NEW BRITAIN – HARTFORD BUSWAY

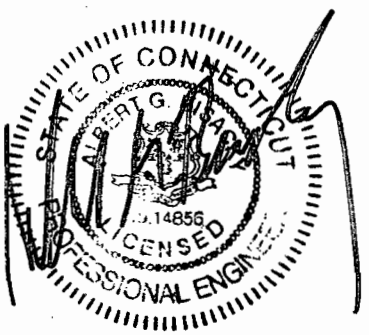
HARTFORD, CT

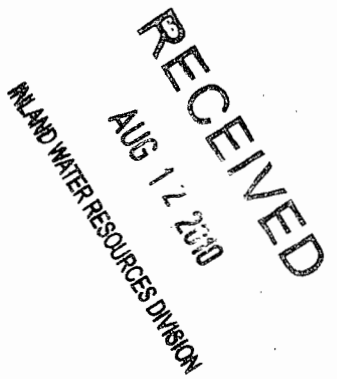
PERMITTING DRAINAGE DESIGN SUBMISSION

January 20, 2010

NEWINGTON JUNCTION 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. The following summarizes the responses received from the other communities.

The Town Engineer for Newington, Anthony Ferraro, responded via letter on November 5, 2008. Mr. Ferraro stated that there are no known drainage issues at either station proposed in Newington (Cedar Street and Newington Junction). His letter also contained information related to the proposed developments adjacent to the Cedar Street Station (National ACME site owned by the Town and the parcel south of the Stop & Shop supermarket owned by Rich Hayes). Mr. Ferraro noted that Mr. Hayes has offered drainage easements to his site (supermarket parcel) so that any needed detention basins for the developments can be combined.

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. HydroCad software was also used to determine ponding depth and flow calculations.

2.2. Assumptions

Drainage areas were delineated using project area mapping provided by the Department.

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, conservative assumptions were made as outlined in the following report sections.

3. Station Analysis and Summaries

3.0. Newington Junction Station

3.0.1. Existing Condition

The Newington Junction station site is approximately 3.3 acres of commercial development with drainage generally from west to east. The majority of the existing site has no structural collection devices; rather runoff sheet flows toward the railroad tracks and to a swale that drains along the railroad tracks to the south. This swale continues to a low point several hundred feet away. It appears this drainage is conveyed to Piper Brook by a 1.7' x 2.3' brick arch culvert located near busway Station 230+75.

Two existing 24-inch storm drain pipes traverse the site at the southern end. This system carries flow from the Willard Avenue and West Hill Road watershed. There are two existing catch basins located within the former Mobil gas station property that connect to this existing storm drain system. The outlet to Piper Brook is approximately 325 feet south of the site (Exhibit 3.4-A).

3.0.2. Proposed Condition

The proposed drainage conditions are divided into two collection systems. The first is a modification of the drainage at Willard Avenue and a new connection to this system designed for collection of the proposed runoff from the local drop-offs and sidewalks. Two catch basins are located along Willard Avenue at the intersection of West Hill Road and the station site entrance. The tributary area to each will be increased from 0.22 to 0.26 acres. In both the existing and proposed condition, these basins drain to the closed conduit traversing the site and outleting in Piper Brook (See exhibit 3.4-B).

The station site runoff is collected by a closed conduit system that discharges to the existing Piper Brook drain line. Offsite areas on the north of the site drain toward the site parking lot and will be collected in a series of catch basins. This drainage system discharges to a water quality swale located at the southern end of the site. The proposed drainage area to this point totals approximately 0.69 acres. The discharge is summarized as follows:

Storm Frequency	Q_{POST} (cfs)
2-year	2.32
10-year	3.05
25-year	3.39
100-year	3.85

The water quality swale carries the runoff from this system in addition to 0.22 acres from the adjacent slope and discharges over a check dam to a riprap lined channel. The check dam has been sized to pass the 10-year peak storm event flow to the

channel. Modified rip rap is proposed in the channel based on an average velocity of 2.30 fps.

The southern end of the station plaza and the adjacent lawn area drains by surface flow to a swale paralleling the busway and discharges to the riprap channel. The swale collects 0.38 acres and has been sized to accommodate the 10-year peak flow from this area.

The flow in the riprap channel is collected by a flared end inlet. This structure is proposed to connect to the existing dual 24-inch system. The exact location of this manhole and hydraulic condition is unknown. An elevation of the HGL was assumed to be one foot below ground surface at 69.00. The discharge at this location is summarized, as follows:

Storm Frequency	Q_{POST} (cfs)
2-year	4.16
10-year	4.49
25-year	4.66
100-year	4.92

The proposed drainage design by Contract No. 93-H046 includes a manhole with a 12-inch RCP stub at Sta. 243+09 for connection of a portion of the station drainage. The invert of the pipe at the station catch basin is 66.07. A tailwater elevation of one foot below the manhole frame elevation was used for design. This elevation is 69.84 ft. This system connects to the same drainage system tributary to Piper Brook as the drainage discussed above.

The site drainage area that is collected by the site catch basins and yard drain system totals approximately 0.75 acres at the connection to the mainline. The discharge is summarized, as follows:

Storm Frequency	Q_{POST} (cfs)
2-year	1.74
10-year	2.47
25-year	2.73
100-year	3.38

3.0.3. Environmental Issues and Stormwater Treatment

No Department flagged wetland areas are located within the station site boundaries. However, a flagged wetland area (No. 16) identified on Exhibit 3.4-C, is located within the alignment of the mainline busway near the Newington Junction Station. This area will be impacted by the West Hartford Section Contract (No. 93-H046).

The station design has incorporated primary stormwater treatment within the station limits. A water quality swale is proposed at the southern end of the site. This swale is designed to temporarily store the water quality volume of 1,800 cubic feet and promote infiltration. The design includes a forebay that will store 25% of this water quality volume.

The station drainage system that ties to the mainline pipe network will be not be directed to the water quality swale. This drainage will be combined with the mainline drainage system and discharged without treatment to the existing drainage system.

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	Newington Junction
Town	Newington
Date	1/22/2010
Designed By	SEA CONSULTANTS
Signature of Engineer	[signature]

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

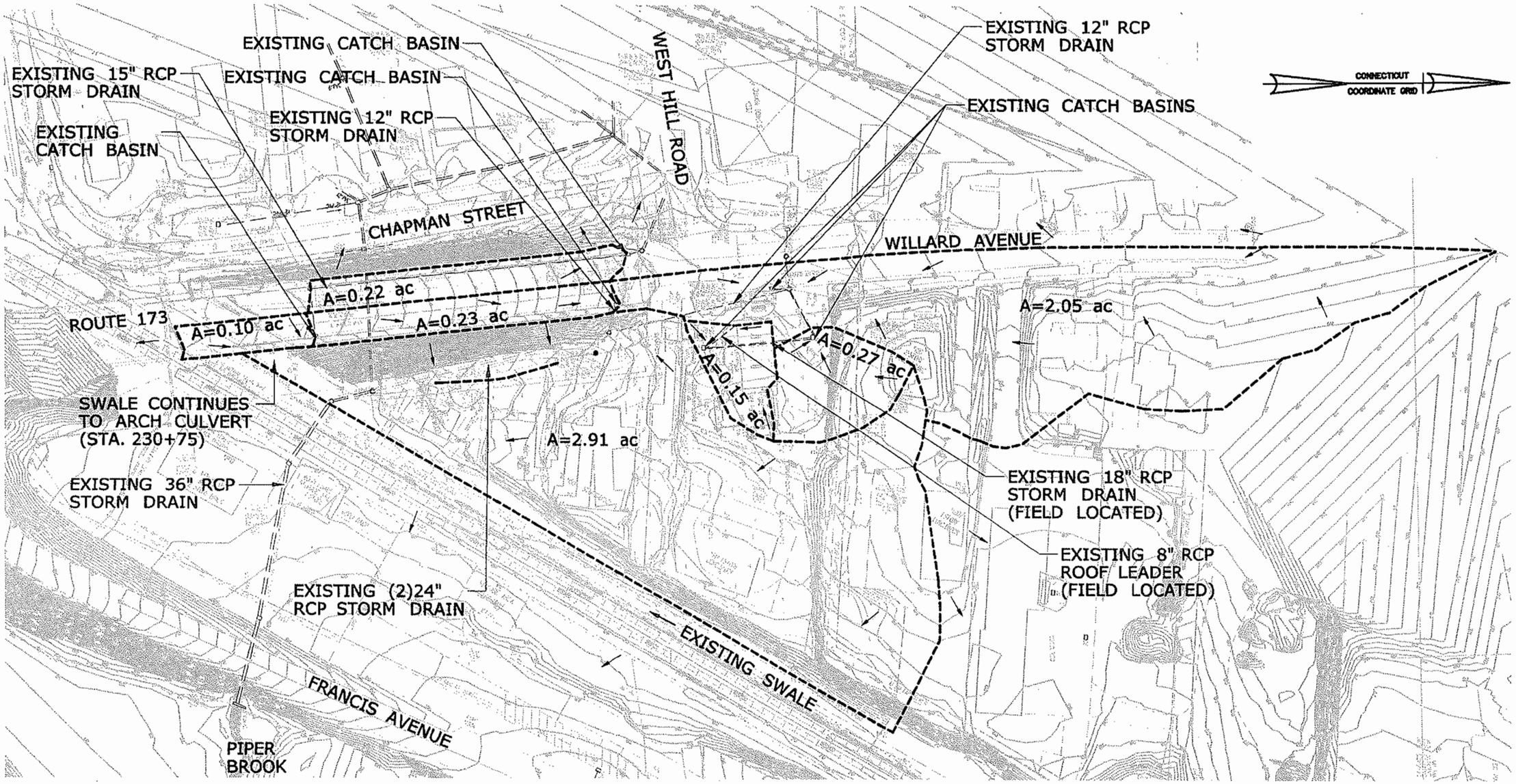
c. Structures with drainage areas > 2.59 km^2 (1 mi^2)

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.

a.2/a.4/a.6 : MANHOLE ON EXISTING SYSTEM FOR PROPOSED CONNECTION NOT FOUND BY SURVEY. TEST PIT TO BE COMPLETED (COORDINATION BY AMANN & WHITNEY). OUTLET OF SYSTEM ANALYZED AND INSPECTED AS PART OF CONTRACT H046.

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: NEWINGTON	APPLICATION BY: STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION	OFFICE OF ENGINEERING SCALE: 1=100	DATE: JANUARY 2010 SITE: NEWINGTON JUNCTION STATION EXHIBIT: 3.4-A

EXISTING CATCH BASINS

CB-11
0.11 ac

CB-12
0.07 ac

PROPOSED 24" RCP
STORM DRAIN CONNECTING
TO EXISTING 24" RCP
STORM DRAIN

PROPOSED
FLARED END
OUTLET (FE-1)
0.39 ac

CHAPMAN STREET

WILLARD AVENUE

ROUTE 173

WATER QUALITY SWALE

CONNECTICUT COORDINATE GRID

0.26 ac

0.11 ac

0.26 ac

0.06 ac

CB-14
0.24 ac

CB-13
0.16 ac

CB-10
0.12 ac

CB-11

CB-12

AD-1
0.01 ac

CB-3
0.32 ac

CB-1
0.13 ac

CB-2
0.18 ac

0.22 ac

0.38 ac

YD-1
0.05 ac

YD-2
0.06 ac

A=1.57 ac
I=5.99 in/hr

605+00
606+00
607+00
507+00
508+00
509+00
510+00
511+00
512+00
513+00
239+00
240+00
241+00
242+00
243+00
244+00
245+00

HIGH POINT
STA. 244+80.18

EXISTING 36" RCP
STORM DRAIN
OUTLETS TO
PIPER BROOK

PROPOSED 12" RCP
STORM DRAIN
(BY OTHERS)

