

APPENDIX E

BULKHEAD DESIGN

Halcrow HPA

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**Memo**

To David Yudelson
From Joseph Silva, P.E.

Ref DWDGOW
Date 7/16/08

Copy David Von Spreckelson, Nimita Shah

Project: Toll Brothers 363-365 Bond Street Development

Subject: Reconstruction of the Existing Bulkhead

The original replacement design of the bulkhead consists of positioning and installing a new steel sheet pile wall outboard of the existing rock filled timber crib bulkhead as close as constructability will allow. This is the optimal solution for providing long term shoreline stabilization with no loss of upland real estate. However, based on a conference call held on Friday, December 21, 2007, Halcrow HPA understands that the DEC no longer allows an existing bulkhead to be reconstructed 18 inches outboard of the existing bulkhead face without substantial justification and/or necessity. As such, reconstruction of the bulkhead under these restrictions will greatly complicate construction procedures and cause a large degree of disturbance to the surrounding environment and additional cost burden to the Owner.

The following is a discussion on the possible alternatives considered for this project site as well as the difficulties associated with each alternative based on the new DEC restrictions. These solutions were carefully considered and ultimately rejected prior to selecting the design approach currently proposed:

- No Action
- Repair the existing rock filled timber crib bulkhead
- Install new steel sheet pile bulkhead behind the existing timber bulkhead
- Complete demolition, excavation, removal, and replacement of the existing bulkhead

ALTERNATIVE 1: No Action

If no action takes place, the existing bulkhead will continue to deteriorate and eventually collapse under its own weight and/or newly imposed loads. Further deterioration and/or collapse of the bulkhead will result in a threat to public safety and property, especially with the addition of the proposed development. Therefore, this alternative is not considered an effective option.

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ALTERNATIVE 2: Repair the existing rock filled timber crib bulkhead

Repairs to the existing rock filled timber crib bulkhead would provide only a short-term solution to the ongoing deterioration and eventual failure of the bulkhead. Repairs would consist of patching the bulkhead and possibly fortifying it along selected portions. However, the deterioration of the bulkhead is so widespread that these types of repairs would be only partially effective and temporary at best. Therefore, this alternative is not considered an effective solution.

ALTERNATIVE 3: Install new steel sheet pile bulkhead behind the existing timber bulkhead

Bulkhead replacement behind the existing timber bulkhead (upland side), in lieu of the outboard (water) side, of the existing bulkhead was considered. The existing rock filled timber crib wall bulkhead extends back into the upland approximately ten feet and is most likely composed of varying types and sizes of rock fill material enclosed by timber framing members. The timber members make up the overall framework of the crib and are necessary to maintain stability of the existing bulkhead. These timber members would directly impede construction of the new steel sheet pile bulkhead and need to be removed in their entirety to permit installation of the new bulkhead. Removal of these timbers could cause the existing bulkhead to fail abruptly. Therefore, a piece-by-piece removal and replacement of the bulkhead was considered as a possible means of avoiding widespread failure and limiting unsupported portions of the bulkhead to relatively short segments. It was ultimately concluded that there is too much risk of failure for each bulkhead segment during these operations, due to the advanced state of deterioration. It is also anticipated that the infill may contain a significant amount of oversized rock fragments, miscellaneous debris, and other obstructions that may not allow for installation of the sheeting. Therefore, this alternative was not considered an feasible solution.

ALTERNATIVE 4: Complete demolition, excavation, removal, and replacement of the existing bulkhead

Complete demolition, excavation and removal of the existing bulkhead and backfill was considered. This alternative would require complete removal of the bulkhead, fill materials, installation of new steel sheet pile bulkhead and the placement of new clean backfill. Excavation of the materials will require a temporary slope extending a minimum of forty feet upland to provide room for removal of all bulkhead components and maintain a safe working slope. Removal of the bulkhead will cause a significant portion of the existing backfill material to slough into the resulting excavation and significant disturbance to the surrounding water environment. Based on the results of the Phase II Environmental Investigation, Halcrow HPA understands the existing site soils contain some

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contaminants and will require special consideration. As such, this alternative was deemed to be to extreme in scope, very disruptive to the environment and cost prohibitive to the project.

