apron (Min. Tailwater Condition)
Length

$$La = \frac{1.8\,(Q-5)}{Sp^{1.5}} + 10$$ ..... CT DOT Drainage Manual 2000 edition Chapter 11.13.5

Then

La = 14.55 ft

Width

W_1 = Width of apron at the pipe outlet
W_2 = Width of the outlet end of apron

$W_1 = 3Sp$ (min.)

$W_2 = 3Sp + 0.7La$ For TW < 0.5 Rp

Then

W_1 = 3.00 ft

W_2 = 13.19 ft Use W_2

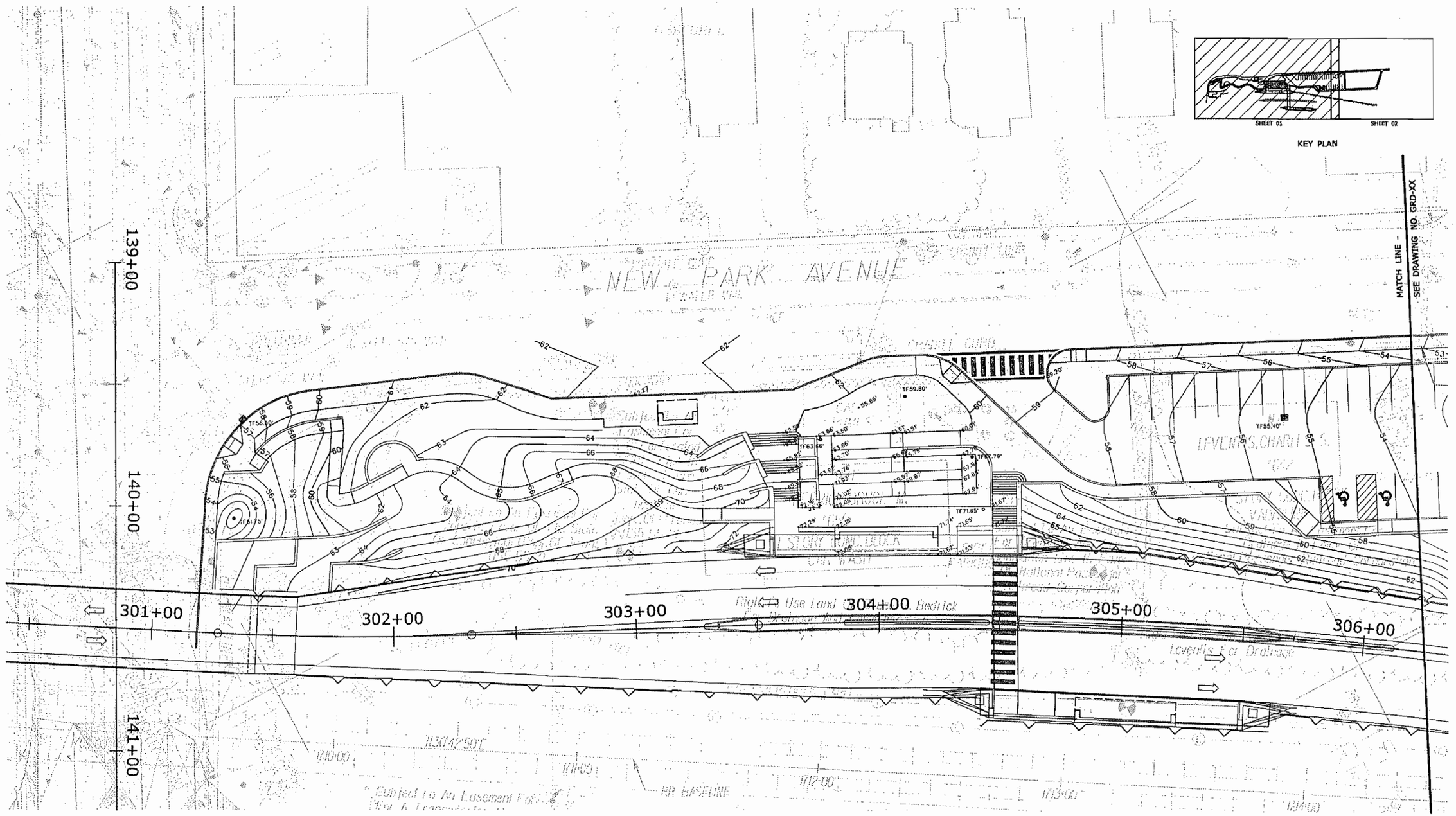
Determine median stone size required

Table 11.11 Allowable Outlet Velocities for Type A and B Riprap Aprons

Outlet Velocity (fps)	Riprap Specification
0-8	Modified
8-10	Intermediate
10-14	Standard

The velocity is less than 10 fps, therefore intermediate riprap applies.

7. Appendix D: Drainage, Grading, and Soil Erosion and Sedimentation Control Plans



KEY PLAN

ENVIRONMENTAL PERMIT REVIEW

REV.	DATE	REVISION DESCRIPTION	SHEET NO.
-	-	-	-

THE INFORMATION, INCLUDING ESTIMATED QUANTITIES OF WORK, SHOWN ON THESE SHEETS IS BASED ON LIMITED INVESTIGATIONS BY THE STATE AND IS IN NO WAY WARRANTED TO INDICATE THE CONDITIONS OF ACTUAL QUANTITIES OF WORK WHICH WILL BE REQUIRED.

Plotted Date: 10/14/2009

DESIGNER/DRAFTER: KRV
CHECKED BY: -

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

Filename: ..\FD_MSH_GRD_88H039_A_ELMWOOD.dgn

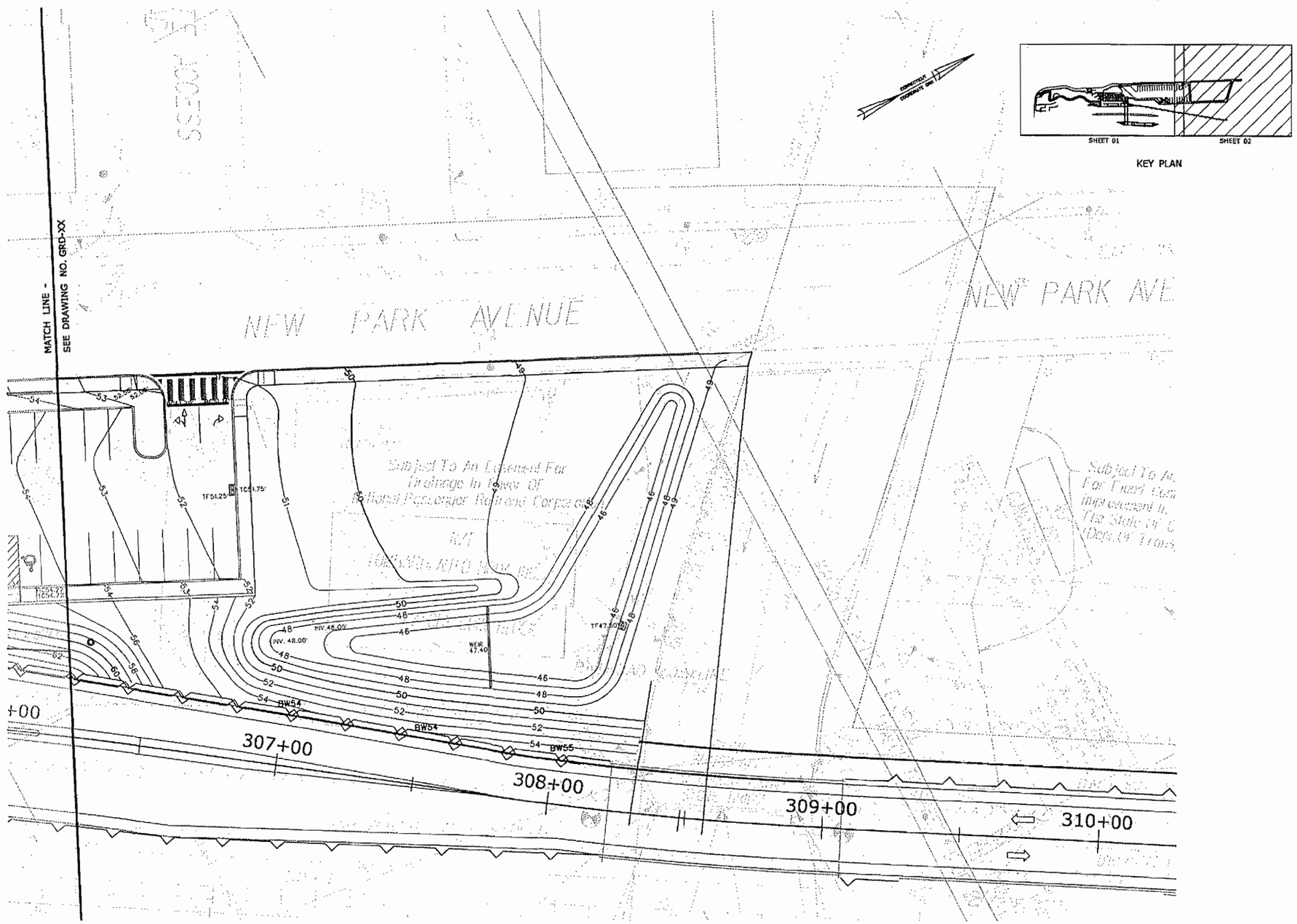
SIGNATURE/BLOCK: OFFICE OF ENGINEERING
APPROVED BY: - DATE: -

PROJECT TITLE: NEW BRITAIN - HARTFORD BUS RAPID TRANSIT STATIONS

TOWN: WEST HARTFORD

DRAWING TITLE: ELMWOOD STATION GRADING PLAN

PROJECT NO. 88-H039
DRAWING NO. GRD-XX
SHEET NO. S



KEY PLAN

ENVIRONMENTAL PERMIT REVIEW

REV.	DATE	REVISION DESCRIPTION	SHEET NO.
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-

THE INFORMATION, INCLUDING ESTIMATED QUANTITIES OF WORK, SHOWN ON THESE SHEETS IS BASED ON LIMITED INVESTIGATIONS BY THE STATE AND IS IN NO WAY WARRANTED TO INDICATE THE CONDITIONS OF ACTUAL QUANTITIES OF WORK WHICH WILL BE REQUIRED.