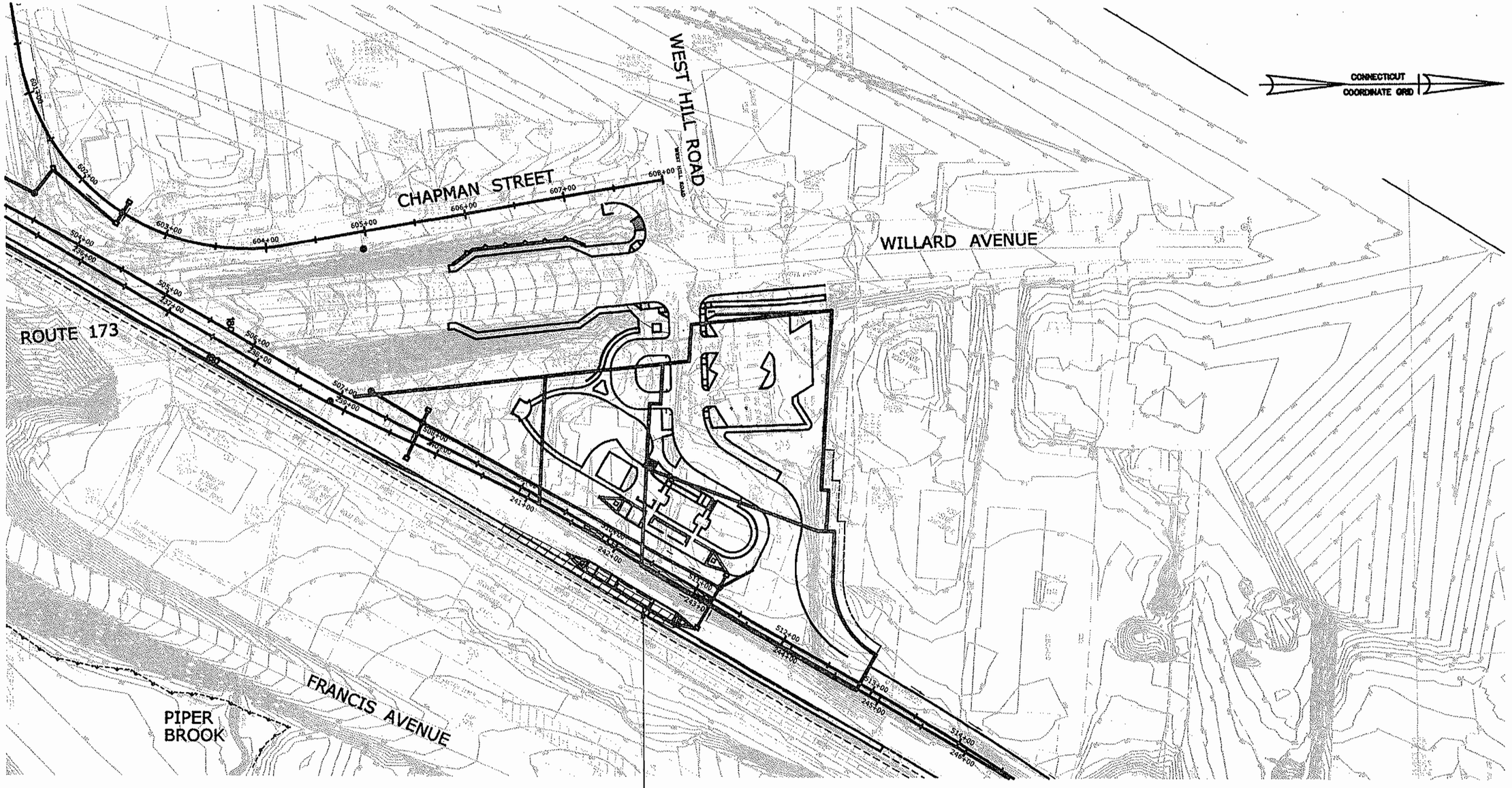
STATION DRAINAGE SYSTEM
TO JOIN MAINLINE
DRAINAGE SYSTEM
STA. 243+09
A=0.75 ac
I=4.78 in/hr

PROPOSED CONDITIONS

SCALE 1" = 50'

100 50 0 100

STATE PROJECT NO.: 88-H039 COUNTY: HARTFORD CITY/TOWN: NEWINGTON	APPLICATION BY: STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION	OFFICE OF ENGINEERING SCALE: 1=50	DATE: JANUARY 2010 SITE: NEWINGTON JUNCTION STATION EXHIBIT: 3.4-B



PROPOSED IMPACT

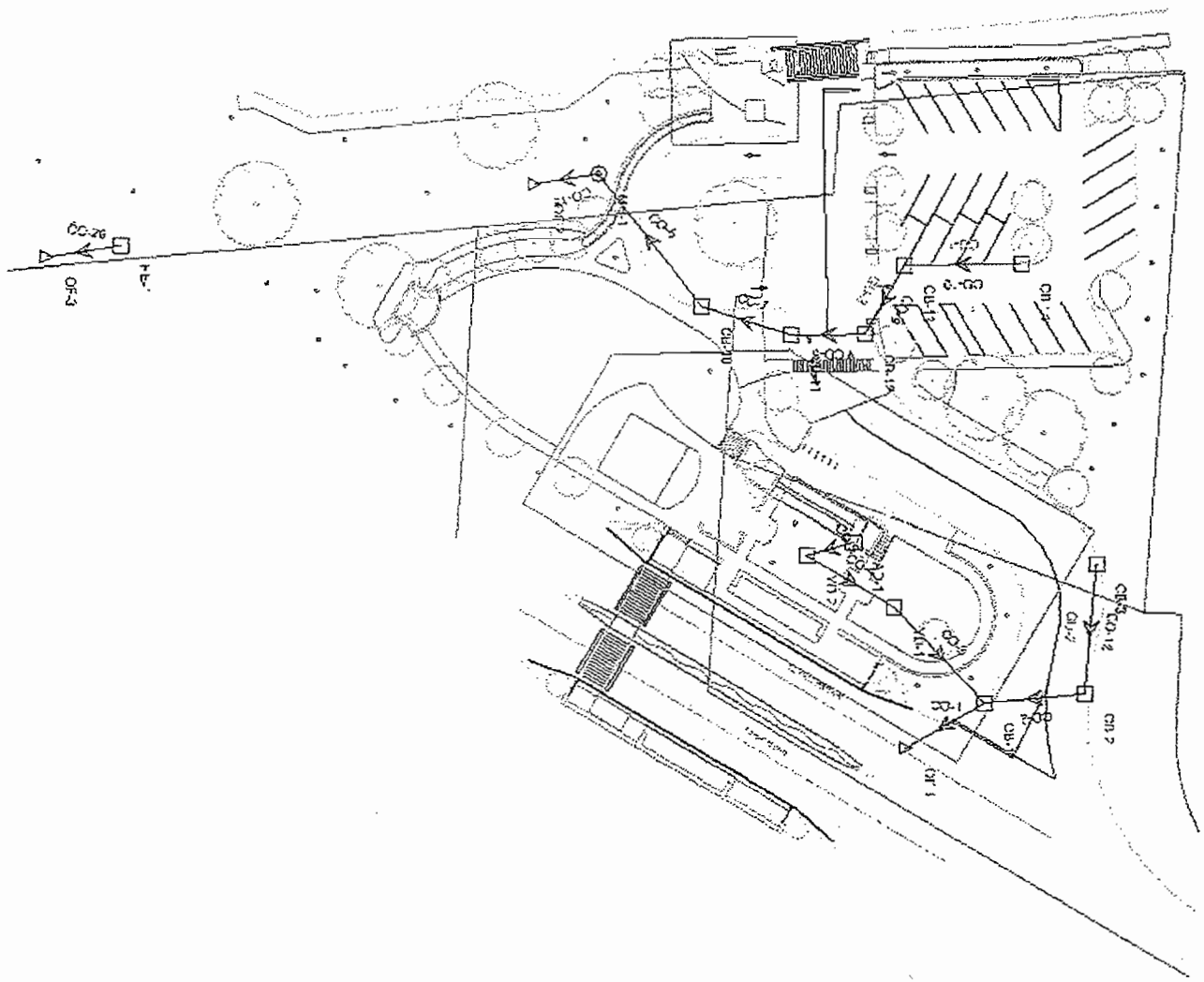
SCALE 1" = 100'

200 100 0 200

STATE PROJECT NO.: 88-H039	APPLICATION BY: STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION	OFFICE OF ENGINEERING	DATE: JANUARY 2010
COUNTY: HARTFORD			SITE: NEWINGTON JUNCTION STATION
CITY/TOWN: NEWINGTON		SCALE: 1=100	EXHIBIT: 3.4-C

6. Appendix C: Hydrologic and Hydraulic Calculations

Newington Junction



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	0.777	0.51	70.8	70.02	2.48	37	3.16	4.801
	OF-1			70.47	69.84				
CO-2	CB-2	0.833	0.37	71.5	70.32	2.22	41	2.82	5.975
	CB-1			70.8	70.16				
CO-3	YD-1	0.517	0.06	71.65	70.18	0.32	53	0.93	5.086
	CB-1			70.8	70.16				
CO-4	YD-2	0.576	0.03	71.65	70.2	0.18	41	0.5	5.363
	YD-1			71.65	70.19				
CO-5	AD-1	0.776	0.01	75.08	70.2	0.04	20	0.12	6
	YD-2			71.65	70.2				
CO-6	CB-10	0.872	0.53	77.6	73.62	3.1	68	3.95	5.838
	MH-1			77	73.11				
CO-7	CB-11	0.849	0.43	77.3	73.96	2.52	38	3.21	5.878
	CB-10			77.6	73.77				
CO-8	CB-12	0.877	0.33	77.3	74.15	1.96	30	2.5	5.918
	CB-11			77.3	74.05				
CO-9	CB-13	0.856	0.17	77.6	74.22	1.03	32	3.83	5.946
	CB-12			77.3	74.2				
CO-10	CB-14	0.555	0.10	78	74.24	0.6	47	2.88	6
	CB-13			77.6	74.24				
CO-20	FE-1	0.394	0.24	70	68.87	1.43	30	9.32	6
	OF-3			70	69				
CO-12	CB-3	0.743	0.21	74	70.3	1.24	53	7.12	6
	CB-2			71.5	70.33				
CO-13	MH-1	(N/A)	0.53	77	72.96	3.06	26	3.9	5.771
	OF-2			72	72.67				

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-2	0.04	0.9	0.04	5	CB-1	0.24
CM-3	0.009	0.3	0.003	5	CB-1	0.02
CM-4	0.02	0.3	0.01	5	CB-1	0.03
CM-5	0.06	0.9	0.055	5	CB-1	0.33
CM-6	0.007	0.9	0.007	5	AD-1	0.04
CM-7	0.002	0.3	0.001	5	AD-1	0
CM-8	0.04	0.3	0.01	5	YD-1	0.07
CM-9	0.02	0.9	0.02	5	YD-1	0.12
CM-11	0.02	0.3	0.01	5	YD-2	0.04
CM-12	0.02	0.9	0.018	5	YD-2	0.11
CM-18	0.134	0.3	0.04	5	CB-14	0.24
CM-19	0.08	0.9	0.07	5	CB-14	0.41
CM-20	0.004	0.3	0.001	5	CB-14	0.01
CM-21	0.003	0.3	0.001	5	CB-13	0.01
CM-22	0.00	0.3	0.00	5	CB-13	0
CM-23	0.146	0.9	0.132	5	CB-13	0.8
CM-24	0.002	0.3	0.001	5	CB-13	0
CM-25	0.005	0.3	0.001	5	CB-13	0.01
CM-26	0.00	0.3	0.00	5	CB-12	0
CM-27	0.051	0.9	0.046	5	CB-12	0.28
CM-28	0.01	0.3	0.003	5	CB-11	0.02
CM-29	0.10	0.9	0.09	5	CB-11	0.57
CM-30	0.01	0.3	0.00	5	CB-10	0.01
CM-31	0.11	0.9	0.10	5	CB-10	0.6
CM-32	0.22	0.3	0.065	5	FE-1	0.39
CM-33	0.14	0.3	0.04	5	FE-1	0.25
CM-34	0.13	0.3	0.04	5	FE-1	0.24
CM-35	0.094	0.9	0.085	5	FE-1	0.51
CM-38	0.016	0.9	0.015	5	CB-14	0.09
CM-39	0.01	0.9	0.009	5	CB-14	0.05
CM-42	0.083	0.3	0.025	5	CB-3	0.15
CM-43	0.07	0.9	0.063	5	CB-3	0.38
CM-44	0.164	0.9	0.147	5	CB-3	0.89
CM-45	0.021	0.9	0.019	5	CB-2	0.11
CM-47	0.02	0.3	0.006	5	CB-2	0.04
CM-48	0.141	0.9	0.127	5	CB-2	0.77
CM-49	0.015	0.9	0.014	5	CB-12	0.08
CM-50	0.019	0.3	0.006	5	FE-1	0.04

