MEMORANDUM

TO: Robert Bass, P.E. - City Engineer, Meriden, Connecticut

FROM: Jessica Clark, M.S, Roy Schiff, PhD. and Nicolle Burnham, P.E.
Milone & MacBroom, Inc.

DATE: October 16, 2008

RE: Factory H Site Alternatives Analysis
Harbor Brook Drainage Improvement Project
Meriden, Connecticut
MMI #1261-14-24

The redevelopment of the Factory H area on Cooper Street is under consideration by the City of Meriden. The current plan for Harbor Brook improvements calls for removal of the Factory H building and creation of a flood bench on the right bank (looking downstream) with the left bank remaining undisturbed. At the request of the City of Meriden, Milone & MacBroom, Inc. (MMI) performed hydraulic modeling to evaluate creating the flood bench on the left bank while leaving the right bank as it exists. Under this scenario, a building pad at elevation 120.0 feet would be maintained at the location of the current Factory H building. Cross sections of each alternative are presented in Figure 1. Figure 2 depicts this alternative configuration that was analyzed as part of this effort. The analysis was completed using HEC-RAS (USACOE, 2008) and the previously developed Harbor Brook model.

The two Factory H alternatives provide similar local channel conveyance and flood storage. Placing the flood bench on the left bank and maintaining the Factory H building leads to small increases in peak flood water surface elevations for the 100-year event over the elevations predicted in the original design concept that eliminated the Factory H Building. The maximum increase of 0.4 feet occurs approximately 670 feet upstream of Cooper Street Bridge (RS 9934) (see Table 1). In most locations water surface elevation increases are between 0.1 and 0.2 feet. With the proposed flood bench on the left bank flow is just contained in a full Harbor Brook channel (Figure 1). Model data suggest that either alternative would be an adequate part of the greater flood protection strategy for Harbor Brook.

With the flood bench on the left bank, predicted water surface elevations at the Factory H building site are below 120.0 for all storm events; however, the predicted 100-year flood elevation is 119.9. To comply with FEMA standards, any new building will need to be elevated a minimum of one foot above the 100-year flood and we recommend that the city consider requiring a minimum of two feet for buildings in the Harbor Brook corridor. This can be achieved by raising the building slab, which would provide additional cover that may be needed for the remediation activities at this property.

It is important to note that under both alternatives, the low area on the north side of the Factory H and Meriden Medical Center buildings floods during the 25-year or larger storm. The hydraulic

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model shows one low area approximately 380 feet upstream (RS 9647) that floods even in the 10-year storm. This situation occurs under existing conditions and the proposed plan will not correct this entirely, although the frequency at which this type of flooding occurs will decrease.

Alternatives were evaluated to reduce flooding in the low area behind the Factory H and Meriden Medical Center buildings (see Figure 1) persisting in the original proposed conditions. Flood waters are contained within the channel under the original proposed conditions until downstream of the Railroad Bridge. Backwatering at the Harbor Brook Apartments bridge forces water to pond and eventually flood over the parking area on the right bank (RS 107+17 to 107+86) and onto Hanover Street (proposed 100-yr peak flood water surface elevations of up to 121.0 feet).

Flood waters also access Hanover Street in the proposed park at the current location of the Dime Savings Bank between Harbor Brook Apartments Bridge and Butler Street Bridge (RS 102+91 to 107+17). The 100-year peak flood water surface elevation is 121.0 feet NGVD in the proposed park, and thus water flows onto Hanover Street that lies at elevation 120.0 feet NGVD. Water reaching Hanover Street then flows south behind the Meriden Medical Center and Factory H buildings.

The original proposed conditions model also shows water exiting the channel in a third location, just upstream of the Meriden Medical Center. Flood waters exit the channel and flow through the parking area to the east side of the buildings and south behind Factory H.

The original proposed grading and infrastructure were evaluated using HEC-RAS and an alternative was selected that contains flood waters up to the 100-year storm within the Harbor Brook channel. The alternative consists of three parts (See accompanying plan set, sheet ??):

1. Increasing the elevation of the top of the proposed retaining wall along the parking area upstream of Harbor Brook Apartments Bridge;
2. Flood-proofing and increasing the top elevation of the proposed decorative wall between the Harbor Brook Apartments Bridge and Butler Street road embankment; and
3. Increasing the elevation of the finished grade of the proposed recreation trail upstream of the Meriden Medical Center Building.