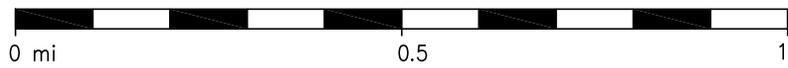
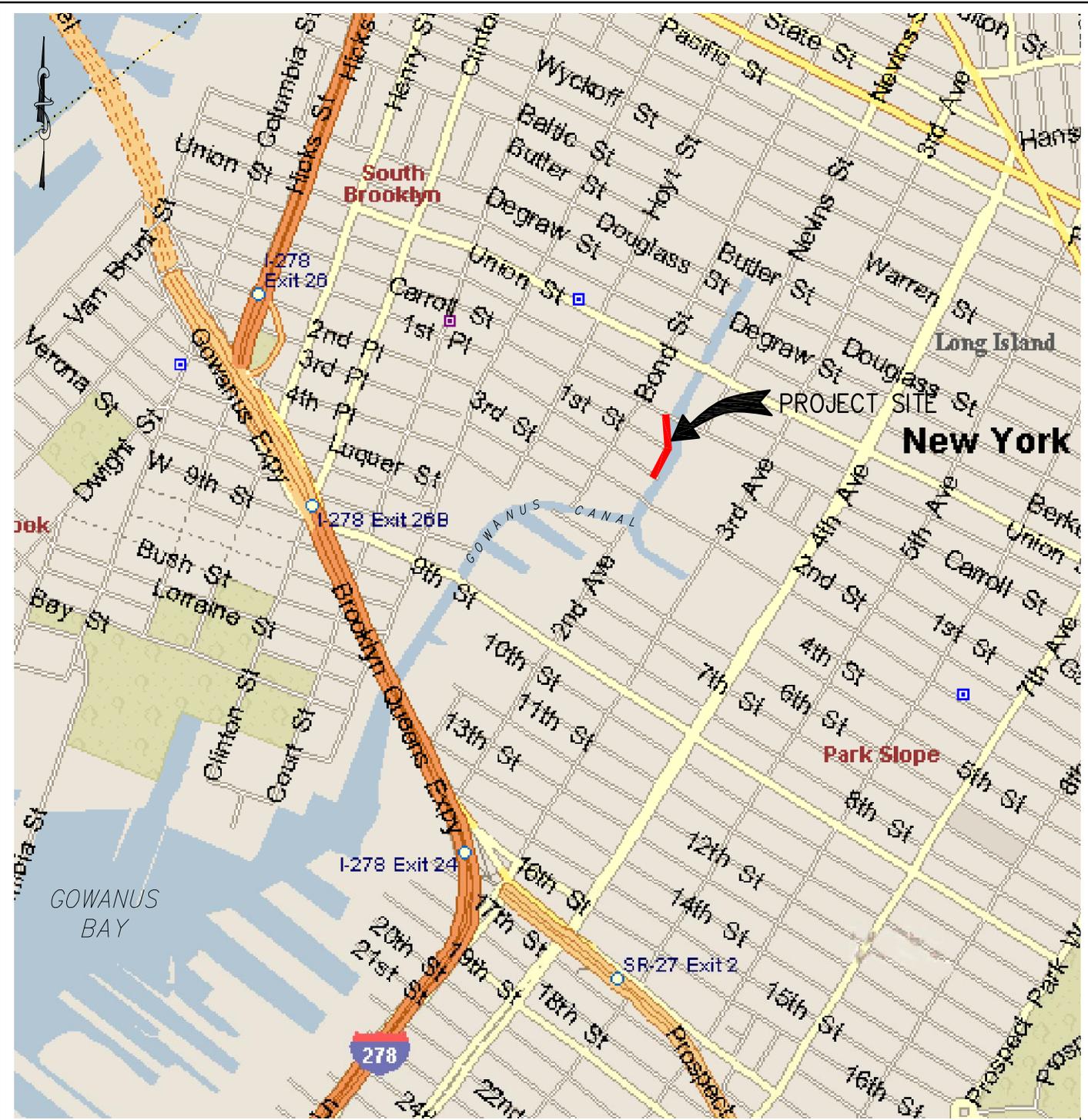
In light of the above, Halcrow HPA recommends pursuing the original design approach for reconstruction of the bulkhead. In this case, construction of the new steel sheet pile wall will consist of a 12 inches deep sheetpile placed up against the existing bulkhead. This approach will be the most optimal solution to ensure proper constructability, minimal impact to the surrounding environment and reasonable cost. Furthermore, this method of bulkhead replacement has been granted by the DEC to numerous property owners along the Gowanus Canal with good results and clearly is a precedent that should be applied to this Owner's situation.