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	OF-1	66.07	65.83	12 inch	2.48	37	0.006	2.87	70.8	70.47	3.73	3.64	3.16
CO-2	CB-2	CB-1	67.33	66.17	12 inch	2.22	41	0.028	5.99	71.5	70.8	3.17	3.63	2.82
CO-3	YD-1	CB-1	67.59	66.49	8 inch	0.32	53	0.021	2.26	71.65	70.8	3.39	3.64	0.93
CO-4	YD-2	YD-1	67.9	67.69	8 inch	0.18	41	0.005	1.12	71.65	71.65	3.08	3.29	0.5
CO-5	AD-1	YD-2	68.1	68	8 inch	0.04	20	0.005	1.11	75.08	71.65	6.31	2.98	0.12
CO-6	CB-10	MH-1	72.49	72.15	12 inch	3.1	68	0.005	2.52	77.6	77	4.11	3.85	3.95
CO-7	CB-11	CB-10	72.78	72.59	12 inch	2.52	38	0.005	2.52	77.3	77.6	3.52	4.01	3.21
CO-8	CB-12	CB-11	73.03	72.88	12 inch	1.96	30	0.005	2.52	77.3	77.3	3.27	3.42	2.5
CO-9	CB-13	CB-12	73.43	73.13	12 inch	1.03	32	0.009	3.45	77.6	77.3	3.17	3.17	3.83
CO-10	CB-14	CB-13	73.83	73.53	12 inch	0.6	47	0.006	2.85	78	77.6	3.17	3.07	2.88
CO-20	FE-1	OF-3	68	66.75	24 inch	4.49	30	0.042	46.18	70	70	0	1.25	9.32
CO-12	CB-3	CB-2	69.83	67.43	12 inch	1.24	53	0.045	7.58	74	71.5	3.17	3.07	7.12
CO-13	MH-1	OF-2	72.05	71.92	12 inch	3.06	26	0.005	2.52	77	72	3.95	-0.92	3.9

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	70.8	64.07	0.777	Combination Type C Single Grate - Grate Type A - Other Curb	6.09	5.95	0.5	0.13	70.16	70.02	1.2	4.9
CB-2	71.5	65.33	0.833	Combination Type C Double Grate - Type I - Grate Type A - Plain Curb	5	4.99	0.98	0.12	70.33	70.32	1.5	6.1
YD-1	71.65	65.59	0.517	Yard Drain	4.6	4.59	0.19	0	70.19	70.18	1.4	120.4
YD-2	71.65	65.09	0.576	Yard Drain	5.11	5.11	0.15	0	70.2	70.2	1.3	105.6
AD-1	75.08	66.1	0.776	Area Drain	4.1	4.1	0.04	0	70.2	70.2	0.7	3.1
CB-10	77.6	70.49	0.872	Grate Type C-L Single Grate - Grate Type A	3.28	3.13	0.61	0	73.77	73.62	1.5	6.3
CB-11	77.3	70.78	0.849	Combination Type C Single Grate - Grate Type A - Other Curb	3.27	3.18	0.59	0	74.05	73.96	-1.4	2.5
CB-12	77.3	71.03	0.877	Combination Type C Single Grate - Grate Type A - Other Curb	3.17	3.12	0.95	0	74.2	74.15	-1	3.8
CB-13	77.6	71.43	0.856	Grate Type C-L Single Grate - Grate Type A	2.81	2.79	0.43	0.59	74.24	74.22	1.1	9.1
CB-14	78	71.83	0.555	Combination Type C Single Grate - Grate Type A - Other Curb	2.41	2.41	0.6	0.2	74.24	74.24	1.3	5.4
FE-1	70	68	0.394	Combination Type C Double Grate - Type I - Grate Type A - Plain Curb	0.87	0.87	4.49	0	68.87	68.87	0	0
CB-3	74	66.83	0.743	Combination Type C Double Grate - Type I - Grate Type A - Plain Curb	3.47	3.47	1.24	0.18	70.3	70.3	1.6	6.7

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Rocky Hill, Connecticut 06067

PROJECT:	New Britain - Hartford Bus Rapid Transit Stations : Nowington Junction			
PROJECT NO.	08-H039	SHEET NO.	1 OF	3
CALCULATED BY	KSR	DATE	9/23/2009	
CHECKED BY		DATE		

Water Quality Swale Sizing

See attached plan and cross section

Total Drainage Area (Acres)

Proposed = 0.91
Impervious Area = 0.50 | Percent Impervious = 54.9 %

Water Quality Volume (WQV)

P = 1 Inch of rainfall
a Percent proposed impervious cover, (I)
I = 54.9 %
b Volumetric runoff coefficient, R
R = 0.05+0.009 (I)
R = 0.54
c A = 0.91 acres
d WQV = (1")R(A)/12
WQV = 0.04 ac-ft
1,799 cf

References
CT DEP Stormwater Quality Manual 2004 edition
Chapter 7, Chapter 11

I = percent impervious cover

R = volumetric runoff coefficient = 0.05+0.009(I)

A = total site area in acres
WQV= water quality volume (ac-ft)

1 acre - ft = 43,560 cf

Volume Required for Forebay

Volume of Forebay = 25 % * WQV
= 450 cf

Volume Provided in Water Quality Swale

Volume of WQS = 2,042 cf * Volume calculated using HydroCad. See attached for calculations.

The swale has a capacity of 2042 cf. The required capacity is 1,799 cf. The design has adequate capacity for the water quality volume.

Volume Provided in Forebay

Volume of Forbay = 540 cf * Volume calculated using HydroCad. See attached for calculations.

The forebay has a capacity of 540 cf. The required capacity is 450 cf. The design has adequate capacity for 25% of the water quality volume.

Depth of Flow Over Check Dam

Given:
Q = 3.06 cfs
V = 2 ft/s (assumed velocity)
w= 15 ft (width of check dam)
Equation:
Q = AV

Depth of Flow = 0.10 ft
1.22 inches

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PROJECT:	New Britain - Hartford Bus Rapid Transit Stations : Newington Junction			
PROJECT NO.	88-HQ30	SHEET NO.	2 OF	3
CALCULATED BY	KSR	DATE	8/21/2009	
CHECKED BY	AGB	DATE	8/28/2009	

Grass Swale Sizing

See attached plan and cross section

Required Depth of Swale

Given:

Q =	1.5 cfs	*Designed for the 10 yr Storm
Side Slope A =	3 :1	
Side Slope B =	4 :1	
b =	2 ft	(bottom width of channel)
Slope =	1.00 %	
Roughness Coefficient =	0.022	for short grass

Depth = 0.24 ft
= 3 inches *Required depth calculated using FlowMaster. See attached for calculations.

Required Freeboard = 12 inches

Total Depth Required = 15 inches

Depth Provided in Swale

Depth = 12.00 inches

The designed swale provides the depth for the flow of 1.5 cfs. The swale only provides 9 inches of freeboard.

Velocity in Swale

Velocity 10 YR Storm = 2.18 ft/s *Velocities calculated using FlowMaster. See attached for calculations.

Velocity 25 YR Storm = 2.25 ft/s

Connecticut Guideline for Soil Erosion and Sedimentation Control, 2002 Figure VW-1 Maximum Permissible Velocities

Figure VW-1 Maximum Permissible Velocity (ft/sec)

Soil Texture	Channel Vegetation Condition: Poor	Fair	Good	Stone Center
Sand, silt loam, sandy loam, loamy sand, loam and muck	2.0	2.5	3.5	8.0
Silty clay loam, sandy clay loam, clay, clay loam, sandy clay, silty clay	3.0	4.0	5.0	8.0

[1]For channels with geosynthetic mat reinforcement, permissible velocities shall be designed on a product-specific basis and for long duration flows (>24 hours).

Source: USDA-NRCS

The swale is of sand, silt loam, sandy loam ,loamy sand, loam and muck with a fair vegetative conditions. The velocity in the swale is 2.18 ft/s for the 10 year storm and 2.25 ft/s for the 25 year storm. Both velocities are less than the maximum permissible velocity. No additional stabilization is required.

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PROJECT:	New Britain - Hartford Bus Rapid Transit Stations : Newington Junction			
PROJECT NO.	68-H030	SHEET NO.	3 OF	3
CALCULATED BY	KSR	DATE	8/21/2009	
CHECKED BY	AGB	DATE	8/28/2009	

Riprap Sizing

See attached plan and cross section

Average Velocity in Main Channel

Given:

Q =	4.56 cfs	
L=	48 ft	
b=	10 ft	
Depth =	0.20 ft	*Depth calculated using FlowMaster. See attached for calculations.
Slope =	10.4 %	
Roughness Coefficient =	0.060	for Riprap

Equation:

$Q = A*V$

Velocity = 2.28 ft/s

ConnDOT Drainage Manual, October 2000

Figure 7-27.1 Angle of Repose of Riprap in Terms of Mean Size and Shape of Stone

Angle of Repose = 42.2 degrees

Figure 7-26 Bank Angle Correction Factor (K_1) Nomograph

K_1 = 0.72

Equation 7.36

$$D_{50} = 0.001 V_a^{3} / (d_{avg.}^{V2} K_1^{3/2})$$

D_{50} = Median Riprap Size (ft.)
V_a = Average velocity in main channel (ft./sec)
$d_{avg.}$ = Average depth in main channel (ft.)
K_1 = Bank angle correction term

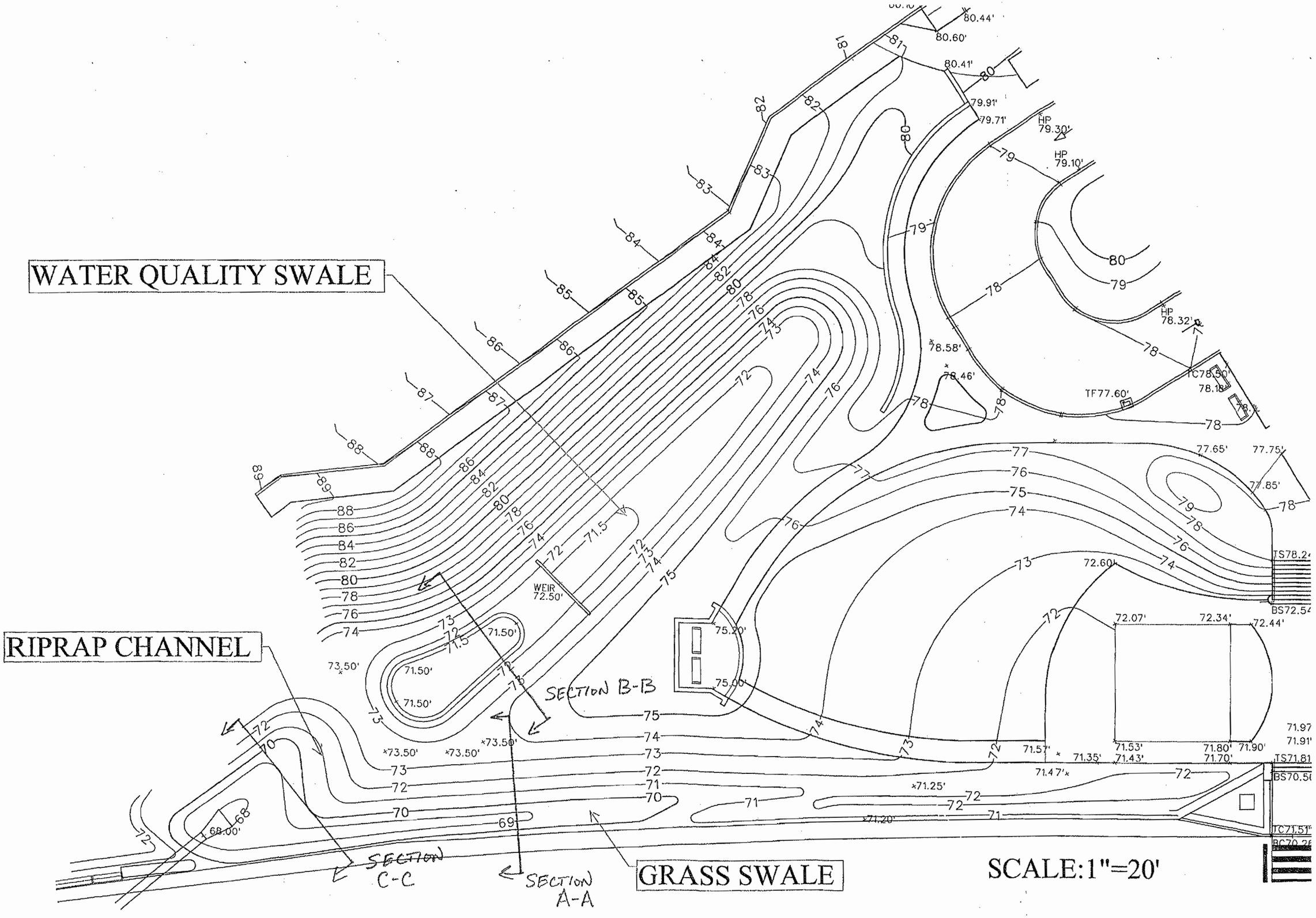
D_{50} = 0.04 ft

Connecticut Guideline for Soil Erosion and Sedimentation Control, 2002

Type of riprap required:

Modified	D50 < 0.42 ft
Intermediate	0.42 ft < D50 < 0.67
Standard	0.67 < D50 < 1.25 ft
Special Design	1.25 ft < D50

With a velocity of 2.28 ft/s, the D_{50} required from the ConnDOT Drainage Manual is 0.04 ft. The Connecticut Guideline for Soil Erosion and Sedimentation Control figure RR-2 indicates that modified riprap is required.


WATER QUALITY SWALE
RIPRAP CHANNEL
GRASS SWALE
WEIR
72.50'
SECTION B-B
SECTION C-C
SECTION A-A
HP 79.30'
HP 79.10'
HP 78.32'
TF77.60'
TC78.50'
78.18'
79.91'
79.71'
80.44'
80.60'
80.41'
78.58'
78.46'
75.20'
75.00'
77.65'
77.75'
77.85'
72.60'
72.07'
72.34'
72.44'
71.57'
71.35'
71.53'
71.43'
71.80'
71.70'
71.90'
71.47'
71.25'
71.20'
73.50'
71.50'
68.00'
SCALE:1"=20'

S E A

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CLIENT: CT DOT	JOB NO: H039	PAGE:
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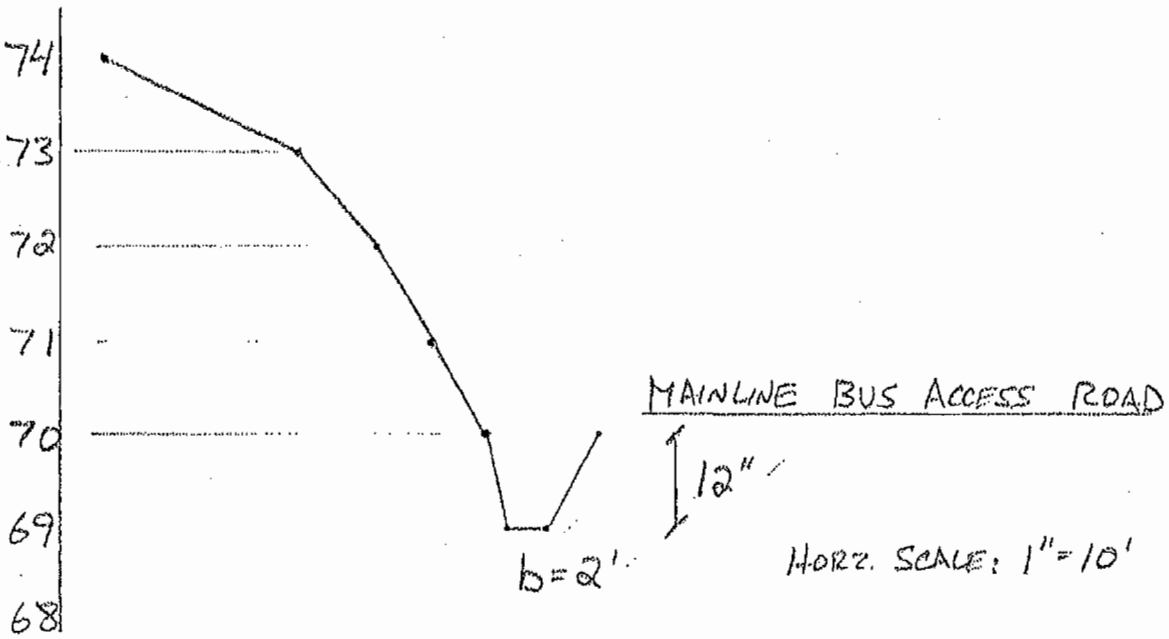
DETAIL: NEWINGTON JUNCTION	OK'D BY: KSL	DATE: 9/24/09

X-SECTION A-A GRASS SWALE



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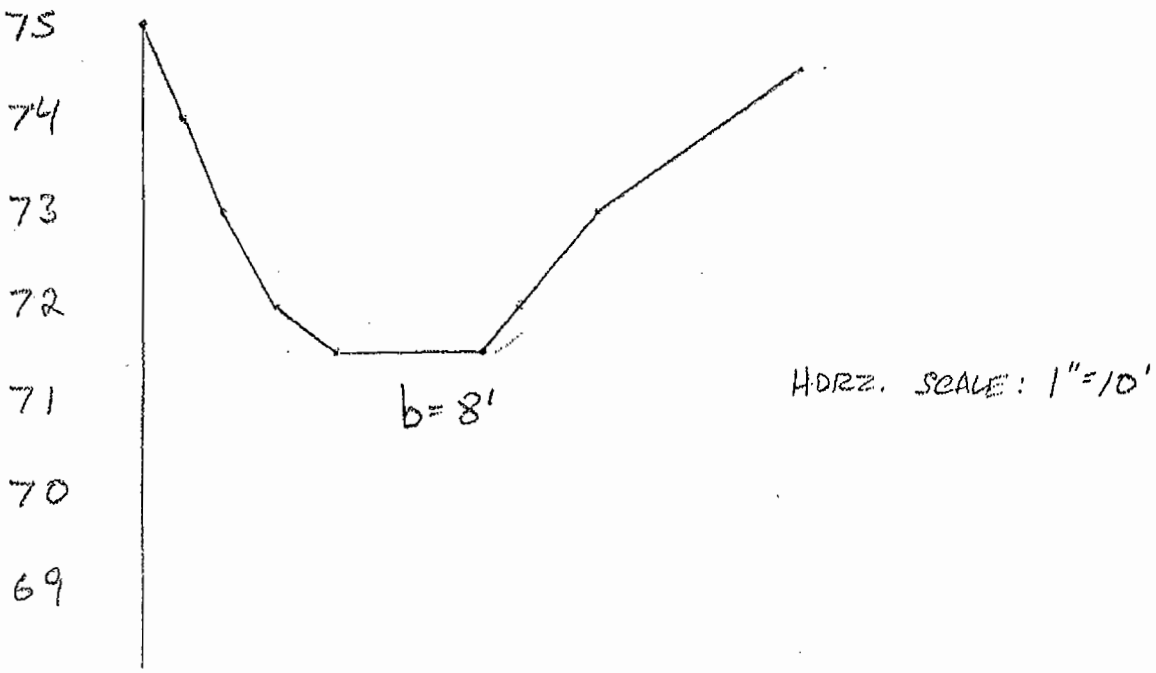
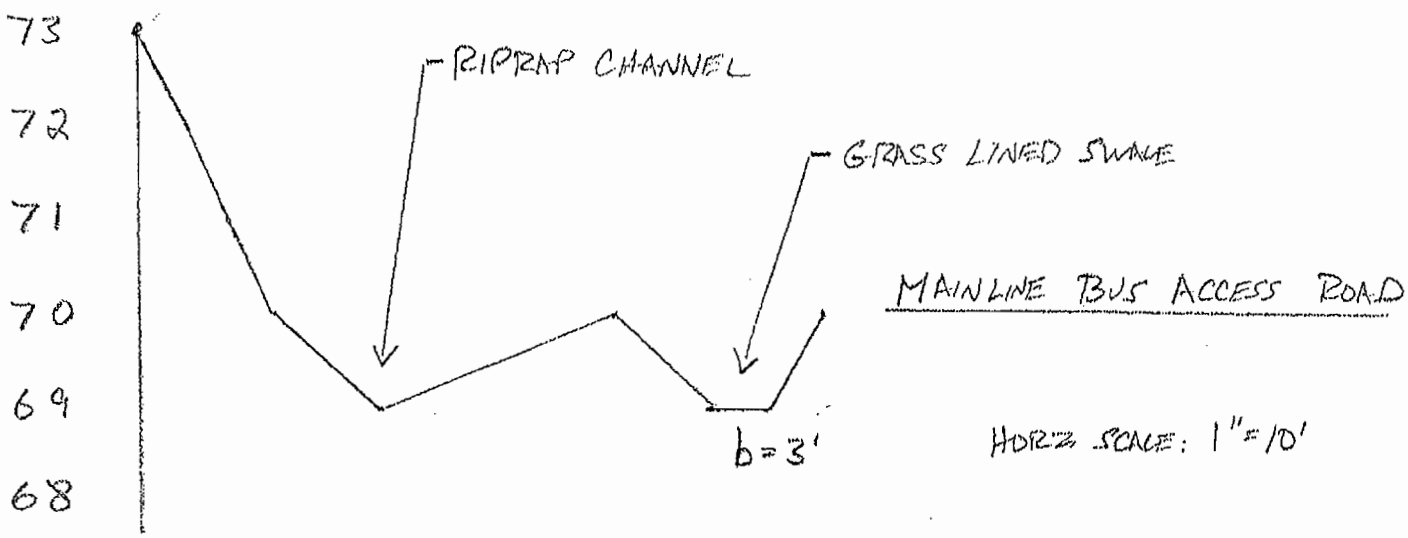
CLIENT: CT DOT	JOB NO: H039	PAGE:
PROJECT: BRT	COMPTD BY: KRV	DATE: 9/23/2009
DETAIL: NEWINGTON JUNCTION	OK'D BY: K [illegible]	DATE: [illegible]

X-SECTION B-B WATER QUALITY SWALE



X-SECTION C-C RIPRAP CHANNEL



Summary for Pond 1P: WQ - Total Volume

[43] Hint: Has no inflow (Outflow=Zero)

Routing by Stor-Ind method
Peak Elev= 0.00' @ 0.00 hrs Surf.Area= 0 sf Storage= 0 cf

Plug-Flow detention time= (not calculated)
Center-of-Mass det. time= (not calculated)

Volume	Invert	Avail.Storage	Storage Description
#1	71.50'	2,042 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
71.50	332	0	0
73.00	2,390	2,042	2,042

Summary for Pond 2P: WQ Forebay

[43] Hint: Has no inflow (Outflow=Zero)

Routing by Stor-Ind method
Peak Elev= 0.00' @ 0.00 hrs Surf.Area= 0 sf Storage= 0 cf

Plug-Flow detention time= (not calculated)
Center-of-Mass det. time= (not calculated)

Volume	Invert	Avail.Storage	Storage Description
#1	71.50'	540 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
71.50	154	0	0
72.50	925	540	540

Grass Swale Cales (10 yr)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.022	
Channel Slope	0.01000	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	1.50	ft³/s

Results

Normal Depth	0.24	ft
Flow Area	0.69	ft²
Wetted Perimeter	3.76	ft
Hydraulic Radius	0.18	ft
Top Width	3.69	ft
Critical Depth	0.23	ft
Critical Slope	0.01289	ft/ft
Velocity	2.18	ft/s
Velocity Head	0.07	ft
Specific Energy	0.32	ft
Froude Number	0.89	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.24	ft
Critical Depth	0.23	ft
Channel Slope	0.01000	ft/ft