Plotted Date: 11/2/2009

DESIGNER/DRAFTER: KSR
CHECKED BY: -
SCALE IN FEET 0 20 40
SCALE 1"=20'

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

Filename: ...\FD_NSH_GRD_88H039_B_ELMWOOD.dgn

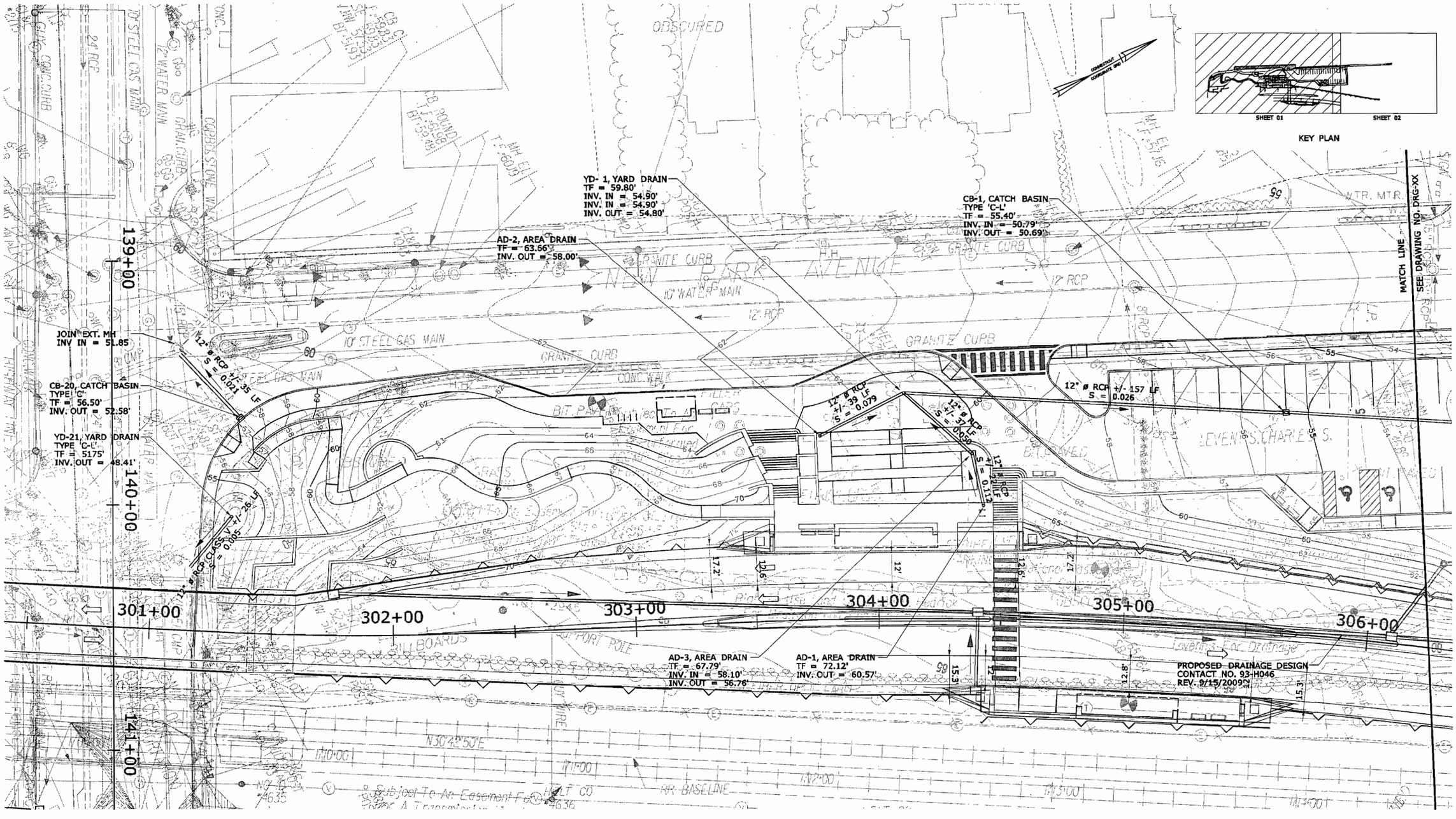
SIGNATURE/BLOCK: OFFICE OF ENGINEERING
APPROVED BY: - DATE: -

PROJECT TITLE: NEW BRITAIN - HARTFORD BUS RAPID TRANSIT STATIONS

TOWN: WEST HARTFORD

DRAWING TITLE: ELMWOOD STATION GRADING PLAN

PROJECT NO. 88-H039
DRAWING NO. GRD-XX
SHEET NO. S



ENVIRONMENTAL PERMIT REVIEW

REV.	DATE	REVISION DESCRIPTION	SHEET NO.
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-

THE INFORMATION, INCLUDING ESTIMATED QUANTITIES OF WORK, SHOWN ON THESE SHEETS IS BASED ON LIMITED INVESTIGATIONS BY THE STATE AND IS IN NO WAY WARRANTED TO INDICATE THE CONDITIONS OF ACTUAL QUANTITIES OF WORK WHICH WILL BE REQUIRED.

Plotted Date: 12/4/2009

DESIGNER/DRAFTER: KSR
CHECKED BY: -
SCALE IN FEET 0 20 40
SCALE 1"=20'

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

Filename: ...\FD_MSH_DRG_88H039_A_ELMWOOD.dgn

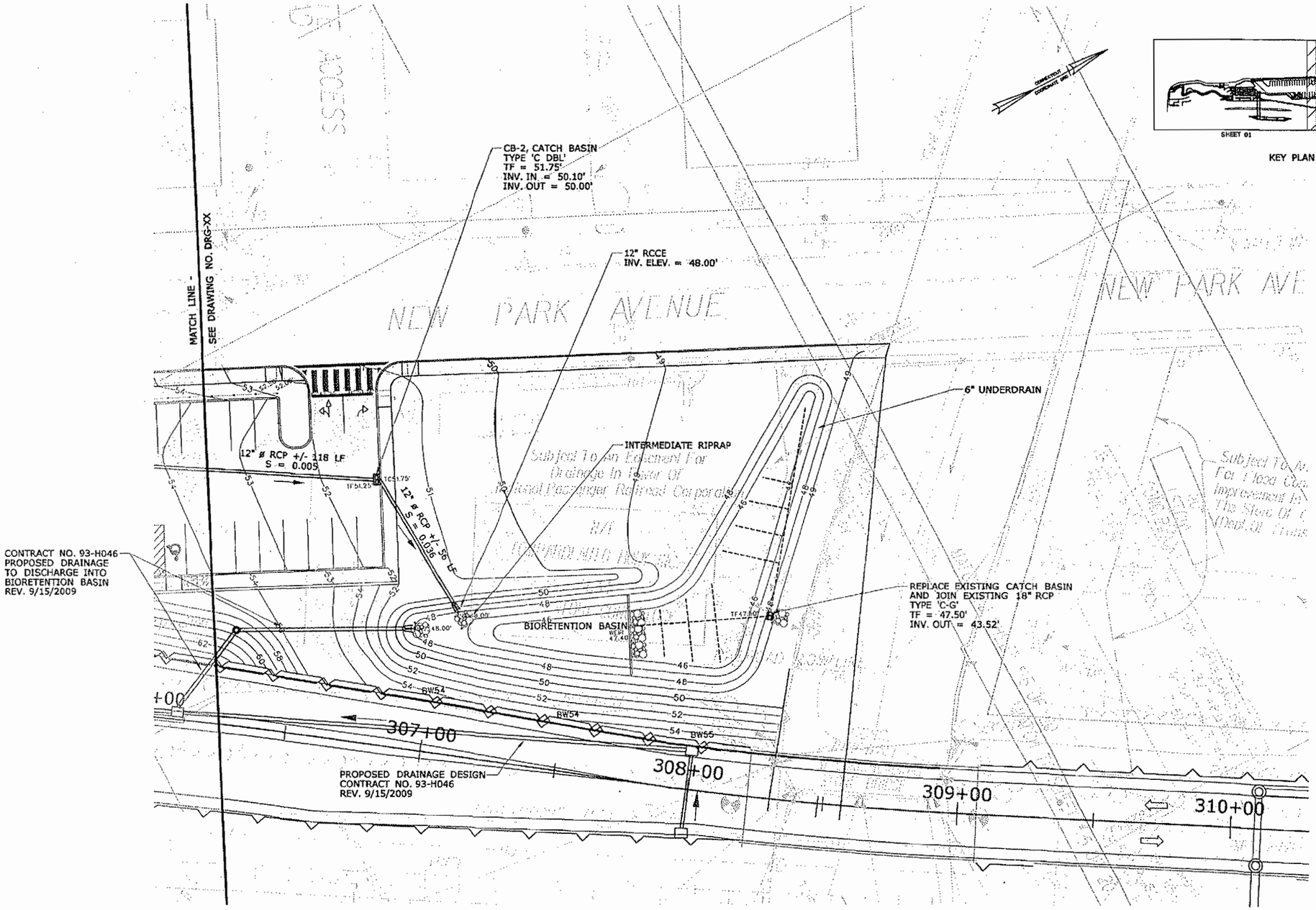
SIGNATURE/BLOCK: OFFICE OF ENGINEERING
APPROVED BY: - DATE: -

PROJECT TITLE: NEW BRITAIN - HARTFORD BUS RAPID TRANSIT STATIONS

TOWN: WEST HARTFORD

DRAWING TITLE: ELMWOOD STATION DRAINAGE PLAN

PROJECT NO. 88-H039
DRAWING NO. DRG-XX
SHEET NO. S



ENVIRONMENTAL PERMIT REVIEW

REV.	DATE	REVISION DESCRIPTION	SHEET NO.
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-

THE INFORMATION, INCLUDING ESTIMATED QUANTITIES OF WORK, SHOWN ON THESE SHEETS IS BASED ON LIMITED INVESTIGATIONS BY THE STATE AND IS IN NO WAY WARRANTED TO INDICATE THE CONDITIONS OF ACTUAL QUANTITIES OF WORK WHICH WILL BE REQUIRED.