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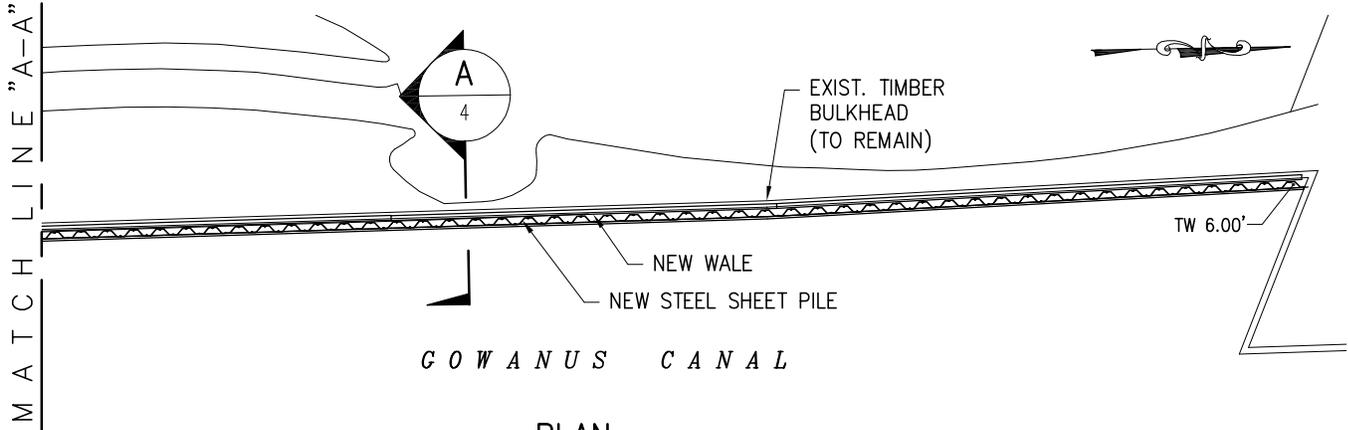
<p>PURPOSE: PROPOSED NEW BULKHEAD</p> <p>PREPARED BY HPA ENGINEERS, P.C.</p>	<p>363-365 BOND STREET</p> <p>LOCATION PLAN</p>	<p>PROPOSED: STEEL SHEET PILE BULKHEAD</p> <p>CITY: BROOKLYN COUNTY: KINGS APPLICANT: TOLL BROTHERS, INC.</p> <p>SHEET 1 OF 7 DATE: 6/19/2008</p>
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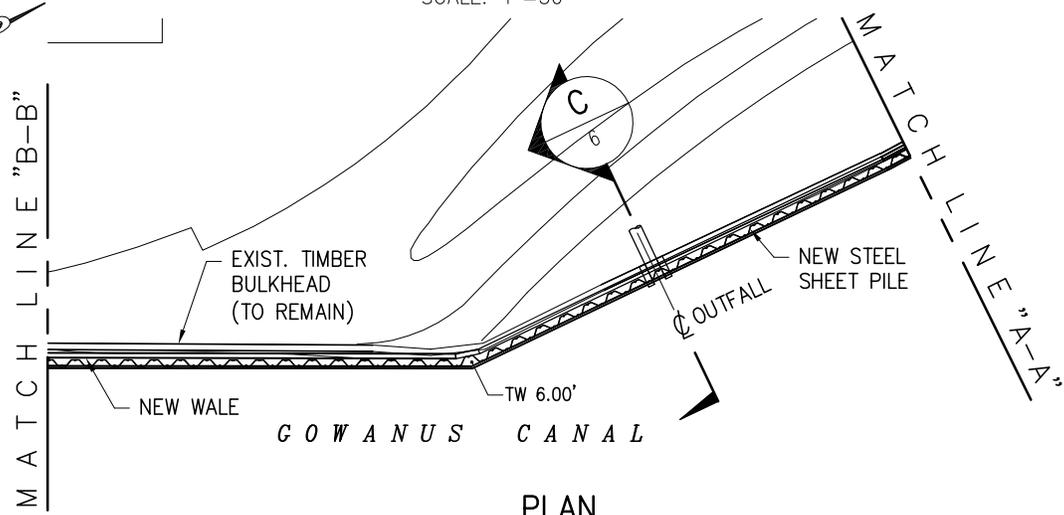