Grass Swale Calcs (10 yr)

GVF Output Data

Critical Slope	0.01289	ft/ft

Grass Swale Calcs (25 yr)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.022	
Channel Slope	0.01000	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	1.68	ft³/s

Results

Normal Depth	0.26	ft
Flow Area	0.75	ft²
Wetted Perimeter	3.87	ft
Hydraulic Radius	0.19	ft
Top Width	3.80	ft
Critical Depth	0.24	ft
Critical Slope	0.01266	ft/ft
Velocity	2.25	ft/s
Velocity Head	0.08	ft
Specific Energy	0.34	ft
Froude Number	0.90	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.26	ft
Critical Depth	0.24	ft
Channel Slope	0.01000	ft/ft

Grass Swale Calcs (25 yr)

GVF Output Data

Critical Slope	0.01266	ft/ft

Riprap Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.069	
Channel Slope	0.10400	ft/ft
Bottom Width	10.00	ft
Discharge	4.56	ft³/s

Results

Normal Depth	0.20	ft
Flow Area	1.98	ft²
Wetted Perimeter	10.40	ft
Hydraulic Radius	0.19	ft
Top Width	10.00	ft
Critical Depth	0.19	ft
Critical Slope	0.12752	ft/ft
Velocity	2.30	ft/s
Velocity Head	0.08	ft
Specific Energy	0.28	ft
Froude Number	0.91	
Flow Type	Subcritical	

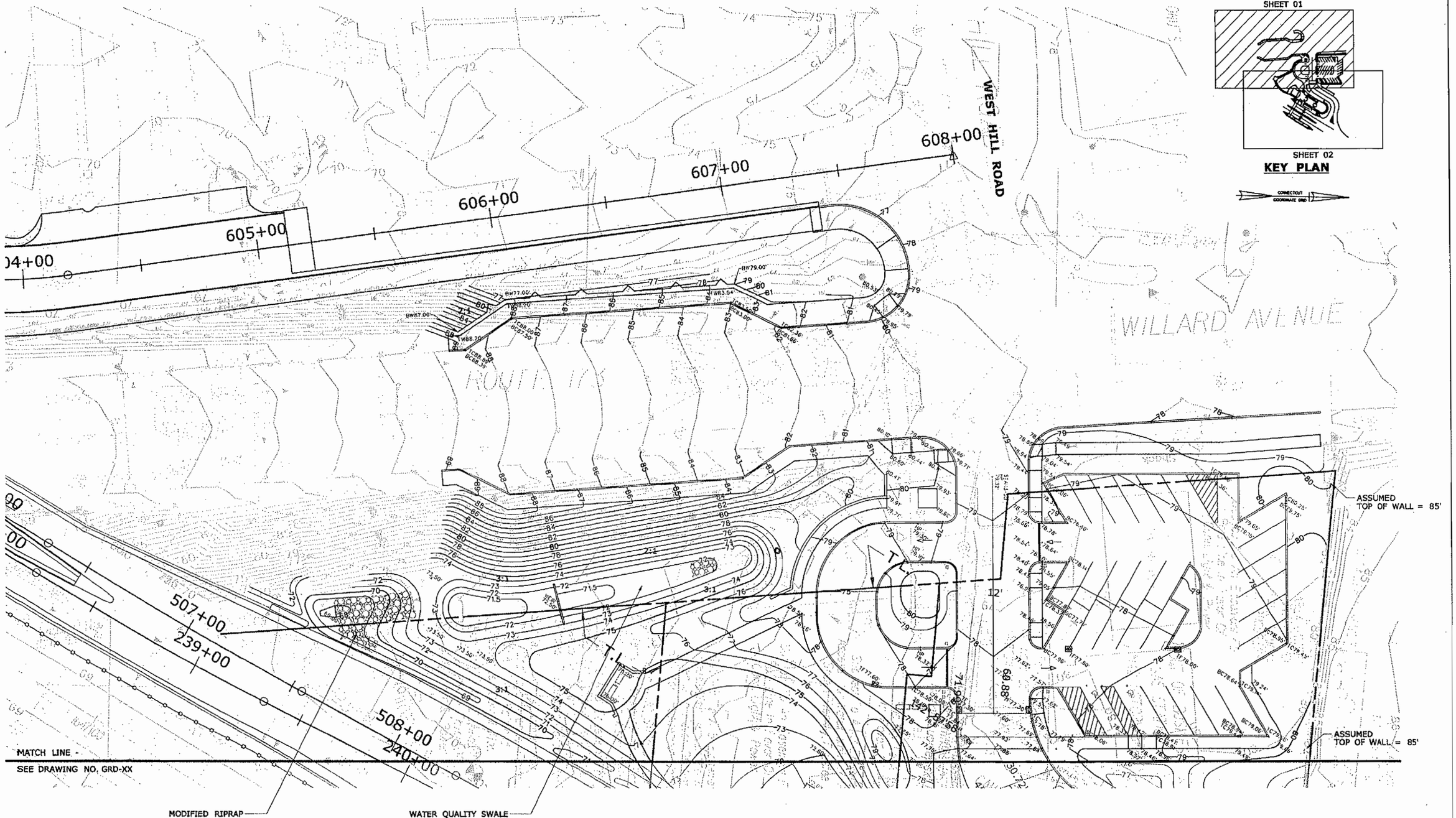
GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.20	ft
Critical Depth	0.19	ft
Channel Slope	0.10400	ft/ft
Critical Slope	0.12752	ft/ft

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



ENVIRONMENTAL PERMIT REVIEW

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1	NOV. 09	DESIGN COORDINATION REVISIONS	-

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Plotted Date: 11/3/2009

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SCALE 1"=20'

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

Filename: ...\FD.MSH.GRD.88H039.A.NEWINGTON JUNCTION.dgn

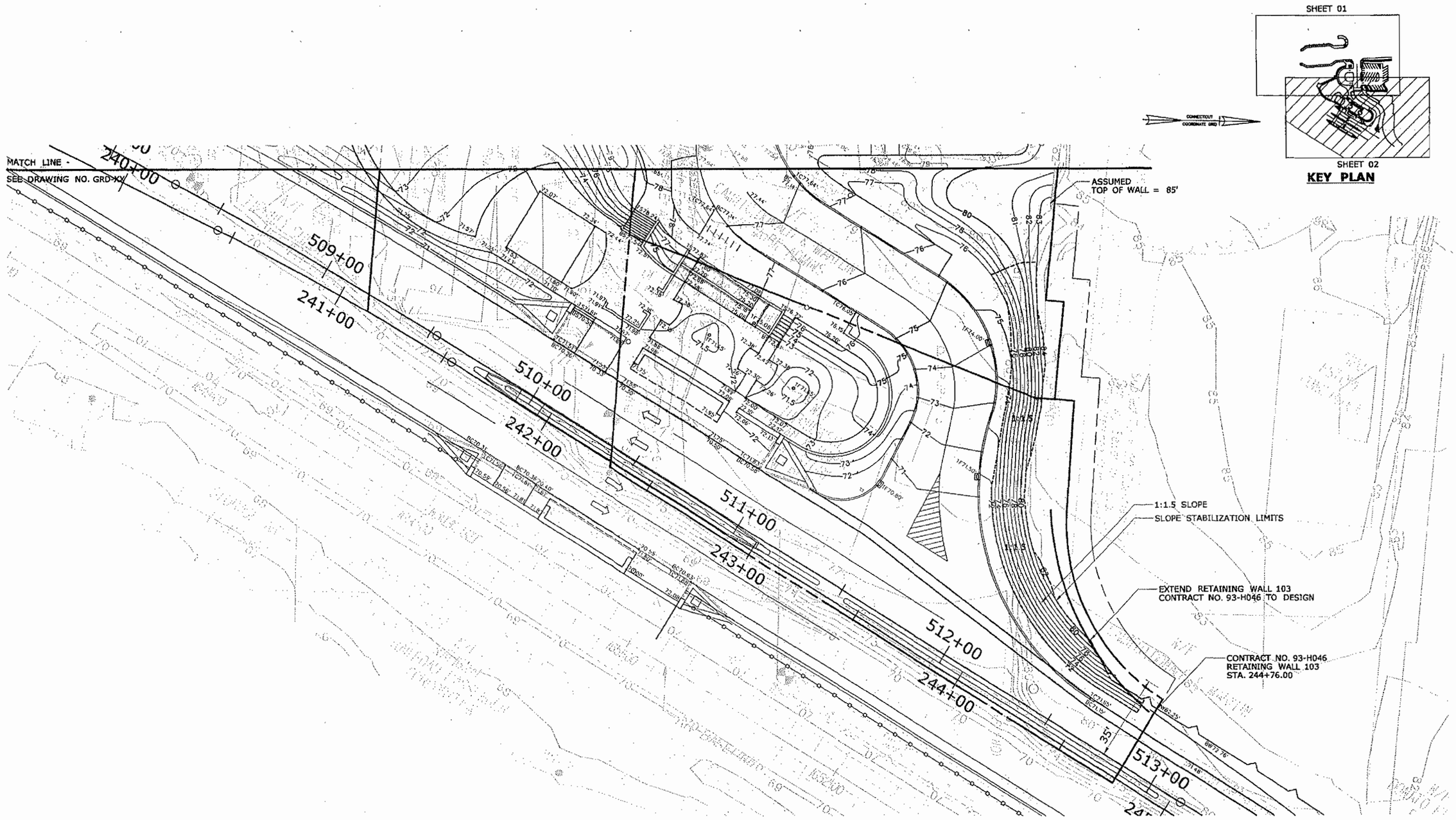
SIGNATURE/BLOCK: OFFICE OF ENGINEERING
APPROVED BY: DATE:

PROJECT TITLE: NEW BRTAIN - HARTFORD BUS RAPID TRANSIT STATIONS

TOWN: NEWINGTON

DRAWING TITLE: NEWINGTON JUNCTION GRADING PLAN

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



ENVIRONMENTAL PERMIT REVIEW

REV.	DATE	REVISION DESCRIPTION	SHEET NO.
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1	NOV. 09	DESIGN COORDINATION REVISIONS	-

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Plotted Date: 11/3/2009

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OFFICE OF ENGINEERING
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PROJECT TITLE:
NEW BRITAIN - HARTFORD
BUS RAPID TRANSIT STATIONS

TOWN: NEWINGTON

DRAWING TITLE:
NEWINGTON JUNCTION
GRADING PLAN

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

SHEET 01

SHEET 02

KEY PLAN

CONNECTICUT COORDINATE GRID

WEST HILL ROAD

WILLARD AVENUE

ROUTE 175

604+00

605+00

606+00

607+00

608+00

MH-1, MANHOLE
TF = 77.00'
INV. IN = 72.15'
INV. OUT = 72.05'
BTM = 70.05'

CB-10, CATCH BASIN
TYPE 'C-L'
TF = 77.60'
INV. IN = 72.59'
INV. OUT = 72.49'
BTM = 70.49'

12" ø RCP +/- 32 LF
S = 0.009

12" ø RCP +/- 30 LF
S = 0.005

MODIFIED RIPRAP

FLARED END
INV. IN = 68.00

6" ø UNDERDRAIN

PIPE OUTLET TO
WATER QUALITY SWALE
INV. OUT = 71.92'

MODIFIED RIPRAP

CONNECT TO EXISTING
DRAIN MANHOLE
INV. IN = 66.75'

24" ø RCP
+/- 25 LF
S = 0.05

12" ø RCP
+/- 25 LF
S = 0.005

12" ø RCP +/- 70 LF
S = 0.005

12" ø RCP +/- 47 LF
S = 0.006

12" ø RCP +/- 98 LF
S = 0.005

507+00

239+00

508+00

240+00

PROPOSED DRAINAGE DESIGN
CONTRACT NO. 93-H046
REV. 10/01/2009

MATCH LINE -
SEE DRAWING NO. DRG-XX

CB-11, CATCH BASIN
TYPE 'C'
TF = 77.30'
INV. IN = 72.88'
INV. OUT = 72.78'
BTM = 70.78'

CB-12, CATCH BASIN
TYPE 'C'
TF = 77.30'
INV. IN = 73.13'
INV. OUT = 73.03'
BTM = 71.03'