Plotted Date: 11/23/2009

DESIGNER/DRAFTER: KSR
CHECKED BY: -

SCALE IN FEET
0 20 40
SCALE 1"=20'

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

Filename: ...\FD_MSH_DRG_88H039_B_ELMWOOD.dgn

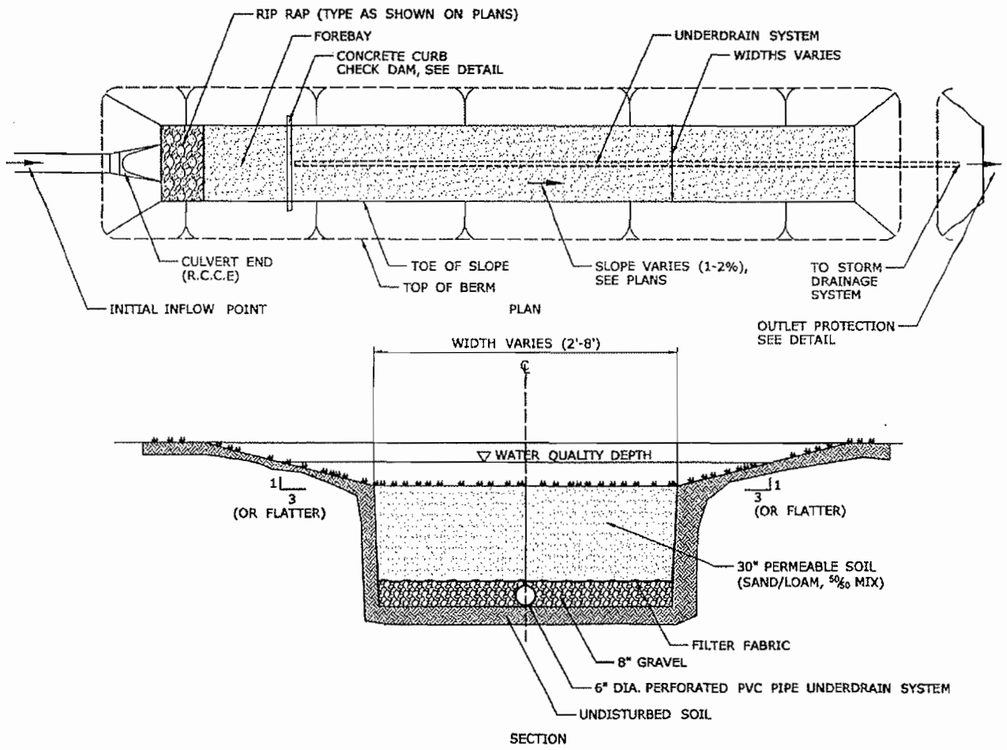
SIGNATURE/BLOCK: OFFICE OF ENGINEERING
APPROVED BY: - DATE: -

PROJECT TITLE: NEW BRITAIN - HARTFORD BUS RAPID TRANSIT STATIONS

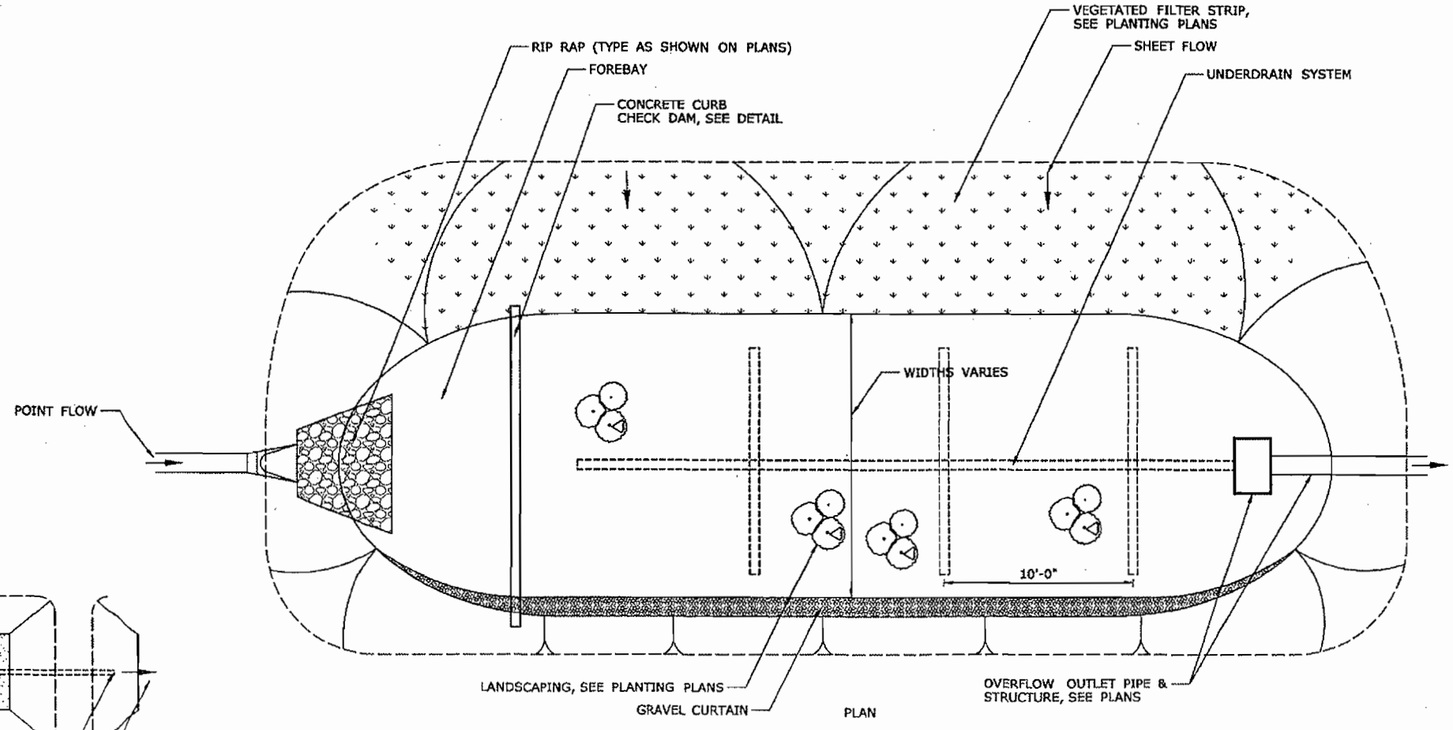
TOWN: WEST HARTFORD

DRAWING TITLE: ELMWOOD STATION DRAINAGE PLAN

PROJECT NO. 88-H039
DRAWING NO. DRG-XX
SHEET NO. S



DRY SWALE



BIORETENTION BASIN

PRELIMINARY DESIGN REVIEW

REV.	DATE	REVISION DESCRIPTION	SHEET NO.

THE INFORMATION, INCLUDING ESTIMATED QUANTITIES OF WORK, SHOWN ON THESE SHEETS IS BASED ON LIMITED INVESTIGATIONS BY THE STATE AND IS IN NO WAY WARRANTED TO INDICATE THE CONDITIONS OF ACTUAL QUANTITIES OF WORK WHICH WILL BE REQUIRED.

Plotted: 11/2/2009

DESIGNER/DRAFTER: KRV
CHECKED BY: -
SCALE AS NOTED

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

Filename: $FILE$

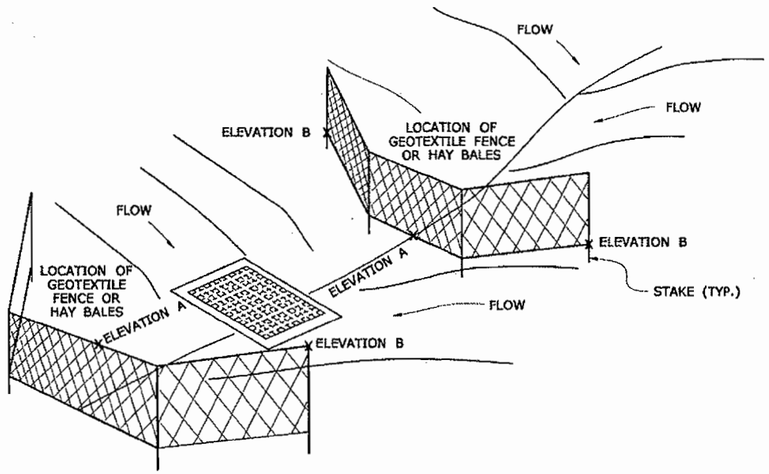
SIGNATURE/BLOCK: OFFICE OF ENGINEERING
APPROVED BY: - DATE: -

PROJECT TITLE: NEW BRITAIN - HARTFORD BUS RAPID TRANSIT STATIONS

TOWN:

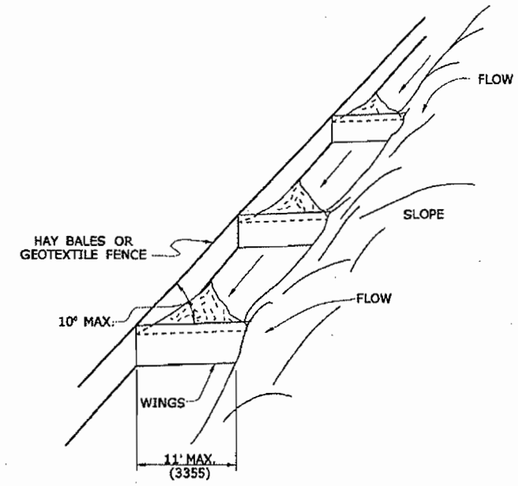
DRAWING TITLE: DETAILS - DRAINAGE

PROJECT NO. 88-H039
DRAWING NO. DET-XX
SHEET NO. S



TREATMENT FOR A CATCH BASIN ON A SLOPE

(SEE NOTE 4)

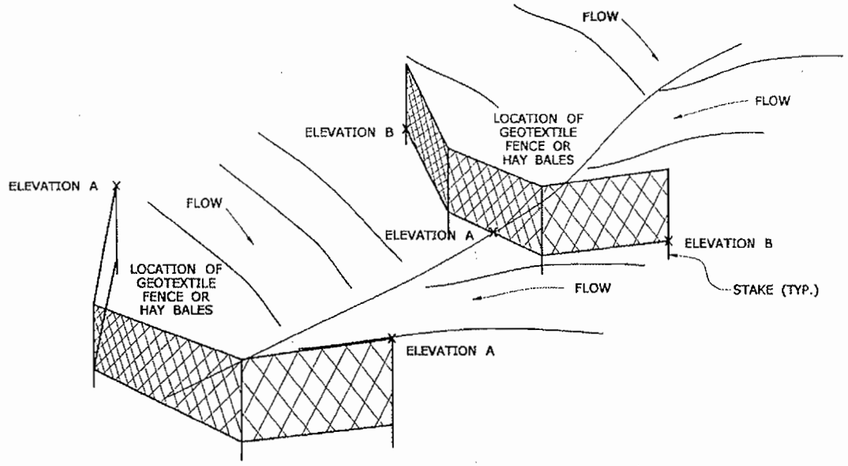


TREATMENT AT TOE OF SLOPE

(SEE NOTE 3)

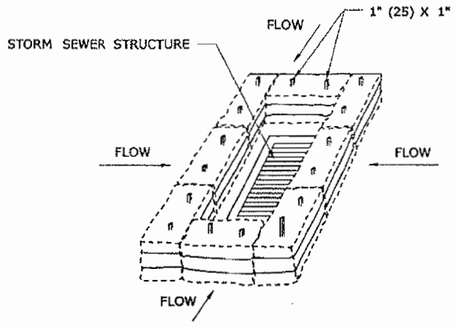
GENERAL NOTES:

1. THE CONTRACTOR SHALL MAINTAIN THE EARTHEN BERM AS DIRECTED BY THE ENGINEER.
2. WHEN USING A SEDIMENTATION CONTROL SYSTEM ALONG THE TOE OF SLOPE, ADD WINGS TO PREVENT SEDIMENT FROM MOVING ALONG THE FENCE AND OFF THE SITE. MINIMUM SPACING FOR WINGS IS 25' (7620).
3. CATCH BASIN ON SLOPE SHOULD NOT BE RINGED. THE SPACING OF SEDIMENTATION CONTROL SYSTEM SHALL VARY WITH SLOPE.
4. ELEVATION B = A + 12" (305) MIN.

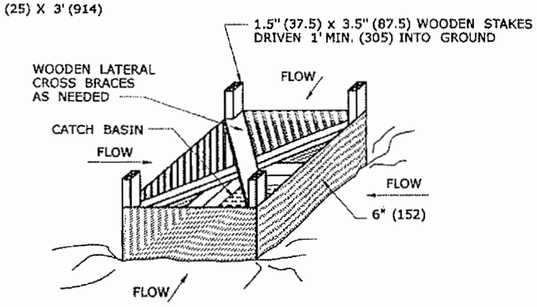


CHECK DAM

(SEE NOTE 4)



HAY BALE AT CATCH BASIN



GEOTEXTILE FENCE AT CATCH BASIN

TREATMENT FOR A CATCH BASIN IN A DEPRESSION

REVISED 9/10/09

REV.	DATE	REVISION DESCRIPTION	SHEET NO.
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-

THE INFORMATION, INCLUDING ESTIMATED QUANTITIES OF WORK, SHOWN ON THESE SHEETS IS BASED ON LIMITED INVESTIGATIONS BY THE STATE AND IS IN NO WAY WARRANTED TO INDICATE THE CONDITIONS OF ACTUAL QUANTITIES OF WORK WHICH WILL BE REQUIRED.

Plotted Date: 10/28/2009

DESIGNER/DRAFTER: -

CHECKED BY: -

NTS

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

Filename: ...\FD.MSH.DET.88H039.SED.CONTROL2.dgn

SIGNATURE/ BLOCK:

OFFICE OF ENGINEERING

APPROVED BY: DATE:

PROJECT TITLE:

NEW BRITAIN - HARTFORD BUS RAPID TRANSIT STATIONS

TOWN:

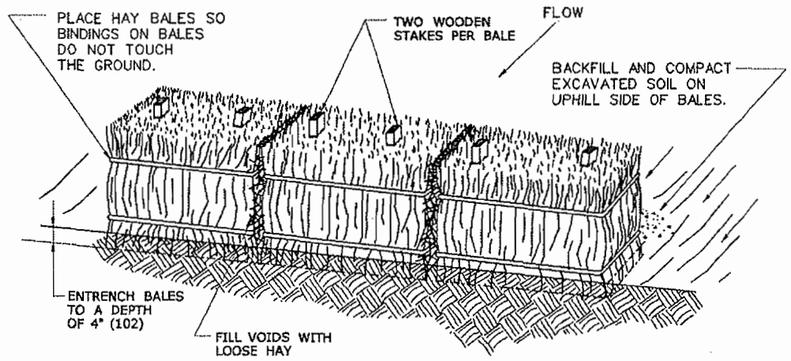
DRAWING TITLE:

SEDIMENTATION CONTROL TREATMENT DETAILS

PROJECT NO. 88-H039

DRAWING NO. DET-XX

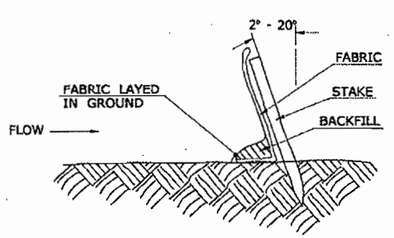
SHEET NO. S

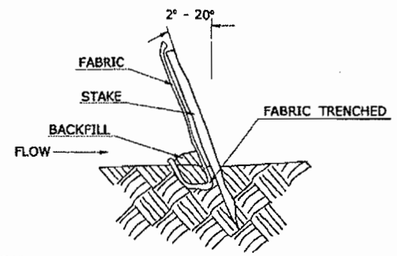


HAY BALE SYSTEM

GENERAL NOTES:

1. HAY BALES SHALL NOT BE USED IN A WATERCOURSE.
2. HAY BALES SHALL BE ENTRENCHED 4" (102) AND TIGHTLY BUTTED TOPGETHER. REMOVE HEAVY BRUSH AND FILL ALL VOIDS WITH LOOSE HAY.
3. WOOD STAKES SHALL HAVE A MINIMUM CROSS-SECTION SIZE OF AT LEAST 1" (102) x 1" (102) AND MINIMUM LENGTH OF 4 FT.(1219)
4. CLEAN OUT ACCUMULATED SEDIMENT WHEN ONE-HALF (1/2) OF THE ORIGINAL HEIGHT OF THE HAY BALE FENCE, AS INSTALLED, BECOMES FILLED WITH SEDIMENT OR AS DIRECTED BY THE ENGINEER.
5. NOT TO BE USED IN THE VICINITY OF URBAN AND RESIDENTIAL AREAS.





END VIEW

BACKFILLING GEOTEXTILE TOE

TRENCHING GEOTEXTILE TOE

GEOTEXTILE FENCE SYSTEM

GENERAL NOTES:

1. GEOTEXTILE FENCE SHOULD BE PLACED SO THE FENCE LEANS TOWARD THE SOURCE OF SEDIMENT.
2. MAXIMUM SPACING FOR WOODEN STAKES OR STEEL POSTS IS 10.0' (3048).
3. WOOD STAKES SHALL HAVE A MINIMUM CROSS-SECTION SIZE OF 1.5" (457) X 1.5" (457) AND MINIMUM LENGTH OF 4 FT. (1219) STEEL POSTS SHALL BE AT LEAST 0.5 LB. PER FOOT WITH A MINIMUM LENGTH OF 4 FT. (1219).
4. WOODEN STAKES OR STEEL POSTS SHALL BE DRIVEN TO A MINIMUM OF 1' (305) INTO THE GROUND.
5. 6" (152) OF GEOTEXTILE SHALL BE BURIED BY BACKFILLING OR TRENCHING AND AT LEAST 2.5' (762) IN HEIGHT OF GEOTEXTILE SHALL BE EXPOSED.
6. FABRIC SHALL BE JOINED ONLY AT A SUPPORT POST WITH A MINIMUM OF 6" (152) OVERLAP AND SECURITY SEALED.
7. UPON RE-ESTABLISHMENT OF GROUND COVER IN DISTURBED AREAS AND WHEN DIRECTED BY THE ENGINEER, OR UPON FINAL INSPECTION FENCE AND ANY SEDIMENT SHALL BE REMOVED. AT NO TIME WILL THE FENCE REMAIN IN PLACE AFTER PROJECT COMPLETION.
8. GEOTEXTILE FENCE SHALL NOT BE USED IN A WATER COARSE.
9. ONLY GEOTEXTILE FROM THE DEPARTMENTS APPROVED PRODUCT LIST SHALL BE USED.
10. BACKFILLING OF GEOTEXTILE SHALL ONLY BE USED WHEN GROUND IS FROZEN OR WHERE OTHER OBSTRUCTIONS ARE ENCOUNTERED THAT PROHIBITE TRENCHING, IE, STUMPS OR ROCKS.
11. CLEAN OUT ACCUMULATION SEDIMENT WHEN ONE-HALF (1/2) OF THE ORIGINAL HEIGHT OF THE GEOTEXTILE FENCE, AS INSTALLED , BECOMES FILLED WITH SEDIMENT OR AS DIRECTED BY THE ENGINEER.