<p>PURPOSE: PROPOSED NEW BULKHEAD</p>	<p>363-365 BOND STREET</p>	<p>PROPOSED: STEEL SHEET PILE BULKHEAD</p>
<p>PREPARED BY HPA ENGINEERS, P.C.</p>	<p>SITE PLAN</p>	<p>CITY: BROOKLYN COUNTY: KINGS APPLICANT: TOLL BROTHERS, INC. SHEET 2 OF 7 DATE: 6/19/2008</p>

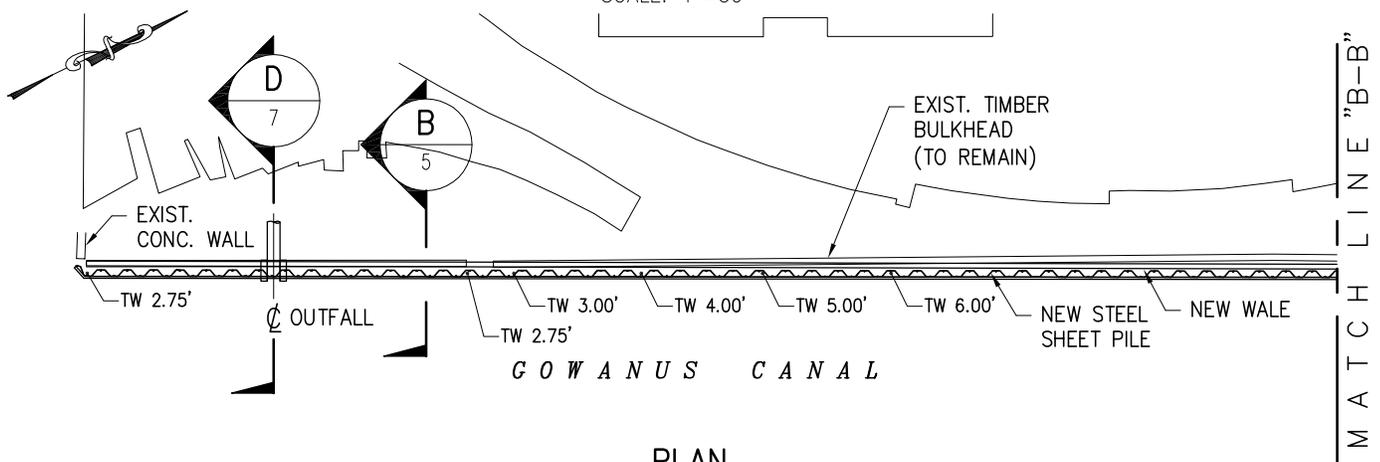
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PLAN
SCALE: 1"=30'



PLAN
SCALE: 1"=30'



PLAN
SCALE: 1"=30'

PURPOSE:
PROPOSED NEW BULKHEAD

PREPARED BY
HPA ENGINEERS, P.C.