CB-13, CATCH BASIN
TYPE 'C'
TF = 77.60'
INV. IN = 73.53'
INV. OUT = 73.43'
BTM = 71.43'

CB-14, CATCH BASIN
TYPE 'C'
TF = 78.00'
INV. OUT = 73.83'
BTM = 71.83'

ENVIRONMENTAL PERMIT REVIEW

REV.	DATE	REVISION DESCRIPTION	SHEET NO.
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Plotted Date: 1/21/2010

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SCALE 1"=20'

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

Filename: ...\FD_MSH_DRG_88H039_A_NEWINGTON_JUNCTION.dgn

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PROJECT TITLE:
NEW BRTAIN - HARTFORD
BUS RAPID TRANSIT STATIONS

TOWN: NEWINGTON

DRAWING TITLE:
NEWINGTON JUNCTION
DRAINAGE PLAN

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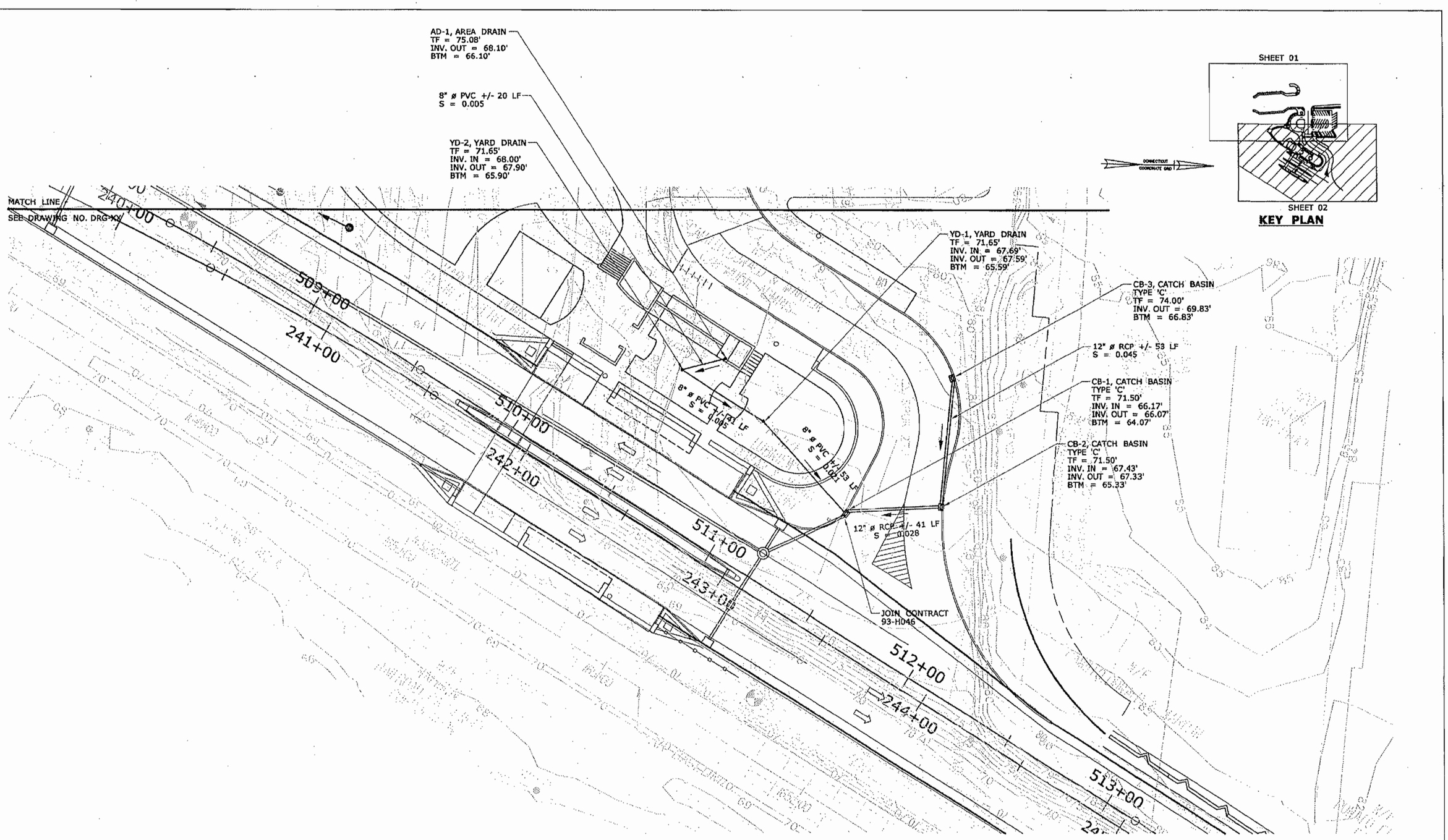

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STATE OF CONNECTICUT
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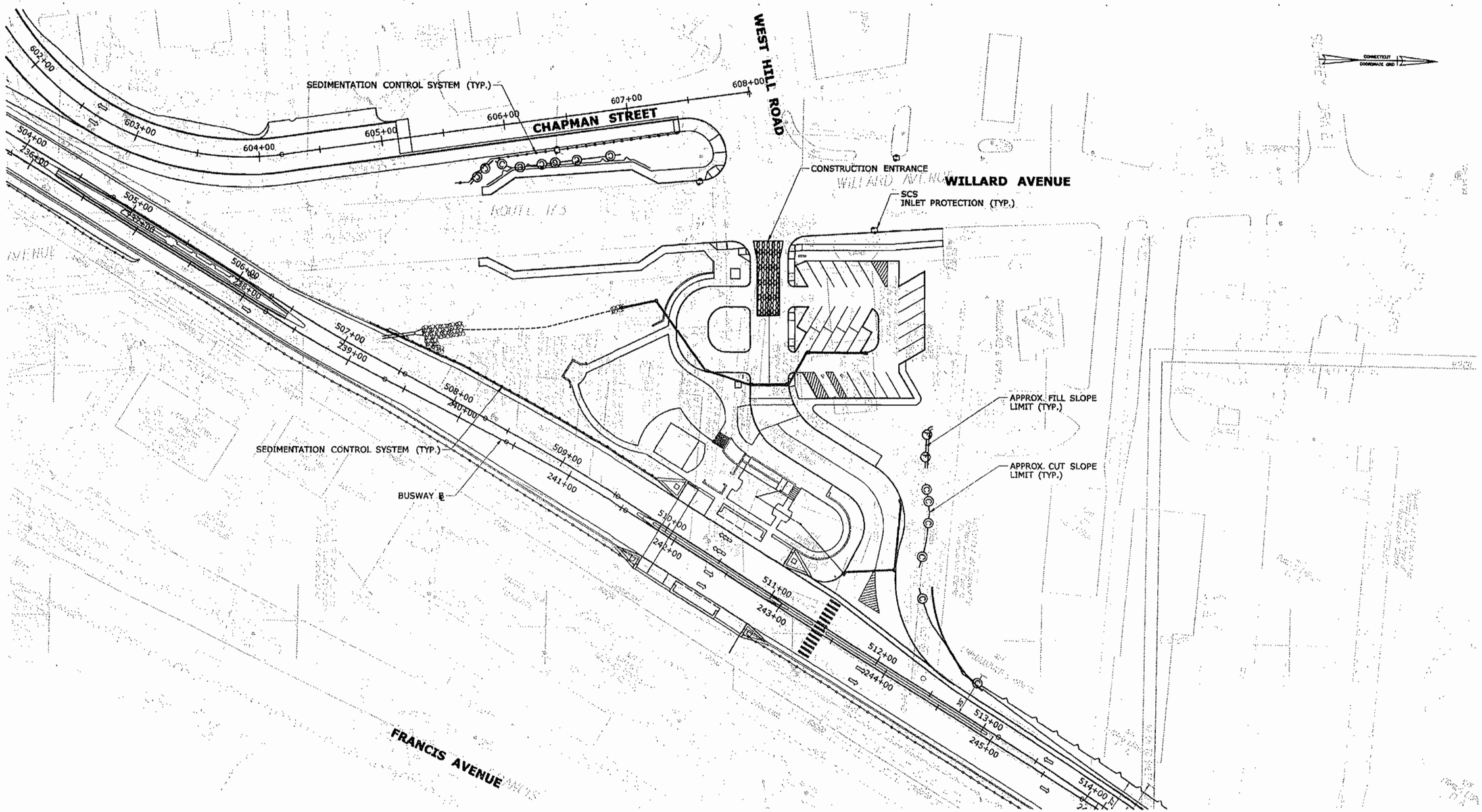
OFFICE OF ENGINEERING
APPROVED BY: DATE:

PROJECT TITLE:
NEW BRITAIN - HARTFORD
BUS RAPID TRANSIT STATIONS

TOWN: NEWINGTON

DRAWING TITLE:
NEWINGTON JUNCTION
DRAINAGE PLAN

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



ENVIRONMENTAL PERMIT REVIEW

REV.	DATE	REVISION DESCRIPTION	SHEET NO.
-	-	-	-
-	-	-	-
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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: 10/22/2009

DESIGNER/DRAFTER: KRV
CHECKED BY: -
SCALE IN FEET 0 40 80
SCALE 1"=40'

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

Filename: ...\FD.MS11.SED.88H039.NEWINGTON JUNCTION.dgn

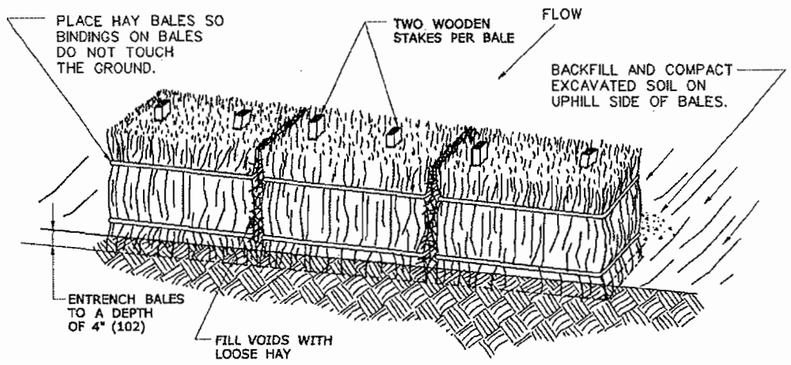
SIGNATURE/ BLOCK:
OFFICE OF ENGINEERING
APPROVED BY: DATE:

PROJECT TITLE:
NEW BRTAIN - HARTFORD
BUS RAPID TRANSIT STATIONS

TOWN: NEWINGTON

DRAWING TITLE:
NEWINGTON JUNCTION
SEDIMENTATION CONTROL

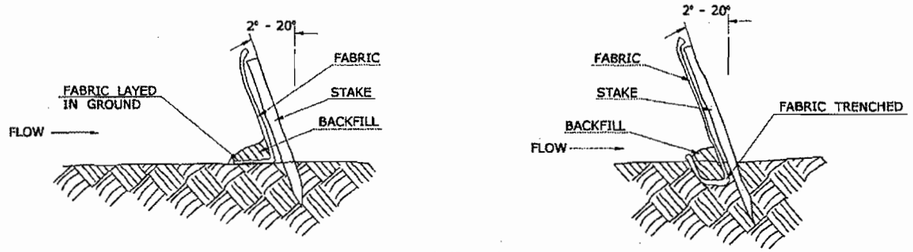
PROJECT NO. 88-H039
DRAWING NO. SED-XX
SHEET NO. S



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.
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Plotted Date: 10/28/2009