REVISED: 9/10/09

REV.	DATE	REVISION DESCRIPTION	SHEET NO.
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-

THE INFORMATION, INCLUDING ESTIMATED QUANTITIES OF WORK, SHOWN ON THESE SHEETS IS BASED ON LIMITED INVESTIGATIONS BY THE STATE AND IS IN NO WAY WARRANTED TO INDICATE THE CONDITIONS OF ACTUAL QUANTITIES OF WORK WHICH WILL BE REQUIRED.

Plotted Date: 10/28/2009

DESIGNER/DRAFTER: -
CHECKED BY: -
NTS

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

Filename: ...\FD_MSH_DET_88H039_SED_CONTROL1.dgn

SIGNATURE/ BLOCK:
OFFICE OF ENGINEERING
APPROVED BY: DATE:

PROJECT TITLE:
NEW BRITAIN - HARTFROD BUS RAPID TRANSIT STATIONS

TOWN:

DRAWING TITLE:
SEDIMENTATION CONTROL SYSTEM DETAILS

PROJECT NO. 88-H039
DRAWING NO. DET-XX
SHEET NO. S

8. Appendix E: CTDOT Preliminary Design Comment Responses

Station: Elmwood Reviewer: Environmental Planning Reviewer Date: 8/11/2009
Responder: Liz Sommer, P.E. Responder Date: 2009-10-09

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

memorandum

subject: Preliminary Design Submission
88-H039 / 171-305
Elmwood Station
New Britain – Hartford Busway

date: August 11, 2009

to	from	ext.
Richard Armstrong Transportation Principal Engineer Consultant Design Bureau of Engineering and Construction	Paul Corrente Transportation Supervising Planner Environmental Planning Division Bureau of Policy and Planning	

Type of Review:

☐ Schematic ☒ Preliminary Design ☐ Semi-Final Design ☐ Final Design ☐ Permit ☐ Other:

My staff has reviewed the above mentioned project and the water resource compliance section of this office offers the following comments:

Comment #	Loc. or Sheet #	Comment	Inc.	Not Inc. (If not, WHY)
1	General	• Please note that many of the preliminary design comments provided for the Cedar Street Station will apply to the Elmwood Station design. Make changes as necessary. • The plan sheets shall include the station markings, toe of slope, cut and fill, drainage, and E&S controls, etc... • Please coordinate with the designers of Project 93-H046 regarding the transition points connecting retaining walls, curbing, etc...between the busway and platform stations.		
7	DRG	• Coordination with the designers of Project 93-H046 is required, as drainage from the busway will connect and discharge within the station footprint. • It was suggested that fill slope between Retaining Wall 109 (under 93-H046) and landscape wall (under 88-H039) be eliminated or minimized to allow for stormwater treatment. Please investigate. • If the above suggestion is doable, a HDS will not be required. • Provide flow arrows. • At the discharge point of the proposed 12-inch RCP, please show and callout an item for a RCCE and riprap. • Is a paved leak off within a proposed sidewalk practical?		
8	LDS	• What is the purpose of proposing a winding ramp for ADA accessibility when accessibility is provided along New Park Avenue? If the existing sidewalk is not ADA accessible, as it is stated, then couldn't the existing sidewalk or area within the station footprint along New Park Avenue be configured to address ADA accessibility? This would eliminate a number of landscape walls and eliminate a significant amount of fill while preserving existing mature evergreen and deciduous trees.		

If you have any questions regarding these comments, please contact Mr. Paul Corrente at 860-594-2932.

Andrew Piraneo/ap
cc: Colleen Kissane – Paul Corrente
Mark Alexander – Kim Lesay – Amanda Freitas
Brian Cunningham – Kevin Mahoney – Jacob Argiro
Dave Mancini – Bob Reilly - Laurie LaRocca
Mike Masayda - Chung Lung Chow – Yolanda Antoniak

Station: Elmwood Reviewer: Environmental Planning Reviewer Date: 8/11/2009
Responder: Liz Sommer, P.E. Responder Date: 2009-10-09

Reviewer Comment 1a).

- Please note that many of the preliminary design comments provided for the Cedar Street Station will apply to the Elmwood Station design. Make changes as necessary.

S E A Response: ***Applicable changes have been incorporated.***

Reviewer Comment 1b).

- The plan sheets shall include the station markings, toe of slope, cut and fill, drainage, and E&S controls, etc...

S E A Response: ***Additional call-outs have been added to the plan sheets, as appropriate.***

Reviewer Comment 1c).

- Please coordinate with the designers of Project 93-H046 regarding the transition points connecting retaining walls, curbing, etc...between the busway and platform stations.

S E A Response: ***Coordination between S E A and the mainline designers is on-going.***

Reviewer Comment 7a).

- Coordination with the designers of Project 93-H046 is required, as drainage from the busway will connect and discharge within the station footprint.

S E A Response: ***Coordination between S E A and the mainline designers is on-going.***

Reviewer Comment 7b).

- It was suggested that fill slope between Retaining Wall 109 (under 93-H046) and landscape wall (under 88-H039) be eliminated or minimized to allow for stormwater treatment. Please investigate.

S E A Response: ***This area has been regarded and primary stormwater treatment has been added to the area. Please see grading sheet for detail.***

Station: Elmwood Reviewer: Environmental Planning Reviewer Date: 8/11/2009
Responder: Liz Sommer, P.E. Responder Date: 2009-10-09

Reviewer Comment 7c).

- If the above suggestion is doable, a HDS will not be required.

S E A Response: ***The HDS has been removed.***

Reviewer Comment 7d).

- Provide flow arrows.

S E A Response: ***Flow arrows have been added to the drainage plan.***

Reviewer Comment 7e).

- At the discharge point of the proposed 12-inch RCP, please show and callout an item for a RCCE and riprap.

S E A Response: ***The drainage system has been modified and the out relocated. Please see revised sheets.***

Reviewer Comment 7f).

- Is a paved leak off within a proposed sidewalk practical?

S E A Response: ***The drainage system has been modified and the out relocated. Please see revised sheets.***

Reviewer Comment 8).

- What is the purpose of proposing a winding ramp for ADA accessibility when accessibility is provided along New Park Avenue? If the existing sidewalk is not ADA accessible, as it is stated, then couldn't the existing sidewalk or area within the station footprint along New Park Avenue be configured to address ADA accessibility? This would eliminate a number of landscape walls and eliminate a significant amount of fill while preserving existing mature evergreen and deciduous trees.

S E A Response: ***The existing sidewalk along New Park Avenue is not ADA accessible. The ramp at the south end of the site will be reconfigured and will connect the corner of New Britain Ave. and New Park Ave. with the local drop-off instead of the busway platform. This will reduce the required infrastructure.***

9. Appendix F: CTDEP Attachment H1 and H2

Attachment H: Engineering Documentation

Part 1: Engineering Report Checklist

The following is a checklist of requirements that need to be completed, included and submitted as part of the Engineering Report. Please complete this checklist by identifying where each requirement listed is addressed in the Engineering Report (report title and page numbers). If an item is not applicable, place "NA" in the box. Attach the completed checklist as the cover sheet to engineering reports, as applicable, which fully describe the design of the proposed facilities or other actions and the hydraulic and hydrologic effects thereof. The application instructions (DEP-IWRD-INST-100) should be consulted for a complete description of each item listed. This checklist is required to be signed and sealed by a professional engineer licensed in the State of Connecticut.