363-365 BOND STREET

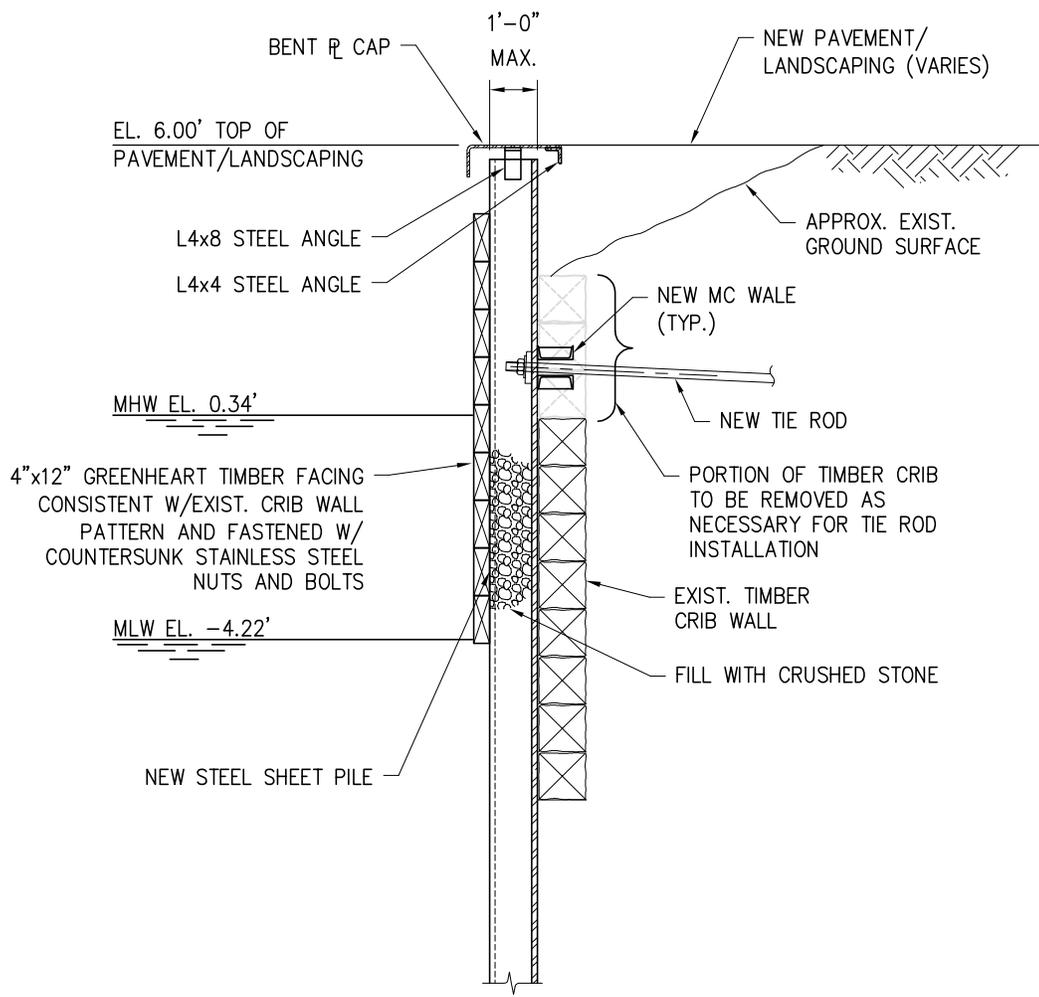
GENERAL PLAN

PROPOSED: STEEL SHEET PILE BULKHEAD

CITY: BROOKLYN
COUNTY: KINGS
APPLICANT: TOLL BROTHERS, INC.

SHEET 3 OF 7 DATE: 6/19/2008

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A SECTION
 3 SCALE 1/4"=1'-0"

PURPOSE:
 PROPOSED NEW
 BULKHEAD

PREPARED BY
 HPA ENGINEERS, P.C.

363-365 BOND STREET

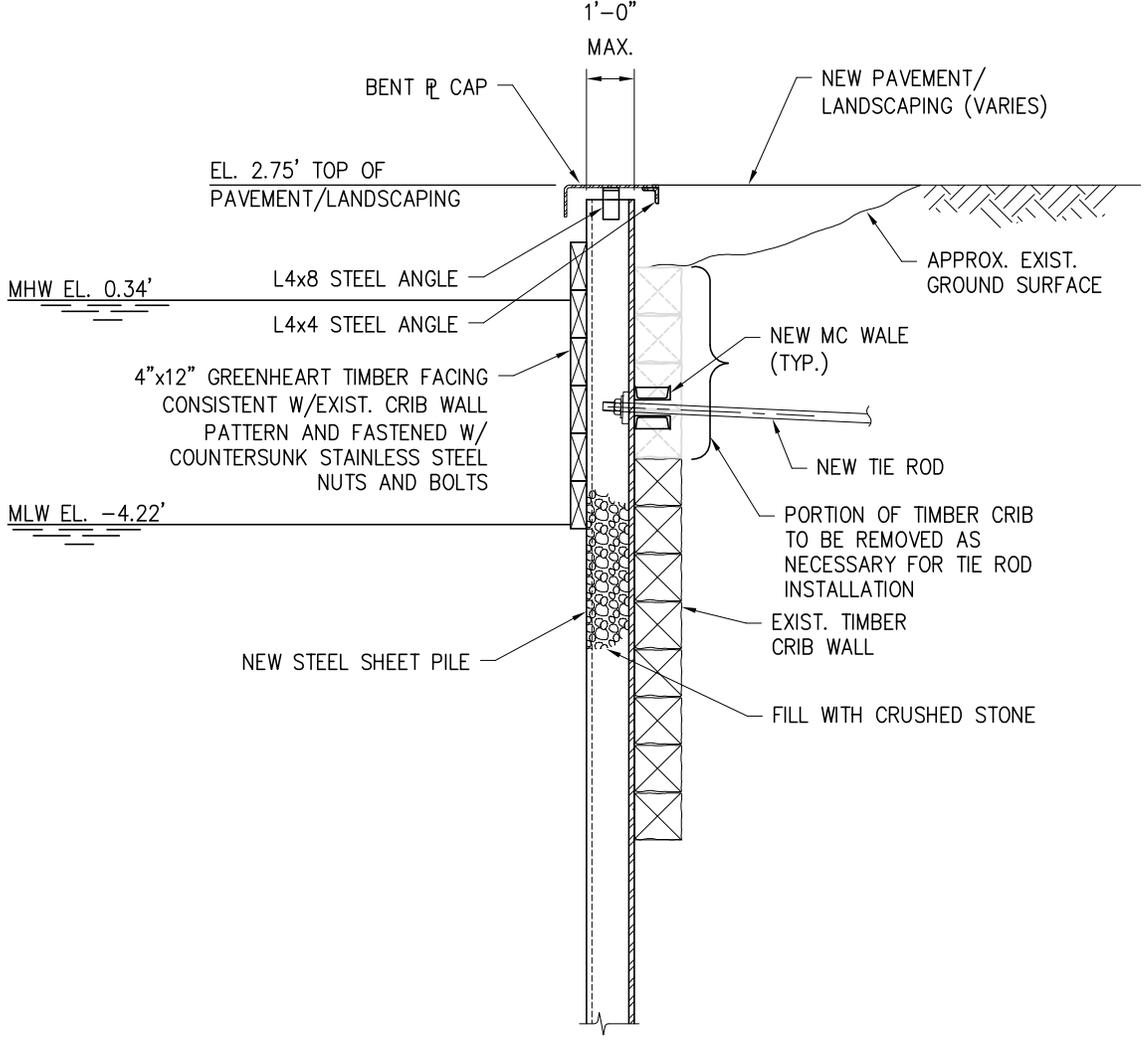
**SHEETPILE BULKHEAD
 SECTION A**

PROPOSED: STEEL SHEET PILE
 BULKHEAD

CITY: BROOKLYN
 COUNTY: KINGS
 APPLICANT: TOLL BROTHERS, INC.

SHEET 4 OF 7 DATE: 6/19/2008

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B SECTION
 3 SCALE 1/4"=1'-0"

PURPOSE:
 PROPOSED NEW
 BULKHEAD

PREPARED BY
 HPA ENGINEERS, P.C.

363-365 BOND STREET

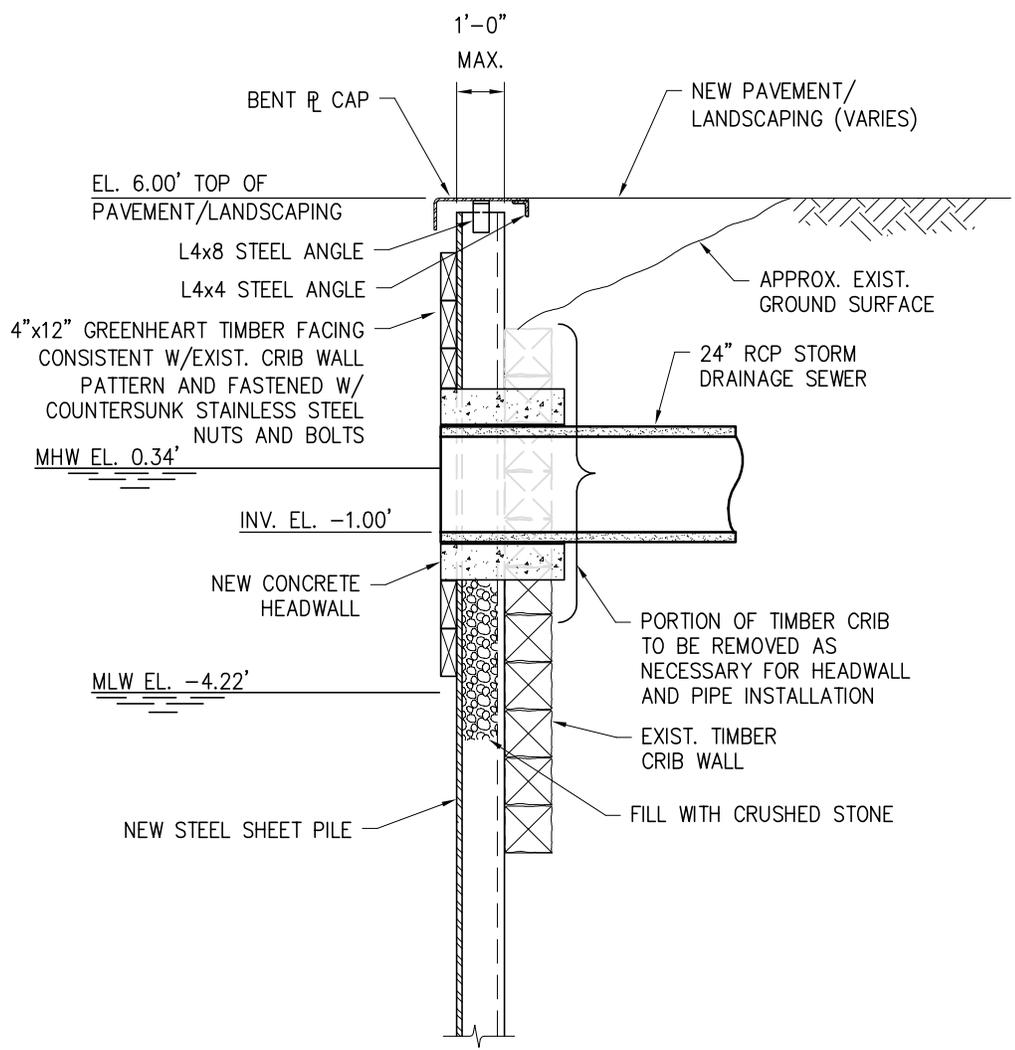
SHEETPILE BULKHEAD
 SECTION B

PROPOSED: STEEL SHEET PILE
 BULKHEAD

CITY: BROOKLYN
 COUNTY: KINGS
 APPLICANT: TOLL BROTHERS, INC.

SHEET 5 OF 7 DATE: 6/19/2008

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C SECTION
 3 SCALE 1/4"=1'-0"

PURPOSE:
 PROPOSED NEW
 BULKHEAD

PREPARED BY
 HPA ENGINEERS, P.C.

363-365 BOND STREET

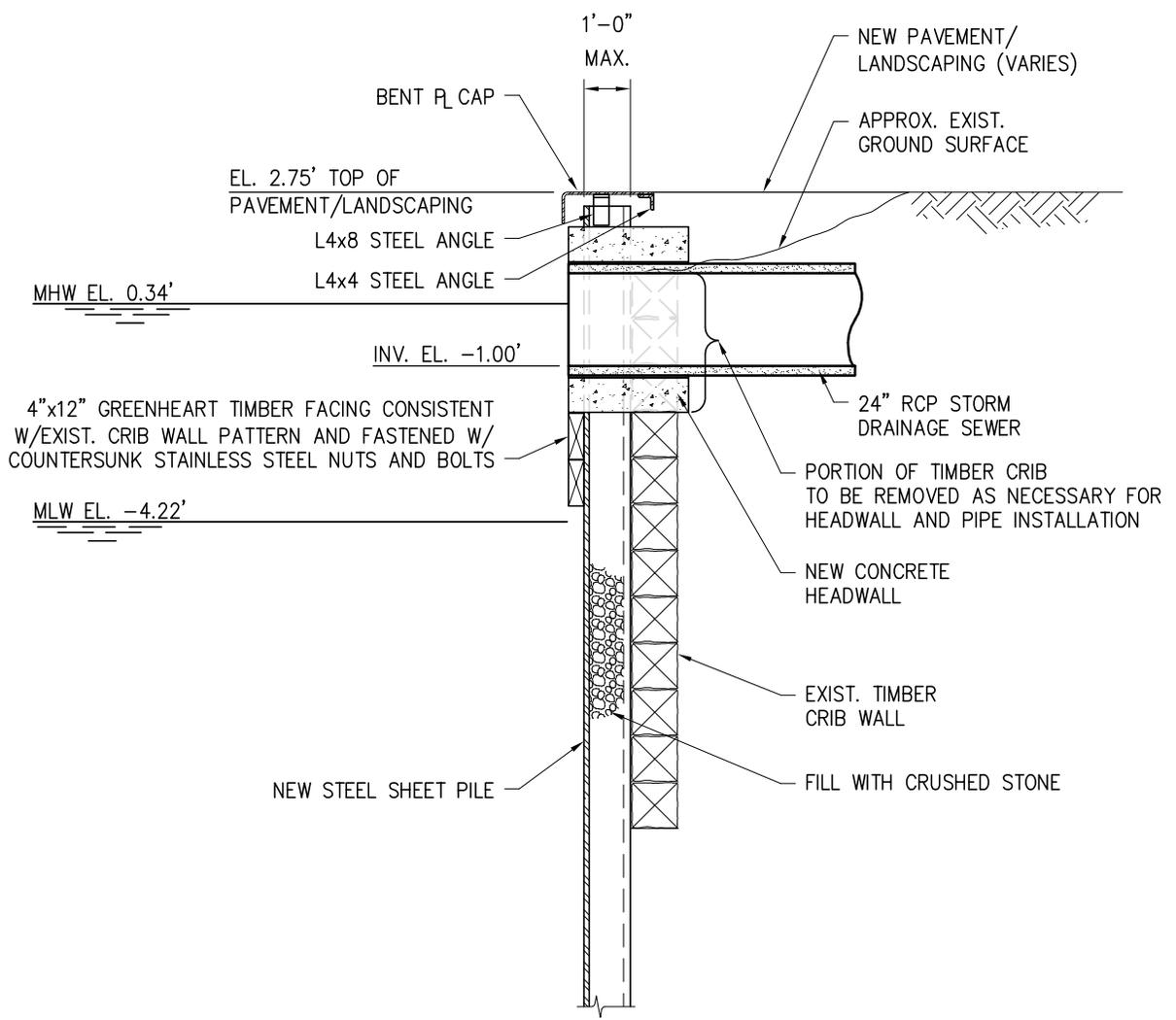
**SHEETPILE BULKHEAD
 SECTION C**

PROPOSED: STEEL SHEET PILE
 BULKHEAD

CITY: BROOKLYN
 COUNTY: KINGS
 APPLICANT: TOLL BROTHERS, INC.

SHEET 6 OF 7 DATE: 6/19/2008

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D SECTION
 3 SCALE 1/4"=1'-0"

PURPOSE:
 PROPOSED NEW
 BULKHEAD

PREPARED BY
 HPA ENGINEERS, P.C.

363-365 BOND STREET

SHEETPILE BULKHEAD
SECTION D

PROPOSED: STEEL SHEET PILE
 BULKHEAD

CITY: BROOKLYN
 COUNTY: KINGS
 APPLICANT: TOLL BROTHERS, INC.

SHEET 7 OF 7 DATE: 6/19/2008