DESIGNER/DRAFTER: --
CHECKED BY: --
NTS

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

Filename: ...\FD_MSH_DET_88H039_SED_CONTROL1.dgn

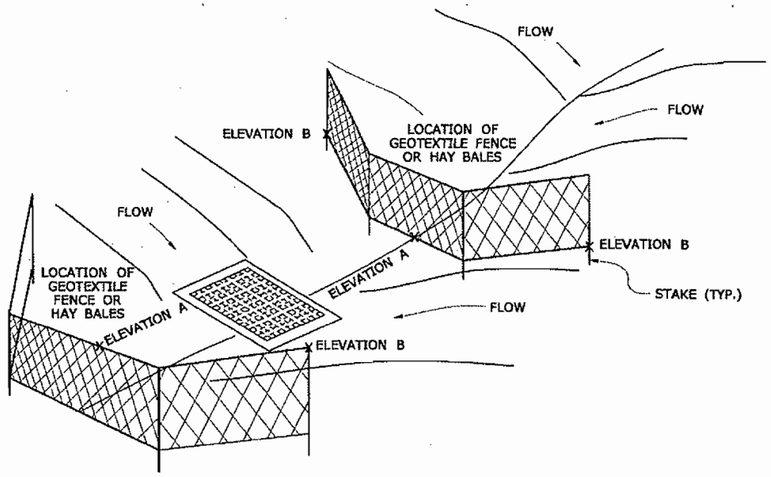
SIGNATURE/ BLOCK:
OFFICE OF ENGINEERING
APPROVED BY: DATE:

PROJECT TITLE:
NEW BRITAIN - HARTFROD BUS RAPID TRANSIT STATIONS

TOWN:

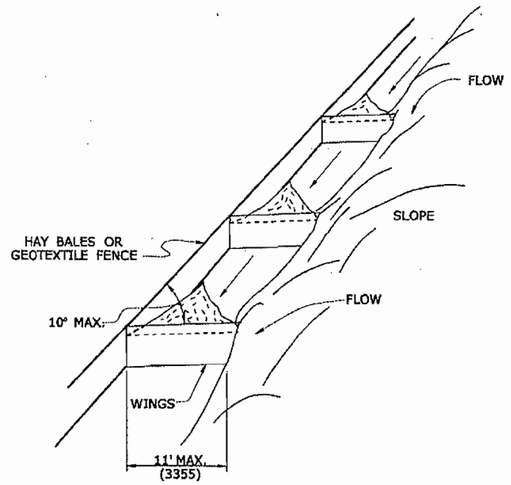
DRAWING TITLE:
SEDIMENTATION CONTROL SYSTEM DETAILS

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



TREATMENT FOR A CATCH BASIN ON A SLOPE

(SEE NOTE 4)

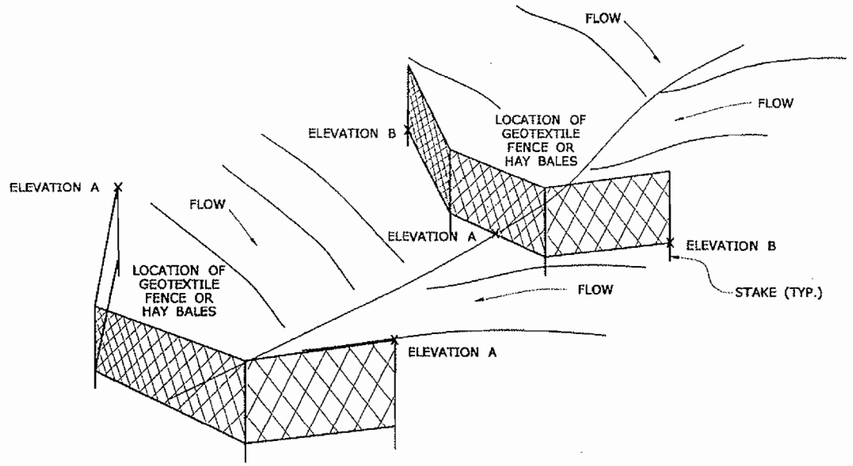


TREATMENT AT TOE OF SLOPE

(SEE NOTE 3)

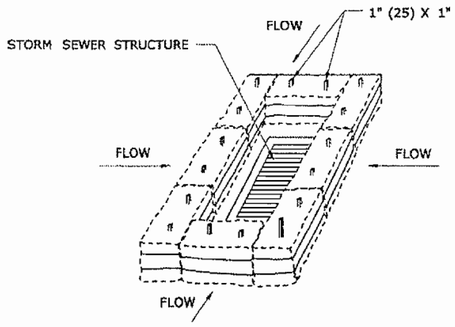
GENERAL NOTES:

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.

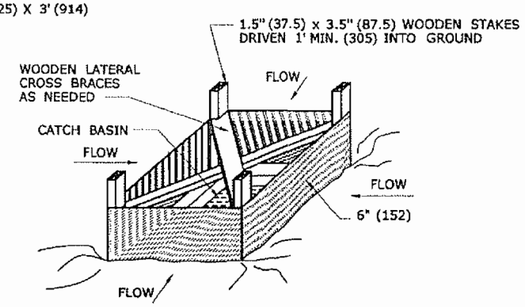


CHECK DAM

(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.
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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 TRANSIST STATIONS

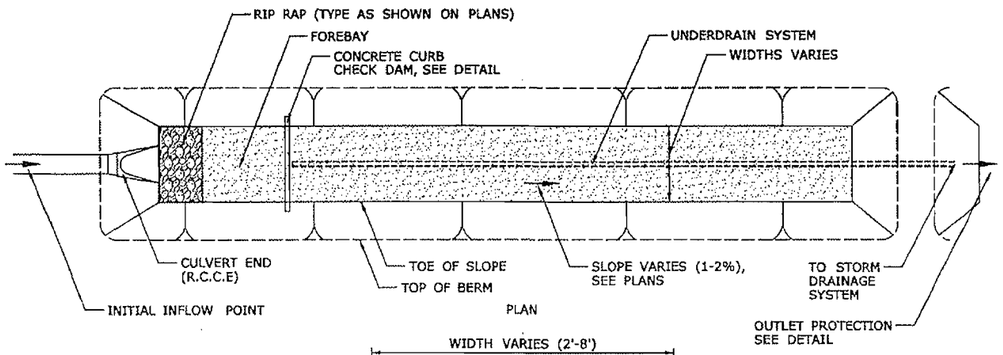
TOWN:

PROJECT NO. 88-H039

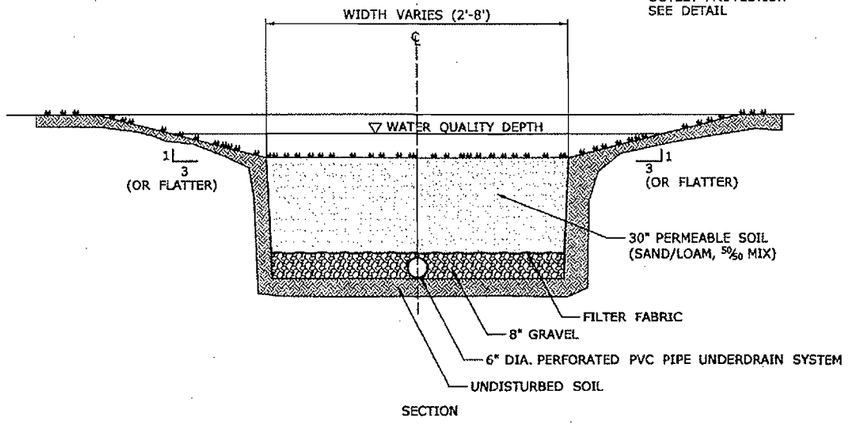
DRAWING NO. DET-XX

DRAWING TITLE: SEDIMENTATION CONTROL TREATMENT DETAILS

SHEET NO. S

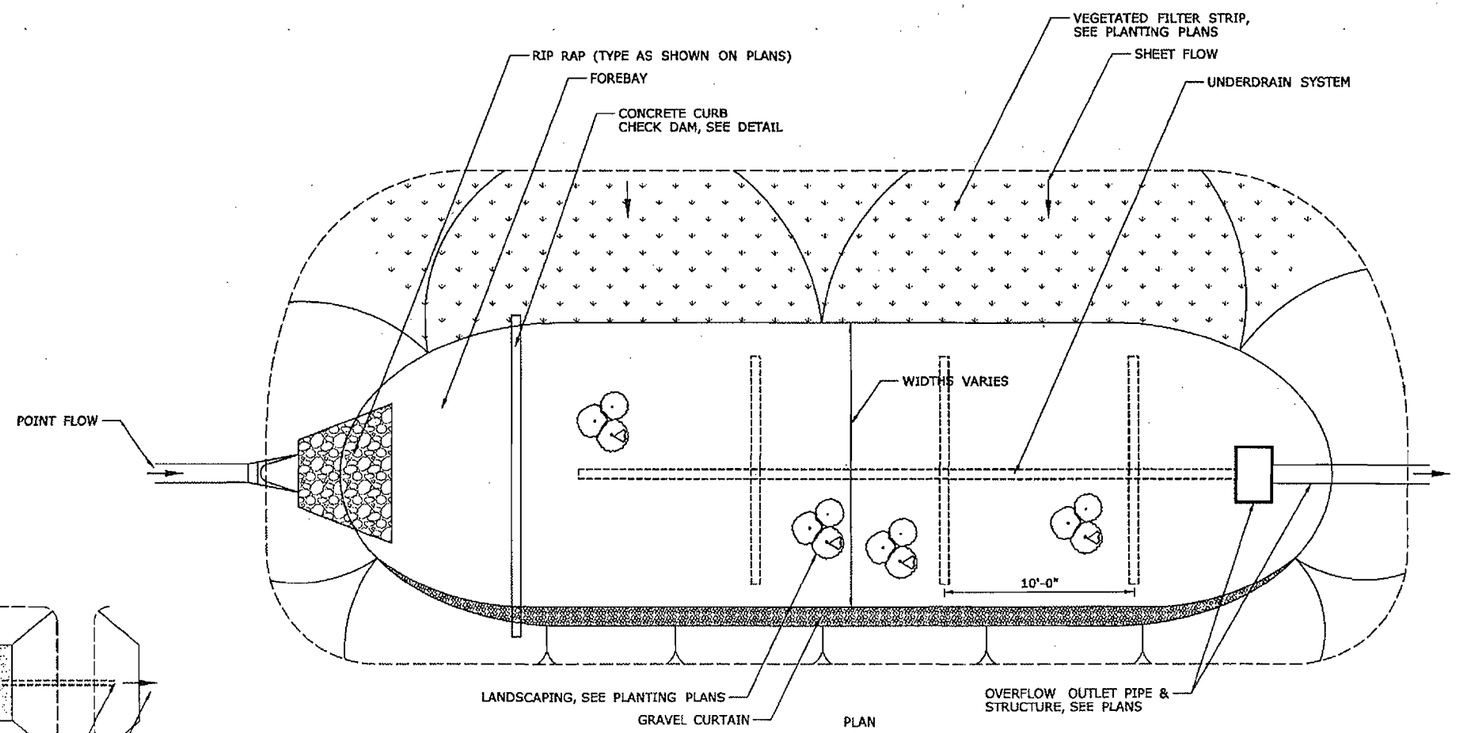


PLAN

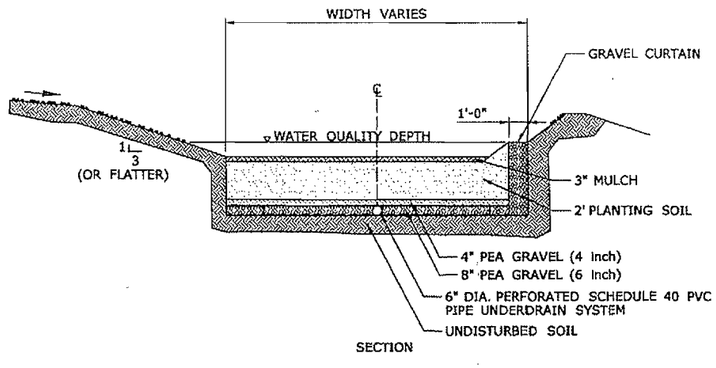


SECTION

DRY SWALE



PLAN



SECTION

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: 1/21/2010

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

8. Appendix E: CTDOT Preliminary Design Comment Responses

Station: Newington Junction Reviewer: Hydraulics & Drainage Reviewer Date: 9/29/2009
Responder: Liz Sommer, P.E. Responder Date: 2009-10-05

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

memorandum

subject: Project No. 88-H039 (171-305 P.E.)
New Britain-Hartford Busway
Newington Junction Station
Preliminary Design Review

date: September 29, 2009

to: Mr. Richard B. Armstrong
Trans. Principal Engineer
Consultant Design
Bureau of Engineering
and Construction

from: Michael E. Masayda
Trans. Principal Engineer
Hydraulics and Drainage
Bureau of Engineering
and Construction

No.	Comment	Inc.	Not Inc.
1	The location of the drainage structures that are proposed for the busway mainline, as depicted on the station plan, do not match the locations shown for adjacent Project No. 93-H046. More coordination is required between the two projects to ensure that drainage systems and connection points are accurately presented on the plans.		
2	Proposed drainage that is depicted on the plans between the station and the mainline busway project should be differentiated from each other to define the respective project limits.		
3	Intersection grading plans should be developed for the station driveways that intersect the roadway or busway to ensure that catch basins will be located at low points and avoid potential ponding or icing conditions.		
4	Plans for adjacent Project No. 93-H046 show the busway drainage is designed with an offline drainage system. Treated stormwater will be carried in the trunkline and connected by manholes. It is recommended that the "treated" runoff coming from the station's stormwater quality swale discharge to the busway's main trunkline system rather than directly to an existing manhole.		
5	The station drainage will outlet to a grass lined stormwater quality swale and then discharge to an existing manhole that is labeled "*Manhole Not Found*". a. Discharging the station runoff to an existing drainage structure that could not be found is undesirable. Additional survey should be performed to verify the location of the manhole. b. Determine the ownership and maintenance responsibilities for the existing drainage system that traverses the property and that will also intercept drainage from the station and busway. Permission to discharge and a maintenance agreement between the owner and the Department may be required.		