Stormwater Management

Location of Item	Item Description
2.0	Description of the design storm frequency intensity, volume and duration
5.0 Appendix B	Watershed maps, existing and proposed
N/A	Computations for Tc
3.0.1/3.0.2	Imperviousness calculations
N/A	NRCS runoff curve numbers, volumetric runoff coefficients
6.0 Appendix C	Computations used to determine peak runoff rates, and velocities for each watershed area (24-hour storm): • Stream Channel Protection: 2-year frequency ("over-control" of 2-year storm) • Conveyance Protection: 10-year frequency • Peak Runoff Attenuation: 2-year, 10-year, and 100-year frequency • Emergency Outlet Sizing: safely pass the 100-year frequency or larger storm
N/A	Hydrograph routing calculations
3.0.1/3.0.	Description, schematics, and calculations for drainage and stormwater management systems, bridges and culverts
N/A	Infiltration rates
2.0	Documentation of sources
6.0 Appendix C	Computer disk containing input and output data and the associated program for all computer models used in the analyses
6.0 Appendix C	Hard copy of input and output data including input/output tables
N/A	Detention basin analysis including timing and duration of expected outflow, stream stability analysis and hydrograph summation

Flood Plain Assessment

Location of Item	Item Description
N/A	Description or simulation of existing and proposed conditions upstream and downstream of the proposed activity
N/A	(For SCEL applications only) A determination of the effect of the proposed activity on flooding and flood hazards together with an equivalent encroachment on the opposite bank for the flood event establishing the encroachment lines
N/A	For any bridge or culvert placement or replacement with a drainage area of 100 acres or more, plan sheets showing the existing and proposed inundation area for the 2, 10, 25, 50, and 100 year discharges, carried to convergence
N/A	A description and analysis of the floodplain modifications required to restore any flood conveyance and flood storage capacity
N/A	Demonstration that backwater from the proposed activity will not impact an existing dam, dike, or similar structure
N/A	Backup data and complete hydraulic analysis for proposed modifications to the floodplain including location plan and plot for sections, profile sheet, summary sheet

Dams, Dikes, Diversion Channels, Similar Structures

Location of Item	Item Description
N/A	Primary and emergency spillway and outlet structure erosion protection
N/A	Dam breach analysis
N/A	Geotechnical evaluation
N/A	Construction Specifications for foundation preparation, embankment material, outlet structure, and construction inspection

Soil Erosion and Sediment Control Plan

Location of Item	Item Description
3.0.4	Narrative
7.0 Appendix D	Drawings
7.0 Appendix D	Details
N/A	Calculations for Engineered Measures

Professional Certification

For any Engineering Report submitted as part of the IWRD permit application, the following certification must be signed and sealed by a professional engineer licensed to practice in Connecticut and submitted with the Engineering Report Checklist and Report.

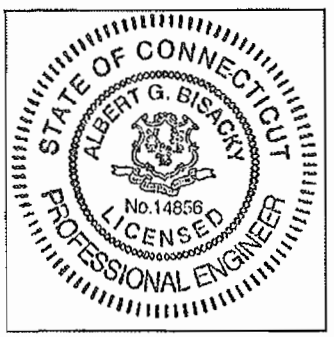
"I certify that in my professional judgement, each requirement listed in the Engineering Report Checklist has been addressed in the Engineering Report submitted as part of the IWRD permit application as Attachment H, Part 1 and that the information is true, accurate and complete to the best of my knowledge and belief.

This certification is based on my review of the Engineering Report.

I understand that a false statement made in the submitted information may, pursuant to Section 22a-6 of the General Statutes, be punishable as a criminal offense under Section 53a-157b of the General Statutes, and may also be punishable under Section 22a-438 of the General Statutes."

Signature of Applicant	Date
CT Department of Transportation Name of Applicant (print or type)	Title (if applicable)
Signature of Professional Engineer	12/4/09 Date
Al Bisacky Name of Professional Engineer (print or type)	14856 P.E. Number (if applicable)

Affix P.E. Stamp Here
(if applicable)



Attachment H: Engineering Documentation

Part 2: Hydrologic and Hydraulic Consistency Worksheet

Inland Water Resources Division Permit Activities

This worksheet has four sections; only complete the section(s) applicable to the proposed project. Where a question requires a "Yes" or "No" answer, select the appropriate response and explain your response, if required, in the space provided.

Section I: **Floodplain Management** *(if the proposed project involves a structure, obstruction, encroachment or work in a watercourse, floodplain, or coastal high hazard area)*

Section II: **Stormwater Management** *(if the proposed project involves stormwater drainage or stormwater runoff)*

Sections III: **State Grants and Loans** and **Section IV: Disposal of State Land** *(only if the applicant is a state agency seeking flood management certification approval for state grants and loans or disposal of state land)*

Contents:

Definitions of terms used in these worksheets are found in Section 25-68b of the Connecticut General Statutes and Section 25-68h-1 of the Regulations of Connecticut State Agencies and in the National Flood Insurance Program Regulations (44 CFR, Chapter 1, Subchapter B, Part 59.1).

Section I: Floodplain Management

Section I: Floodplain Management

Name of Applicant: **Connecticut Department of Transportation**

Name of Proposed Project: **New Britain-Hartford Busway, Proj. No. 171-305 (88-H039)**

1. General Criteria

a. *Critical Activity* - Does the proposed project involve the treatment, storage and disposal of hazardous waste or the siting of hospitals, housing for the elderly, schools or residences, in the 0.2 per cent [500 year] floodplain? ☐ Yes ☒ No

If yes, the base flood for the critical activity shall have a recurrence interval equal to the 500 year flood event; if no, the base flood for the activity shall have a recurrence interval equal to the 100 year flood event.

b. *Nonintensive Floodplain Uses* - Will the proposed project promote development in floodplains or will utilities servicing the project be located so as to enable floodplain development?

☐ Yes ☒ No

Explain:

c. *National Flood Insurance Program* (NFIP) - Will the proposed project be located within an area of special flood hazard designated by the Federal Emergency Management Agency (FEMA)?

☐ Yes ☒ No If yes, list the FEMA flood zone(s):

Does the proposed project meet the NFIP minimum standards established in 44 CFR, Chapter 1, Subchapter B, Part 60.3, floodplain management criteria for flood-prone areas?

☒ Yes ☐ No

d. *Municipal Regulations* - Has the municipality in which the proposed project is to be located adopted floodplain regulations containing requirements that are more restrictive than the NFIP floodplain management criteria for flood-prone areas? ☐ Yes ☒ No

If yes, describe the more restrictive requirements:

Does the proposed project comply with the more restrictive standards of the municipality?

☐ Yes ☐ No

Section I: Floodplain Management (continued)

2. *Flooding and Flood Hazards*

a. *Flooding* - Will the proposed project pose any hazard to human life, health or property in the event of a base flood? ☐ Yes ☒ No

If yes, explain:

b. *Flood Velocities* - Will the proposed project cause an increase in flow velocity or depth during the base flood discharge? ☐ Yes ☒ No

If yes, the increase in velocity is: fps
and/or the increase in depth is: ft.

Will such increase in velocity or depth cause channel erosion or pose any hazard to human life, health or property? ☐ Yes ☐ No

Explain:

c. *Flood Storage* - Will the proposed project affect the flood storage capacity or flood control value of the floodplain? ☐ Yes ☒ No

If yes, describe the effects:

d. *Degrading or Aggrading Stream Beds* - Is the streambed currently degrading or aggrading?

☐ Degrading ☐ Aggrading ☒ Neither

Has the project design addressed degrading or aggrading streambed conditions?

☐ Yes ☐ No

e. *Ice Jams* - Is the watercourse prone to ice jams or floods due to ice? ☐ Yes ☒ No

Has the project design considered ice jams or floods due to ice? ☐ Yes ☒ No

Section I: Floodplain Management (continued)

f. *Storage of Materials & Equipment* - Will the construction or use of the proposed project involve the storage of materials below the 500 year flood elevation that are buoyant, hazardous, flammable, explosive, soluble, expansive or radioactive, or the storage of any other materials which could be injurious to human, animal or plant life in the event of a flood?

☐ Yes ☒ No

If yes, describe the materials and how such materials will be protected from flood damage, secured or removed from the floodplain to prevent pollution and hazards to life and property.

Storage of materials that could be injurious to human health or the environment in the event of flooding is prohibited below the elevation of the 500 year flood. Other material or equipment may be stored below the 500 year flood elevation provided that such material or equipment is not subject to major damage by floods, and provided that such material or equipment is firmly anchored, restrained or enclosed to prevent it from floating away or that such material or equipment can be removed prior to flooding.

g. *Floodwater Loads* - Will structures, facilities and stored materials be anchored or otherwise designed to prevent floatation, collapse, or lateral movement resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy? ☐ Yes ☒ No

3. *Standards for Structures in Floodplains or Coastal High Hazard Areas*

Does the proposed project involve a new or substantially improved structure or facility located within a floodplain or coastal high hazard area? ☐ Yes ☒ No

If yes, complete this subsection; if no, skip to subsection 4 (***Topography Changes within Floodplain***).

a. *Structures in Coastal High Hazard Areas* - Will the structure or facility be located within an NFIP coastal high hazard area? ☐ Yes ☐ No

If no, skip to paragraph 3(b); if yes:

1. Will the structure or facility be located landward of the reach of mean high tide?

   ☐ Yes ☐ No

2. Will a new structure or facility be located on an undeveloped coastal barrier beach designated by FEMA? ☐ Yes ☐ No

3. If the structure or facility is/will be located within a coastal high hazard area, the structure or facility must be elevated on pilings or columns so that the bottom of the lowest horizontal structural member of the lowest floor (excluding the pilings or columns) is elevated to at least one foot above the base flood level and the pile or column foundation and structure attached thereto must be anchored to resist floatation, collapse and lateral movement due to the effects of wind, velocity waters, hurricane wave wash, and base flood water loads acting simultaneously on all building components.

   Does the proposed structure or facility meet these standards? ☐ Yes ☐ No

   The base flood elevation is: ft. (Datum:)

   The elevation of the lowest horizontal structural member is: ft. (Datum:)

Section I: Floodplain Management (continued)

4. Will the space below the lowest floor be either free of obstruction or constructed with non-supporting breakaway walls? ☐ Yes ☐ No

5. Will fill be used for structural support of any buildings within coastal high hazard areas?

   ☐ Yes ☐ No

b. *Structures in Floodplain Areas* - Are the structures residential or nonresidential?

☐ Residential ☐ Nonresidential If *nonresidential*, skip to paragraph 3(d) below.

c. *Residential Structures* - If the structure or facility is for human habitation will the lowest floor of such structure or facility, including its basement, be elevated one foot above the level of the 500 year flood?

☐ Yes ☐ No

The 500 year flood elevation is: ft. (Datum:)

The elevation of the lowest floor, including basement, is: ft. (Datum:)

d. Non-residential Structures - If the structure or facility is not intended for residential uses, will the lowest floor of such structure or facility, including its basement, be elevated to or above the 100 year flood height or be floodproofed to that height, or in the case of a critical activity, the 500 year flood height?