This alternative assumes that the originally proposed flood bench is located on the left bank.

Model results show the 100-year peak flood is contained within the Harbor Brook channel and unable to access the areas behind Factory H and the Meriden Medical Center. Maximum water surface elevation in the channel is 119.85 between Cooper and Butler Street Bridges. With this alternative the water surface elevation increases by a maximum of 0.17 feet (see Table 2). Water velocities under this alternative are lower in many places than the original proposed conditions, and increase no more than 0.25 ft/s.

REFERENCES

USACOE, 2008. Hydrologic Engineering Center River Analysis System (HEC-RAS) (V. 4.0). U.S. Army Corps of Engineers, Hydrologic Engineering Center, Davis, CA.

Table 1: Comparison of Peak Flood Water Surface Elevations for Two Factory H Alternatives

Proposed River Station	Description of Cross Section Location	Peak WSE (feet)- 100 year flood			Peak WSE (feet)- 50 year flood			Peak WSE (feet)- 10 year flood		
		Left Bank Floodshelf	Right Bank Floodshelf	Difference	Left Bank Floodshelf	Right Bank Floodshelf	Difference	Left Bank Floodshelf	Right Bank Floodshelf	Difference
9266	U/S face of Cooper Street Bridge	119.1	119.0	0.1	118.3	118.3	0.0	116.5	116.6	-0.1
9337		119.5	119.5	0.0	118.6	118.7	-0.1	116.8	116.9	-0.2
9497		119.7	119.7	0.1	118.8	118.8	0.0	116.9	117.1	-0.1
9647		119.8	119.7	0.1	119.0	118.9	0.1	117.1	117.1	0.0
9674	D/S face of Medical Center Bridge #1	119.9	119.7	0.2	118.2	118.1	0.1	117.2	117.1	0.1
9701	U/S face of Medical Center Bridge #1	119.9	119.7	0.2	116.1	116.1	0.0	117.2	117.1	0.1
9738		119.9	119.7	0.2	119.0	118.8	0.2	117.2	117.1	0.1
9934		119.9	119.5	0.4	119.0	118.6	0.5	117.3	116.9	0.4
9971	D/S face of Medical Center Bridge #2	119.9	119.7	0.3	119.1	118.9	0.1	117.3	117.3	0.0
10001	U/S face of Medical Center Bridge #2	120.0	120.0	-0.1	119.1	119.3	-0.2	117.3	117.5	-0.3
10025		120.0	120.1	-0.1	119.1	119.4	-0.3	117.3	117.6	-0.4
10205		119.8	119.9	-0.1	119.1	119.2	-0.1	117.6	117.6	0.0
10239		119.8	119.9	-0.1	119.1	119.2	-0.1	117.6	117.6	0.0
10257	D/S face of Hanover Towers Bridge	119.9	119.9	-0.1	119.1	119.3	-0.1	117.7	117.7	0.0
10291	U/S face of new Hanover Towers Bridge	120.6	120.7	-0.1	119.4	119.6	-0.2	117.7	117.8	0.0
10341		120.7	120.7	0.0	119.8	119.9	-0.1	118.1	118.1	0.0
10492		121.0	121.0	0.0	119.9	120.1	-0.1	118.2	118.2	0.0
10546		120.9	121.0	0.0	120.0	120.1	-0.1	118.2	118.2	0.0
10678		121.1	121.1	0.0	120.1	120.2	-0.1	118.4	118.4	0.0
10697	D/S face of Harbor Brook Apartment Bridge	120.9	121.0	0.0	119.9	120.0	-0.1	118.3	118.3	0.0
10736	U/S face of Harbor Brook Apartment Bridge	121.0	121.0	0.0	120.0	120.2	-0.2	118.4	118.4	0.0
10786		121.4	121.4	0.0	120.3	120.6	-0.3	118.6	118.7	0.0

Table 2: Comparison of Peak Flood Water Surface Elevations for Two Butler Road Area Alternatives