Station: Newington Junction Reviewer: Hydraulics & Drainage Reviewer Date: 9/29/2009
Responder: Liz Sommer, P.E. Responder Date: 2009-10-05

To: Mr. Richard B. Armstrong -2- Project No. 88-H039 (1710395 P.E.)
From: Michael E. Masayda New Britain-Hartford Busway
Date: September 29, 2009 Newington Junction Station
Preliminary Design Review

No.	Comment	Inc.	Not Inc.
6	The storm drainage calculations show that several catch basins will intercept less than 0.5 cfs. Consider regrading these subareas to allow runoff to discharge onto the pavement rather than collecting in a low spot that will require an inlet. See also the inlet at CB 4 which will intercept 0.6 cfs. The catch basin is not located in a low point and is proposed 50 feet upgrade from CB 13 which intercepts 1.0 cfs.		

Yolanda Antoniak/ya:sd
cc: Joseph J. Obara
Chong Lung Chow
088-H039H

Station: Newington Junction Reviewer: Hydraulics & Drainage Reviewer Date: 9/29/2009
Responder: Liz Sommer, P.E. Responder Date: 2009-10-05

Reviewer Comment 1)

The location of the drainage structures that are proposed for the busway mainline, as depicted on the station plan, do not match the locations shown for adjacent Project No. 93-H046. More coordination is required between the two projects to ensure that drainage systems and connection points are accurately presented on the plans.

S E A Response: ***Coordination between designers has occurred regarding the proposed drainage system. Continued efforts between all parties will continue through final design.***

Reviewer Comment 2)

Proposed drainage that is depicted on the plans between the station and the mainline busway project should be differentiated from each other to define the respective project limits.

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

Reviewer Comment 3)

Intersection grading plans should be developed for the station driveways that intersect the roadway or busway to ensure that catch basins will be located at low points and avoid potential ponding or icing conditions.

S E A Response: ***Intersection grading plans will be developed during final design.***

Reviewer Comment 4)

Plans for adjacent Project No. 93-H046 show the busway drainage is designed with an offline drainage system. Treated stormwater will be carried in the trunkline and connected by manholes. It is recommended that the "treated" runoff coming from the station's stormwater quality swale discharge to the busway's main trunkline system rather than directly to an existing manhole.

S E A Response: ***The station drainage and mainline busway drainage are both tributary to the existing storm drain system that traverses the proposed site. Independent connections are proposed for the station and busway systems.***

Station: Newington Junction Reviewer: Hydraulics & Drainage Reviewer Date: 9/29/2009
Responder: Liz Sommer, P.E. Responder Date: 2009-10-05

Reviewer Comment 5a)

The station drainage will outlet to a grass lined stormwater quality swale and then discharge to an existing manhole that is labeled "*Manhole Not Found*".

a. Discharging the station runoff to an existing drainage structure that could not be found is undesirable. Additional survey should be performed to verify the location of the manhole.

S E A Response: ***Additional survey has been requested.***

Reviewer Comment 5b)

b. Determine the ownership and maintenance responsibilities for the existing drainage system that traverses the property and that will also intercept drainage from the station and busway. Permission to discharge and a maintenance agreement between the owner and the Department may be required.

S E A Response: ***Ownership of the drainage system will be researched.***

Reviewer Comment 6)

The storm drainage calculations show that several catch basins will intercept less than 0.5 cfs. Consider regrading these subareas to allow runoff to discharge onto the pavement rather than collecting in a low spot that will require an inlet.

See also the inlet at CB 4 which will intercept 0.6 cfs. The catch basin is not located in a low point and is proposed 50 feet upgrade from CB 13 which intercepts 1.0 cfs.

S E A Response: ***The drainage inlets have been located to collect site runoff and minimize the likelihood of icing conditions and unsafe pedestrian areas.***

CB 14 is intercepting 0.6 cfs out of the 0.81 cfs that is tributary to the inlet. This bypass of 0.2 cfs is added to the catchment flow at CB 13 of 0.82 cfs for a total Q of 1.02 cfs. However, CB 13 is only able to intercept 0.43 cfs with the remainder bypassing to CB 12 where it is completely captured. Ponding spreads at these inlets vary from 5 to 9 feet. We believe these inlets are appropriately designed and located.

Station: Newington Junction Reviewer: Environmental Planning Reviewer Date: 9/3/2009
Responder: Liz Sommer, P.E. Responder Date: 2009-09-29

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

memorandum

subject: Preliminary Design Submission
88-H039 / 171-306
Newington Junction Station
New Britain – Hartford Busway

date: September 3, 2009

to
Brian Cunningham
Transportation Supervising Engineer
Consultant Design - Highways
Bureau of Engineering and Construction

from
Paul Corrente
Transportation Supervising Planner
Environmental Planning Division
Bureau of Policy and Planning

ext.

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 consider the use of a geogrid system or erosion control blankets in lieu of sloped pavers for stabilization as this system would be more cost effective.		
5	CIV-XX	• The CIV plan sheets shall include the Station markings, toe of slope, drainage, cut and fills, and E&S controls, etc... • Please coordinate with the project designers of Project 93-H046 regarding the transition points connecting concrete curbing, RW, etc...between the busway and platform stations.		
7	DRG	• Please coordinate with the designers of Project 93-H046. • Drainage from the busway should be transitioned into the water quality swale. Please investigate. • The angle in which the drainage discharges into the water quality swale should always flow in the direction of the swale. Provide a flared end and MH in order to discharge in the proper direction. • Since the station will have limited access, the drainage design should consider alternative pipes. Determination should be based on overall cost savings. • Ensure there is access to maintain the water quality swale. • Water quality swale details will be required.		
8	LDS	• Remove Meadow Mix from the project. • The water quality basin will require a wetland seed mix and conservation seed mix for the side slopes.		

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

Andrew Piraneo/ap
cc: Paul Corrente – Andrew Piraneo
Mark Alexander – Kim Lasay – Amanda Freitas
Dave Mancini – Bob Reilly
Laurie LaRocca
Mike Masayda - Chong Lung Chow – Yolanda Antoniak
Jacob Argiro

Station: Newington Junction Reviewer: Environmental Planning Reviewer Date: 9/3/2009
Responder: Liz Sommer, P.E. Responder Date: 2009-09-29

Reviewer Comment 1).

- Please consider the use of a geogrid system or erosion control blankets in lieu of sloped pavers for stabilization as this system would be more cost effective.

S E A Response: ***Alternative slope stabilization measures will be considered.***

Reviewer Comment 5a).

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

S E A Response: ***Applicable detail will be added to the plans.***

Reviewer Comment 5b).

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

S E A Response: ***Coordination between designers has occurred regarding the proposed design. Continued efforts between applicable parties will continue through final design.***

Reviewer Comment 7a).

- Please coordinate with the designers of Project 93-H046.

S E A Response: ***Coordination between designers has occurred regarding the proposed drainage system. Continued efforts between applicable parties will continue through final design.***

Reviewer Comment 7b).

- Drainage from the busway should be transitioned into the water quality swale. Please investigate.

S E A Response: ***The site area is too small to provide treatment of the busway runoff within the station footprint.***

Reviewer Comment 7c).

- The angle in which the drainage discharges into the water quality swale should always flow in the direction of the swale. Provide a flared end and MH in order to discharge in the proper direction.

S E A Response: *A manhole has been added, as requested.*

Reviewer Comment 7d).

- Since the station will have limited access, the drainage design should consider alternative pipes. Determination should be based on overall cost savings.

S E A Response: *Alternate pipe materials will be considered during final design.*

Reviewer Comment 7e).

- Ensure there is access to maintain the water quality swale.

S E A Response: *Appropriate access has been provided to the swale.*

Reviewer Comment 7f).

- Water quality swale details will be required.

S E A Response: *Details have been added to the plan set.*

Reviewer Comment 8a).

- Remove Meadow Mix from the project.

S E A Response: *An alternative seed mix will be proposed during final design upon coordination with the appropriate parties at the Department.*

Reviewer Comment 8b).

- The water quality basin will require a wetland seed mix and conservation seed mix for the side slopes.

S E A Response: *Appropriate seed mixes will be proposed during final design upon coordination with the appropriate parties at the Department.*

Station: Newington Junction Reviewer: Environmental Planning Reviewer Date: 9/14/2009
Responder: Liz Sommer, P.E. Responder Date: 2009-10-07

From: Jacob Argiro [mailto:Jargiro@cmeengineering.com]
Sent: Monday, September 14, 2009 11:00 AM
To: Al Bisacky
Cc: Elizabeth Sommer; Cunningham, Brian T
Subject: FW: Newington Junction Station

OEP-Wetlands comments on Newington Junction are below.

From: Lesay, Kimberly C [mailto:Kimberly.Lesay@ct.gov]
Sent: Monday, September 14, 2009 10:55 AM
To: Jacob Argiro
Cc: Cunningham, Brian T; Corrente, Paul N; Piraneo, Andrew; Alexander, Mark W
Subject: Newington Junction Station

I have reviewed the PD plans and offer the following general comments:

There are numerous utilities in the area, including sanitary sewer line. The depth of these should be plotted onto the profile plans and cross sections as developed.

- The stability of all ultimate outfalls for drainage must be confirmed and capacity of pipes as well.

It is my understanding you are already in receipt of comments from our Stormwater Section. Thank you - Kim

Kimberly Lesay

Environmental Planning Division

Department of Transportation

2800 Berlin Turnpike

PO Box 317546

Newington, CT 06131-7546

phone (860) 594-2933

fax (860) 594-3028

Kimberly.Lesay@po.state.ct.us

Station: Newington Junction Reviewer: Environmental Planning Reviewer Date: 9/14/2009
Responder: Liz Sommer, P.E. Responder Date: 2009-10-07

Reviewer Comment 1)

There are numerous utilities in the area, including sanitary sewer line. The depth of these should be plotted onto the profile plans and cross sections as developed.

S E A Response: *Utility coordination and required relocations will be examined in detail during final design.*

Reviewer Comment 2)

The stability of all ultimate outfalls for drainage must be confirmed and capacity of pipes as well.

S E A Response: *The stability of the outfalls is outside the scope of the station drainage design and will be completed by the 93-H046 designer.*

9. Appendix F: HARTFORD – NEW BRITAIN BUSWAY TABLE

Stormwater Drainage & Receiving Waters
New Britain-Hartford Busway
State Project #302-008

Drainage System Number/ Description (Station)	Wetland Impact Site Number	Receiving Waters (Name)	Outlet Protection Type	# of Catch Basins	Maximum Flows (Q) (cfs)	Contributing Drainage Area (sq. mi)	Treatment	Notes
Newington Junction Station (outlet into existing 36-inch RCP storm drain)	16 (Impact by Contract No. 88-H046)	Piper Brook	N/A	11 total inlets	10 Year Peak = 6.96	0.004 sq. mi (2.64 acres)	Primary Treatment within Water Quality Swale	