☐ Yes ☐ No

If yes, the structure will be: ☐ Elevated ☐ Floodproofed

The base flood elevation is: ft. (Datum:)

The elevation of the lowest floor, including basement, is: ft. (Datum:)

The structure is floodproofed to: ft. (Datum:)

Note: for insurance purposes nonresidential structures must be floodproofed to at least one foot above the base flood elevation. DEP strongly encourages that the height of floodproofing incorporate one foot of freeboard.

e. *Utilities* - Will service facilities such as electrical, heating, ventilation, plumbing, and air conditioning equipment be constructed at or above the elevation of the base flood or floodproofed with a passive system? ☐ Yes ☐ No

f. *Water Supply Systems* - Does the proposed project include a new or replacement water supply system?
☐ Yes ☐ No

If yes, is the water supply system designed to prevent floodwaters from entering and contaminating the system during the base flood? ☐ Yes ☐ No

g. *Sanitary Sewage Systems* - Does the proposed project include a new or replacement sanitary sewage or collection system? ☐ Yes ☐ No

If yes, is the sanitary sewage system designed to minimize or eliminate the infiltration of flood waters into the systems and discharges from the systems into flood waters during the base flood?

☐ Yes ☐ No

h. *Foundation Drains* - Are foundation drains of buildings designed to prevent backflow from the 100 year frequency flood into the building?

☐ Yes ☐ No ☐ No foundation drains

Section I: Floodplain Management (continued)

4. *Activity within Floodplain*

Does the proposed project involve activity in a floodplain including but not limited to filling, dumping, construction, excavating, or grading?

☐ Yes ☒ No If no, skip to subsection 5 ***(Alterations of Watercourses)***.

If yes, does the proposed project include encroachments, including fill, new construction, substantial improvements, or other development within a NFIP adopted regulatory floodway?

☐ Yes ☐ No If yes, skip to paragraph 4(b) below.

a. *No Regulatory Floodway* - The NFIP requires that until a regulatory floodway is designated, that no new construction, substantial improvements, or other development (including fill) shall be permitted within Zones A1-30 and AE unless it is demonstrated that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any point. (If no regulatory floodway has been adopted, project impacts may be evaluated by considering an equivalent conveyance loss on the opposite side of the river from the proposed project.)

Is the proposed project consistent with this requirement? ☐ Yes ☐ No

b. *Floodway Encroachments* - Will the proposed encroachment into the floodway result in any increase in flood levels during either the 100 year or 10 year discharges?

100 year: ☐ Yes; the increase is: (in 1/100ths of a foot) ☐ No

If yes, has the applicant received approval of such increase in accordance with 44 CFR, Chapter 1, Subchapter B, Part 65.12? ☐ Yes ☐ No

10 year: ☐ Yes; the increase is: (in 1/100ths of a foot) ☐ No

c. *Coastal Areas* - Flood hazard potential in coastal areas shall be evaluated considering surface profiles of the combined occurrence of tides, storm surges, and peak runoff. The starting water surface elevation for the base flood in watersheds with time of concentrations of over 6 hours shall be the 10 year frequency tidal surge level.

If the proposed project is in a coastal area, have the hydraulic analyses incorporated these criteria?

☐ Yes ☐ No ☐ Not in Coastal Area

5. *Alterations of Watercourses*

Does the proposed project include the construction or alteration to a natural perennial watercourse or man-made channel?

☐ Yes ☒ No If no, skip to subsection 6 ***(Culverts and Bridges)***; if yes, complete the following subsection:

a. *Topography Change* - Is the watercourse or channel located within a regulatory floodway or Zone A1-30 or AE as designated by the NFIP? ☐ Yes ☐ No

b. *Hydraulic Capacity* - Does the channel have a minimum flow capacity of a flood equal to at least the 25 year frequency flood? ☐ Yes ☐ No

The channel capacity is designed for the: year flood.

Does the channel have an inner channel with a capacity of a 2 year frequency flood? ☐ Yes ☐ No

Section I: Floodplain Management (continued)

c. *Aquatic Habitat* - Channel alterations should be designed to create aquatic habitats suitable for fisheries, including suitable habitat for maintaining fish populations and to enable fish passage, and to maintain or improve water quality, aesthetics, and recreation.

Has the applicant had any pre-application meetings or correspondence with DEP Fisheries?

☐ Yes ☐ No

Check each of the following criteria that have been incorporated into the project design:

☐ 1. artificial channel linings have been avoided;

☐ 2. the channel will encourage ecological productivity and diversity;

☐ 3. the channel and its banks will be compatible with their surroundings;

☐ 4. the channel will vary in its width, depth, invert elevations, and side slopes to provide diverse aquatic habitat;

☐ 5. straightening existing channels and thereby decreasing their length has been avoided;

☐ 6. the channel will not create barriers to upstream and downstream fish passage;

☐ 7. the channel will contain pools and riffles and a low flow channel to concentrate seasonal low water flows;

☐ 8. the channel will contain flow deflectors, boulders and low check dams to enhance aquatic habitat;

☐ 9. stream bank vegetation will be preserved where feasible and disturbed stream bank areas will be replanted with suitable vegetation;

☐ 10. clean natural stream bed materials of a suitable size will be incorporated in the new channel; and

☐ 11. construction of the proposed project will be scheduled to minimize conflicts with spawning, stocking, and recreational fishing seasons.

Describe how the above aquatic habitat design criteria have been incorporated into the project design:

Section I: Floodplain Management (continued)

6. *Culverts and Bridges*

Does the proposed project involve the repair or new construction of a culvert or bridge?

☐ Yes ☒ No If no, go to subsection 7 ***(Temporary Hydraulic Facilities)***.

If yes, complete this subsection:

a. *Fish Passage* - Does the culvert design allow for the passage of fish? ☐ Yes ☐ No

If yes, describe the specific design provisions for fish passage:

b. *Depressed Structural Floors* - Is the rigid structural floor of the culvert or bridge depressed below the normal stream bed to allow a natural stream bed to form over the floor?

☐ Yes ☐ No ☐ No rigid structural floor

c. *Multiple Openings* - The use of a single large culvert or bridge opening is preferred over the use of multiple small openings. Has the design minimized the use of multiple small openings?

☐ Yes ☐ No

If no, explain:

d. *Sag Vertical Curves* - Does the design utilize solid parapet walls in the sag part of a vertical curve?

☐ Yes ☐ No ☐ Not located in a sag vertical curve

e. *Debris Blockage* - Is the culvert or bridge prone to blockage by debris? ☐ Yes ☐ No

If yes, has the project design incorporated measures to minimize the potential for debris blockage?

☐ Yes ☐ No

f. *Topography Change* - Is the culvert or bridge located within a regulatory floodway or Zone A1-30 or AE as designated by the NFIP? ☐ Yes ☐ No

Section I: Floodplain Management (continued)

g. *State Highways* - Does the watercourse pass under a state roadway?

☐ Yes ☐ No If no, skip to paragraph 6(g)(2).

If yes, culverts and bridges for state highways shall be designed in accordance with the Connecticut Department of Transportation (DOT) Drainage Manual and all applicants should refer to it for specific design criteria. In general, however, the Drainage Manual requires the following:

(Place a check mark for all applicable criteria utilized)

☐ *Minor Structures* - Minor structures have a drainage area of less than one square mile in which there is no established watercourse. They shall be designed to pass the 25 year frequency discharge.

☐ *Small Structures* - Small structures have a drainage area of less than one square mile in which there is an established watercourse. *They* shall be designed to pass the 50 year frequency discharge.

☐ *Intermediate Structures* - Intermediate structures have a drainage area greater than one square mile and less than 10 square miles. They *shall* be designed to pass the 100 year frequency discharge with reasonable underclearance.

☐ *Large Structures* - Large structures have a drainage area greater than 10 square miles and less than 1000 square miles. They shall be designed to pass the 100 year frequency discharge with an underclearance not less than two feet.

☐ *Monumental Structures* - Monumental structures *have* a drainage area greater than 1000 square miles. They shall be designed to meet the requirements of the Connecticut Department of Environmental Protection, U.S. Army Corps of Engineers, and the U.S. Coast Guard.

☐ *Tidal Structures* - Tidal structures are subject to tidal action and shall be classified as minor, small, intermediate, etc. depending on their drainage area. These structures shall be designed in accordance with the previously listed *classifications*. However if the highway is subject to frequent tidal flooding, the design storm may be made consistent with the frequency of flooding by tidal action. The proposed culvert or bridge is classified as:

☐ Tidal, minor

☐ Tidal, small

☐ Tidal, intermediate

☐ Tidal, large

☐ Tidal, monumental

1. Has the structure been designed in accordance with the criteria established in the DOT Drainage Manual? ☐ Yes ☐ No

   If no, describe the lower design standards and the reasons for not complying with the DOT Drainage Manual:

Section I: Floodplain Management (continued)

2. Will the proposed culvert or bridge increase upstream water surface elevations in the event of a base flood above that which would have been obtained in the natural channel if the highway embankment were not constructed? ☐ Yes ☐ No

   If yes, is the increase in elevation more than one foot? Describe:

3. Will the proposed culvert or bridge be designed so that flooding during the design discharge does not endanger the roadway or cause damage to upstream developed property? (NOTE: The design discharge for culverts and bridges on state highways should be that which was determined by FEMA. If the applicant judges that the FEMA discharge is inappropriate, the project should be analyzed for both the applicant's computed flow and the FEMA discharge. The project, however, must still meet the standards of the NFIP.) ☐ Yes ☐ No

   Explain:

h. *Local Roads & Driveways* - Local roads (not state highways) and driveways may be designed for flood frequencies and underclearances less stringent than those specified in the DOT Drainage Manual when (check all that have been incorporated into the project design):

   ☐ 1. the road is at or close to the floodplain grade

   ☐ 2. water surface elevations are not increased by more than one foot nor cause damage to upstream properties

   ☐ 3. provisions are made to barricade the road when overtopped

   ☐ 4. the road or driveway is posted as being subject to flooding

   ☐ 5. the road or driveway has low traffic volume

   ☐ 6. alternate routes are available

   The culvert or bridge has been designed to pass the: year frequency discharge with an underclearance of: feet.