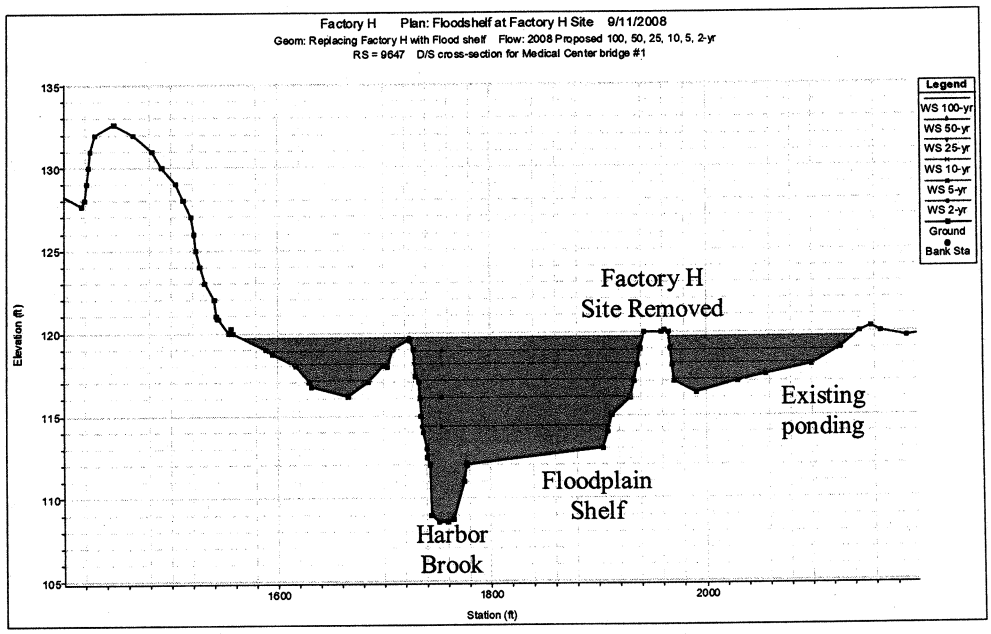
Proposed River Station	Description of Cross Section Location	Peak WSE (feet)- 100 year flood			Peak WSE (feet)- 50 year flood			Peak WSE (feet)- 10 year flood		
		No Changes at Bulter Street	Includes Changes at Butler Street	Difference	No Changes at Bulter Street	Includes Changes at Butler Street	Difference	No Changes at Bulter Street	Includes Changes at Butler Street	Difference
9266	U/S face of Cooper Street Bridge	119	119	0	118.28	118.28	0	116.54	116.54	0
9337		119.39	119.39	0	118.62	118.62	0	116.75	116.75	0
9497		119.61	119.61	0	118.82	118.82	0	116.94	116.94	0
9647		119.73	119.71	0.02	118.95	118.94	0.01	117.1	117.1	0
9674	D/S face of Medical Center Bridge #1	119.75	119.75	0	118.18	118.18	0	117.16	117.16	0
9701	U/S face of Medical Center Bridge #1	119.77	119.77	0	116.11	116.11	0	117.2	117.2	0
9738		119.76	119.76	0	118.98	118.98	0	117.17	117.17	0
9934		119.78	119.77	0.01	119.02	119.02	0	117.28	117.28	0
9971	D/S face of Medical Center Bridge #2	119.82	119.82	0	119.03	119.03	0	117.27	117.27	0
10001	U/S face of Medical Center Bridge #2	119.86	119.85	0.01	119.07	119.07	0	117.27	117.27	0
10025		119.85	119.86	-0.01	119.07	119.08	-0.01	117.26	117.26	0
10205		119.75	119.74	0.01	119.07	119.05	0.02	117.6	117.58	0.02
10239		119.74	119.77	-0.03	119.08	119.1	-0.02	117.61	117.65	-0.04
10257	D/S face of Hanover Towers Bridge	119.79	119.82	-0.03	119.13	119.15	-0.02	117.66	117.69	-0.03
10291	U/S face of new Hanover Towers Bridge	119.96	119.98	-0.02	119.29	119.31	-0.02	117.81	117.85	-0.04
10341		120.05	120.15	-0.1	119.48	119.5	-0.02	117.98	118.01	-0.03
10492		120.37	120.45	-0.08	119.67	119.72	-0.05	118.11	118.14	-0.03
10546		120.4	120.42	-0.02	119.67	119.69	-0.02	118.09	118.12	-0.03
10678		120.55	120.55	0	119.82	119.85	-0.03	118.28	118.31	-0.03
10697	D/S face of Harbor Brook Apartment Bridge	120.22	120.39	-0.17	119.65	119.68	-0.03	118.18	118.21	-0.03
10736	U/S face of Harbor Brook Apartment Bridge	120.39	120.55	-0.16	119.82	119.86	-0.04	118.3	118.33	-0.03
10786		120.93	120.94	-0.01	120.13	120.2	-0.07	118.56	118.58	-0.02
11049		117.9	117.9	0	117.45	117.45	0	120.57	120.57	0

Table 3: Alternatives to Reduce flooding behind Meriden Medical Center and Factory H Buildings

Item	Proposed River Stations (ft)	New Flood Protection Elevation (ft NGVD)	New Proposed 100-year peak WSE (ft NGVD)	Available Freeboard (ft)
Parking Lot Retaining Wall Upstream of Harbor Brook Apartments Bridge	RS 107+17 to RS 102+91	122.0	121.0	1.0
Flood wall between Harbor Brook Apartments Bridge and Butler Street	RS 102+91 to RS 107+17	121.5	121.0	0.5
Butler Street to Cooper Street	RS 92+66 to RS 102+57	120.0	119.85	0.15

Figure 1

Floodplain shelf on right bank, removal of Factory H building



Floodplain shelf on left bank, retain of Factory H building

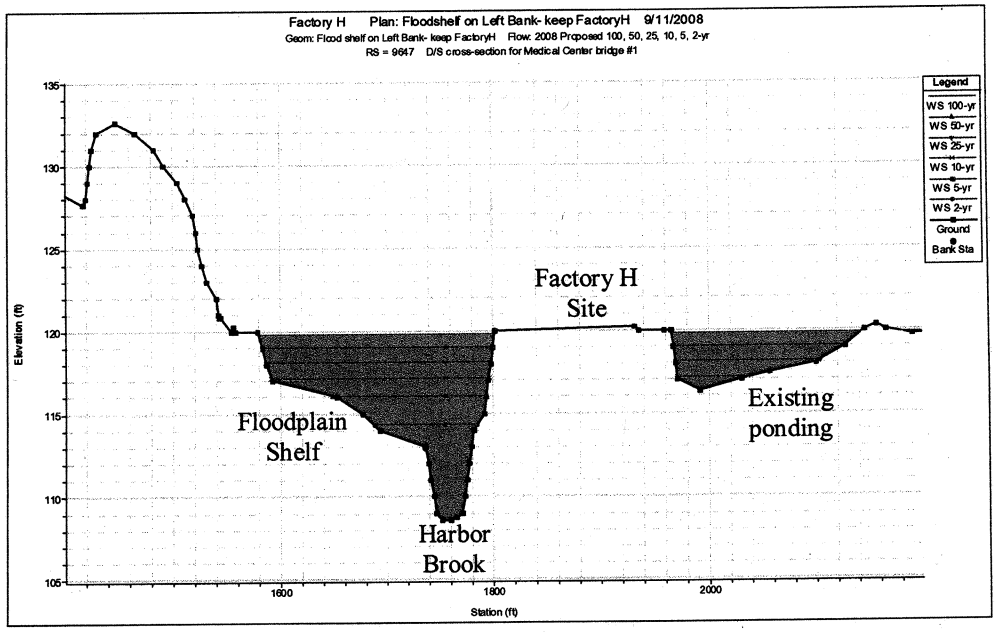


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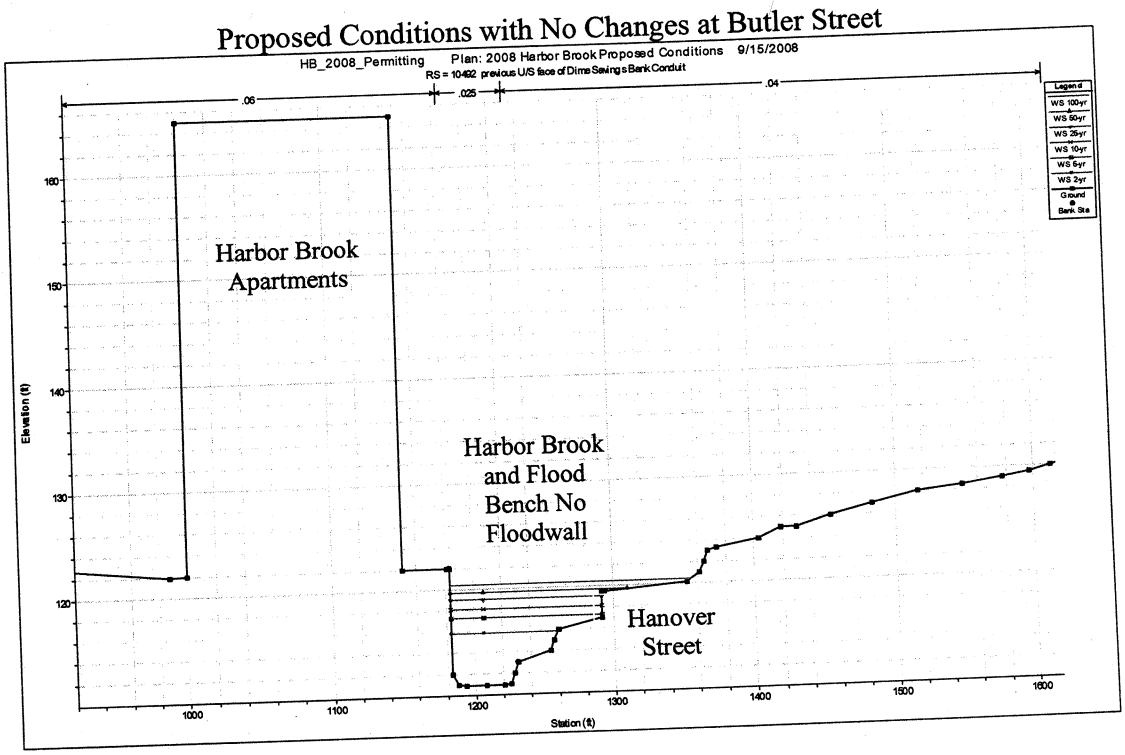
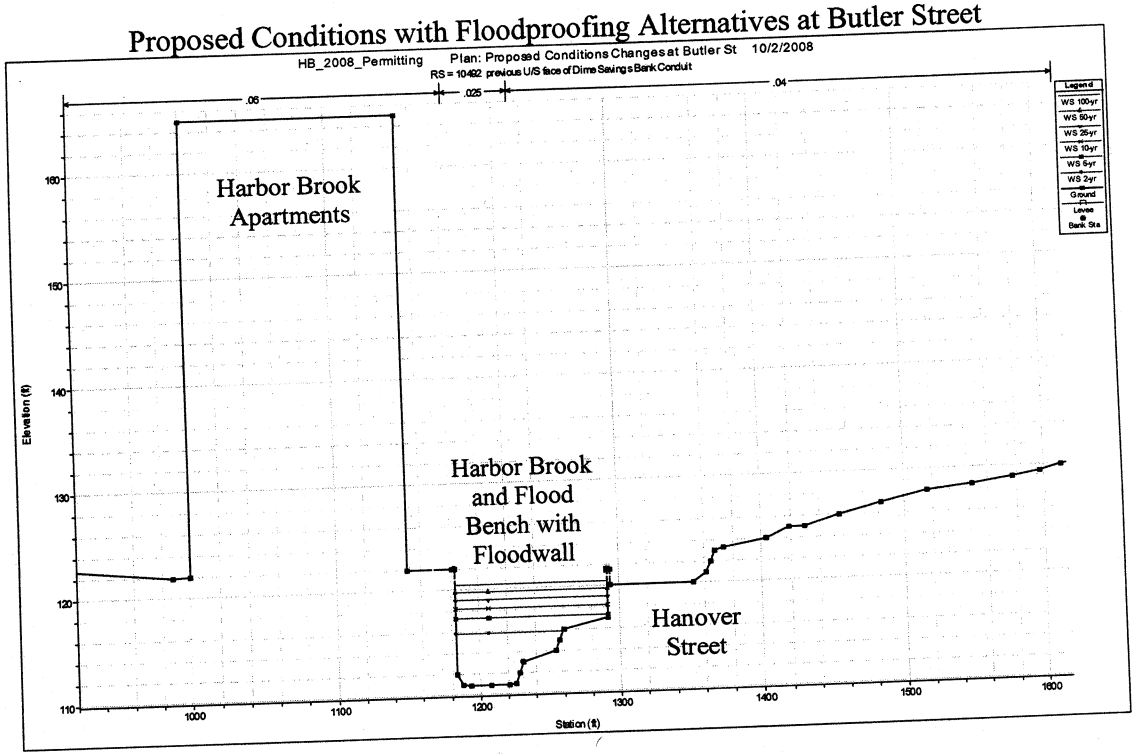
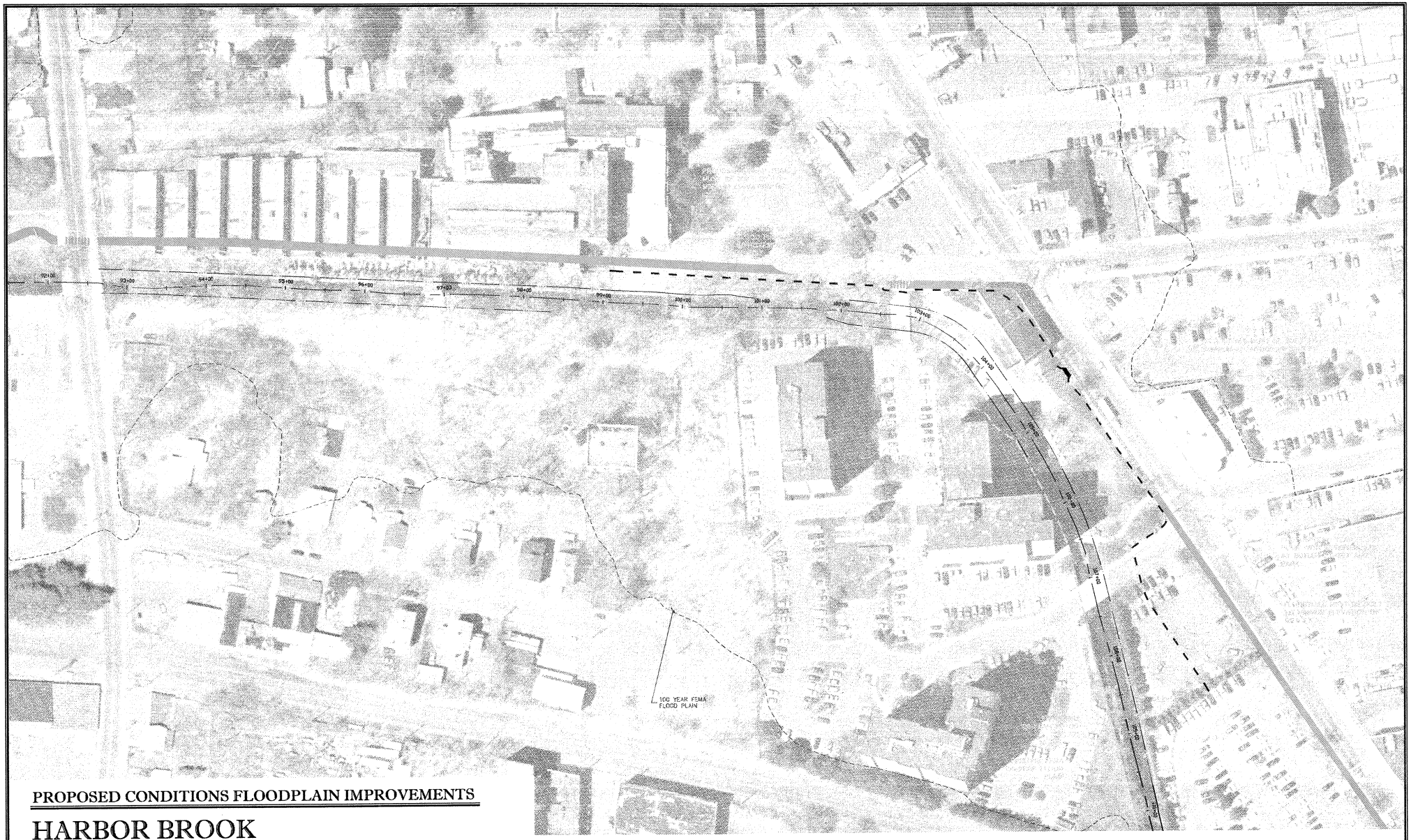
Figure 2

Proposed Conditions with No Changes at Butler Street



Proposed Conditions with Floodproofing Alternatives at Butler Street





PROPOSED CONDITIONS FLOODPLAIN IMPROVEMENTS

HARBOR BROOK DRAINAGE IMPROVEMENTS

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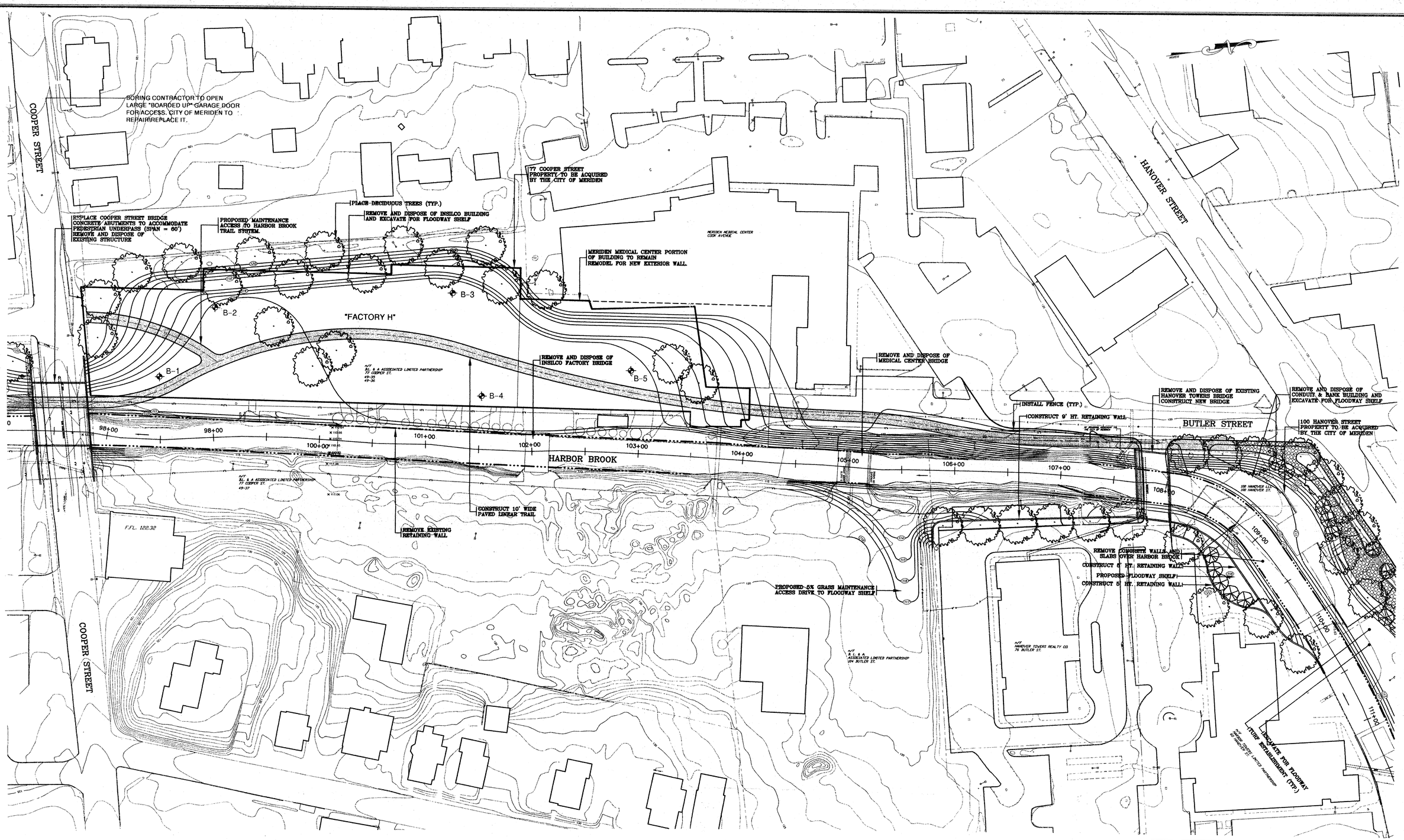

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