   Utilizing the DOT Drainage Manual classifications listed under paragraph 6(g) above, the culvert or bridge is classified as a: structure.

Section I: Floodplain Management (continued)

h. If the culvert or bridge is designed to standards lower than which is stipulated in the DOT Drainage Manual, list such standards and the reasons for the lower design standards:

i. *Downstream Peak Flows* - Will the proposed culvert or bridge increase downstream peak flows by decreasing existing headwater depths during flooding events? ☐ Yes ☐ No

If yes, describe the selected design criteria and the impacts to downstream properties:

7. *Temporary Hydraulic Facilities*

Temporary hydraulic facilities include all channels, culverts or bridges which are required for haul roads, channel relocations, culvert installations, bridge construction, temporary roads, or detours. They are to be designed with the same care which is used for the primary facility.

If the proposed activity involves a temporary hydraulic facility(s), has such facility been designed in accordance with Chapter 6, Appendix F, "Temporary Hydraulic Facilities," of the DOT Drainage Manual?

☐ Yes ☐ No ☒ No temporary hydraulic facilities

If yes, the design flood frequency is the: year flood.

Describe the temporary facilities:

Section II: Stormwater Management

Name of Applicant: **Connecticut Department of Transportation**

Name of Proposed Project: **New Britain-Hartford Busway Proj. No. 171-035 (88-H039)**

1. *Stormwater Runoff*

The proposed project will (check all that apply):

- ☒ Increase the area of impervious surfaces
- ☐ Increase runoff coefficients
- ☒ Alter existing drainage patterns
- ☒ Alter time of concentrations
- ☐ Change the timing of runoff in relation to adjacent watersheds

Will the proposed project impact downstream areas by increasing peak flow rates, the timing of runoff, or the volume of runoff? ☒ Yes ☐ No

If yes, describe the downstream impacts for the 2, 10 and 100 year frequency discharges:

The pre and post development peak flow rates at the downstream design point are as follows:

Return Frequency (Year)	Peak Discharges (CFS)	
	Pre-Development	Post-Development
2	**Please see attached sheet.**	
10		
100		

The above peak discharges were computed utilizing the: hour duration storm. This duration storm was selected because:

Peak discharges for the busway and site discharges were developed for pre and post development conditions using the rational method. The storm duration was considered to be two (2) times the time of concentration (Tc).

Section II: Stormwater Management
1. ***Stormwater runoff***

Pre-Development and Post-Development Comparison

	Return Frequency Discharge (cfs)					
	2 Year		10 Year		100 Year	
	Pre-Development	Post-Development	Pre-Development	Post-Development	Pre-Development	Post-Development
To New Britain Avenue systems	3.00	0.80	3.92	1.02	5.09	1.27
To New Park Avenue system	2.79	1.99	3.64	2.59	4.73	3.37
Through Trout Brook flood wall	4.04	6.25	5.27	8.62	6.84	11.62

To New Britain Systems

	Area (ac)	Rational Method C value
Pre-Development	0.92	0.71
Post-Development	0.42	0.52

To New Park Systems

	Area (ac)	Rational Method C value
Pre-Development	0.69	0.88
Post-Development	0.48	0.90

Through Trout Brook Flood Wall

	Area (ac)	Rational Method C value
Pre-Development	1.17	0.75
Post-Development	2.13	0.73

Three design points are relevant in this hydrologic analysis of the development area. Existing drainage systems within New Britain Avenue and New Park Avenue collect flow from the proposed site. Each system was selected to compare the site development impact.

Additionaly, an existing discharge through the Trout Brook flood wall collects a portion of the proposed bus station site. A bioretention basin is proposed to discharge through the existing pipe and was analyzed as a third design point.

System 7, part of the busway construction, will discharge to the proposed Bioretention basin. These flow rates are included in the analysis above.

Section II: Stormwater Management (continued)

Describe the location of the design point and why this location was chosen:

Please see attached sheet.

2. *Stormwater Detention Facilities*

Does the proposed project include the construction of any stormwater detention facilities?

☐ Yes ☒ No If no, skip to subsection 3 ***(Storm Drainage Systems)***.

If yes, has the DEP determined whether a dam construction permit is required? ☐ Yes ☐ No

The pre and post development peak flow rates at the downstream design point are as follows:

Return Frequency (Year)	Peak Discharges (CFS)		
	Pre-Development	Post-Development (without detention)	Post-Development (with detention)
2			
10			
100			

The above peak discharges were computed utilizing the: hour duration storm. This duration storm was selected because:

Describe the location of the design point and why this location was chosen:

Section II: Stormwater Management (continued)

If the proposed project increases peak flow rates for the 2, 10 or 100 year frequency discharges, describe the impacts to downstream areas:

Will the detention facility aggravate erosion along the downstream channel? ☐ Yes ☐ No

In certain situations, detention of stormwater aggravates downstream flooding. This occurs when the discharge from a subwatershed is delayed by a detention facility so that it adds to the peak discharge from another subwatershed. Adding the hydrographs of the two subwatersheds results in a higher peak discharge over that which would occur if detention were not present.

Is the location of the detention facility within the watershed suitable for detention? ☐ Yes ☐ No

Explain:

3. *Storm Drainage Systems*

Does the proposed project include the construction of subsurface storm drainage systems?

☒ Yes ☐ No If no, you have completed Section II of the worksheets.

If yes, complete this subsection:

a. *DOT Standards* - Is the proposed storm drainage system designed in accordance with the Connecticut Department of Transportation's (DOT) Drainage Manual? ☒ Yes ☐ No

If no, describe the lower design standards and the reasons for not complying with the Drainage Manual:

b. *Design Storm* - Is the storm drainage system designed for a ten year frequency storm without closing the use of the facility? ☒ Yes ☐ No

c. *Future Development* - Has the design of the system considered future development of adjacent properties? ☐ Yes ☒ No

Section II: Stormwater Management (continued)

d. *Outlet Protection* - Have the outlets from the system been designed to minimize the potential for downstream erosion? ☒ Yes ☐ No

e. *Overland Flow* - Has the use of curbing been minimized to encourage overland dispersed flow through stable vegetated areas? ☒ Yes ☐ No

f. *Vegetated Filter Strips* - Has the design incorporated the use of vegetated filter strips or grass swales to improve the quality of water outletting from the storm drainage system? ☒ Yes ☐ No

g. *Stormwater Treatment* - Describe features of the stormwater collection system intended to improve the quality of stormwater runoff prior to its discharge to surface waters.

The stormwater that will be discharged to Trout Brook will be treated in an on-site bioretention basin. The basin contains a volume in excess of the 10-year storm volume. The design is in accordance with the 2002 Guidelines.

h. *E & S Control Plan* - Has the design and installation of the storm drainage system been coordinated with the soil erosion and sediment control plan prepared in accordance with the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control? ☒ Yes ☐ No

Explain:

The Erosion and Sedimentaion Control plans are designed presuming that the busway will be built prior to the station site. By implementing best management practices during construction, the project will minimize construction impacts.

Erosion will be minimized by providing temporary or permanent cover on surfaces exposed by construction activities. Sediment from erosion which does occue will be captured and kept on site by perimeter sediment barriers.

Section III: State Grants and Loans

Name of Applicant:

Name of Proposed Project:

1. This Flood Management Certification concerns a: ☐ grant ☐ loan

2. Total amount of grant or loan: $

3. The recipient of the grant or loan will be:

   Name:

   Mailing Address:

   City/Town: State: Zip Code:

   Phone: ext. Fax:

   Recipient Contact person:

   Name:

   Mailing Address:

   City/Town: State: Zip Code:

   Phone: ext. Fax:

4. The recipient will use the grant or loan to (check all that apply):

   ☐ construct a structure, obstruction or encroachment or conduct other work within a floodplain or coastal high hazard area.

   ☐ construct a facility or develop a site affecting drainage and stormwater runoff.

   ☐ conduct a study or prepare a report concerning land use or land use planning affecting a floodplain, drainage or stormwater runoff.

5. If the grant or loan is for a study or report, describe the anticipated effects on floodplains, drainage or stormwater runoff if the recommendations are implemented:

6. Will the proposed project promote development in floodplains or will utilities servicing the project be located so as to enable floodplain development? ☐ Yes ☐ No

   Explain:

If the grant or loan is for construction of a structure, obstruction or encroachment or other work within a floodplain, or if it is for construction of a facility or development of a site that will affect drainage and stormwater runoff, Sections I and/or II of this Worksheet must be completed and the engineering report (Attachment H) and plans (Attachment G) must be provided as part of this application.

Section IV: Disposal of State Land

Name of Applicant:

Name of Proposed Project:

1. The grantee will be:

   Name:

   Mailing Address:

   City/Town: State: Zip Code:

   Phone: ext. Fax:

   Contact Person: Phone:

2. Describe the current state of development and use of the land to be disposed.

3. Why is the agency disposing of the land?

4. Describe the grantee's intended use of the land.

5. Will the disposal of the land promote development in floodplains? ☐ Yes ☐ No

   Explain:

6. Will the grantee's use of the land be consistent with the state's flood management statutes and regulations?

   ☐ Yes ☐ No Explain: